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INSTITUT FÜR MEERESKUNDE
an der
CHRISTIAN-ALBRECHTS-UNIVERSITÄT · KIEL

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Nordatlantik '84

– Data Report –

by

Eberhard Fahrbach, Wolfgang Krauss
Jens Meincke and Alexander Sy

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CONTENTS

Summary

The active field phase of the "Warmwassersphäre des Atlantiks" research project at the University of Kiel, which began in 1981 was continued in 1984. During this year the area under investigation was extended from the Mid-Atlantic Ridge to the West into the source region of the North Atlantic Current. R.V "Meteor" surveyed, as a continuation of the French-German "Topogulf"-program, the area of the Mid-Atlantic Ridge between 45°N and the Subpolar Front. Two CTD sections were carried out at the eastern and the western flanks of the ridge and two further ones perpendicular to them. Oxygen, nutrient and anthropogenic tracer observations were included in the program. R.V "Poseidon" performed five meridional sections across the North Atlantic Current up to 40°W. This was done in cooperation with the Estonian R.V. "Arnold Veimer" which extended the observations as far as 48°W.

The long term current meter mooring 265 was replaced by R.V. "Meteor". Mooring 280 was reinstalled after an interruption of one year. A further mooring (305) was laid about 60 nm north of mooring 280. Four clusters of three moorings each, which had been laid in 1983 along 48°N between 20°W and 35°W were recovered. Each cluster was replaced by a single mooring. The cluster centered at 25°W, to which mooring 265 belonged, was equipped by the Institut für Meereskunde, Kiel; three other clusters by the Centre Océanologique de Bretagne, Brest. Only the records of current meters from the cluster located at 25°W are presented here.

On board R.V. "Poseidon" and R.V. "Arnold Veimer" a GEK (Geomagnetic Electrokinetograph) built by the Institut für Angewandte Physik, Kiel, was towed. As in previous years satellite-tracked buoys were launched. All data obtained on board R.V. "Poseidon" and R.V. "Meteor" are presented in this report. After the processing of the complete "Topogulf"-data-set a French-German report will be published. The combined data set of R.V. "Arnold Veimer" and R.V "Poseidon will be presented in a separate paper (KRAUSS et al., in prep.).

Zusammenfassung

Die aktive Feldphase des Sonderforschungsbereiches "Warmwassersphäre des Atlantiks", die im Sommer 1981 begann, wurde 1984 fortgesetzt. In diesem Jahr wurde das Arbeitsgebiet vom Mittelatlantischen Rücken aus nach Westen erweitert. F.S. "Meteor" führte als Fortsetzung des "Topogulf" Programmes im Bereich des Mittelatlantischen Rückens zwischen 45°N und der Subpolarfront CTD-Stationen aus, an denen auch Proben zur Bestimmung von Sauerstoff, Nährstoffen und anthropogenen Spurenstoffen genommen wurden. Die Schnitte verliefen parallel und senkrecht zum Rücken und bildeten somit eine geschlossene Box. F.S. "Poseidon" führte auf fünf meridionalen Schnitten Messungen westlich des Rückens bis 40°W aus. Dies erfolgte im Rahmen eines gemeinsamen Programmes mit dem estnischen F.S. "Arnold Veimer". Damit konnte der Nordatlantische Strom bis 48°W erfaßt werden.

Die Langzeitverankerung 265 konnte von F.S. "Meteor" ausgewechselt werden. Verankerung 280 wurde nach einjähriger Unterbrechung wieder ausgelegt. Die Messungen wurden durch eine weitere Verankerung (305) etwa 60 sm nördlich von Verankerung 280 ergänzt. Vier Verankerungsgruppen in Dreiecksform, die 1983 auf 48°N zwischen 20°W und 35°W ausgelegt wurden, sind jeweils durch eine neue Verankerung ersetzt worden. Die Verankerungsgruppe bei 25°W, zu der auch Verankerung 265 zählt, wurde vom Institut für Meereskunde, Kiel bestückt, die übrigen drei vom Centre Océanologique de Bretagne , Brest. In diesem Bericht werden nur die Registrierungen der Verankerungsgruppen bei 25°W dargestellt.

An Bord von F.S. "Arnold Veimer" und F.S. "Poseidon" wurde ein GEK (Geomagnetischer Elektrokinetograph) geschleppt, der im Institut für Angewandte Physik der Universität Kiel entwickelt wurde. Wie in den Jahren zuvor kamen Satelliten-geortete Driftkörper zum Einsatz. Alle während des Jahres 1984 an Bord von F.S. "Poseidon" und F.S. "Meteor" gewonnenen Daten werden im vorliegenden Datenband vorgestellt. Nach dem Abschluß der "Topogulf" Arbeiten wird ein deutsch-französischer Datenband den gesamten Datensatz vorgestellen. Der gemeinsame Datensatz von F.S "Arnold Veimer" und F.S. "Poseidon" wird separat diskutiert (KRAUSS et al., in Vorbereitung).

1. Introduction

In summer 1981 the active field phase of the research project "Warmwassersphäre des Atlantiks" began. This is a combined effort of physical oceanography groups at the University of Kiel to investigate the processes of heat transfer in the upper oceanic layers with temperatures exceeding 8° - 10° C. These layers cover a depth range up to 800 m and extend from the equator to the Subpolar Front. The North Atlantic "warmwatersphere" is especially important for the European climate because the North Atlantic Current displaces it anomalously far poleward.

The field-work carried out from 1981 to 1983 yielded an abundant data set of CTD- and XBT-profiles. Sections along and perpendicular to the Mid-Atlantic Ridge were made north of the Azores, and from the ridge to the European shelf. Furthermore mapping surveys were performed in two boxes between the Azores and 46°N.

A repeated section showed that the North Atlantic Current is, in the area of the Mid-Atlantic Ridge, a well defined, permanent feature. It crosses the ridge between the Azores and the Subpolar Front with an estimated volume transport of about 27 Sv. This transport is concentrated in a variable number of current branches with a width generally less than 100 km. Long term moored current meter measurements supported the impression that geostrophic calculations with meridionally constant reference levels do not yield adequate estimates of the volume transport. To get some further insight into the reliability of reference level assumptions, the 1983 survey was performed to provide sections which form closed large scale boxes. The inclusion of conservation of mass and dissolved substances in the transport calculation should allow more accurate estimates. Furthermore the sections parallel and perpendicular to the ridge should yield information on the influence of the bottom topography on the current structure.

Similar ideas had lead the group of M. Arhan and A. Colin de Vérdière belonging to the Centre Oceanologique de Bretagne (COB) to establish the "Topogulf"-program. Their program included CTD measurements, moored current meter work and the use of SOFAR floats. Close cooperation with this group resulted in a CTD survey from 24°N to 53°N. Unfortunate weather conditions did not allow us to survey the area up to the Subpolar Front in 1983.

Consequently the field work during 1984 was designed to yield a large scale survey box on the Mid-Atlantic Ridge which should include the Subpolar Front. This was be archieved during the R.V. "Meteor"-cruise M69/2.

During this year the area under investigation was extended towards the west. In cooperation with the Estonian R.V. "Arnold Veimer", R.V. "Poseidon" surveyed the North Atlantic Current east and southeast of Flemish Cap as far west as the Newfoundland continental slope (Fig. 1).

The current meter work was done on board R.V. "Meteor". Twelve current meter moorings laid in 1983 in clusters along 48°N were recoverd (Fig. 2). Each cluster was replaced by a single mooring. Long term mooring 265 which was included in the cluster at 25°W was replaced. Mooring 280 at the Gibbs-Fracture-Zone was reinstalled after an interuption of one year. A further mooring (305) was laid about 60 nm north of mooring 280.

In this report only the data obtained on board R.V. "Poseidon" and R.V. "Meteor" are presented. The cruises are summarized in table 1. After the processing of a complete data set a French-German report on the "Topogulf" data will be published.

Ship	Cruise No.	Observation Period	Area	Activity
R.V. "Poseidon"	111/2	02-24 Aug. 84	Southeast of Flemish Cap	CTD, XBT, launching of sat.-tracked drifters, GEK.
R.V. "Meteor"	69/2	27 July - 24 Aug. 84	Mid-Atlantic Ridge north of the Azores	CTD, water samples for oxygen, nutrients and tracers, recovery and laying of moorings.

Table 1: Cruises carried out during 1984.

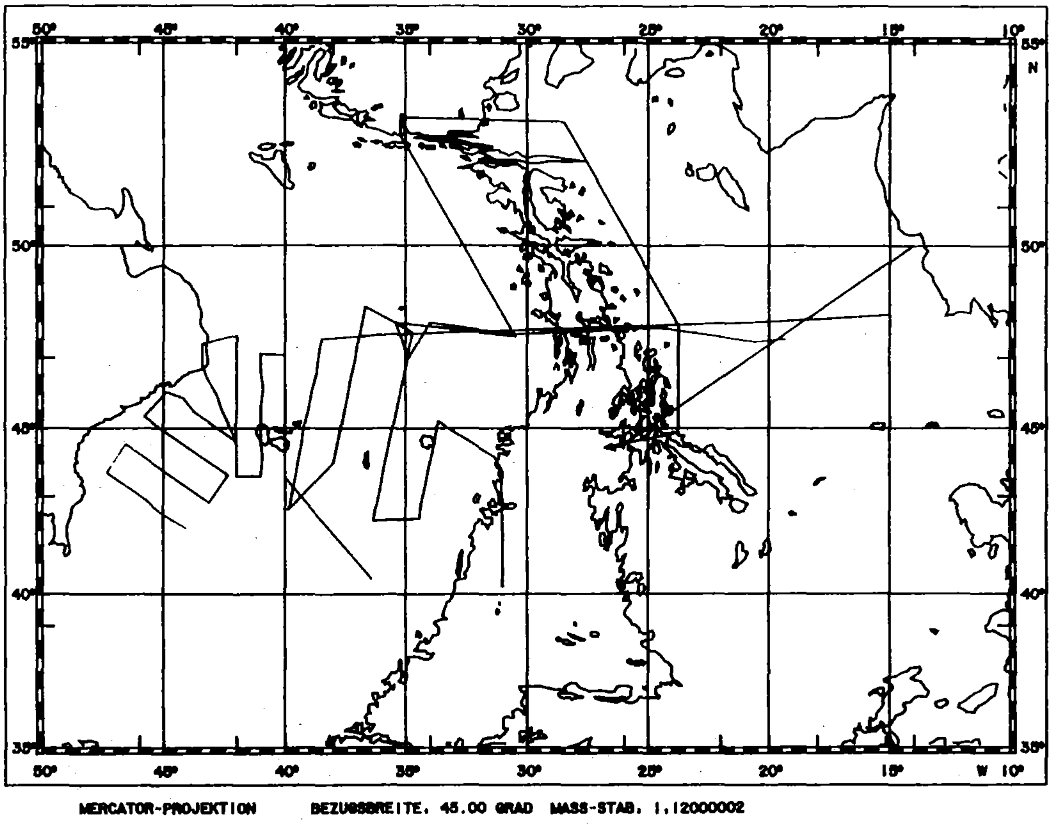


Fig. 1: The cruise tracks of R.V. "Arnold Veimer", R.V. "Meteor" and R.V. "Poseidon" during 1984.

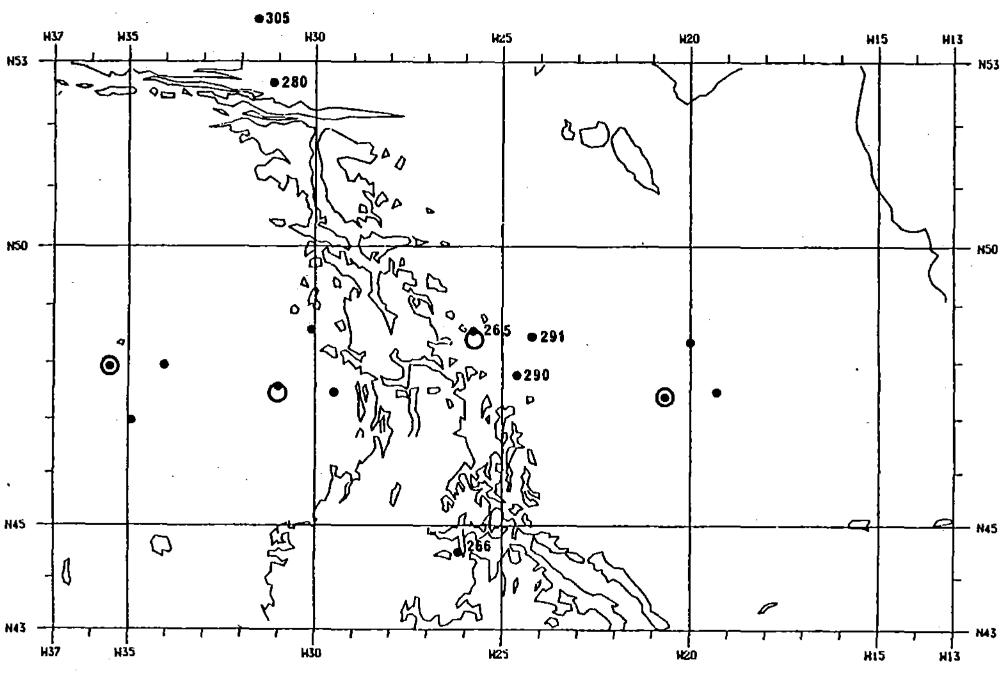


Fig. 2: Location of current meter moorings recovered • and laid ○ by R.V. "Meteor".

2. Hydrographic measurements

The CTD-systems used in this project consisted of "Multisondes" which are manufactured by "Meereselektronik", Trappenkamp, West Germany. It is a commercialized version of a system which was developed in the Institut für Angewandte Physik at the University of Kiel (KROEBEL et al., 1976). Because the obtained raw data showed serious off-sets and a high noise level, intensive despiking and corrections were necessary. The various "Multisondes" provide a rather different data quality which required different processing of the "Meteor" and "Poseidon" data sets.

To control the data quality, reference measurements were carried out on both ships using "General Oceanic" rosette water samplers with 12 bottles. The samples have been analysed with a "Guildline Autosal Laboratory Salinometer". The calculation of salinity was done using the practical salinity formula (UNESCO,1981). The in situ pressure comparisons are carried out by a zero pressure level check. Neither temperature comparison nor thermometric depth calculations, on the basis of reversing thermometer observations, gave significant deviations from the laboratory calibration.

The quality of data during the individual cruises is discussed in chapter 2.1 and 2.2. The data are presented by station lists, station maps and vertical sections in chapter 2.3. Anthropogenic tracers are not included in this report. The vertical sections are drawn from data with a vertical interval of 20 dbar and are horizontally smoothed by a smoothing spline interpolation.

2.1 CTD measurements during P111/2

On board R.V. "Poseidon" CTD's MS1 and MS35 were used. Both instruments showed an offset of about 0.1 mS/cm which therefore requiered careful insitu calibrations. It came out, that the offset was not stable but drifted from station to station (Fig. 3) This required an individual correction of each profile.

The quality of the correction was restricted by various reasons:

- Unrealiability of the rosette sampler, which did not allow control of the individual bottle to close at the correct level. Serious errors due to this effect could be excluded by using the measurements from the reversing thermometers at four depths. Further the vertical salinity differences obtained from the CTD profiles and the samples were compared.

- Some bottles did not remain closed. Serious errors could be detected by comparing the vertical salinity differences of the samples and the CTD profiles. But it must be assumed that small errors of 0.01 - 0.02 are not detected.

- The salinity determination on board suffered from various problems. Most important was insufficient air conditioning, which caused a high noise level in the salinometer readings. Various leaking pipe connections had to be repaired. It must be assumed that small errors were induced before the leaks were detected. Finally bubbles in the cell, which occured frequently, might have been overlooked.

A further error source was detected when the salinity or conductivity measurements of the hoisting and the lowering profiles were compared on constant temperature levels. As most of the samples are taken at less than 1000 m depth comparison at potential temperatures did not yield better results. It had to be concluded, that the conductivity sensors were subject to a temperature or a pressure effect or even both. Consequently the correction data could not be derived from the hoisting profiles when the water samples were taken, but from the lowerings under the assumption of the TS-relation to be constant in time. As this assumption does not necessarily hold in the upper ocean, a further uncertainty is introduced in the corrections.

Finnaly low period oscillations on the temperature measurements were detected which are due to electronic malfunctions of the data transmission within the CTD. This affected both the lowering as the hoisting readings.

Having in mind the limited accuracy which can be expected under these conditions only a reducted data set was processed. It was aquired on board by a "DEC Professional 350" Personal Computer with a data rate of about 1 cycle per 5 db. Spikes were removed using a median filter combined with a maximum difference criterion (SY, 1985). Some spikes, which were too broad, to be detected by the program were hand edited. The edited data were then interpolated on 5 m intervals. Corrections in conductivity or salinity are applied to the interpolated data.

The observed salinity and conductivity differences between Multisonde and water samples varied with time (Fig. 3) and with depth and temperature. Multiple linear regressions did not yield significant results. Therefore linear regressions between the observed differences and pressure, logarithm of pressure and temperature were calculated for each individual station. The most simple correction curve was selected to reduce the influence of erroneous differences. The corrections were calculated in the following order: Corrections constant with depth, linear with depth, linear with temperature and logarithmic with pressure. A correction was selected when it yielded a mean difference between the corrected "Multisonde" values and the sample data smaller than 0.01. An standard deviation of the differences smaller than 0.02 had to be obtained. In two cases 0.022 and 0.027 where accepted because the large differences occured in depth levels where conservation of TS-relation seems doubtful. Stations which yielded higher deviations were rejected. In table 2 the applied corrections and there result are summarized.

Station	Multisonde	corrected parameter	lowering hoisting	type of correction	Number of salinity samples	A	B	average difference after correction	R.M.S. difference
645	1	C	L	P	9	-0.089	$0.789 \cdot 10^{-5}$	0.000	0.013
652	1	C	L	P	10	-0.095	$0.976 \cdot 10^{-5}$	0.000	0.009
675	1	C	L	P	4	-0.094	$0.708 \cdot 10^{-5}$	-0.001	0.010
678	1	C	L	P	10	-0.068	$0.094 \cdot 10^{-5}$	0.000	0.015
680	1	C	L	T	8	-0.054	$-5.826 \cdot 10^{-3}$	0.000	0.012
683	1	C	L	T	8	-0.071	$-2.119 \cdot 10^{-3}$	0.000	0.011
684	1	no correction possible							
686	35	C	H	CON	11	-0.08	-	0.001	0.007
688	35	C	H	CON	10	-0.08	-	0.001	0.005
690	35	C	H	CON	10	-0.08	-	0.002	0.004
692	35	C	H	CON	9	-0.08	-	-0.002	0.004
694	35	C	H	CON	10	-0.08	-	0.008	0.014
696	35	C	H	CON	10	-0.08	-	-0.006	0.015
698	35	C	H	CON	4	-0.08	-	-0.001	0.002
706	35	C	H	CON	4	-0.09	-	0.001	0.008
708	35	C	H	CON	4	-0.09	-	0.002	0.004
710	35	C	H	T	3	-0.075	$-0.806 \cdot 10^{-3}$	0.002	0.005
712	35	S	L	LNP	4	-0.171	$1.168 \cdot 10^{-2}$	0.000	0.011
714	35	S	L	LNP	3	-0.207	$1.731 \cdot 10^{-2}$	0.001	0.002
716	35	S	L	LNP	3	-0.042	$-0.752 \cdot 10^{-2}$	0.000	0.001
718	35	S	L	LNP	4	-0.055	$-0.597 \cdot 10^{-2}$	0.000	0.007
720	35	S	L	LNP	4	-0.036	$-0.802 \cdot 10^{-2}$	0.000	0.002
722	35	S	L	LNP	4	-0.018	$-1.117 \cdot 10^{-2}$	0.000	0.005
724	35	S	L	CON	4	-0.105	-	0.005	0.010
730	35	S	L	LNP	4	-0.064	$-0.445 \cdot 10^{-2}$	0.000	0.008
732	35	S	L	LNP	3	-0.192	$1.374 \cdot 10^{-2}$	0.005	0.022
734	35	S	L	LNP	4	-0.201	$1.190 \cdot 10^{-2}$	0.000	0.014
736	35	S	L	CON	4	-0.103	-	-0.003	0.008
738	35	S	L	LNP	4	-0.586	$6.334 \cdot 10^{-2}$	0.000	0.013
740	35	S	L	LNP	4	-0.205	$1.360 \cdot 10^{-2}$	0.000	0.027
742	35	S	L	LNP	4	-0.241	$1.892 \cdot 10^{-2}$	0.000	0.009
744	35	no correction possible							
746	35	no correction possible							
748	1	C	L	P	3	-0.085	$2.525 \cdot 10^{-5}$	0.000	0.005
750	1	C	L	P	6	-0.092	$1.690 \cdot 10^{-5}$	0.000	0.003
752	1	no correction possible							
758	1	C	L	CON	4	-0.07	-	0.002	0.008
760	1	C	L	P	10	-0.072	$1.274 \cdot 10^{-5}$	0.000	0.014
762	1	C	L	P	8	-0.091	$2.479 \cdot 10^{-5}$	0.000	0.011
764	1	C	L	P	7	-0.097	$3.321 \cdot 10^{-5}$	0.000	0.012
766	1	C	L	P	12	-0.095	$3.345 \cdot 10^{-5}$	0.000	0.011
768	1	C	L	P	7	-0.078	$0.066 \cdot 10^{-5}$	0.000	0.010
770	1	C	L	T	4	-0.023	$-7.122 \cdot 10^{-3}$	0.000	0.021
772	1	C	L	T	3	0.014	$-8.545 \cdot 10^{-3}$	0.000	0.002
774	1	C	L	P	3	-0.101	$1.48 \cdot 10^{-5}$	0.000	0.003
776	1	no correction possible							
778	1	no correction possible							

Station	Multisonde	corrected parameter	lowering hoisting	type of correction	Number of salinity samples	A	B	average difference after correction	R.M.S. difference
780	1	C	L	T	4	-0.021	$-7.031 \cdot 10^{-3}$	0.000	0.018
782	1	C	L	CON	3	-0.095	-	0.000	0.018
784	35	C	H	CON	4	-0.100	-	0.001	0.004
786	35	C	H	P	4	-0.106	$1.033 \cdot 10^{-5}$	0.000	0.004
788	35	C	H	T	4	-0.084	$-1.41 \cdot 10^{-3}$	0.000	0.007
790	35	C	H	P	4	-0.113	$1.810 \cdot 10^{-5}$	0.000	0.002
792	35	C	H	CON	4	-0.080	-	-0.003	0.007
794	35	C	H	CON	4	-0.100	-	-0.005	0.009

Table 2: Summary of the corrections applied on the Multisonde profils showing the used Multisonde, the parameter on which the corrections were applied (salinity or conductivity), Multisonde measurements which were compared with the salinometer values from the hoisting (H) or lowering (L) profile, type of correction D, average difference between the corrected profil and the salinometer values,
standard deviation of differences.

CON = constant error $D = A$,
P = linear dependence pressure $D = A + B \cdot P$
LNP = logarithmic dependence on pressure $D = A + B \cdot \ln(P)$
T = linear dependence on temperature $D = A + B \cdot T$,

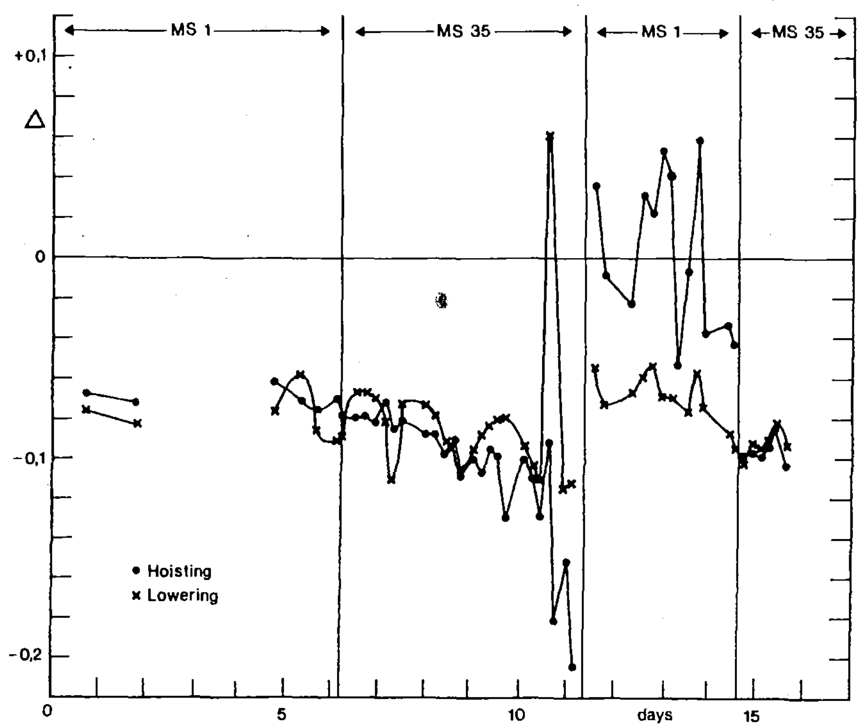


Fig. 3: Vertical mean deviation between the salinity samples and the C T D measurements during P111/2. Hoisting data represent records before closing the bottle, lowing data are selected on the profile at the same temperature as the bottle was closed.

2.2. CTD, oxygen and nutrient measurements during M69/2

For the measurements of all CTD profiles during the cruise "Meteor" No. 69 leg 2 the "Multisonde" MS45 was used without serious problems except a drift of 0.05 in salinity over 23 days, which was caused by a drift in conductivity. To identify and to correct this instrumental drift reference measurements were carried out using a "General Oceanic" rosette water sampler. A total of 350 samples have been analysed on board with a "Guildline Autosal Laboratory Salinometer". The calculation of salinity was done using the practical salinity formula (UNESCO, 1981).

The in-situ temperature comparison was done by means of reversing thermometers which were calibrated just one month before. This comparison was performed mainly at two depths (500 dbar and 1100 dbar) with some exceptions in the deep water. In all 120 temperature measurements were compared from 21 thermometers used in a rotating mode to increase the statistical independence. The deviation from the laboratory calibration was smaller than 0.01 K and not significant. Thus no correction was applied.

The pressure correction was restricted to a zero pressure level correction of $P = 3.0$ dbar. The in situ pressure comparison was done by means of 10 protected and 21 unprotected thermometers at the above mentioned two pressure levels. The mean deviation from the laboratory calibration was $P = 13.6 \pm 6.5$ dbar. This is composed of the offset (3.0 dbar, observed on deck before lowering), the hysteresis (3.0 dbar maximum), the error according to manufacturer's declaration of 0.35 % of the pressure range and an error which was proved during this cruise to be due to the temperature dependence of the pressure sensor of about 10 dbar. Because the pressure correction was restricted to the zero pressure level check an error of 10 dbar has to be taken into account.

Oxygen measurements were carried out by means of "Winckler Titration" on water samples collected with the rosette water sampler in 12 levels and the nutrients, silicate, phosphate and nitrate by means of an automated system (AKEA automatic chemical analysis system). Since the oxygen content in the deep and bottom waters is high, degassing could occur if the trapped samples were heated above their saturation temperature (WORTHINGTON, 1982). According to the tables of GREEN and CARRIT (1967) for our data the saturation temperature is not below 6°C. Thus, having the uppermost sampling at 180 dbar depth, no stop over in the warm mixed layer and bottling the deep samples first, we are sure that we avoided any danger of depassing of oxygen. The nutrient analysis was performed according to the procedures described by GRASSHOFF et al. (1983).

The standards were prepared from destillated water and nutrient poor surface seawater. They were used for calibration every 10 samples. One station (#86) at the end of the cruise was used to estimate the precision of the oxygen and nutrient samples. The obtained values are shown in table 4 and are close to the analytical precision reported by GRASSHOFF et al. (1983).

The processing of CTD data was done along the line of the Technical Report about handling and processing of hydrographic data (SY, 1983) and is documented in a flow diagramm (Fig. 4). Because the data showed a high noise level in intermediate depths, especially in the main thermocline, the application of the median filter (SY, 1985) was necessary. The fastest possible lowering speed for the "Multisonde" without rosette sampler is about 2 m/sec. The rosette water sampler mounted on top of the CTD changed the form drag of the instrument body significantly. When the lowering speed exceeded 1.3 m/sec, the descent became unstable. Due to the lateral or staggering motion of the CTD the distorted flow in and around the conductivity cell increased the noise level. Finally an additional correction was applied to the processed data (not documented in the flow diagram) to eliminate errors due to differences of the hoisting and lowering profile which seems to be caused by a pressure or temperature effect of the conductivity sensor. The accuracy of the final data is shown in Table 3.

CTD Processing Cruise M69/2

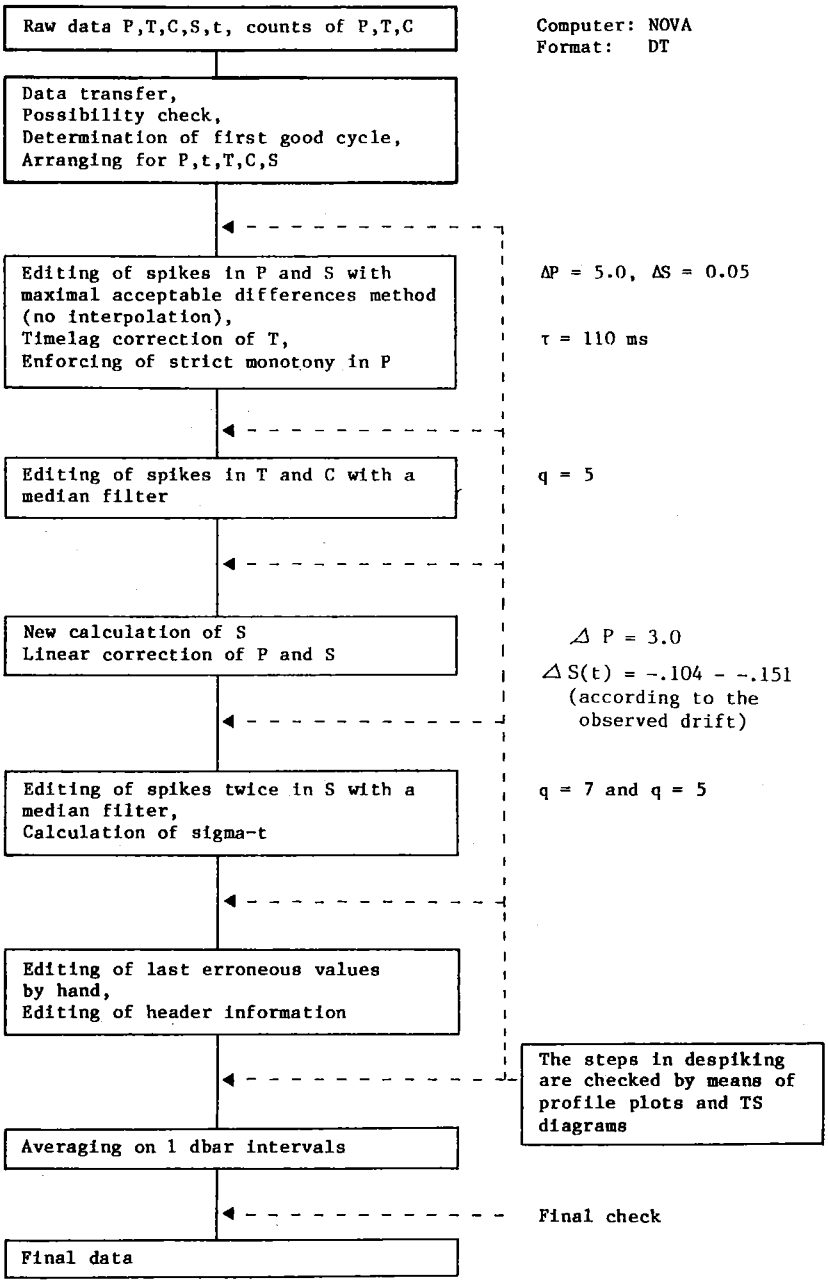


Fig. 4: Flow diagram representing CTD-processing during "Meteor" cruise M69/2

	According to manufacturer's declaration	Final data P111/2 MS1	Final data P111/2 MS35	Final data M69/2 MS45
employed Multisonde		MS1	MS35	MS45
Pressure:				
Principle	Strain-Gauge Pressure Cell			
Range	0 - 6000 dbar			
Resolution	0.2 dbar	5.0		1.0 dbar
Accuracy	0.35 % of range	10.0		10.0 dbar
Temperature:				
Principle	Platinum Resistance			
Range	-2.0 °C - +35.0 °C			
Time lag	60 ms (without protecting sheat)			
Resolution	1 mK			
Long Term Stability	±5 mK/0.5 y			
Accuracy	±5 mK	±10 mK		±10 mK
Conductivity:				
Principle	Symmetric Electrode Cell			
Range	5 - 55 mS/cm			
Resolution	2 µS/cm			
Long Term Stability	±10 µS/cm/0.5 y			
Accuracy	±5 µS/cm			
Salinity:				
Accuracy		$\pm 0.02 \cdot 10^{-3}$		$\pm 0.01 \cdot 10^{-3}$

Table 3: Technical data of the "Multisonde" MS1 and MS 35 used during P111 and MS45 during M69/2 and quality of final CTD data.

	mean	rms	coeff. of variation [%]
Oxygen (ml/l)	5.05	0.043	0.85
Nitrate (µmol/l)	16.3	0.18	1.1
Phosphate (µmol/l)	0.93	0.024	2.6
Silicate (µmol/l)	7.8	0.26	3.3
pH	8.09	0.008	0.1

Table 4: Estimated mean and standard deviation of oxygen and nutrients calculated from 12 samples in the level in 700 dbar.

2.3 Data Presentation

2.3.1 Cruise P111/2

STATION LIST

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Poseidon" Cruise 111/2			
04.08.	1612	638	48 20.9 N	09 40.8 W	1341	XBT1, Start GEK
	1913	639	48 20.1	10 25.2	2286	XBT2
	2208	640	48 18.4	11 10.8	3188	XBT3
05.08.	0100	641	48 16.3	11 56.7	3056	XBT4
	0339	642	48 15.2	12 41.6	2970	XBT5
	0622	643	48 12.4	13 24.1	4519	XBT6
	1252	644	48 11.3	14 11.7	4707	XBT7
	1529-2110	645	48 09.6	14 54.7	4814	XBT8, MS 1
	2351	646	48 08.6	15 39.0	4815	XBT9
06.08.	0234	647	48 06.7	16 24.6	4550	XBT10
	0515	648	48 05.1	17 09.0	4667	XBT11
	0807	649	48 05.7	17 52.2	4410	XBT12
	1107	650	48 03.8	18 36.8	4586	XBT13
	1347	651	48 00.4	19 22.0	4501	XBT14
	1604-1816	652	47 58.0	19 59.5	4312	MS 1
	1822	653	47 57.9	20 06.6	4302	XBT15
	2120	654	47 56.3	20 48.2	4336	XBT16
07.08	0002	655	47 55.3	21 33.0	4448	XBT17
	0237	656	47 53.4	22 16.8	4450	XBT18
	0531	657	47 51.0	23 01.1	4375	XBT19
	0819	658	47 50.1	23 44.3	4242	XBT20
	1120	659	47 49.0	24 28.4	3424	XBT21
	1429	660	47 50.1	25 16.2	3330	XBT22
	1714	661	47 45.5	25 58.0	3445	XBT23
	2010	662	47 44.0	26 40.8	2050	XBT24
	2322	663	47 42.6	27 25.0	2357	XBT25
08.08	0229	664	47 41.0	28 02.2	3165	XBT26
	0541	665	47 39.4	28 52.6	2724	XBT27
	0847	666	47 36.7	29 35.7	3536	XBT28
	1152	667	47 36.1	30 20.3	3204	XBT29
	1436	668	47 38.5	31 03.2	3480	XBT30
	1729	669	47 41.0	31 47.3	3775	XBT31
	2022	670	47 45.4	32 29.4	4116	XBT32
	2200		47 45.4	32 58.1		Stop GEK
09.08.	0012		47 45.5	33 06.3		Start GEK
	0059	671	47 45.5	33 13.9	4207	XBT33
	0406	672	47 43.2	33 57.3	4403	XBT34
	0730	673	47 41.0	34 43.0	4178	XBT35
	1030	674	47 38.6	35 27.2	4271	XBT36
	1338-1657	675	47 36.6	36 11.2	4267	MS 1, XBT37
	2041					GEK Stop
	2055	676	47 34.5	36 55.8	4247	XBT38
	2104		47 34.3	36 56.7	4223	DR 3570 launched
	2120					Start GEK
10.08.	0113	677	47 36.6	37 44.3	4625	XBT39
	0525-0843	678	47 30.2	38 29.0	4600	MS 1,XBT40

The GEK record was interupted during each Multisonde-station. Only exceptional interruptions are reported in the present list.

STATION LIST

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Poseidon" Cruise 111/2			
10.08.	1018	679	47 15.3 N	38 33.2 W	4596	XBT41
	1127-1417	680	47 01.9	38 36.8	4600	MS 1 DR 3573 launched, XBT42
	1703	681	46 46.7	38 41.8	4577	XBT43
	1752-2045	682	46 32.4	38 42.2	4577	MS 1,DR 3568 launched, XBT44
	2240	683	46 16.2	38 51.0	4533	XBT45
11.08	0002-0213	684	46 02.1	38 54.6	4552	MS 1 DR 3529 launched XBT46
	0346	685	45 45.9	38 59.1	4546	XBT47
	0512-0726	686	45 32.0	39 03.4	4530	MS 35, DR 3547 launched, XBT48
	0856	687	45 17.2	39 08.8	4005	XBT49
	1039-1221	688	45 01.9	39 14.7	3750	MS 35 DR 3593 launched XBT50
	1347	689	44 46.7	39 15.2	4156	XBT51
	1510-1729	690	44 33.6	39 19.2	4138	MS 35 DR 3516 launched XBT52
	1852	691	44 18.0	39 23.1	3775	XBT53
	2022-2155	692	44 04.7	39 28.0	4566	MS 35 DR 3591 launched XBT54
	2328	693	43 48.8	39 32.0	4579	XBT55
12.08.	0052-0316	694	43 35.5	39 35.1	4593	MS 35 DR 3506 launched XBT56
	0449	695	43 20.6	39 39.9	4484	XBT57
	0615-0752	696	43 05.9	39 43.6	4634	MS 35 DR 3576 launched XBT58
	0911	697	42 51.3	39 48.0	4736	XBT59
	1041-1231	698	42 36.1	39 52.5	4950	MS 35 DR 3589 launched XBT60
	1410	699	42 47.3	39 37.0	4441	XBT61
	1515	700	42 58.1	39 22.6	4269	XBT62
	1636	701	43 08.2	39 08.9	4365	XBT63
	1757	702	43 19.1	38 55.0	4457	XBT64
	1928	703	43 29.7	38 38.0	4842	XBT65
	2047	704	43 40.5	38 27.2	3917	XBT66
	2211	705	43 51.4	38 11.9	4126	XBT67
13.08.	2320-0049	706	43 59.9	38 00.2	4336	MS 35, XBT 68

STATION LIST

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Poseidon" Cruise 111/2			
13.08.	0224	707	44 16.5 N	37 54.8 W	4167	XBT 69
	0338-0500	708	44 28.6	37 51.1	4192	MS 35, XBT 70
	0631	709	44 44.1	37 47.1	4090	XBT 71
	0752-0910	710	44 58.1	37 42.7	4119	MS 35, XBT 72
	1033	711	45 13.4	37 38.4	4281	XBT 73
	1202-1330	712	45 27.7	37 33.8	4376	MS 35, XBT 74
	1506	713	45 42.0	37 30.3	4293	XBT 75
	1655-1818	714	45 57.1	37 25.0	4574	MS 35, XBT 76
	1958	715	46 12.2	37 20.9	4574	XBT 77
	2129-2248	716	46 26.5	37 16.5	4641	MS 35, XBT 78
14.08.	0013	717	46 41.4	37 14.4	4461	XBT 79
	0144-0322	718	46 55.6	37 05.7	4405	MS 35, XBT 80
	0437	719	47 09.9	37 04.1	4477	XBT 81
	0600-0720	720	47 24.1	36 59.4	4305	MS 35, XBT 82
	0833	721	47 38.6	36 54.6	4174	XBT 83
	1002-1116	722	47 55.0	36 48.9	4448	MS 35, XBT 84
	1234	723	48 08.7	36 45.9	4290	XBT 85
	1406-1543	724	48 22.6	36 40.6	4114	MS 35, XBT 86
	1654	725	48 15.7	36 26.7	4309	XBT 87
	1815	726	48 09.5	36 01.2	4421	XBT 88
	1930	727	48 01.9	35 48.2	4320	XBT 89
	2055	728	47 53.9	35 20.8	4371	XBT 90
	2215	729	47 47.1	35 00.9	4192	XBT 91
	2331-0104	730	47 41.0	34 43.2	4210	MS 35, XBT 92
15.08.	0220	731	47 26.3	34 47.0	4126	XBT 93
	0352-0517	732	47 12.3	34 52.0	4162	MS 35, XBT 94
	0633	733	46 57.3	34 56.0	4401	XBT 95
	0748-0910	734	46 42.4	34 58.7	4349	MS 35, XBT 96
	1020	735	46 28.1	35 05.4	4405	XBT 97
	1137-1304	736	46 13.4	35 10.1	4136	MS 35, XBT 98
	1430	737	45 58.4	35 15.0	4208	XBT 99
	1557-1728	738	45 44.0	35 19.2	4140	MS 35, XBT 100
	1851	739	45 28.8	35 24.2	4024	XBT 101
	2012-2130	740	45 14.2	35 28.4	4363	MS 35, XBT 102
	2254	741	44 58.7	35 33.0	3861	XBT 103
16.08.	0015-0150	742	44 44.5	35 38.1	3961	MS 35, XBT 104
	0304	743	44 29.5	35 41.8	3983	XBT 105
	0429-0548	744	44 14.4	35 47.3	3817	MS 35, XBT 106
	0703	745	44 00.8	35 50.7	3732	XBT 107
	0830-1030	746	43 44.8	35 56.4	3850	MS 35, XBT 108
	1155	747	43 29.8	36 00.0	3926	XBT 109
	1347-1453	748	43 15.3	36 03.8	3809	MS 1, XBT 110
	1629	749	42 59.9	36 09.0	4190	XBT 111
	1800-1916	750	42 45.4	36 12.9	4131	MS 1, XBT 112
	2042	751	42 31.0	36 12.0	4076	XBT 113
	2200-2318	752	42 16.3	36 21.2	4000	MS 1, XBT 114
17.08.	0042	753	42 16.8	36 01.5	4412	XBT 115
	0154	754	42 17.4	35 40.5	3908	XBT 116

STATION LIST

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Poseidon" Cruise 111/2			
17.08.	0332	755	42 18.9 N	35 15.6 W	4406	XBT 117
	0434	756	42 19.0	35 00.4	4329	XBT 118
	0553	757	42 19.2	34 40.2	3944	XBT 119
	0638-0757	758	42 20.2	34 24.9	4016	MS 1, XBT 120
	0939	759	42 34.3	34 25.3	3904	XBT 121
	1136-1320	760	42 48.9	34 21.8	3772	MS 1 DR 3590 launched XBT 122
	1431	761	43 03.7	34 16.2	2759	XBT 123
	1614-1743	762	43 18.1	34 12.3	3567	MS 1, XBT 124
	1914	763	43 33.3	34 07.0	3734	XBT 125
	2051-2216	764	43 47.0	34 04.3	3700	MS 1, XBT 126
	2349	765	44 01.9	33 59.5	3701	XBT 127
18.08	0135-0302	766	44 15.3	33 54.5	3497	MS 1, XBT 128
	0437	767	44 29.9	33 51.0	3023	XBT 129
	0620-0746	768	44 44.1	33 46.5	3448	MS 1, XBT 130
	0926	769	44 58.7	33 43.1	3617	XBT 131
	1104-1303	770	45 12.4	33 40.1	3790	MS 1, XBT 132
	1350	771	45 01.0	33 20.9	3664	XBT 133
	1508-1619	772	44 55.9	33 05.7	3089	MS 1, XBT 134
	1744	773	44 47.3	32 44.8	3449	XBT 135
	1859-2004	774	44 41.2	32 29.5	3629	MS1, XBT 136
	2126	775	44 32.3	32 10.6	3444	XBT 137
19.08.	2249-0019	776	44 24.2	31 52.8	3384	MS 1, XBT 138
	0142	777	44 16.0	31 35.7	3083	XBT 139
	0303-0450	778	44 09.4	31 18.3	4015	MS 1, XBT 140
	0615	779	43 59.4	31 00.7	3035	XBT 141
	0745-0900	780	43 45.0	31 00.0	2894	MS 1, XBT 142
	1025	781	43 30.0	31 01.4	2889	XBT 143
	1154-1310	782	43 15.2	31 03.3	3097	MS 1, XBT 144
	1438	783	43 00.0	31 00.0	2760	XBT 145
	1554-1724	784	42 45.5	31 00.4	3040	MS 35, XBT 146
	1844	785	42 30.0	31 00.0	3053	XBT 147
	2005-2126	786	42 15.0	31 00.0	2773	MS 35, XBT 148
	2241	787	42 00.0	31 00.0	2745	XBT 149
20.08.	0004-0130	788	41 47.7	30 58.9	2515	MS 35, 150
	0308	789	41 28.5	31 00.0	1972	XBT 151
	0422-0552	790	41 15.8	31 00.0	2236	MS 35, XBT 152
	0712	791	41 00.0	31 00.0	2152	XBT 153
	0833-0948	792	40 45.2	30 59.9	2385	MS 35, XBT 154
	1105	793	40 30.0	31 00.5	2207	XBT 155
	1233-1359	794	40 15.3	31 00.8	2091	MS 35, XBT 156
	1502	795	40 00.9	30 59.9	2120	XBT 157
	1617	796	39 45.0	31 00.0	1691	XBT 158
	1734	797	39 30.5	30 59.7	1638	XBT 159
	1853	798	39 15.0	31 00.0	1736	XBT 160
	2019	799	39 10.3	30 41.9	2019	XBT 161
	2150	800	39 05.9	30 23.1	2053	XBT 162

S T A T I O N   L I S T

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Poseidon" Cruise 111/2			
20.08.	2334	801	39 00.2 N	30 00.0 W	994	XBT 163
21.08.	0106	802	39 14.9	29 59.8	1349	XBT 164
	0225	803	39 29.0	30 00.9	2397	XBT 165
	0348	804	39 04.2	30 00.1	-	XBT 166
	0512	805	39 59.7	29 59.8	1687	XBT 167
	0635	806	39 48.8	29 47.5	1555	XBT 168
	0755	807	39 34.6	29 35.8	1765	XBT 169
	0901	808	39 27.0	29 23.0	1988	XBT 170
	1031	809	39 37.0	29 08.0	1570	XBT 171
	1206	810	39 46.8	28 54.0	1978	XBT 172
	1333	811	39 32.9	28 49.0	1404	XBT 173
	1419		39 32.9	28 46.1		Stop GEK
	1516	812	39 18.1	28 42.5	1639	XBT 174
	1630	813	39 02.5	28 38.5	1545	XBT 175

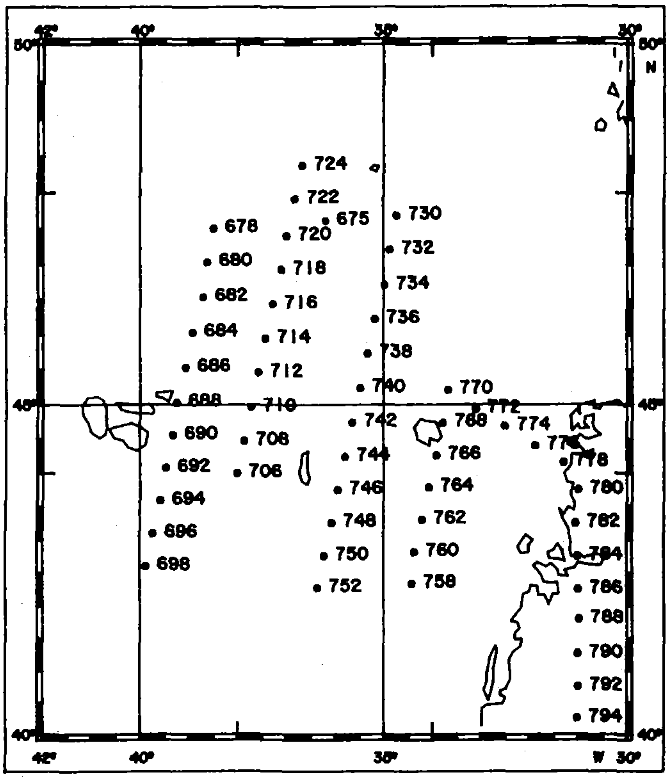


Fig. 5: Station map during P111/2.

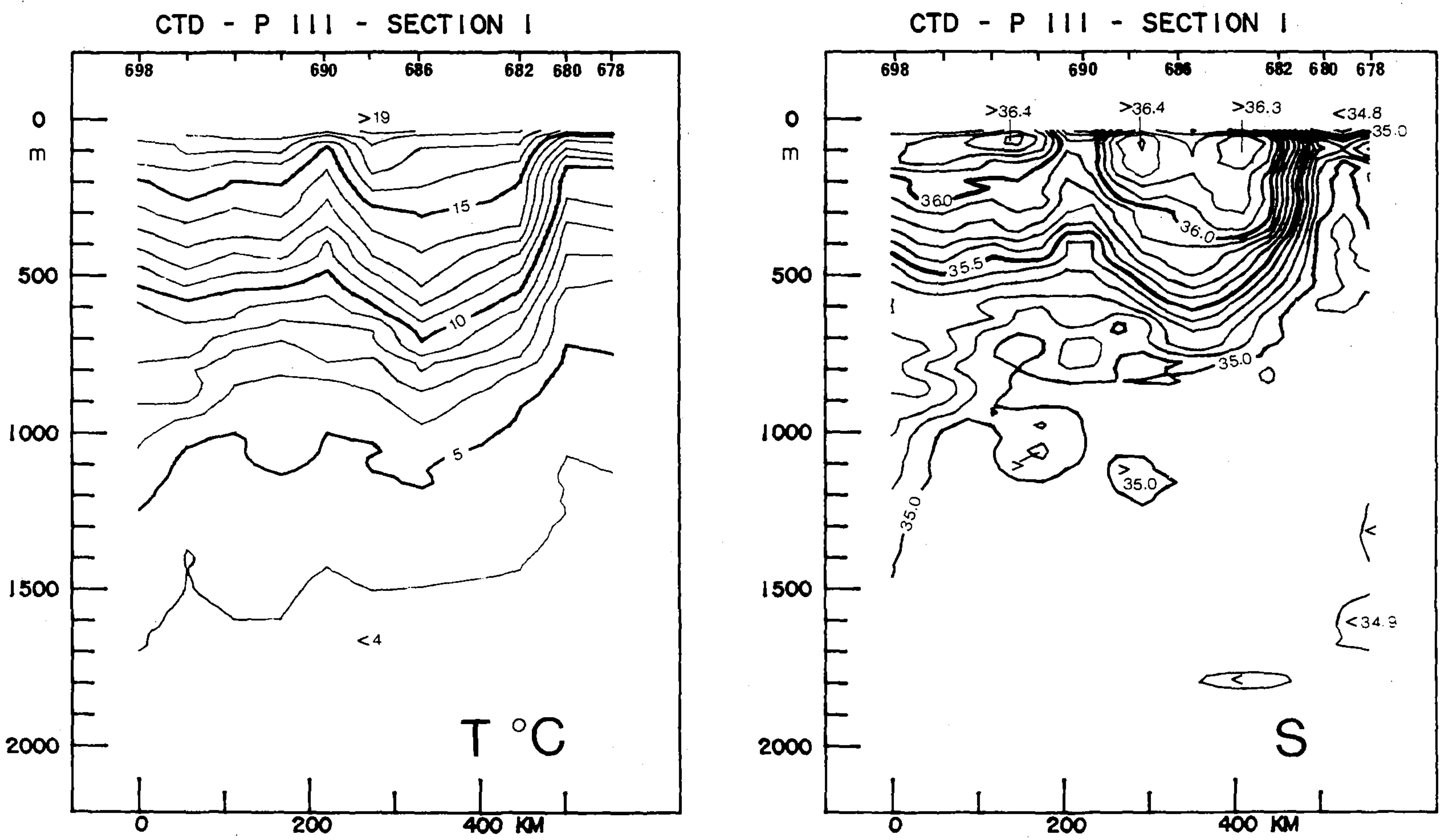
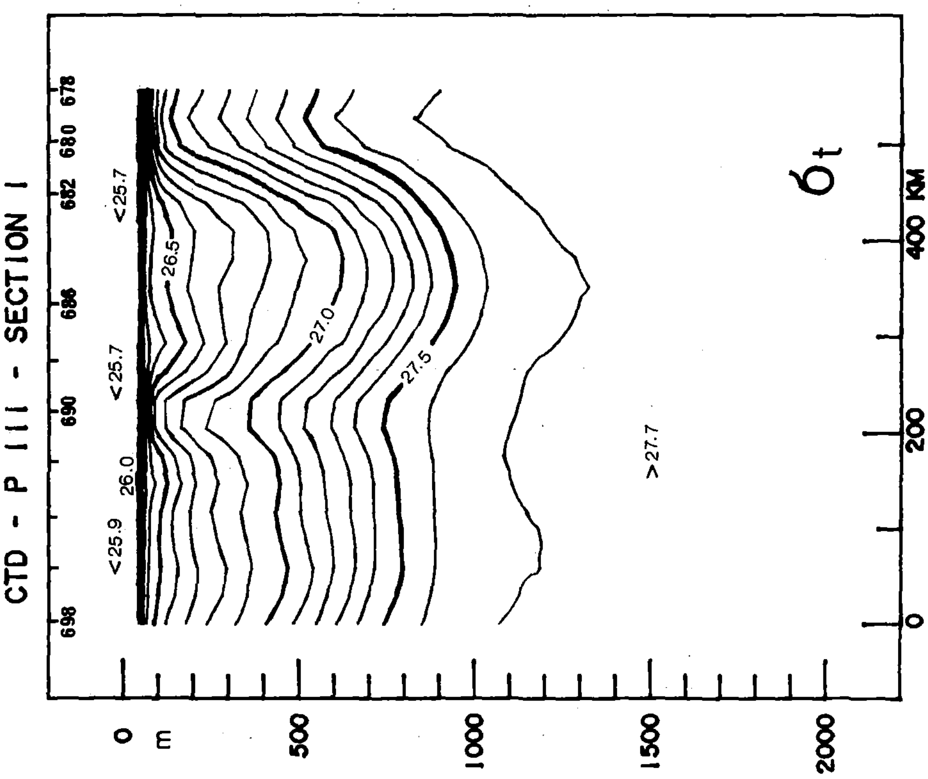
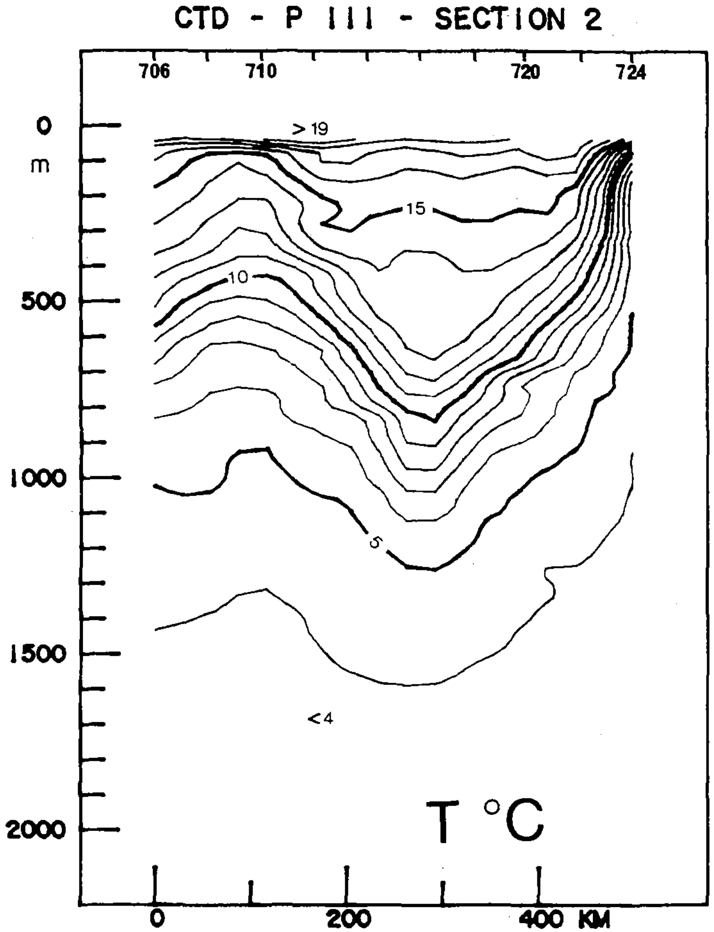
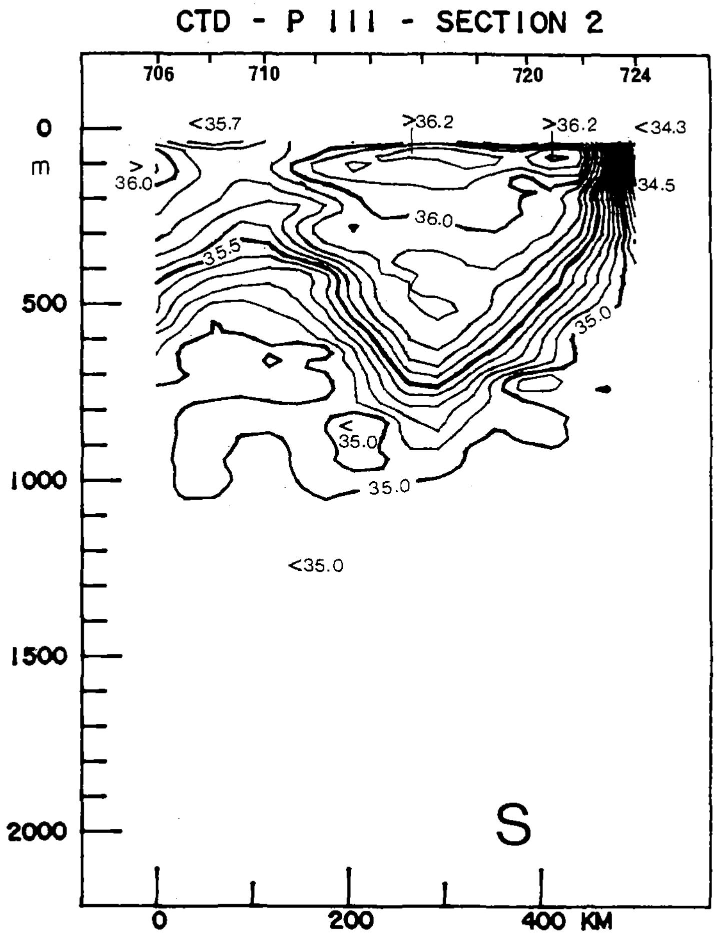
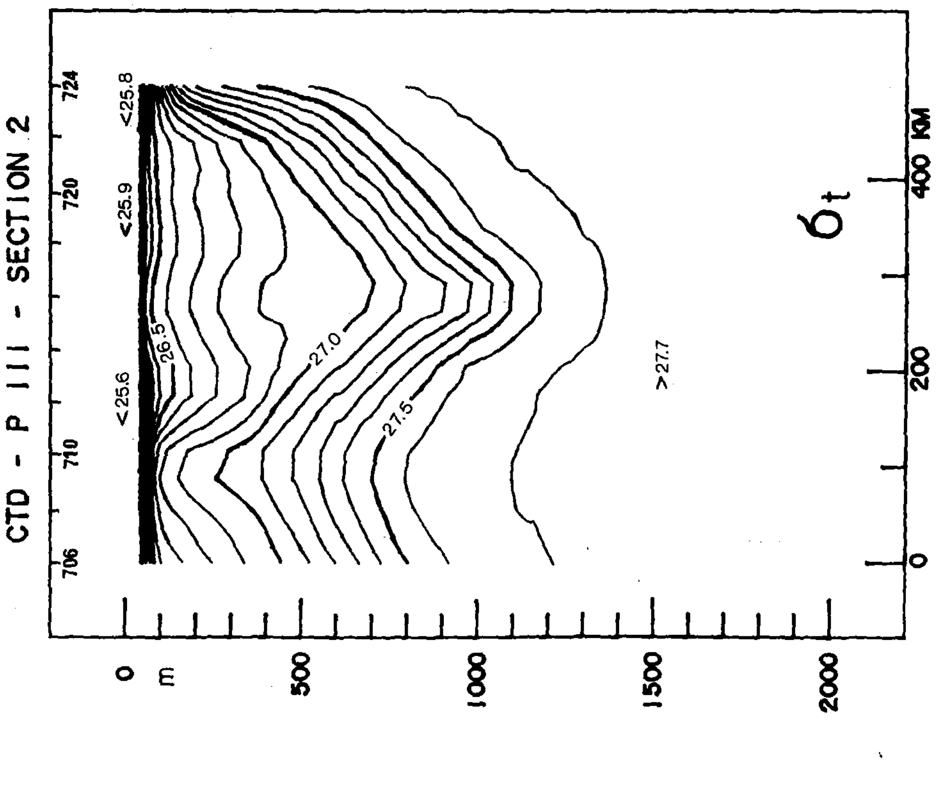


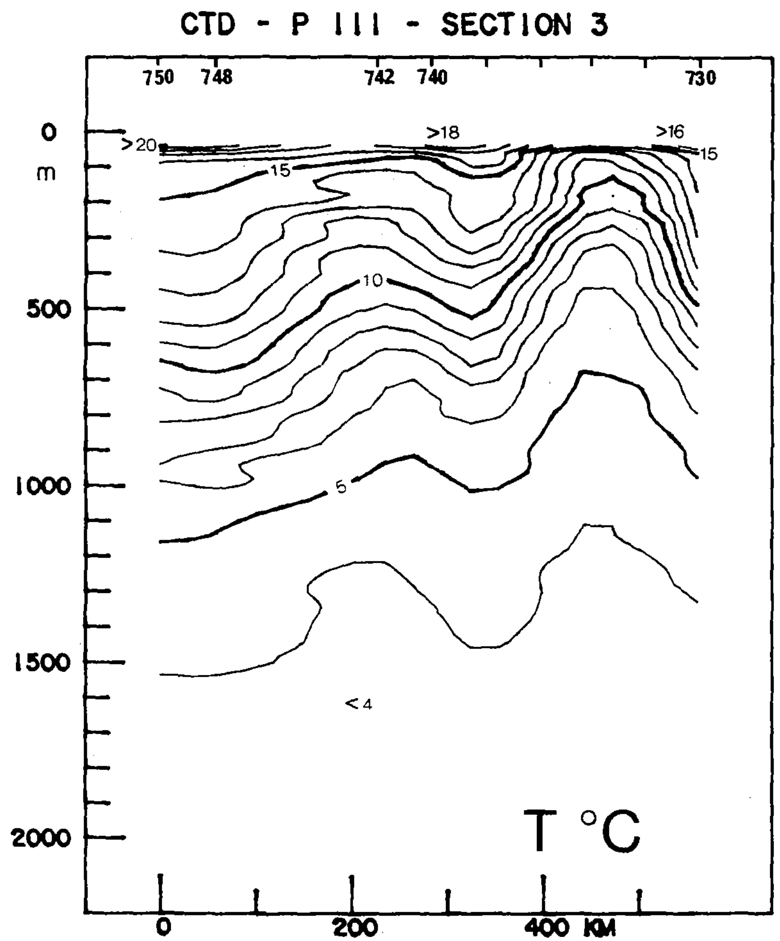
Fig. 6: Hydrographic section carried out along the tracks given in figure 5

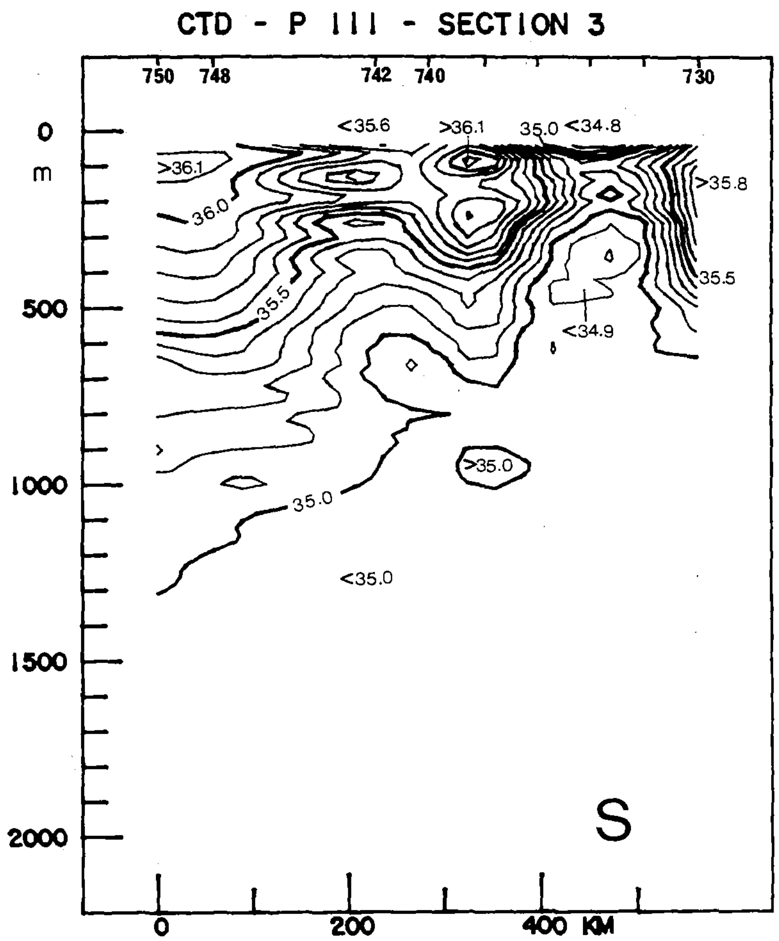

CTD - P III - SECTION I
698
690
686
682
680
678
<25.9
26.0
<25.7
<25.7
26.5
27.0
27.5
>27.7
0
200
400 KM
0
m
500
1000
1500
2000
σt

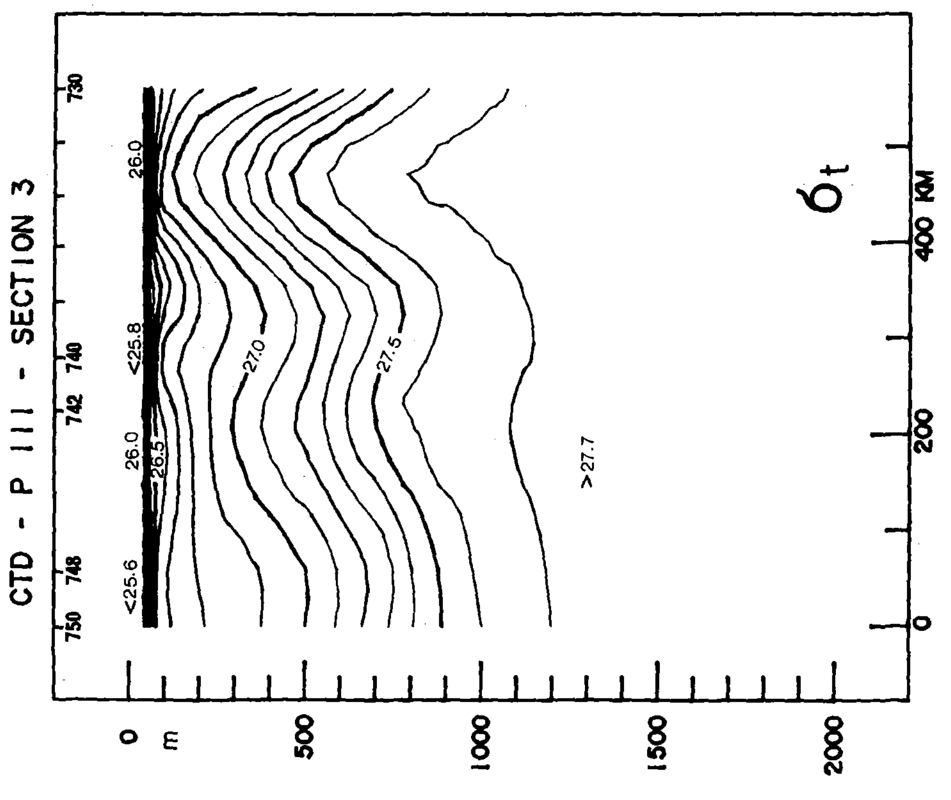

CTD - P III - SECTION 2
706
710
720
724
0
m
500
1000
1500
2000
>19
15
10
5
<4
T °C
0
200
400 KM

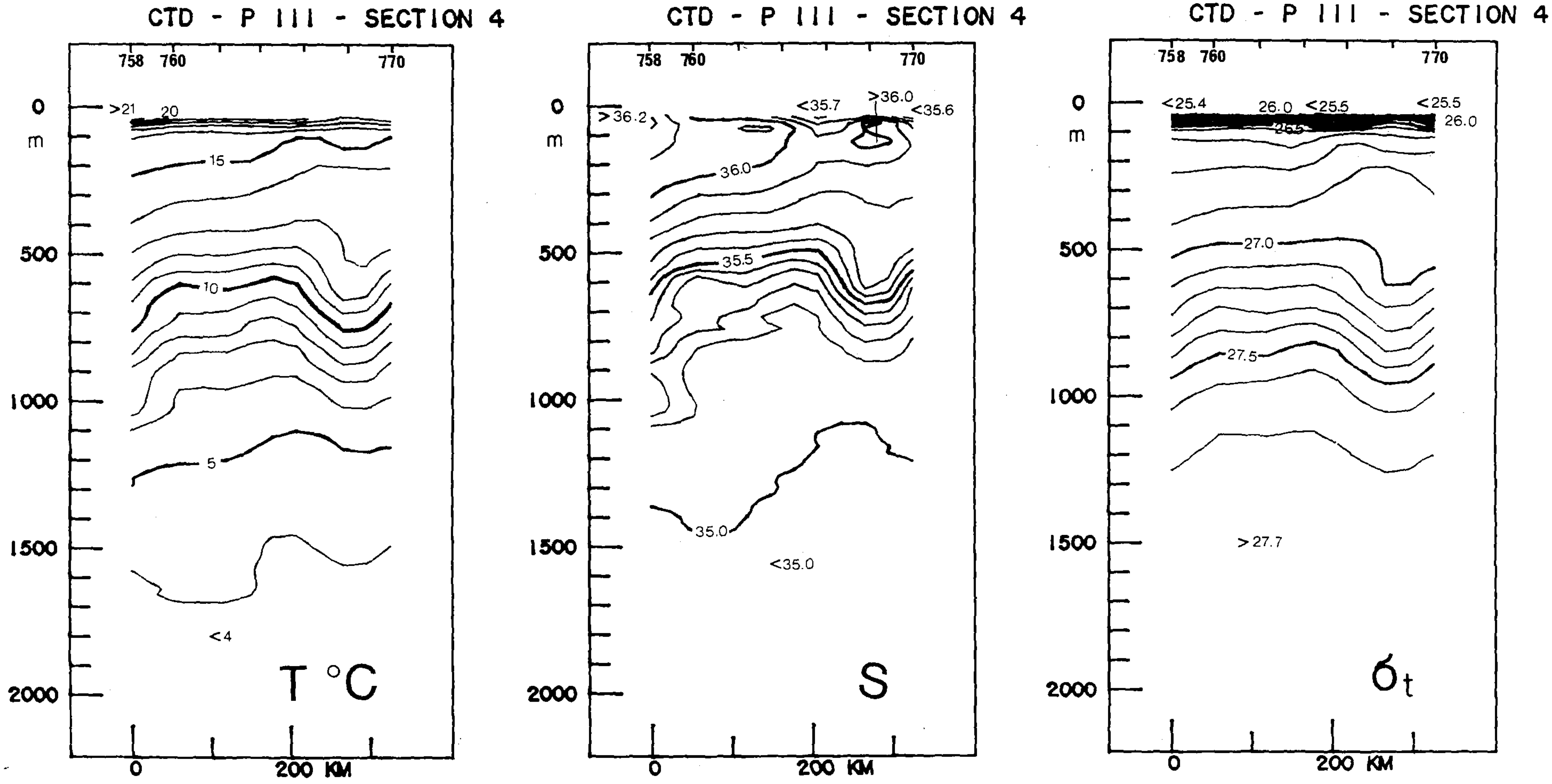

CTD - P III - SECTION 2
706
710
720
724
0
m
500
1000
1500
2000
<35.7
>36.2
>36.2
<34.3
> 36.0
34.5
36.0
35.5
35.0
< 35.0
35.0
<35.0
S
0
200
400 KM

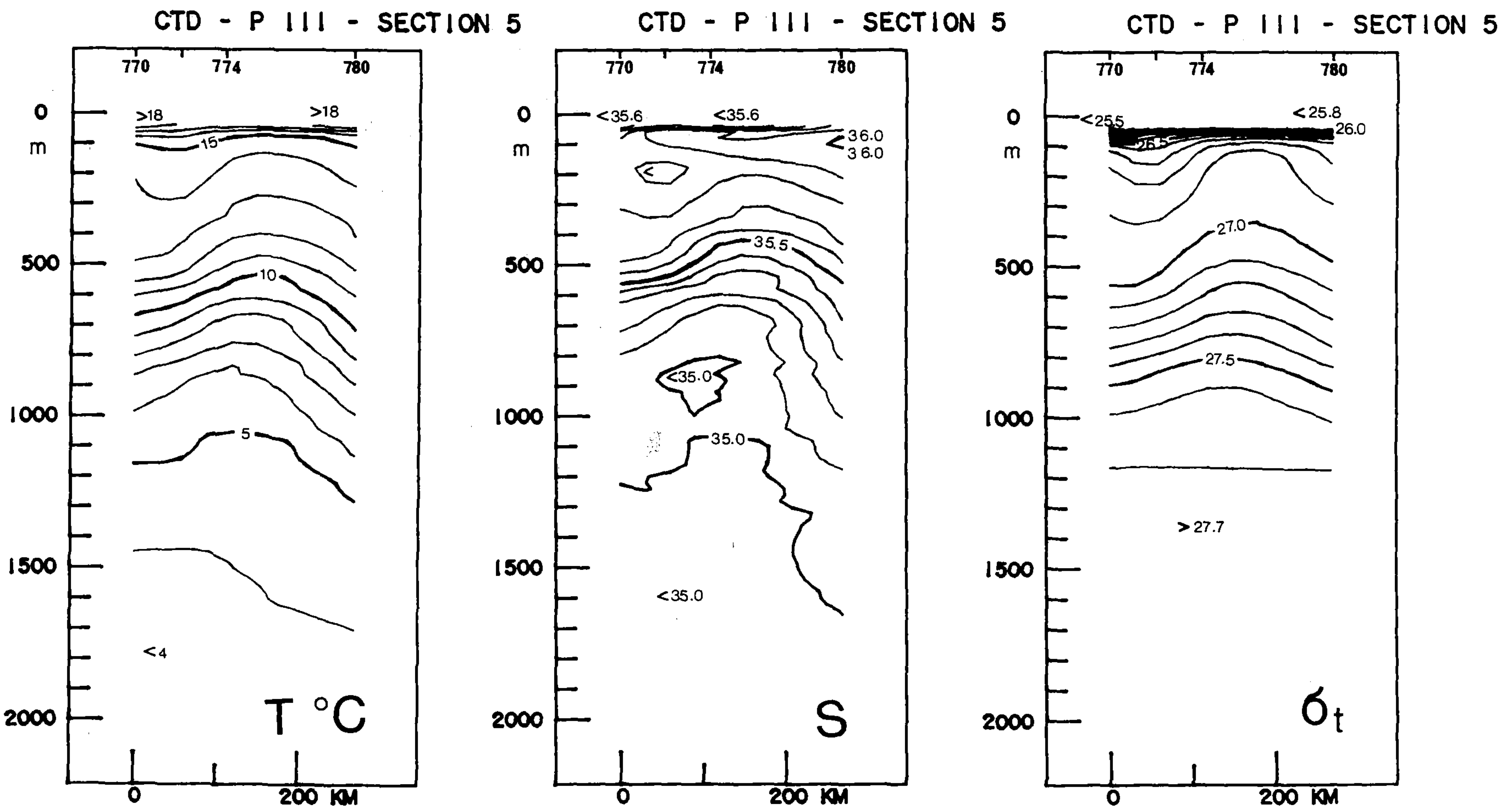

CTD - P III - SECTION 2
706
710
720
724
<25.6
<25.9
<25.8
26.5
27.0
27.5
>27.7
0
m
500
1000
1500
2000
0
200
400 KM
σt


CTD - P III - SECTION 3
750 748 742 740 730
0
m
500
1000
1500
2000
>20
>18
>16
15
10
5
<4
0
200
400 KM
T °C

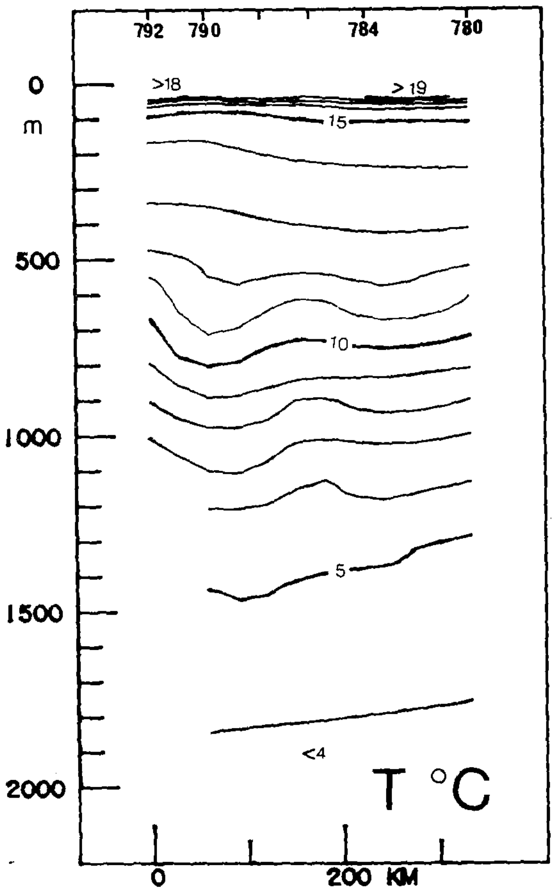

CTD - P III - SECTION 3
750 748 742 740 730
0
m
500
1000
1500
2000
<35.6
>36.1
35.0
<34.8
>36.1
36.0
>35.8
35.5
35.5
<34.9
>35.0
35.0
<35.0
0
200
400 KM
S


CTD - P III - SECTION 3
750
748
742
740
730
<25.6
26.0
26.5
<25.8
26.0
27.0
27.5
>27.7
0
200
400 KM
0 m
500
1000
1500
2000
σ_t

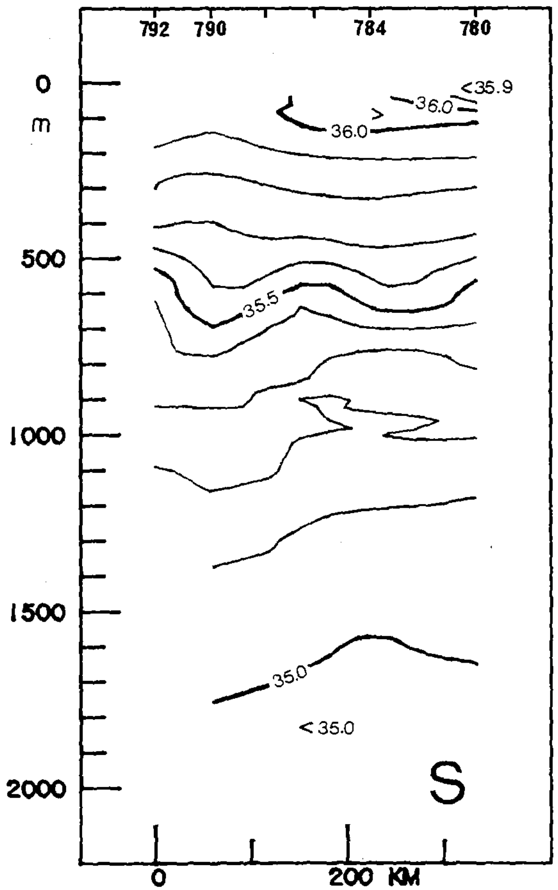

CTD - P III - SECTION 4
758 760 770
0 500 1000 1500 2000
m
>21 20 15 10 5 <4
0 200 KM
T °C
CTD - P III - SECTION 4
758 760 770
0 500 1000 1500 2000
m
>36.2 <35.7 >36.0 <35.6 36.0 35.5 35.0 <35.0
0 200 KM
S
CTD - P III - SECTION 4
758 760 770
0 500 1000 1500 2000
m
<25.4 26.0 <25.5 <25.5 26.0 25.5 27.0 27.5 >27.7
0 200 KM
σt


CTD - P III - SECTION 5
770
774
780
0
m
500
1000
1500
2000
>18
>18
15
10
5
<4
T °C
0
200 KM
CTD - P III - SECTION 5
770
774
780
<35.6
<35.6
36.0
36.0
35.5
<35.0
35.0
<35.0
S
CTD - P III - SECTION 5
<25.5
<25.8
26.0
26.5
27.0
27.5
>27.7
σt

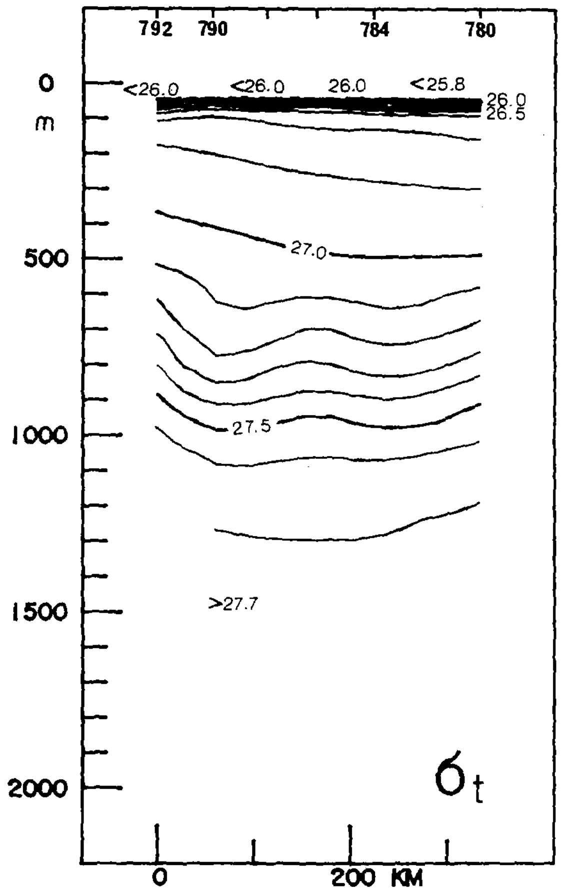
CTD - P III - SECTION 6



CTD - P III - SECTION 6



CTD - P III - SECTION 6



2.3.2 Cruise M69/2

STATION LIST

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Meteor" Cruise 69/2			
29.07.	0800-0824	17	48 47.8 N	10 41.8 W	-	NIS
	0930-0942	17a	48 46.0	10 54.9	-	NIS
30.07.	1806-2330	18	47 29.7	19 15.3	4560	V-D3 recovered, MS
31.07.	0600-0806	19	48 22.9	19 57.6	4400	V-D1 recovered
	1448-0454	20	47 25.4	20 36.5	4470	V-D2 recovered, MS
02.08.	0342-0548	21	47 48.1	24 29.9	3585	MS
	0624-0924	22	47 47.6	24 35.7	3650	V-C3 recovered
	1400-1600	23	48 30.0	24 13.4	3775	V-C1 recovered
	1712-2312	24	48 18.3	24 08.8	4100	NIS, MS
03.08.	0630-0848	25	48 34.7	25 44.4	3480	V-C2 recovered
	1024-1436	26	48 31.8	25 45.5	3450	V265/5 launched, MS
	1948-2130	27	47 44.6	25 12.9	3140	MS
04.08.	0112-0248	28	47 42.8	25 59.0	2800	MS
	0618-0754	29	47 40.0	26 43.6	2215	MS
	1124-1318	30	47 38.2	27 29.5	3250	MS
	1648-1842	31	47 35.9	28 12.9	2960	MS
	2212-0000	32	47 32.5	28 58.2	3420	MS
05.08.	0706-0954	33	48 35.3	30 05.9	3460	V-B1 recovered
	1600-1800	34	47 30.6	29 28.2	3370	V-B3 recovered
	1930-2112	35	47 30.7	29 44.3	3030	MS
06.08.	0036-0224	36	47 37.3	30 29.5	3335	MS
	0630-0836	37	47 36.0	30 57.6	3630	V-B2 recovered
	1042-1300	38	47 30.0	30 52.8	3525	V-B launched
	1318-1600	39	47 30.4	30 49.9	3200	NIS, MS
07.08.	0700-0918	40	47 56.7	34 00.8	4470	V-A1 recovered
	1600-2318	41	46 59.3	34 52.4	4330	V-A3 recovered, MS
08.08.	0642-0900	42	47 56.9	35 26.8	4355	V-A2 recovered
	0936-1400	43	47 55.8	35 25.7	4340	V-A launched, MS
09.08.	0848-1042	44	47 33.7	30 28.8	3360	MS
	1336-1530	45	48 00.1	30 50.7	3680	MS
	1842-2042	46	48 27.4	31 14.5	3850	MS
	2324-0124	47	48 54.1	31 32.8	3550	MS
10.08.	0424-0630	48	49 17.6	32 00.0	3460	MS
	0954-1200	49	49 44.1	32 22.7	3760	MS
	1524-1730	50	50 12.2	32 44.1	4110	MS
	2042-2242	51	50 35.8	33 09.0	3755	MS
11.08.	0212-0400	52	51 03.9	33 34.7	3745	MS
	0648-0848	53	51 27.7	33 56.6	3555	MS
	1212-1412	54	51 55.2	34 22.8	3565	MS
	1642-1848	55	52 21.7	34 46.6	3820	MS
	2148-2348	56	52 45.8	35 12.9	3213	MS
12.08.	0230-0354	57	53 12.1	35 11.9	2400	MS
	0648-0830	58	53 11.8	34 21.9	2975	MS
	1124-1306	59	53 10.5	33 31.0	2900	MS
	1542-1724	60	53 10.2	32 40.6	2900	MS
	2012-2218	61	53 07.8	31 51.4	2945	MS
13.08.	1624-2012	62	53 40.9	31 31.4	2880	V-305 launched, MS

STATION LIST

Date 1984	Time (GMT)	Station	Latitude	Longitude	Depth (m)	Remarks
			F.S. "Meteor" Cruise 69/2			
13.08.	2348-0130	63	53 07.8 N	31 00.7 W	3025	MS
14.08.	0530-1048	64	52 41.9	31 02.6	3525	V-280/3 launched,MS
	1436-1624	65	53 06.5	30 08.3	3155	MS
	1906-2106	66	53 05.8	29 19.8	3370	MS
	2354-0418	67	53 05.9	28 28.3	3387	MS, NIS
15.08.	0730-0918	68	52 39.6	28 03.8	3530	MS
	1212-1418	69	52 14.3	27 38.0	3685	MS
	1712-1912	70	51 46.5	27 14.9	3740	MS
	2206-2354	71	51 21.5	26 50.3	3544	MS
16.08.	0306-0848	72	50 55.0	26 25.1	4090	NIS
	1206-1442	73	50 28.6	26 01.1	3775	MS
	1754-1942	74	50 02.1	25 38.1	3300	MS
	2242-0036	75	49 35.7	25 16.0	4100	MS
17.08.	0336-0536	76	49 10.2	24 52.9	3900	MS
	0824-1043	77	48 44.1	24 29.9	3760	MS
	1354-1600	78	48 17.9	24 07.2	4085	MS
	1900-2106	79	47 51.5	23 43.8	4310	MS
18.08.	0012-0212	80	47 22.0	23 45.1	3700	MS
	0518-0718	81	46 51.9	23 46.2	3530	MS
	1018-1212	82	46 22.1	23 45.3	3628	MS
	1500-1700	83	45 52.1	23 45.2	3465	MS
	1942-2130	84	45 22.1	23 45.0	3280	MS
19.08.	0018-0200	85	44 52.0	23 45.2	2955	MS
	0548-0700	86	44 43.6	24 29.5	2355	MS
	1042-1206	87	44 38.5	25 17.2	2500	MS
	1548-2200	88	44 28.9	26 04.4	3155	MS, NIS
20.08.	0118-0254	89	44 25.4	26 46.4	2985	MS
	0600-1924	90	44 28.0	26 07.0	3130	V 266/3 attempted to recover
21.08.	1312-1800	91	46 35.1	22 13.2	4140	MS, NIS
22.08.	0236-0842	92	47 25.1	20 42.0	4475	V-D2 launched, MS
	1900-2242	93	48 18.0	18 25.0	4530	MS, NIS
23.08.	0630-0736	94	49 09.9	16 12.0	4780	MS
	1542-1836	95	49 59.8	14 00.3	3735	MS, NIS

NIS $\hat{=}$ Bottle station for anthropogenic tracers.

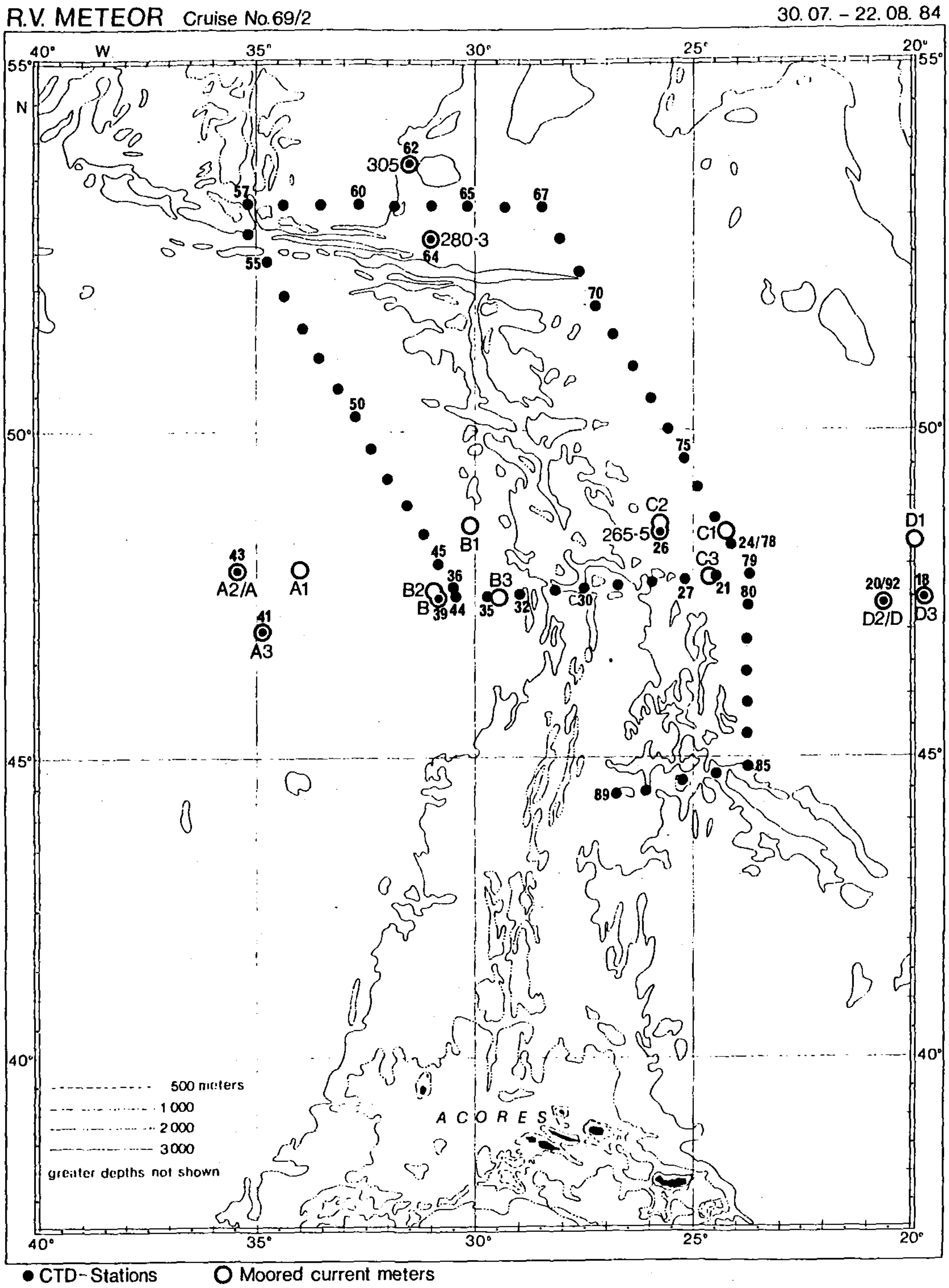


Fig. 7: Station map M69/2

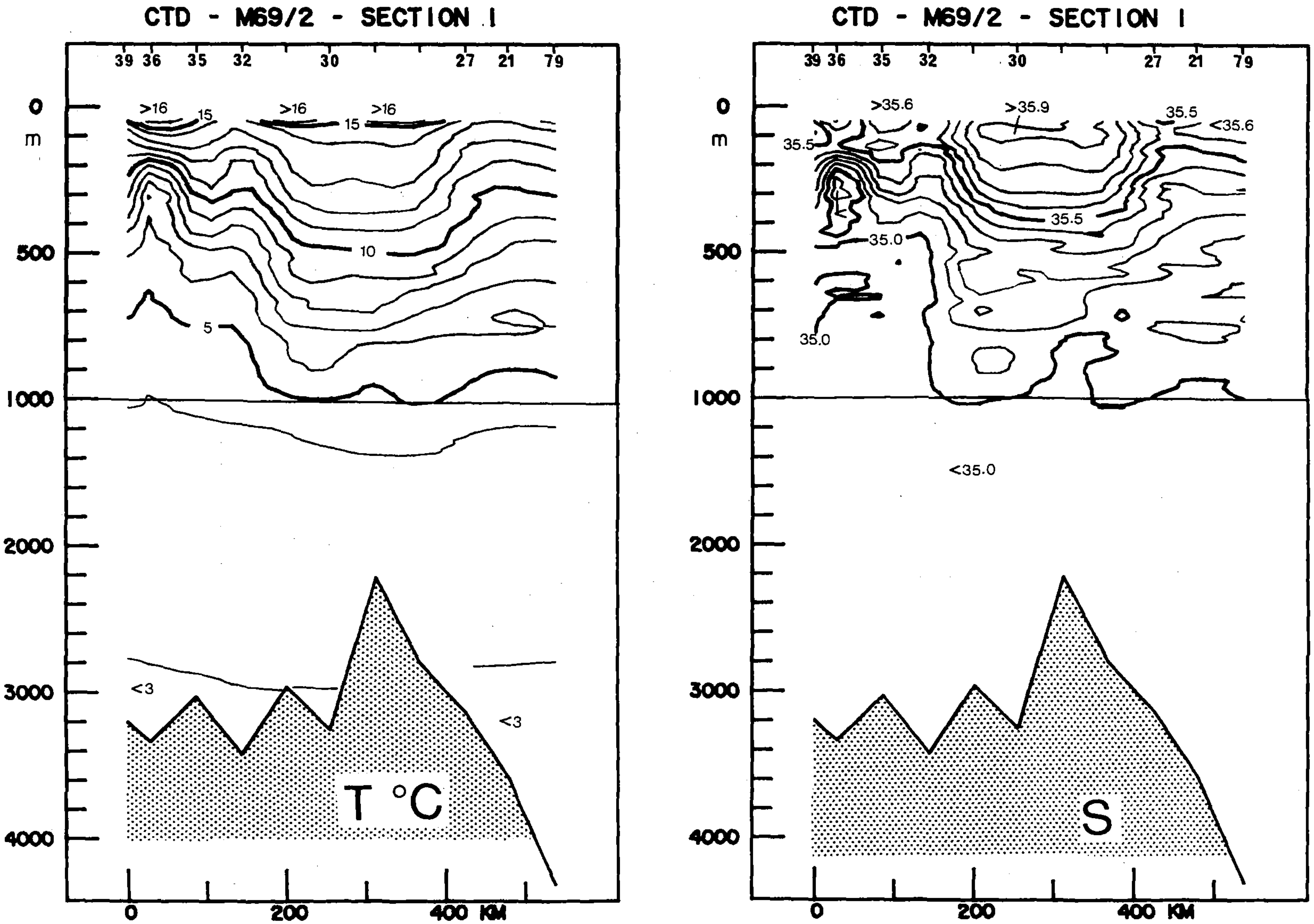
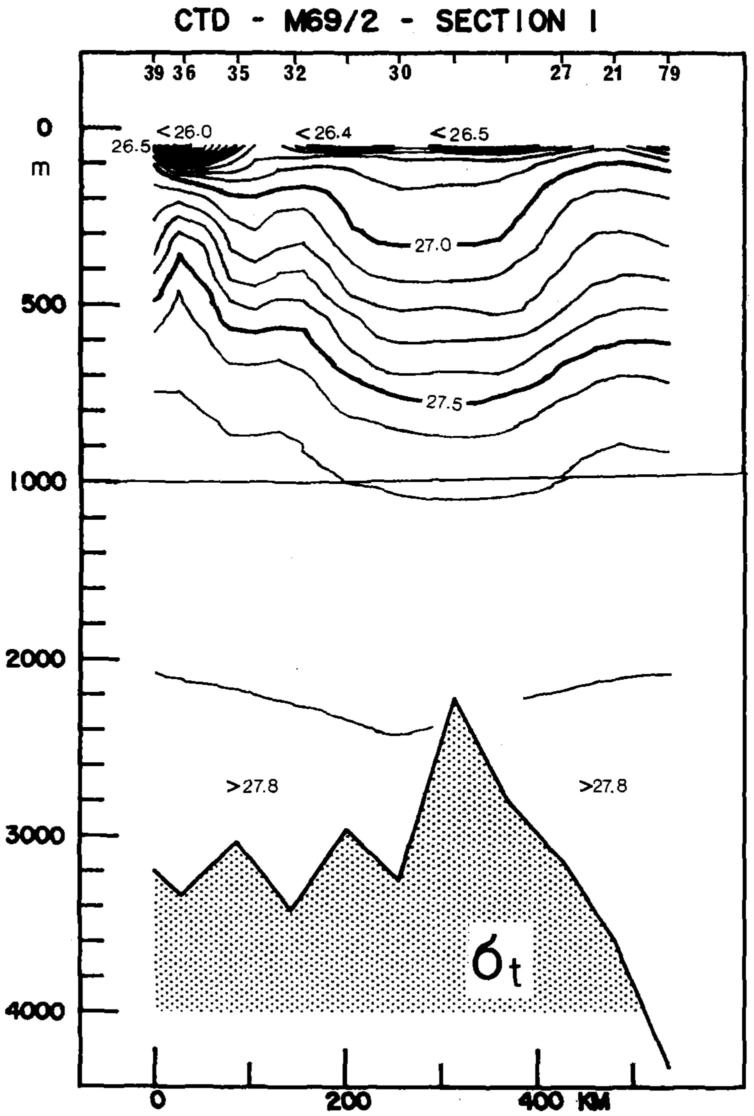
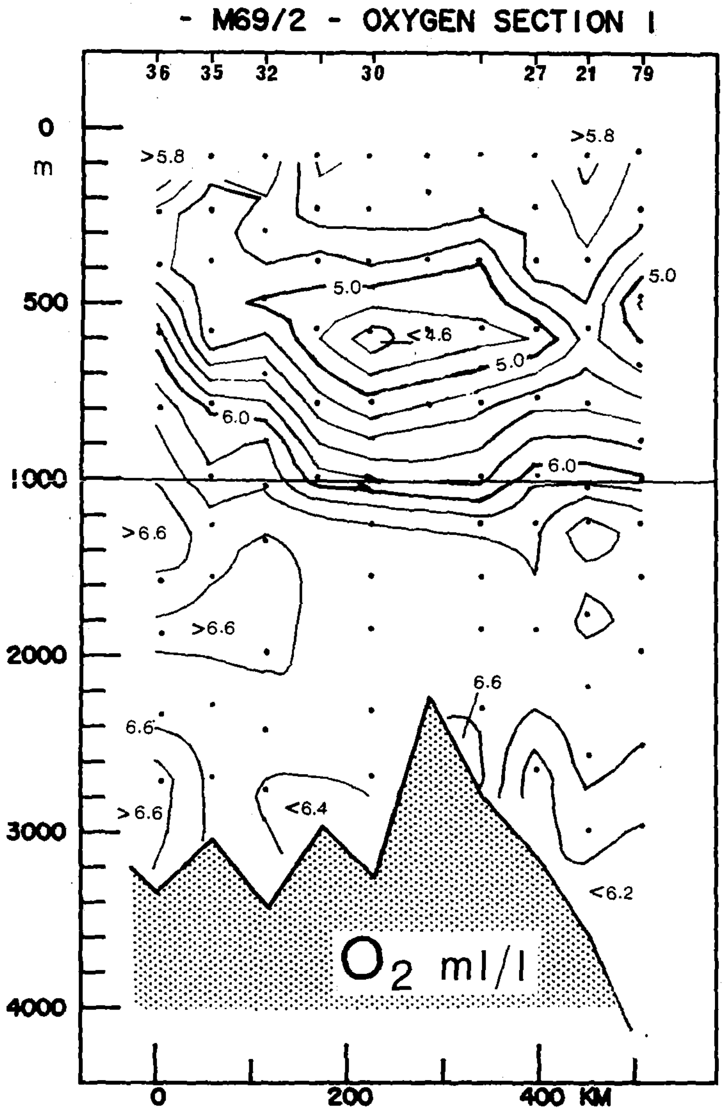
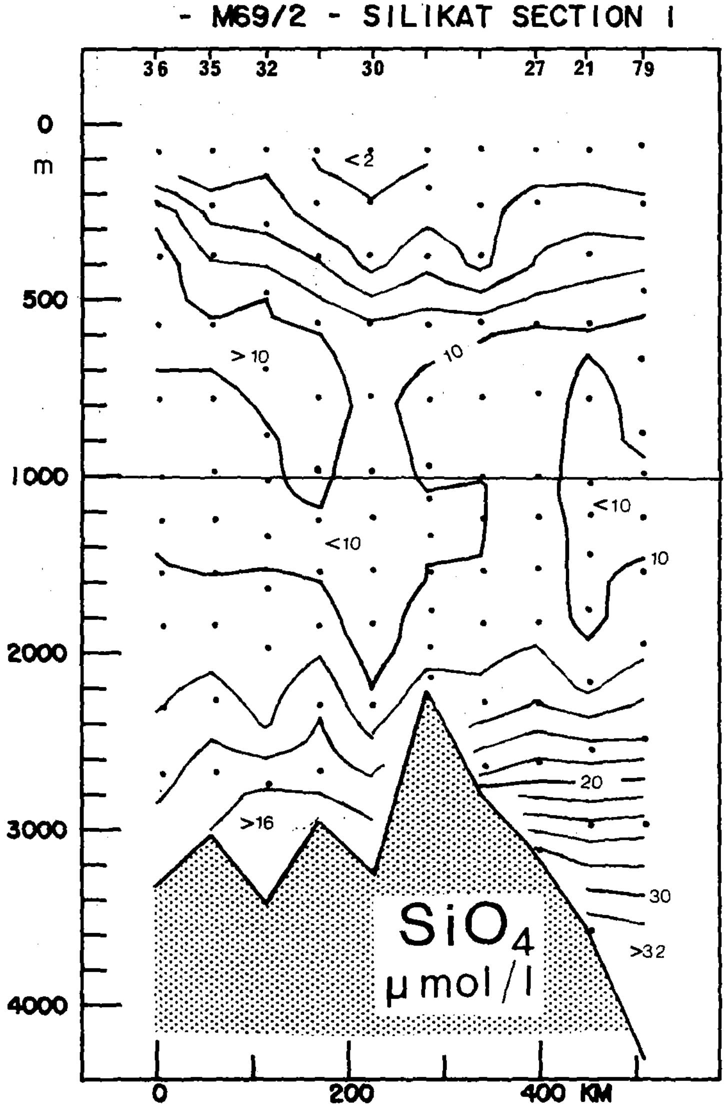


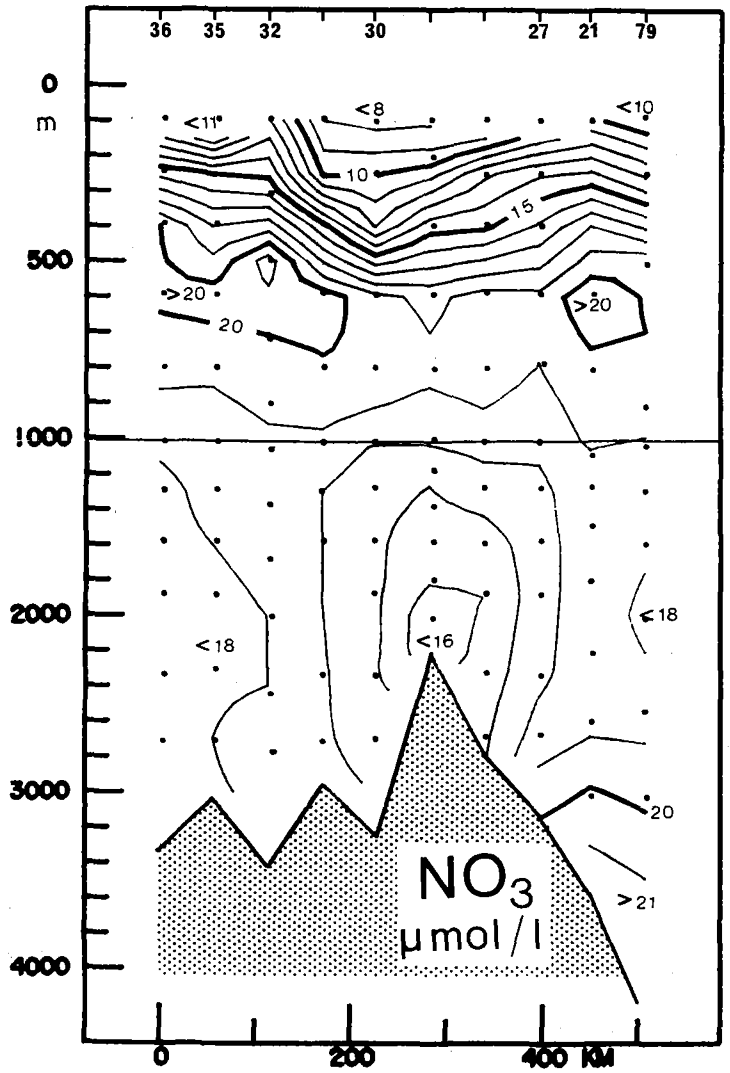
Fig. 8: Hydrographic section carried out along the tracks given in fig. 7


CTD - M69/2 - SECTION I
39 36 35 32 30 27 21 79
0
m
500
1000
2000
3000
4000
< 26.0
26.5
< 26.4
< 26.5
27.0
27.5
>27.8
>27.8
σt
0
200
400 KM

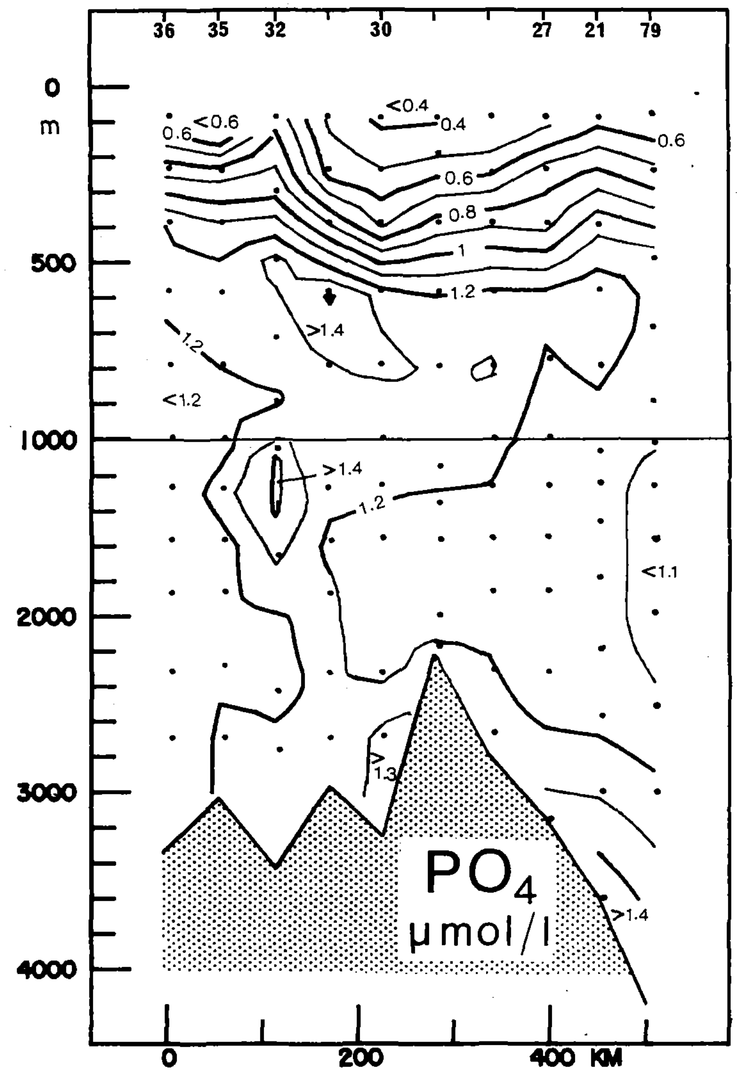

- M69/2 - OXYGEN SECTION I
36 35 32 30 27 21 79
0
m
500
1000
2000
3000
4000
0
200
400 KM
>5.8
>5.8
5.0
5.0
<4.6
5.0
6.0
6.0
>6.6
>6.6
6.6
6.6
>6.6
<6.4
<6.2
O2 ml/l

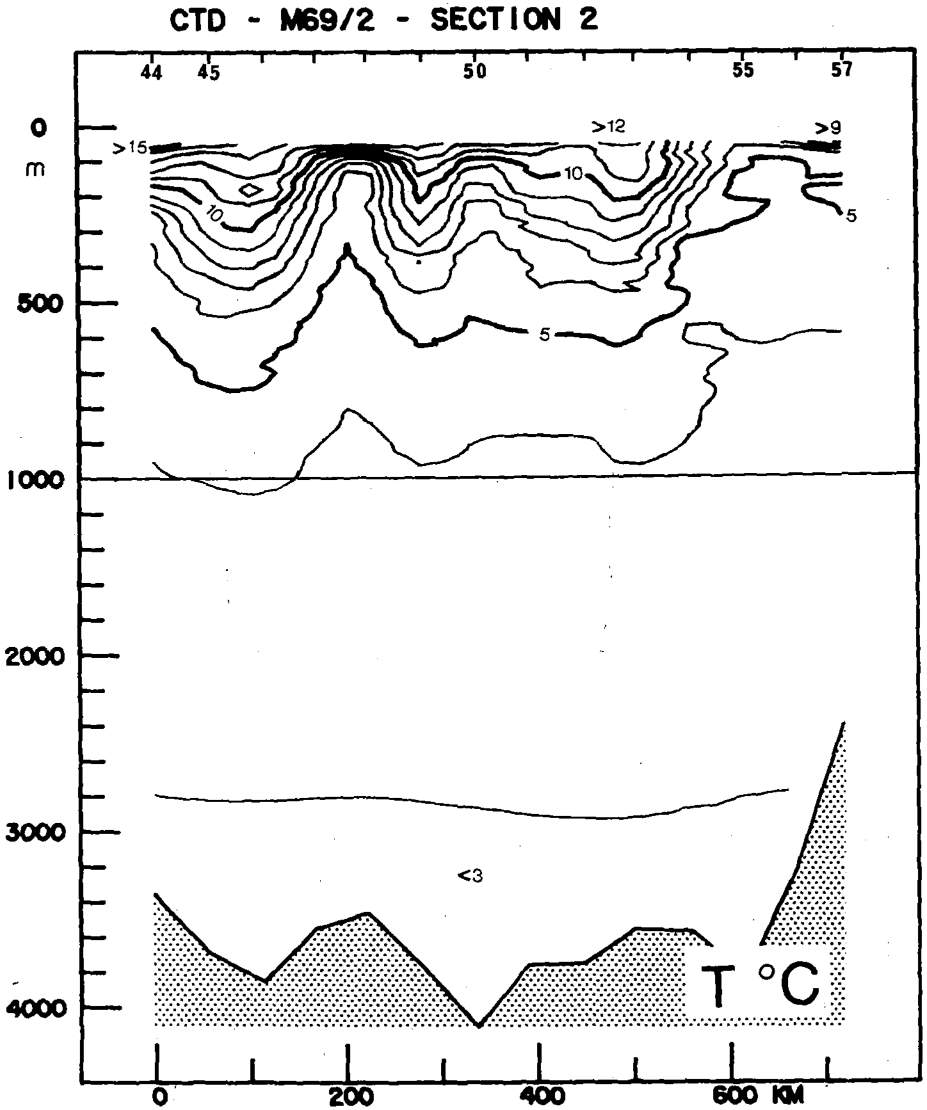

- M69/2 - SILIKAT SECTION I
36 35 32 30 27 21 79
0
m
500
1000
2000
3000
4000
0
200
400 KM
<2
>10
10
<10
<10
10
20
>16
30
>32
SiO4
μmol/l

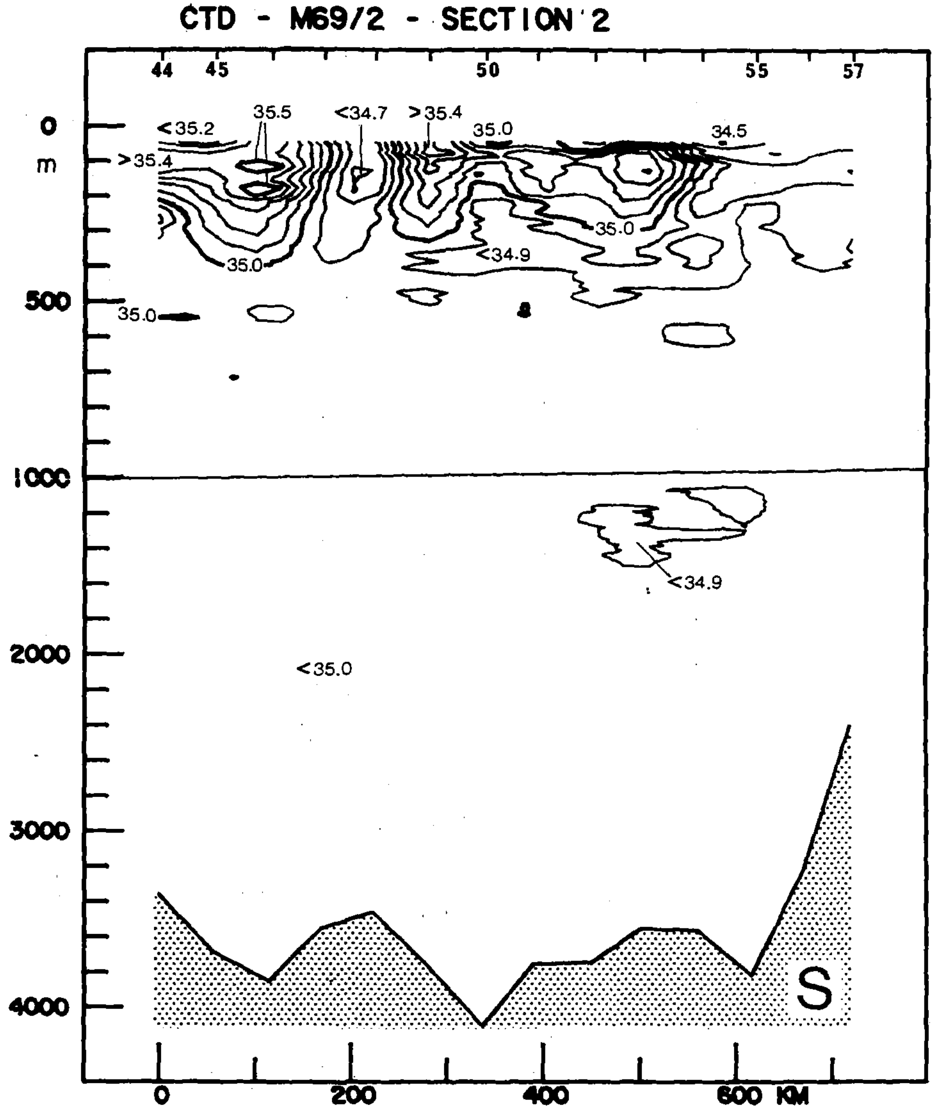
- M69/2 - NITRAT SECTION I



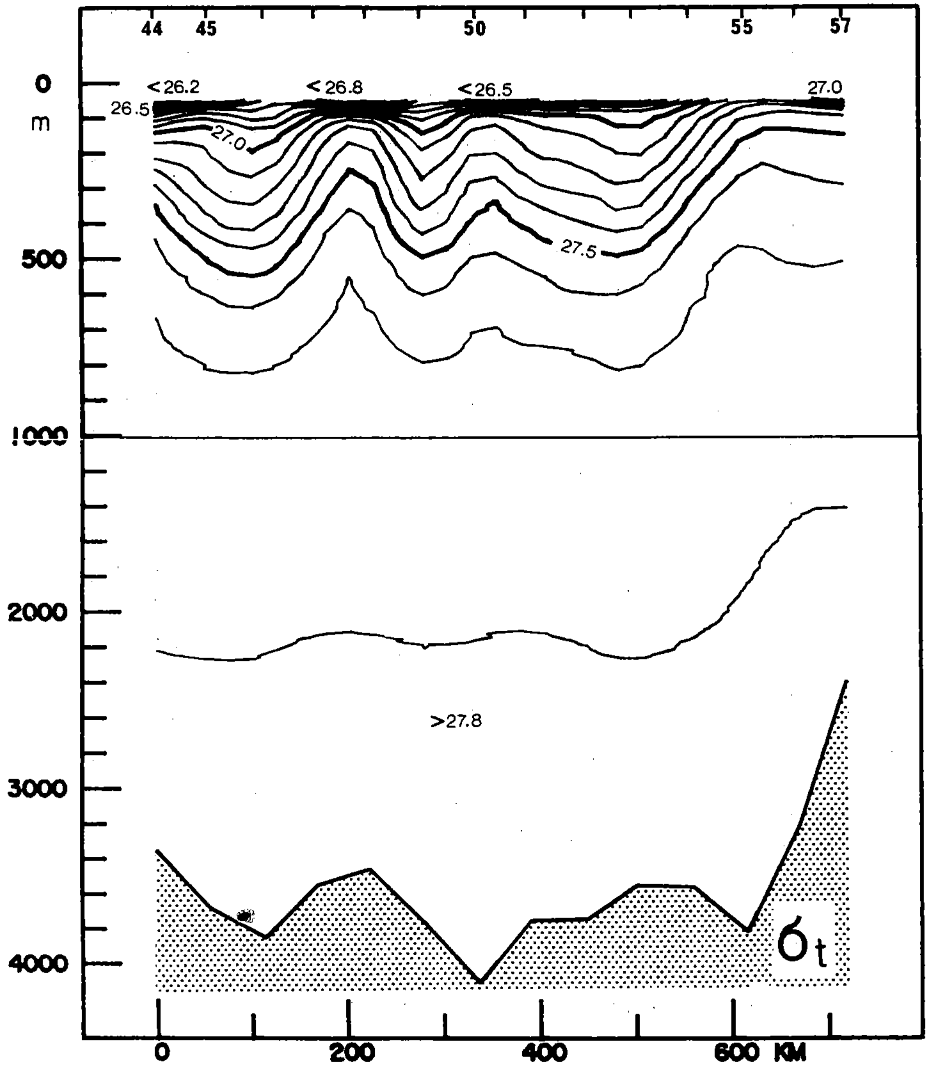
- M69/2 - PHOSPHAT SECTION I

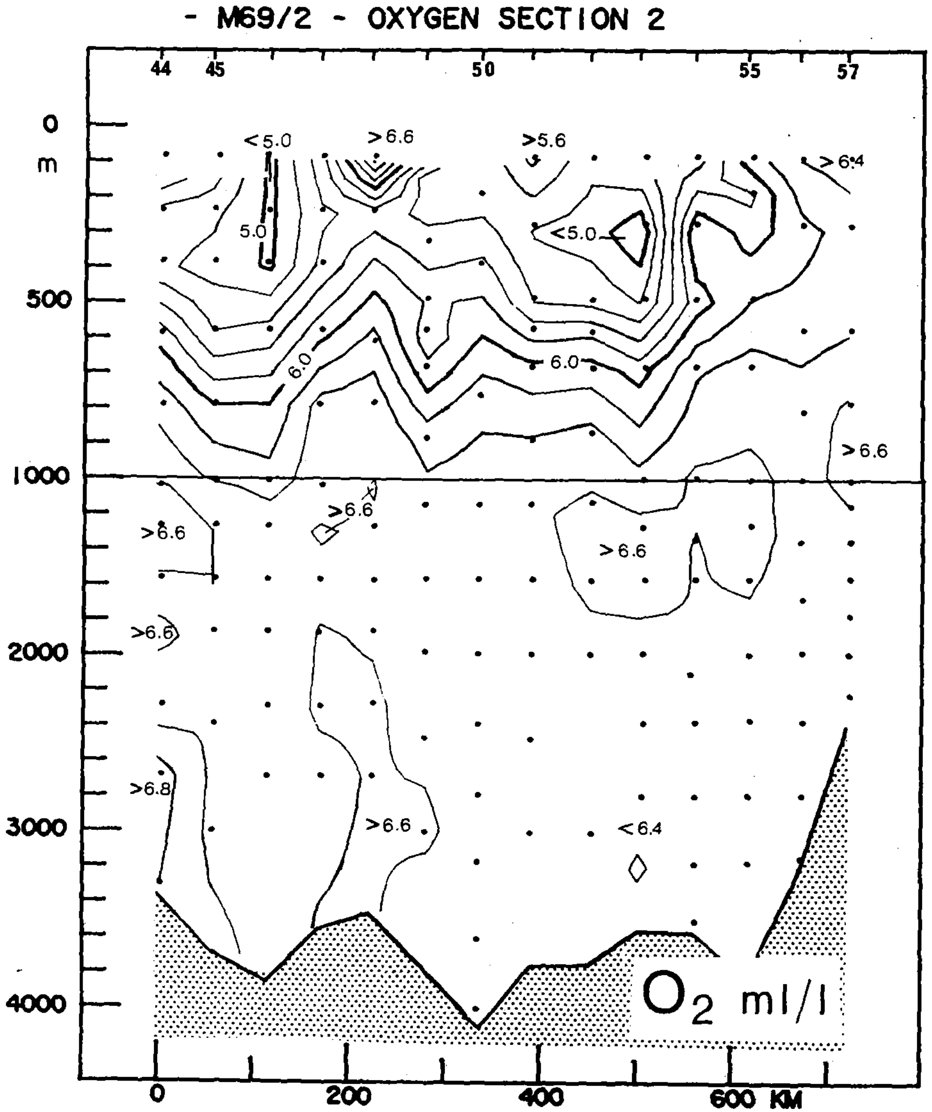


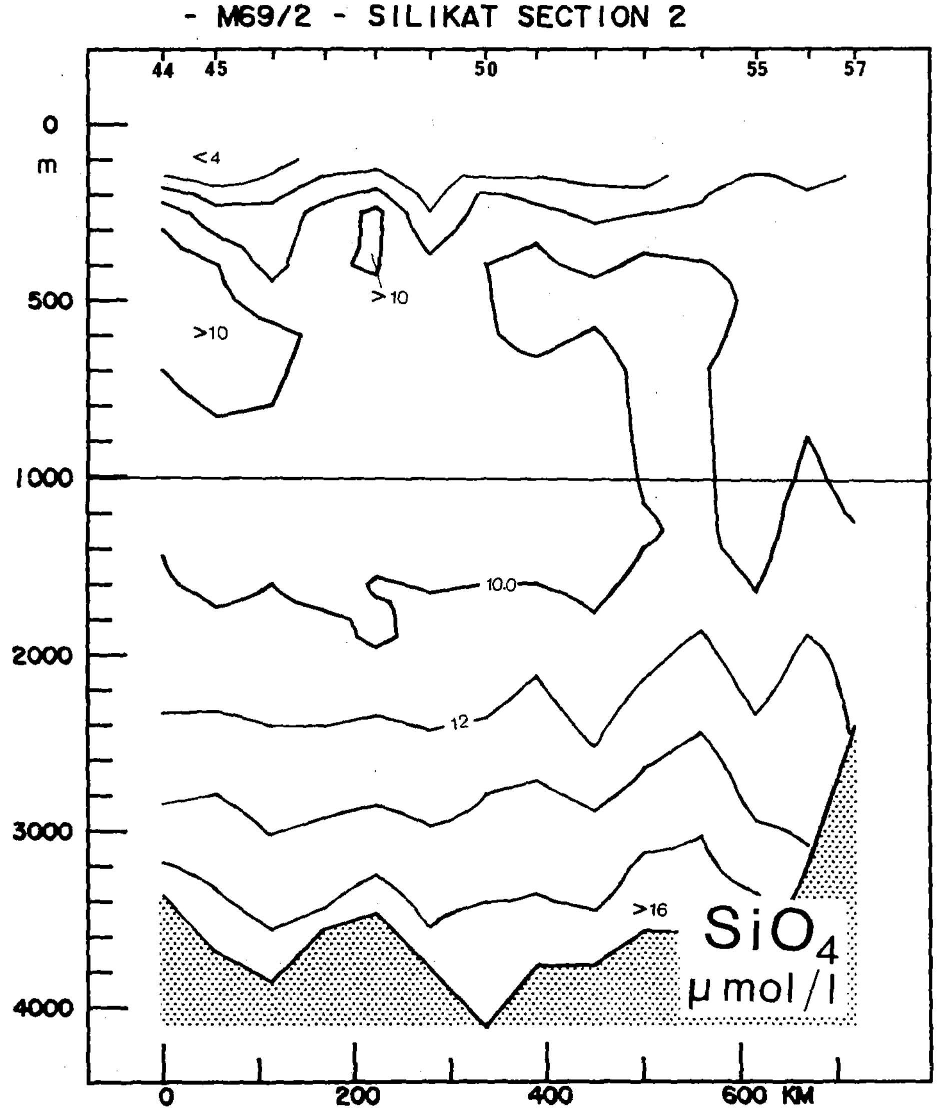

CTD - M69/2 - SECTION 2
44
45
50
55
57
0
m
500
1000
2000
3000
4000
>15
>12
>9
10
10
5
5
<3
T °C
0
200
400
600 KM


CTD - M69/2 - SECTION 2
44
45
50
55
57
0
m
500
1000
2000
3000
4000
<35.2
35.5
<34.7
>35.4
35.0
34.5
>35.4
35.0
<34.9
35.0
35.0
<34.9
<35.0
S
0
200
400
600 KM

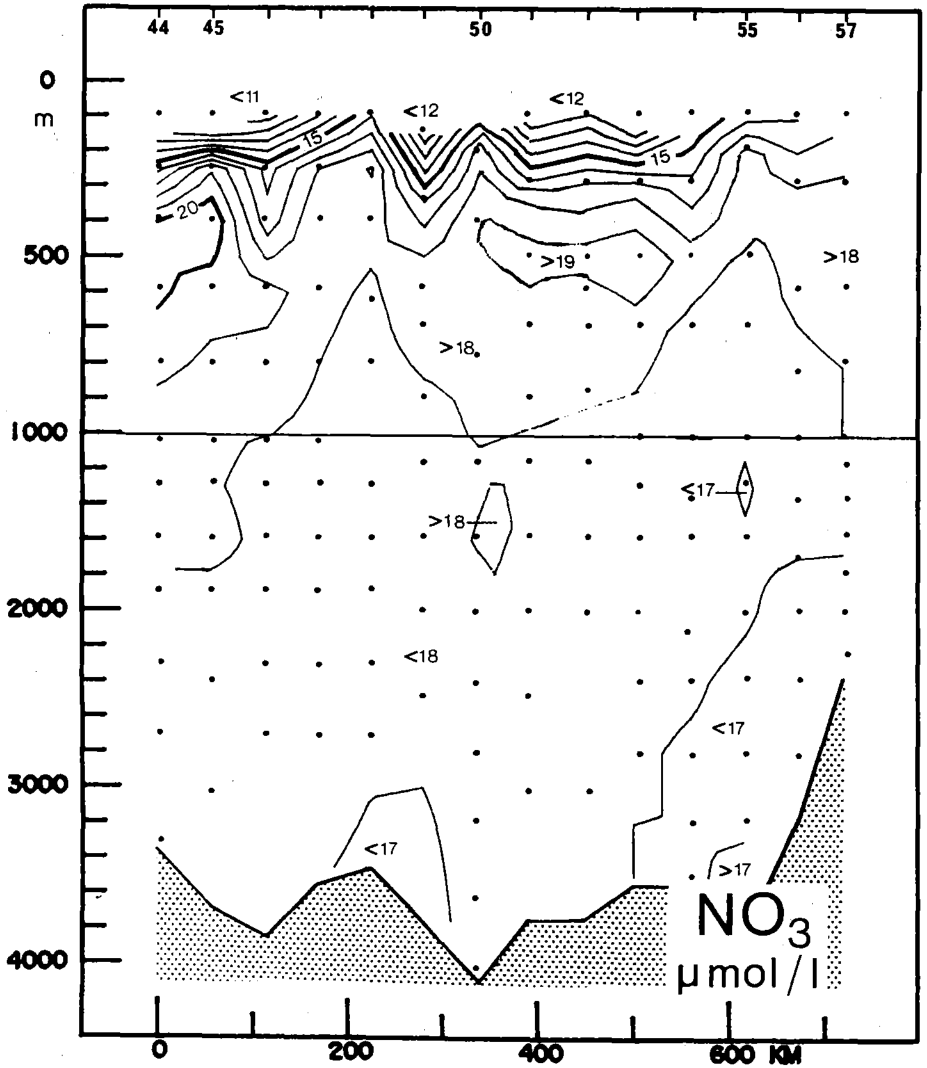
CTD - M69/2 - SECTION 2



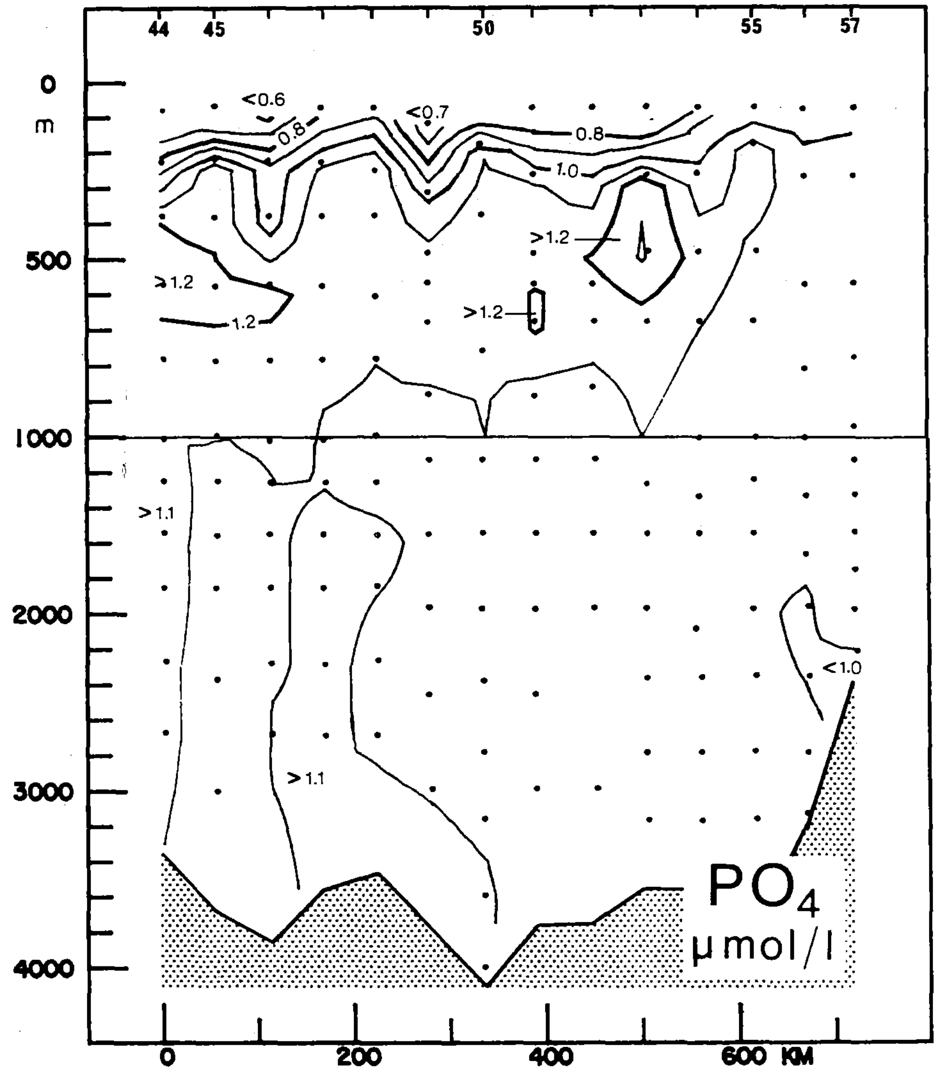

- M69/2 - OXYGEN SECTION 2
44
45
50
55
57
0
m
500
1000
2000
3000
4000
<5.0
>6.6
>5.6
>6.4
5.0
<5.0
6.0
6.0
>6.6
>6.6
>6.6
>6.6
>6.6
>6.6
>6.8
>6.6
<6.4
O2 ml/l
0
200
400
600 KM

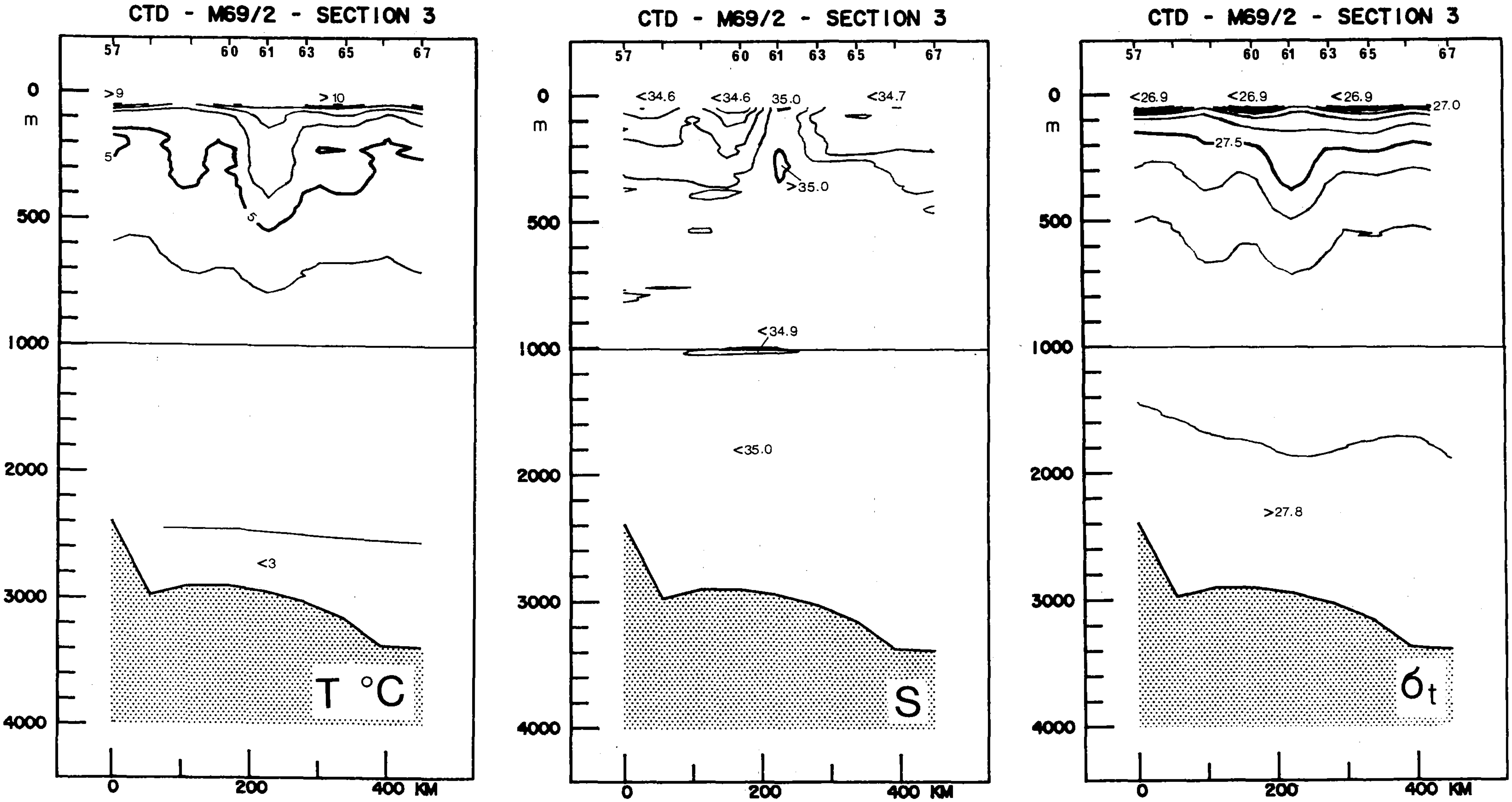

- M69/2 - SILIKAT SECTION 2
44
45
50
55
57
0
m
500
1000
2000
3000
4000
<4
>10
>10
10.0
12
>16
SiO4
μmol/l
0
200
400
600 KM

- M69/2 - NITRAT SECTION 2

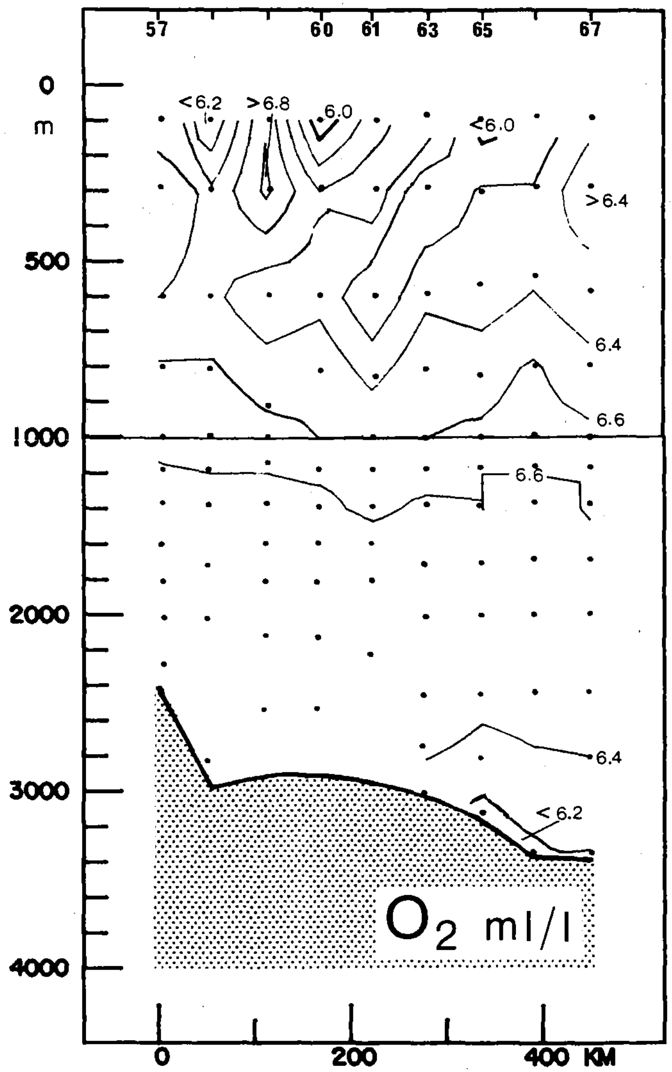


- M69/2 - PHOSPHAT SECTION 2

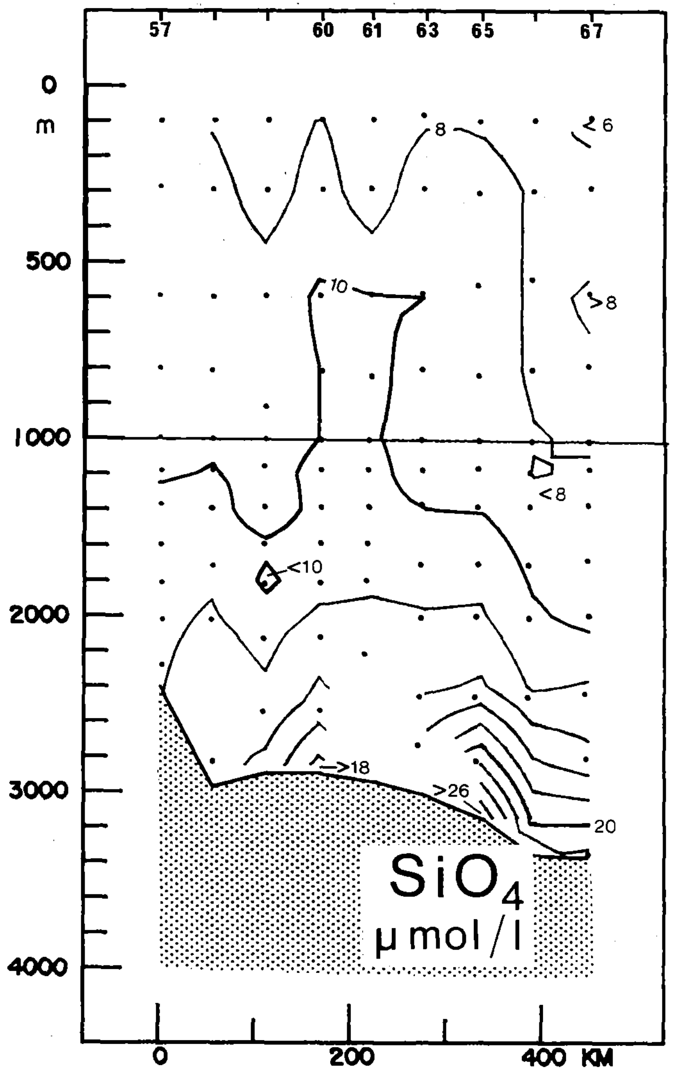



CTD - M69/2 - SECTION 3
57
60
61
63
65
67
0
m
500
1000
2000
3000
4000
>9
>10
5
<3
0
200
400 KM
T °C
CTD - M69/2 - SECTION 3
<34.6
<34.6
35.0
<34.7
>35.0
<34.9
<35.0
S
CTD - M69/2 - SECTION 3
<26.9
<26.9
<26.9
27.0
27.5
>27.8
σt

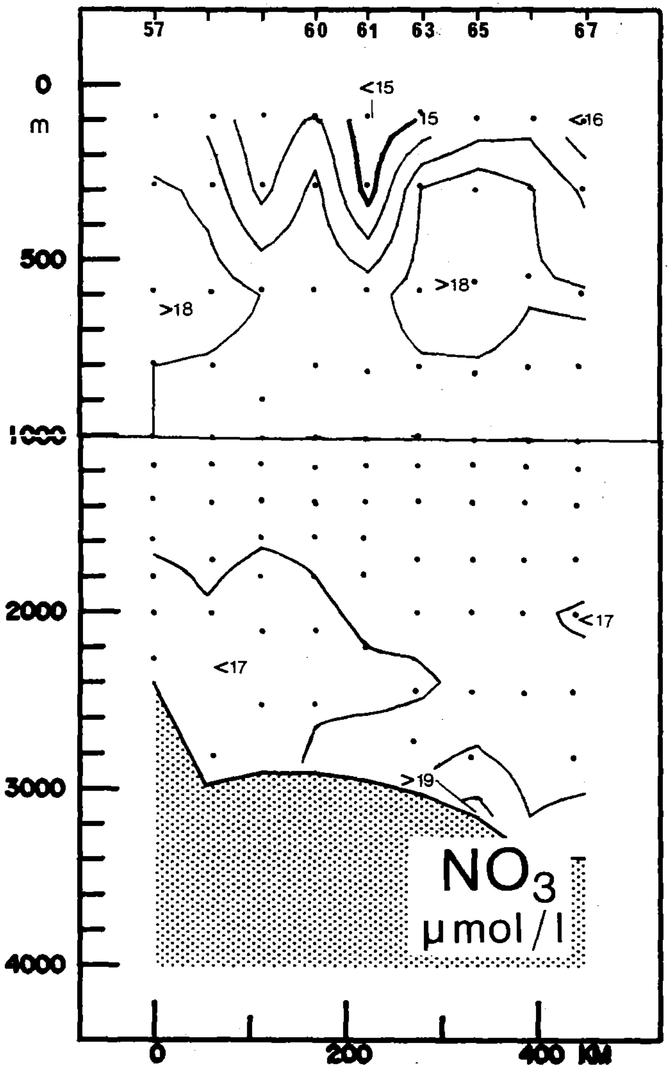
- M69/2 - OXYGEN SECTION 3



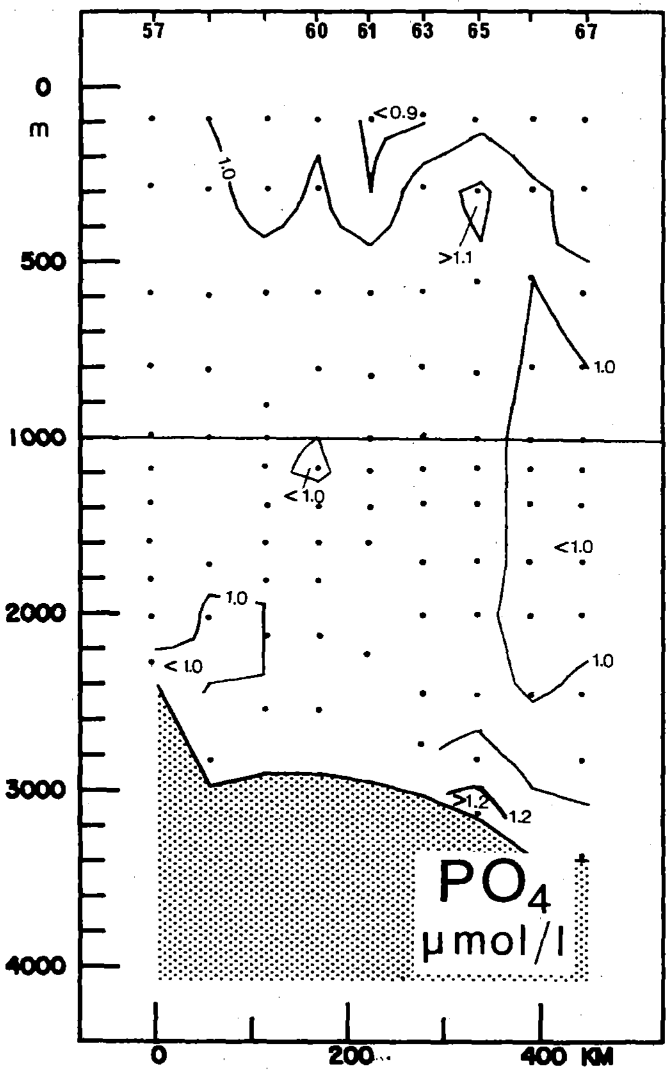
- M69/2 - SILIKAT SECTION 3

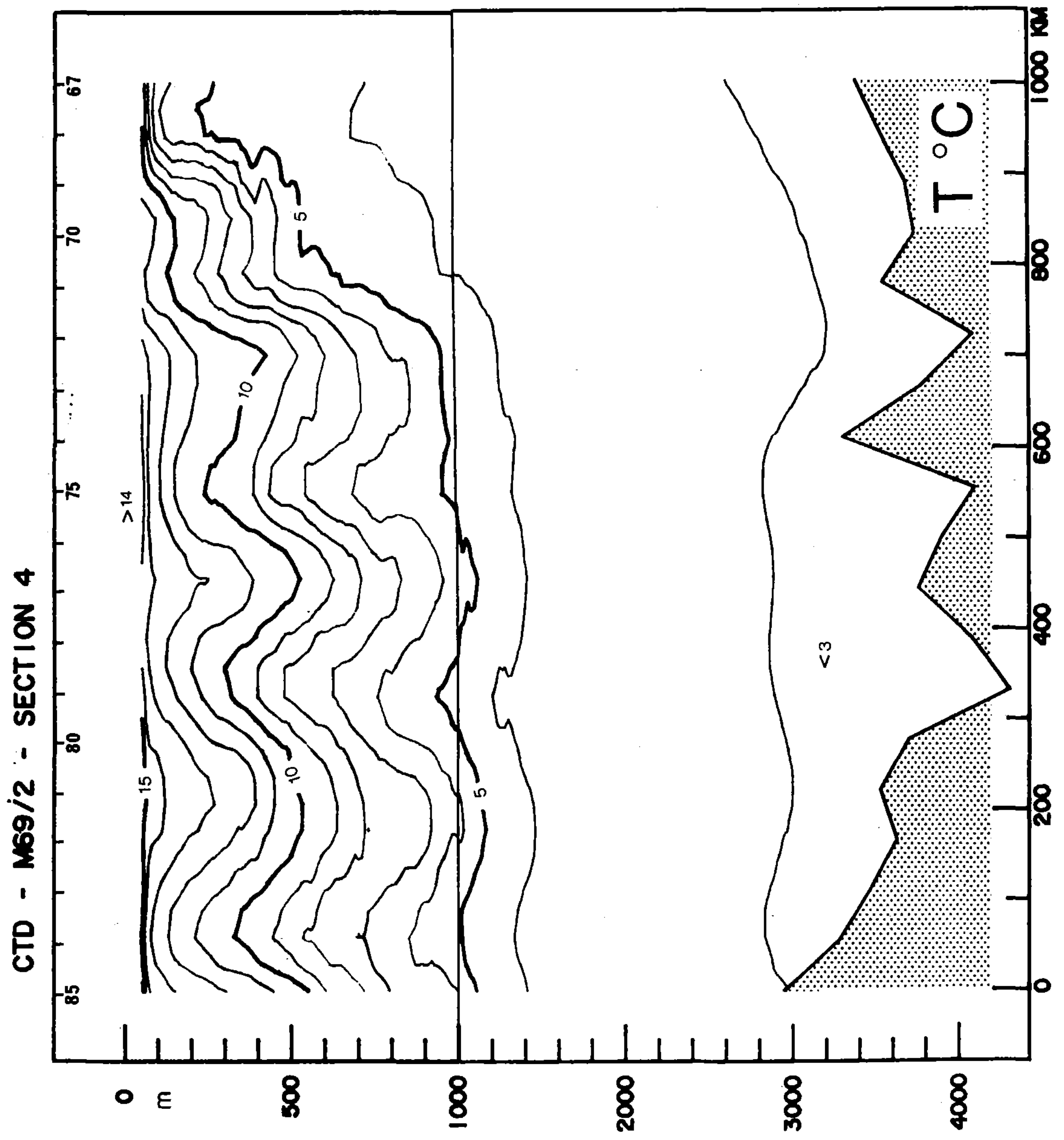


- M69/2 - NITRAT SECTION 3

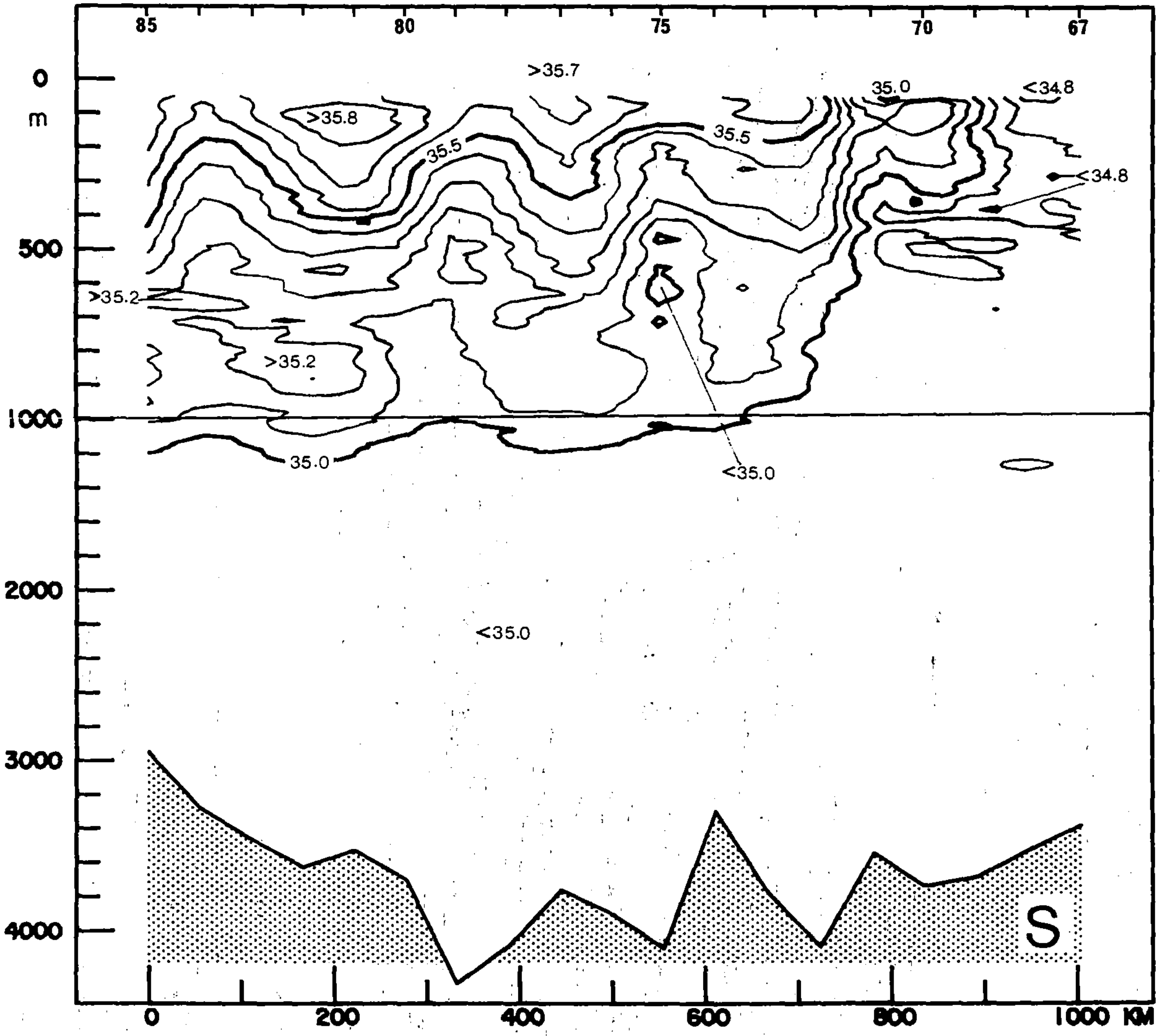


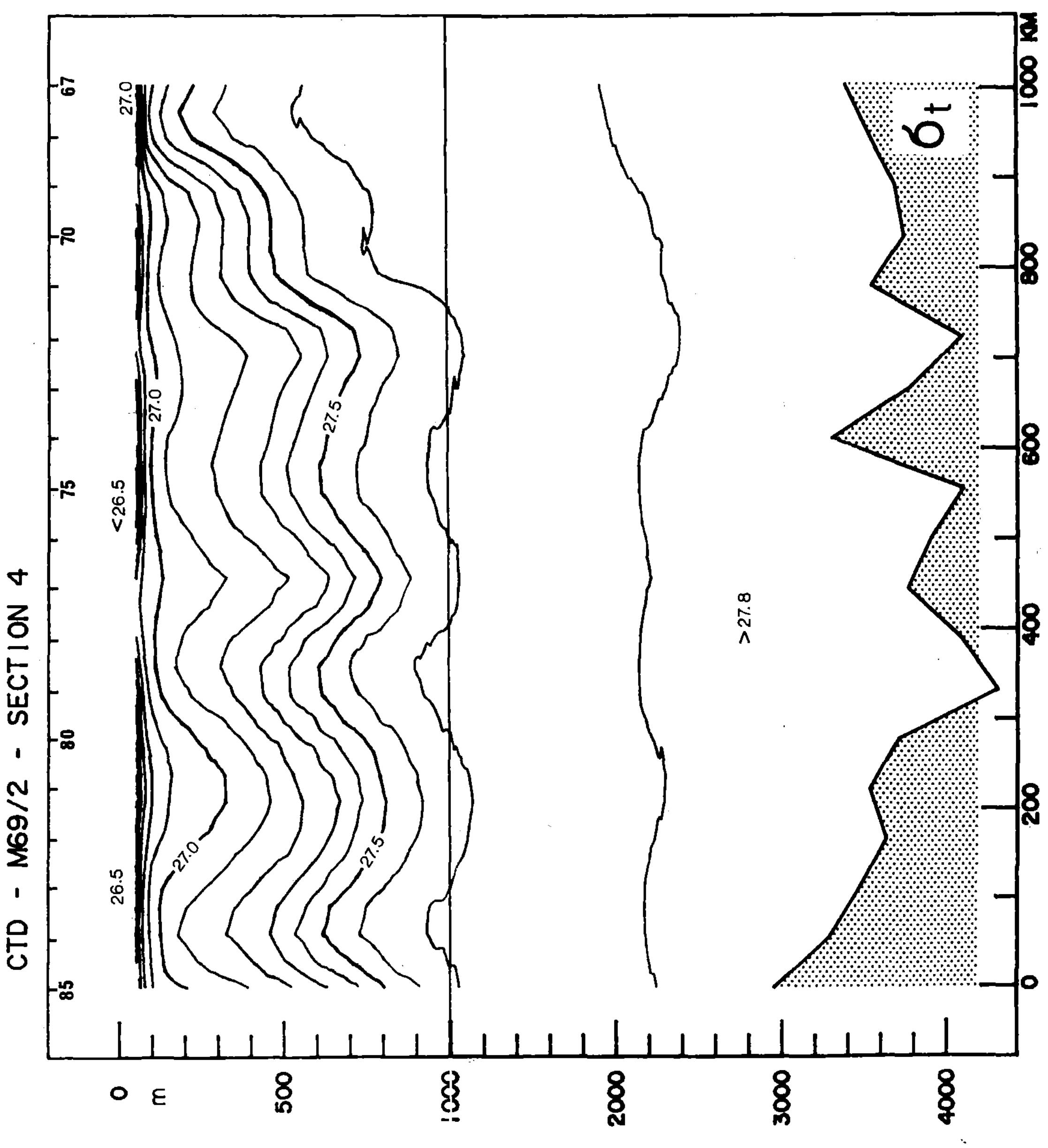
- M69/2 - PHOSPHAT SECTION 3

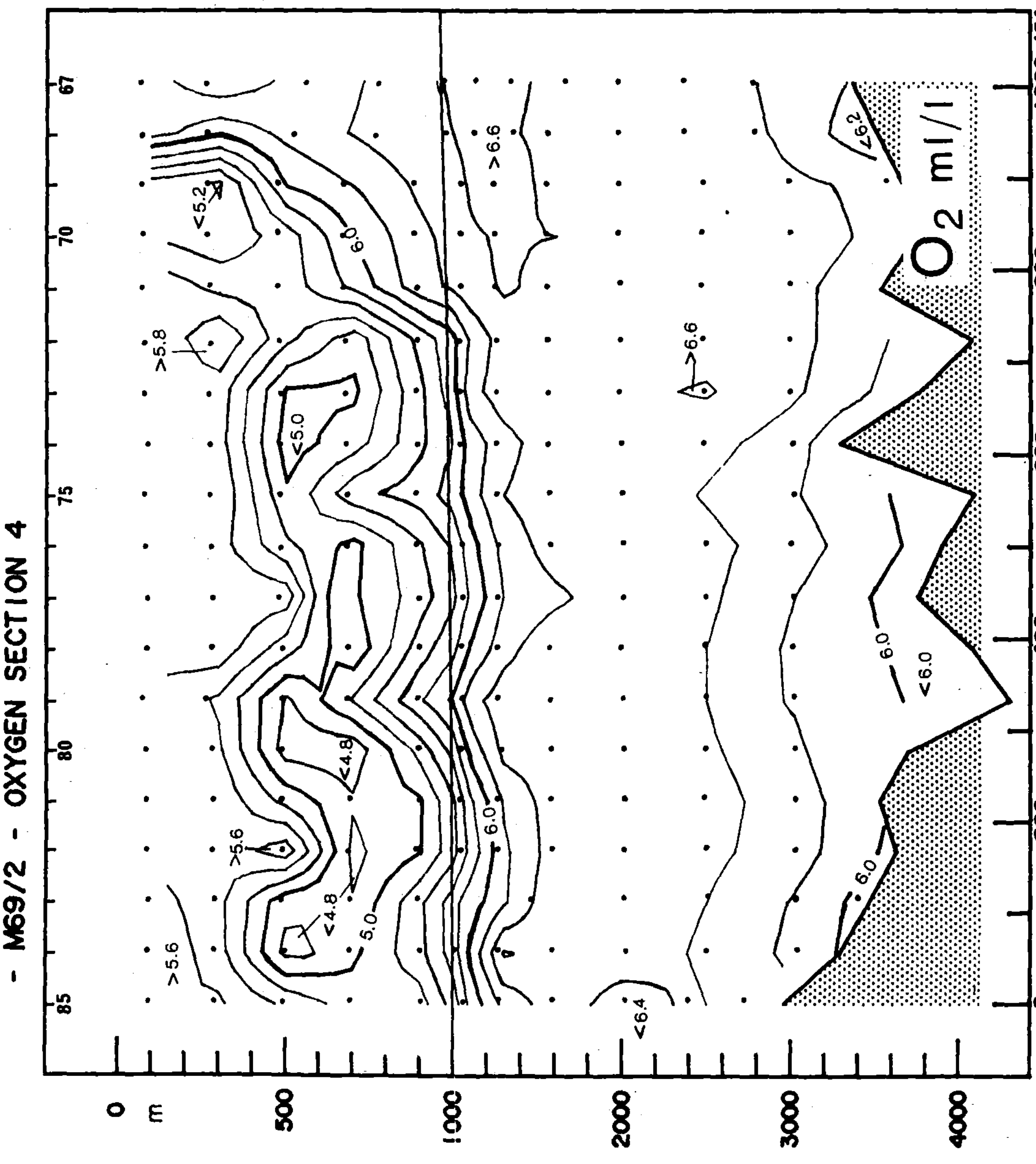



CTD - M69/2 - SECTION 4
T °C
85
80
75
70
67
0
200
400
600
800
1000 KM
0 m
500
1000
2000
3000
4000
15
>14
10
5
<3

CTD - M69/2 - SECTION 4

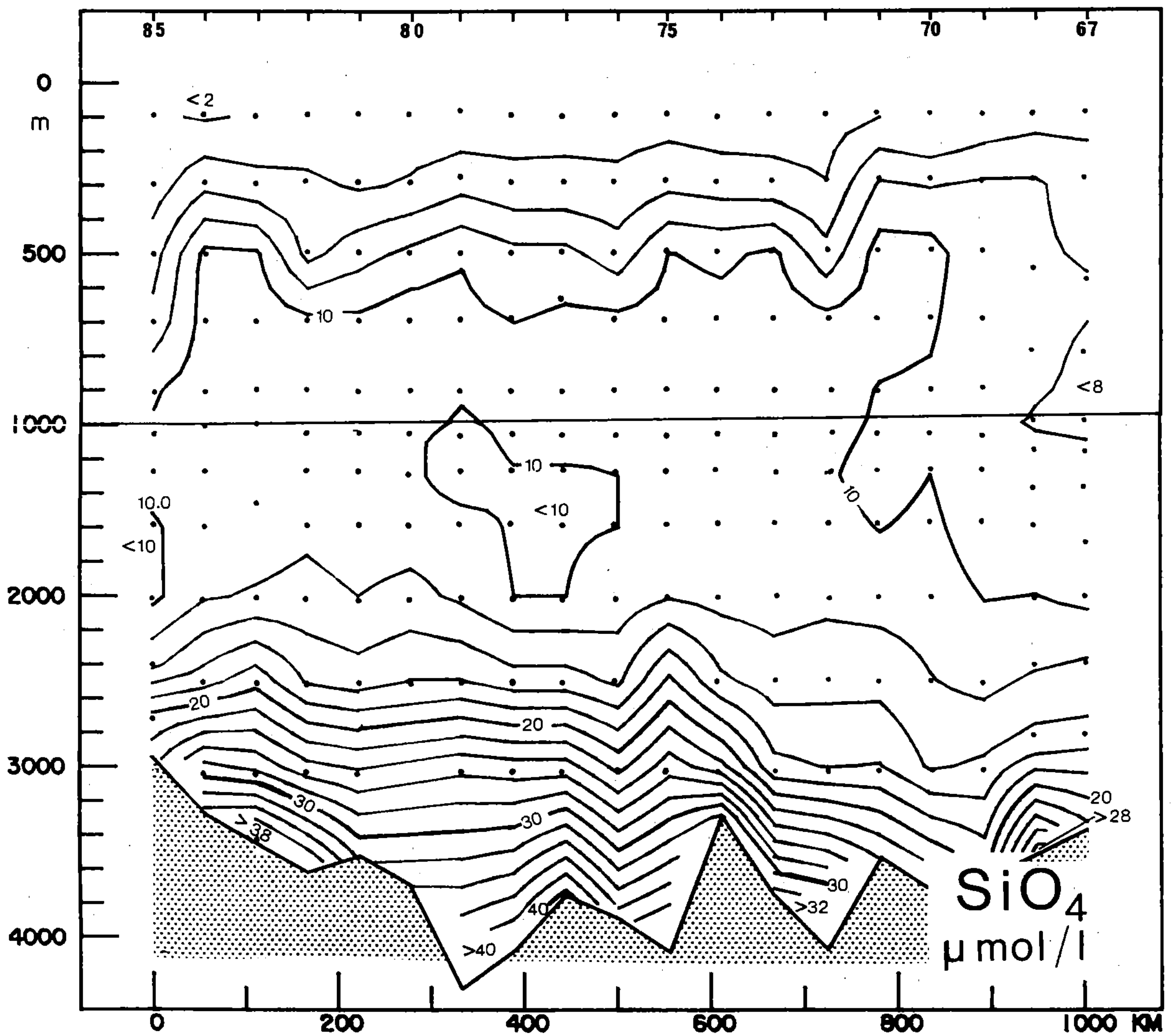


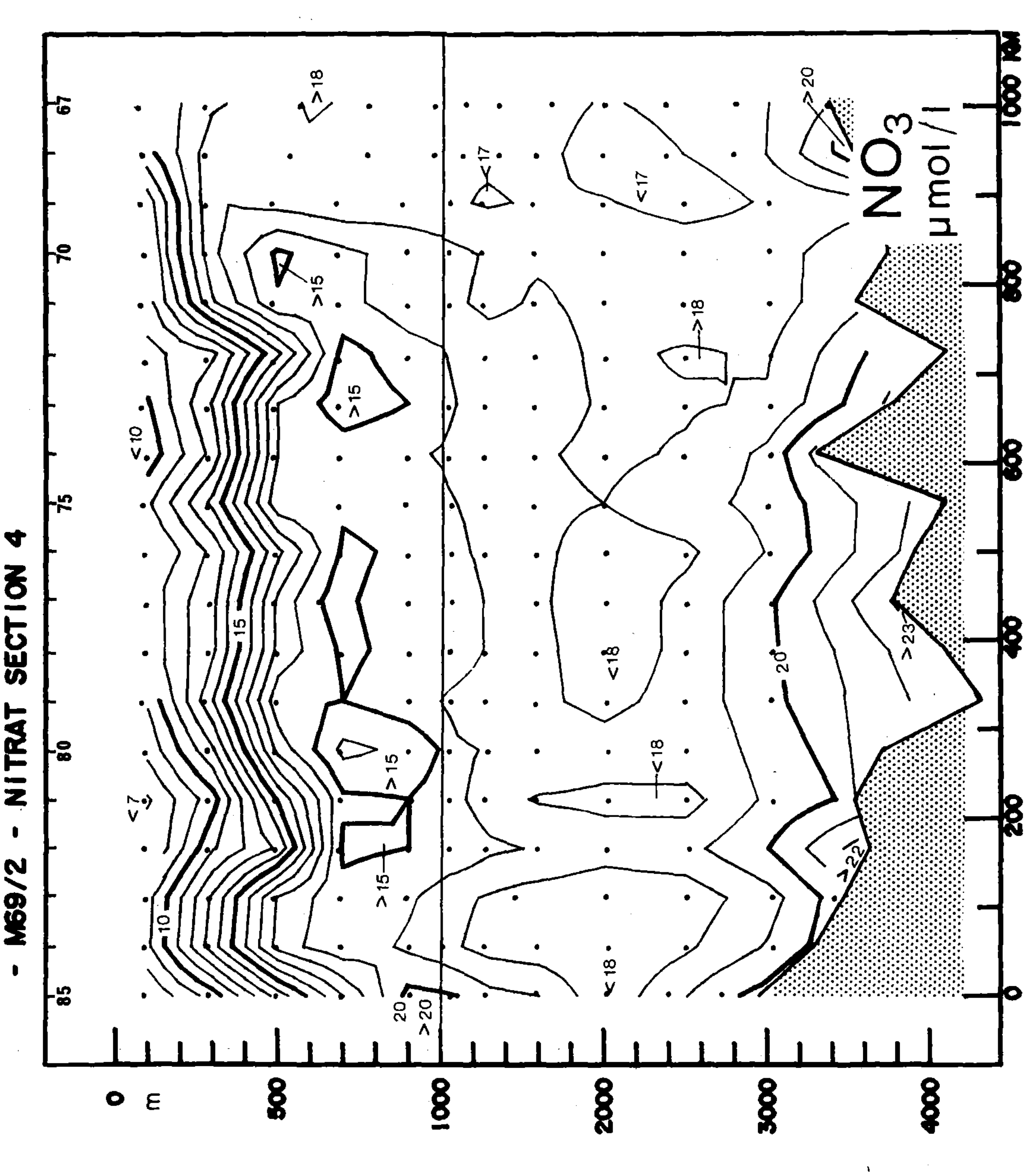

CTD - M69/2 - SECTION 4
85
80
75
70
67
26.5
<26.5
27.0
27.0
27.0
27.5
27.5
>27.8
0
m
500
1000
2000
3000
4000
0
200
400
600
800
1000 KM
σt

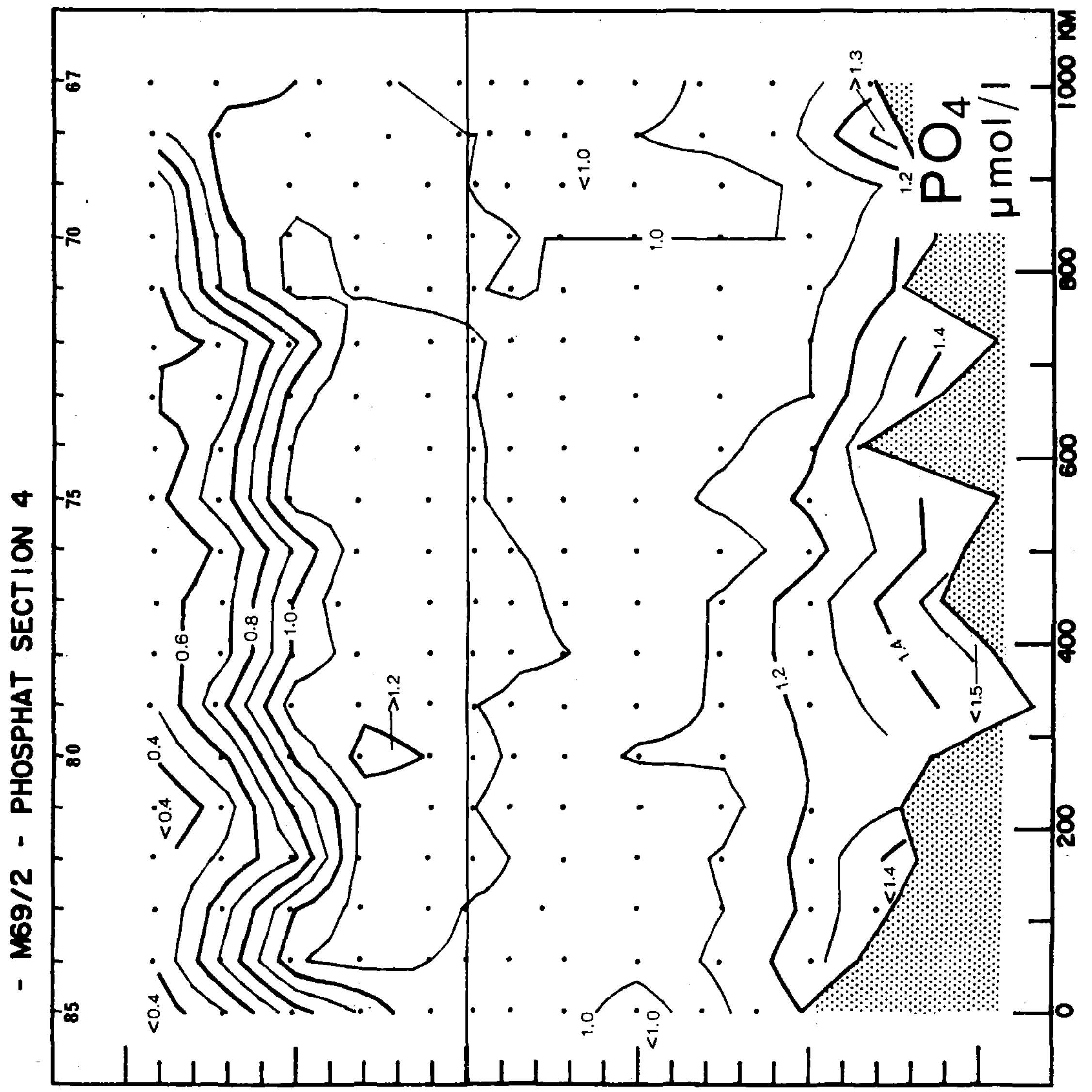


- M69/2 - OXYGEN SECTION 4
O2 ml/l
85
80
75
70
67
0
200
400
600
800
1000 KM
0
m
500
1000
2000
3000
4000
>5.6
<4.8
5.0
>5.6
6.0
<4.8
>5.8
<5.0
6.0
<5.2
>6.6
>6.6
<6.4
6.0
6.0
<6.0
<6.2

- M69/2 - SILIKAT SECTION 4




- M69/2 - NITRAT SECTION 4
m
0
500
1000
2000
3000
4000
85
80
75
70
67
0
200
400
600
800
1000 KM
NO3
µmol/l
<7
<10
10
15
>15
>18
20
>20
<18
18
<17
17
>22
>23


- M69/2 - PHOSPHAT SECTION 4
PO4
µmol/l

3. XBT measurements

During the "Poseidon"-cruise 175 XBTs were launched to increase the horizontal resolution to 10 or 15 nm. The data were collected with a digital recording system consisting of a Commodore CBM 8032 with its periphery. The appropriate interface to the launcher and the software was supplied by W. Emery, UBC, Vancouver, Canada. The probes reached a depth of about 800 m (T7). The accuracy of the data is given with ± 0.1 K. Within this range the data correlate with the sea surface temperature measurements. This data is not displayed within this report, because as sections it does not present significantly more information than the CTD temperature sections.

4. GEK measurements (W. Dasch and P. Koske)

The Institut für Angewandte Physik der Universität Kiel participated at the R.V. "Arnold Veimer" and R.V. "Poseidon" cruise with GEK mesurements on both ships. They used GEK's developed and built in this institution. The GEK consisted in a modification of a von Arx-type instrument.

The Ag/AgCl Electrodes were enclosed in a container with a well defined NaCl solution to increase their stability. The potential was sensed at a diaphragm. The electrodes were towed 30 and 50 m behind the ship on two different cables which allows an easy zero-determination of the electrodes by approaching one to the other. The high stability of the electrodes required a zero-check only every 2 to 3 hours. The resulting tracks are shown in Fig. 9.

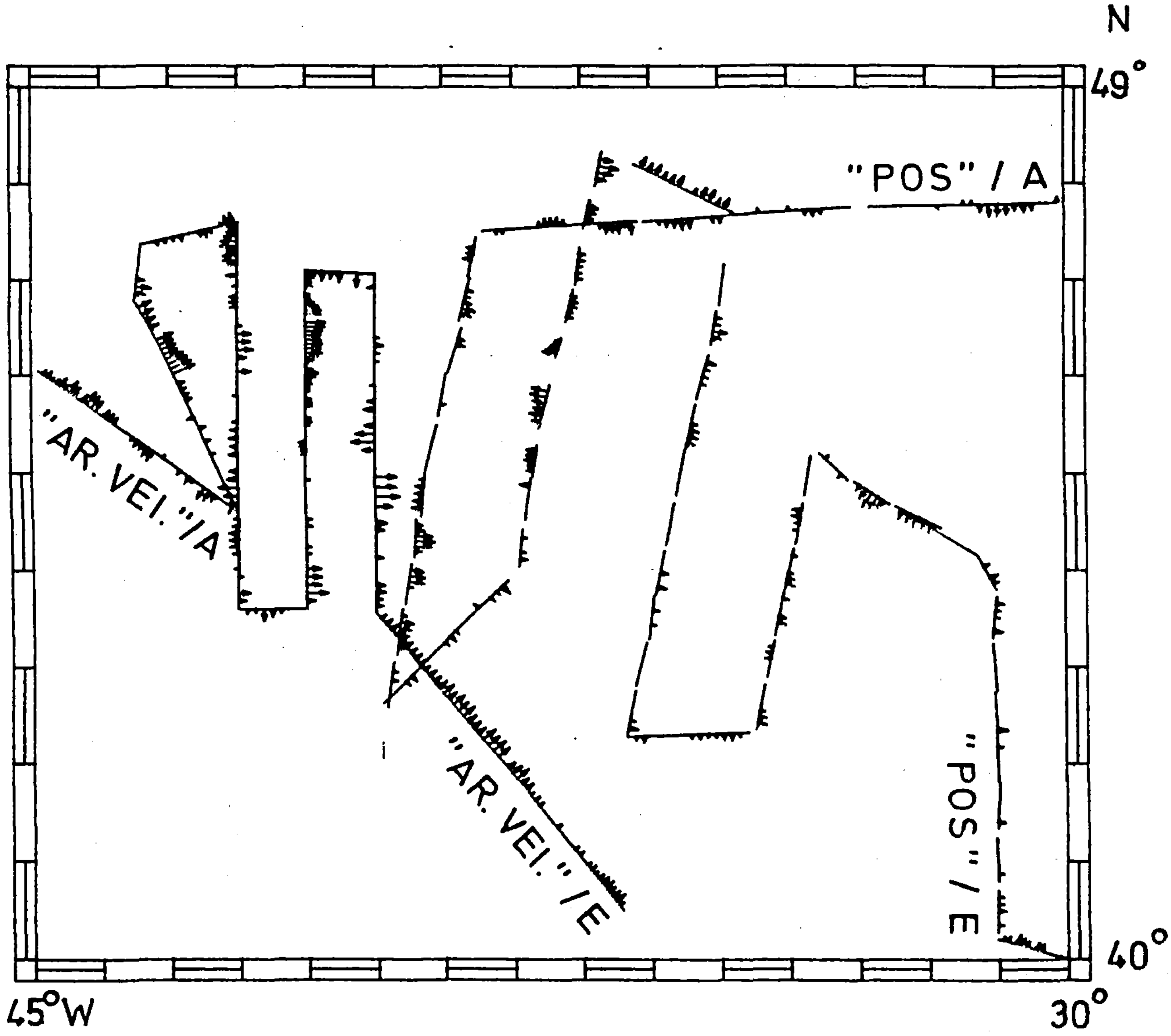


Fig. 9: GEK observations along the CTD-lines of R.V. "Arnold Veimer" and R.V. "Poseidon". The arrows along the track are propotional of the measured voltages.

5. Drifting buoy measurements

The investigation of the large scale surface current field requires appropriate current measurements. Satellite-tracked drifting buoys can yield this information. Therefore 24 drifting buoys were launched in 1984 (Table 5). The buoys were launched by R.V. "Arnold Veimer" and R.V. "Poseidon" during the survey of the North Atlantic Current in a mesoscale experiment. The longer term drift provides the large scale information. In order to show the area covered by the observations during 1984 the tracks of the buoys from launchings in 1984 and from 1 January 1984 when launched during the years before are presented in figure 10. All tracks end at December 31, 1984. Table 6 indicates date and location of the beginning and the end of the tracks shown in figure 10.

The drogues were located at 100 m depth. It should be noted, that all buoys which were recovered in earlier years had lost their drogues because of corrosion of the sail cloth due to rust from the iron yards. In the following years drogues were built in the Institut für Meereskunde. Protection against corrosion was considered with greatest care. However, there is still evidence that drogues might be lost. The longest time period after which a drifter was recovered with its drogue in good shape was four months. Investigations on the changes of the buoy tracks due to the loss of the drogue are not yet conclusive. Probably the loss occurs during a change of weather conditions. In this case the onset of a period of strong wind increases the strain on the drogue causing the possible break of tether, shackle etc. simultaneously with a change in the near surface current regime. Both affect the characteristics of the tracks and are difficult to separate. To date no definite life expectance of the drouges can be given.

Drifter No. Decimal	Hexadecimal	Date 1984	Time GMT	Latitude (N)	Longitude (W)
3581	37F6E	06.08.	1505	43 29.8	46 42.0
3583	37FC8	07.08.	1340	43 50.0	44 59.0
3585	3805D		1726	43 42.1	44 45.9
3588	38111		1908	43 33.3	44 29.4
3587	380FB		2307	43 23.6	44 15.7
3584	3800E	08.08.	0112	43 14.1	43 57.4
3586	380A8		0421	43 05.4	43 41.5
3579	37ED7		1917	43 37.0	42 20.0
3578	37E84		2138	43 46.4	42 39.3
3580	37F3D	09.08.	0050	43 55.2	42 55.8
3582	37F9B		0300	44 01.5	43 14.0
3577	37E71		0645	44 11.9	43 28.3
3570	37CDA		2105	47 34.3	36 56.7
3573	37D5O	10.08.	1412	47 01.6	38 37.0
3568	37C16		2039	46 33.1	38 41.0
3529	37253	11.08.	0216	46 01.8	38 56.7
3547	376DA		0723	45 32.2	39 03.3
3593	38263		1216	45 01.9	39 14.7
3516	36F27		1721	44 31.3	39 23.1
3591	381E4		2151	44 04.6	39 28.4
3506	36CAO	12.08.	0309	43 36.8	39 34.3
3576	37E22		0748	43 05.8	39 43.8
3589	38142		1230	42 36.1	39 52.2
3592	38230	14.08.	0440	47 09.0	37 04.1
3590	381B7	17.08.	1310	42 53.2	34 18.6

Table 5: Drifting buoys launched during 1984.

Drifter No.	Begin Date	Begin Latitude (N)	Begin Longitude (W)	End Date	End Latitude (N)	End Longitude (W)
1812	01.01.84	31 24.78	55 51.90	30.07.84	34 41.46	55 35.70
3506	12.08.84	43 42.78	39 34.02	31.12.84	43 36.06	24 15.84
3512	01.01.84	37 22.80	31 39.66	15.01.84	37 59.52	32 07.98
3513	01.01.84	27 56.40	48 11.40	29.02.84	27 28.02	52 33.72
3514	01.01.84	30 20.52	59 30.24	14.01.84	30 27.84	59 29.40
3516	11.08.84	44 33.60	39 27.24	30.12.84	43 43.50	28 54.24
3528	01.01.84	54 45.18	19 53.64	16.02.84	54 52.98	14 54.66
3529	11.08.84	46 02.88	38 53.52	31.12.84	40 28.80	38 24.78
3536	01.01.84	57 13.26	15 53.34	16 01.84	57 14.40	11 26.04
3537	01.01.84	55 01.02	08 13.20	02.01.84	55 03.60	08 21.00
3547	11.08.84	45 33.00	39 04.62	31.12.84	46 10.32	39 28.86
3560	01.01.84	55 58.50	21 03.30	14.01.84	55 10.20	09 11.28
3561	01.01.84	55 31.44	33 12.00	22.07.84	60 05.52	07 21.72
3562	01.01.84	54 27.76	33 52.38	30.07.84	58 51.72	03 22.68
3563	01.01.84	54 55.20	17 37.80	30.07.84	53 44.64	09 49.74
3564	01.01.84	52 07.50	19 16.20	02.02.84	51 04.08	04 14.82
3566	01.01.84	60 00.78	15 19.62	28.01.84	58 24.96	06 27.78
3567	01.01.84	55 43.32	15 22.92	16.01.84	55 01.62	08 48.54
3568	10.08.84	46 51.42	38 27.78	31.12.84	44 03.18	29 00.48
3569	01.01.84	58 34.38	15 24.60	17.05.84	57 21.60	07 23.40
3570	10.08.84	47 35.28	36 49.32	31.12.84	47 22.20	08 25.38
3571	01.01.84	51 54.18	22 19.98	09.03.84	48 56.58	13 21.96
3572	01.01.84	53 14.04	21 36.48	16.01.84	52 28.20	10 11.22
3573	08.10.84	46 10.86	34 09.96	31.12.84	47 35.76	20 07.26
3574	01.01.84	42 46.26	28 04.98	26.09.84	38 47.10	27 06.84
3575	01.01.84	45 42.00	23 46.98	31.12.84	13 12.06	57 26.94
3576	12.08.84	43 06.96	39 42.84	31.12.84	43 55.80	23 22.74
3578	09.08.84	43 40.98	42 38.34	31.12.84	37 54.84	35 45.90
3579	08.08.84	43 32.22	42 13.26	31.12.84	46 45.90	23 33.66
3580	09.08.84	43 39.18	42 52.92	06.10.84	41 43.32	42 28.74
3581	06.08.84	43 33.84	46 35.76	31.12.84	42 52.80	35 07.86
3582	09.08.84	43 50.70	43 12.60	31.12.84	37 31.08	38 02.10
3583	07.08.84	43 45.64	44 49.32	31.12.84	46 01.32	29 07.50
3584	08.08.84	43 12.06	43 57.30	31.12.84	38 26.88	41 00.90
3585	07.08.84	43 46.26	44 33.06	30.09.84	43 20.88	35 13.98
3586	08.08.84	43 01.08	43 44.88	31.12.84	42 23.58	41 28.74
3587	08.08.84	43 21.30	44 16.74	31.12.84	41 25.56	43 46.86
3588	07.08.84	43 38.76	44 21.54	31.12.84	41 47.52	43 36.48
3589	12.08.84	42 40.68	39 52.32	30.09.84	41 32.10	39 03.78
3590	17.08.84	42 53.10	34 18.60	09.11.84	41 46.32	30 37.56
3591	12.08.84	44 04.98	39 23.88	31.12.84	48 28.14	24 23.34
3592	14.08.84	47 12.24	37 00.00	31.12.84	40 56.40	34 16.38
3593	11.08.84	45 01.44	39 21.30	31.12.84	44 38.28	22 56.88

Table 6: Date and location of the beginning and the end of drifting buoy tracks during 1984.

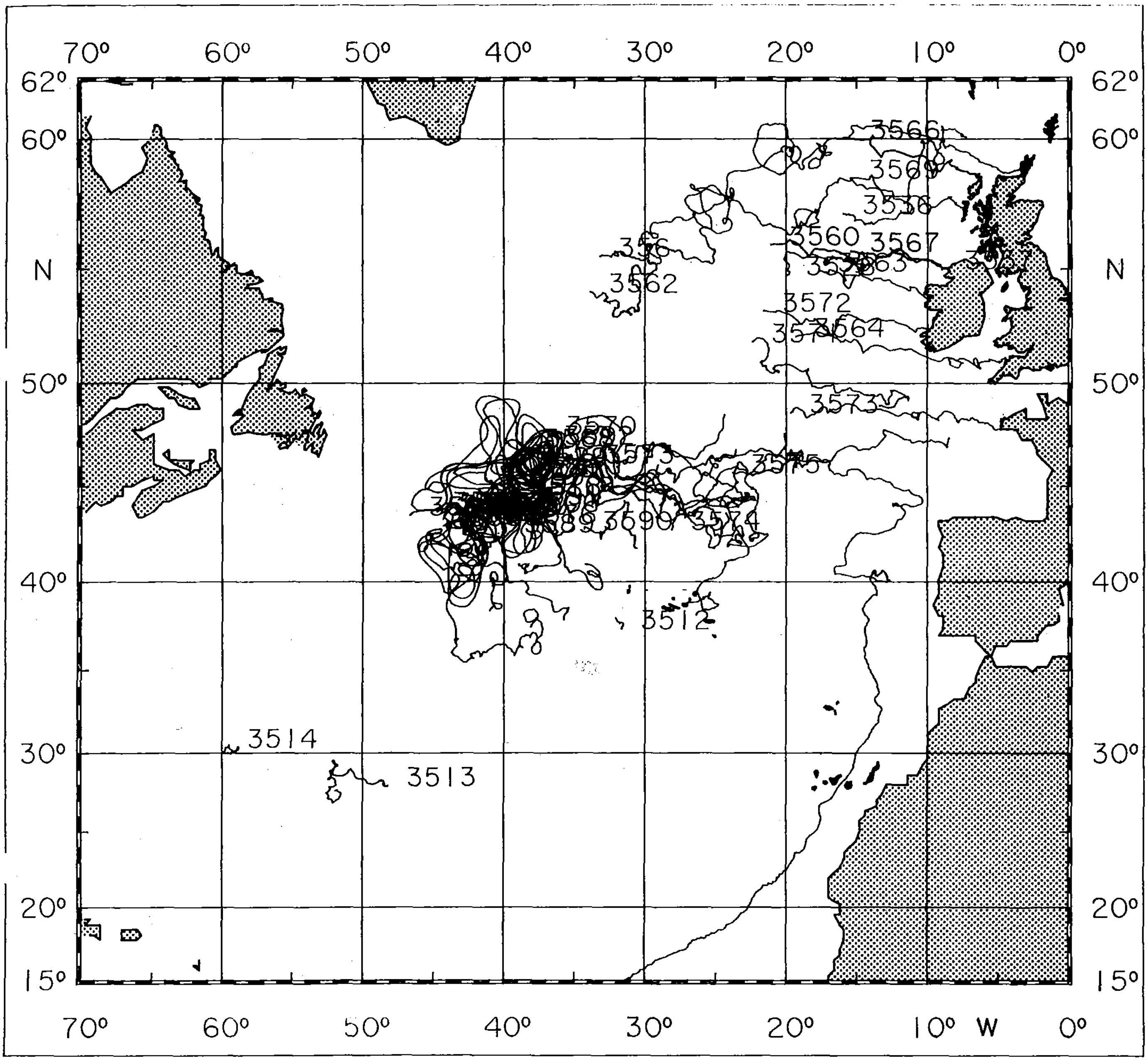


Fig. 10: Tracks of drifting buoys according to Table 6.

6. Moored current meter measurements

The moored current meter measurements were planned with the objective of obtaining long term statistics at selected locations and to study the relevant processes causing the observed fluctuations. Therefore three current meter moorings were laid in 1983 on the eastern flank of the Mid-Atlantic Ridge north of the Azores. Moorings 265/4 represent the continuation of a time series which began in 1980. Mooring 266/3 could not be recovered during two attempts and has to be accepted as lost.

The resulting observation periods since 1980 are summarized in figure 11. Information on the moorings is given in table 8 and simple statistics in table 7. For a comparison the statistics of the hourly original data as well as of the low and lowlow passed data are shown. The data are presented as time series plots of velocity components, temperature and pressure figures 12a-j and as progressive vector diagrams (Figure 13a-c).

The low passed time series are filtered with a Lanczos square taper with 121 weights at a time interval of 1 hour and a half power period of 40 hours. By this filter tides and inertial motion should be suppressed. Then daily averages were calculated and plotted. From the daily averages lowlow passed time series are calculated with a Lanczos square taper with 15 days half power period and 45 weights. High frequency noise due to mooring motions is not to be expected because subsurface mooring techniques are used with the shallowest bouancy float at about 200 m below the sea surface.

The influence of low frequency current fluctuations on the mooring can be seen in the pressure records. Vertical displacements range up to 130 m at a nominal depth of 319 m for mooring 265/4, to more than 65 m at a nominal depth of 739 m for mooring 290 and 70 m at a nominal depth of 398 m for mooring 291. Displacements of this range require a correction of the temperature records. Therefore vertical temperature gradients are deduced for the depth ranges of the current meters as averages of temperature profiles obtained with a CTD in the vicinity of the moorings when they were laid and recovered. The depth changes of current meters without pressure sensors were derived by simple geometric arguments under the assumption of a rigid mooring wire. Although the fluctuations seem important the effect of the correction is hardly visible in the scale of the presented plots. As the current fluctuations are dominated by motions of low vertical order a correction of the current components by the vertical current gradient was rejected. The error induced in the current measurements due to the fact that the current meter follows the current was estimated as neglegible.

In the moorings Aanderaa current meters RCM 4 and RCM 5 were used. AANDERAA (1978) gives an accuracy in speed of 1 cm/s or 2 % at a speed ranging from 6 to 100 cm/s. The records were not affected by the relatively large threshold of 2.5 cm/s. The accuracy of the thermistors is given as 0.05 K. At the deepest current meters the resolution was increased by introducting a smaller range from 2.6 °C to 5.9 °C. The accuracy of the pressure sensor is given with 1 % of the range. It results an accuracy of 7 m for 265402, 290101 and 291101.

Various current meters suffered from problems with the rotor bearings. Five rotors were lost and two records were interupted when the rotors where blocked at speeds significantly above the threshold.

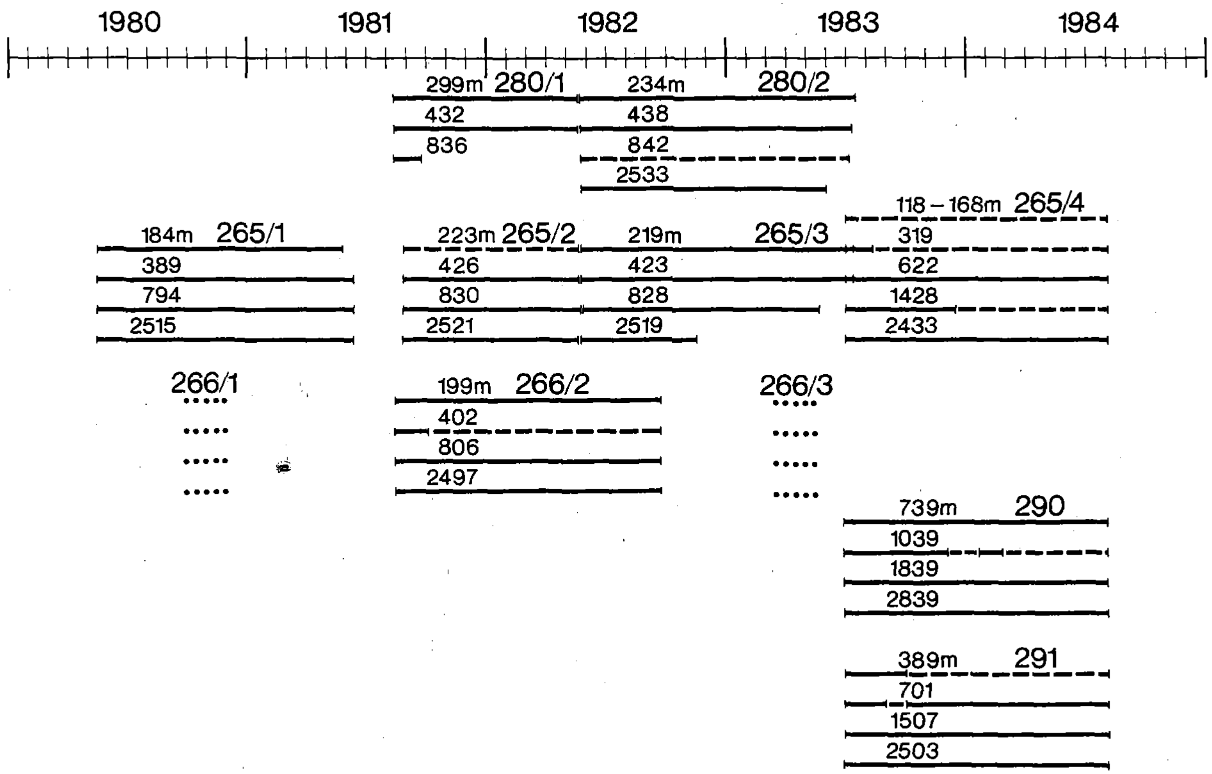


Fig. 11: Observation periods of moored current meters since 1980 on the location shown in figure 2. The broken lines indicate the loss of the rotor and consequently only a temperature record. Lines made from points stand for lost current meters.

6.1 Statistics of moored current meter time series

		Record duration Hours	Period	Hourly values Mean	Std.	Low Pass 40h H P P Mean	Std.	Low Low Pass 15 d H P P Mean	Std.
265402	T	9667	27.6.83 13.00 -03.8.84 07.00	10.75	1.12	10.74	1.08	10.78	1.15
	U	1018	27.6.83 13.00	- 1.64	13.11	- 3.21	10.17		
	V	1018	-08.8.83 21.00	-10.19	3.47	- 9.93	2.64		
265403	T	9666	27.6.83 13.00 -03.8.84 06.00	7.42	1.13	7.40	1.10	7.24	1.10
	U	9666		4.05	9.39	4.26	7.99	3.51	6.89
	V	9666		- 0.25	7.86	0.01	5.88	1.95	3.92
265404	T	9666	27.6.83 13.00 -03.8.84 06.00	3.82	0.10	3.82	0.09	3.81	0.10
	U	4080	27.6.83 13.00	0.24	4.05	0.25	2.68	- 0.71	2.13
	V	4080	-14.12.83 10.00	0.34	3.57	0.32	2.11	1.30	1.62
265405	T	9666	27.6.83 13.00 -03.8.84 06.00	3.28	0.05	3.28	0.04	3.27	0.05
	U	9666		0.78	3.74	0.81	2.16	0.62	2.08
	V	9666		- 0.19	3.27	- 0.15	2.17	0.44	1.56
290101	T	9667	26.6.83 12.00 -02.8.84 06.00	6.71	0.61	6.73	0.56	6.77	0.54
	U	9667		4.60	6.55	4.48	4.87	3.98	3.94
	V	9667		- 3.58	8.38	- 3.66	7.24	- 5.35	6.27
290102	T	9667	26.6.83 12.00 -02.8.84 06.00	4.68	0.27	4.69	0.25	4.69	0.20
	U	4669	26.6.83 12.00	3.73	4.59	3.76	2.31	3.12	0.89
	V	4669	-2.12.83 13.00 20.1.84 04.00 -24.2.84 11.00	- 0.08	5.46	0.19	4.58	1.73	3.03
290103	T	9667	26.6.83 12.00 -02.8.84 06.00	3.24	0.03	3.24	0.03	3.24	0.03
	U	9667		2.04	2.83	1.97	1.73	1.96	1.45
	V	9667		- 1.79	3.53	- 1.83	2.86	- 2.41	2.63
290104	T	9667	26.6 83 12.00 -02.8.84 06.00	3.01	0.07	3.01	0.06	3.02	0.06
	U	9667		0.21	3.34	0.19	1.94	0.13	1.13
	V	9667		- 1.91	3.88	- 1.93	3.27	- 2.17	3.05
291101	T	9663	27.6.83 00.00 -02.8.84 14.00	9.01	0.43	9.00	0.39	9.08	0.35
	U	1892	27.6.83 00.00	3.68	6.21	3.39	4.45		
	V	1892	-13.9.83 18.00	1.72	7.22	1.22	4.75		
291102	T	9663	27.6.83 00.00 -02.8.84 14.00	6.21	0.40	6.21	0.37	6.25	0.35
	U	8901	27.6.83 00.00	0.12	5.76	0.27	3.35	0.26	2.83
	V	8901	-29.8.83 16.00 30.9.83 13.00 -02.8.83 14.00	- 0.01	5.04	- 0.25	3.00	- 1.64	1.83

	Record duration Hours	Period	Hourly values Mean	Std.	Low Pass 40h H P P Mean	Std.	Low Low Pass 15 d H P P Mean	Std.
291103 T	9663	27.6.83 00.00 -02.8.84 14.00	3.70	0.05	3.70	0.04	3.71	0.04
U	9663		0.19	4.07	0.27	3.07	0.80	2.95
V	9663		- 0.26	3.89	- 0.38	2.86	- 0.81	2.77
291104 T	9663	27.6.83 00.00 -02.8.84 14.00	3.14	0.03	3.14	0.02	3.14	0.02
U	9663		- 0.49	3.25	- 0.42	1.88	0.02	1.56
V	9663		0.11	2.41	0.05	1.50	- 0.14	1.45

Table 7: Simple statistics of current meter time series. (T - temperature, U,V- eastward, northward current components , Std - standard deviation). For a comparison statistics of origianal, low and low low passed data is given.

Position		Water depth (m)	Mooring No.	Type of instrument	Instr. depth (m)	First value date	Last value date	Duration (days)	Record interval (min)
48°34.5'N	25°44.3'W	3450	265401	TK	116-156	27.06.83	03.08.84	403	60
			265402	AVTP	319				
			265403	AVT	622				
			265404	AVT	1428				
			265405	AVTT	2433				
47°47.8'N	24°36.1'W	3380	290101	AVTP	739	26.06.83	02.08.83	403	60
			290102	AVT	1039				
			290103	AVT	1839				
			290104	AVTT	2839				
48°29.2'N	24°11.4'W	3700	291101	AVTP	389	27.06.83	02.08.83	402	60
			291102	AVT	701				
			291103	AVT	1507				
			291104	AVTT	2503				

AVT = Aanderaa Current meter with thermistor
AVTT = Aanderaa Current meter with thermistor and two ranges
AVTP = Aanderaa Current meter with thermistor and pressure sensor

Table 8: Observation periods of current meter moorings.

6.2 Moored current meter time series

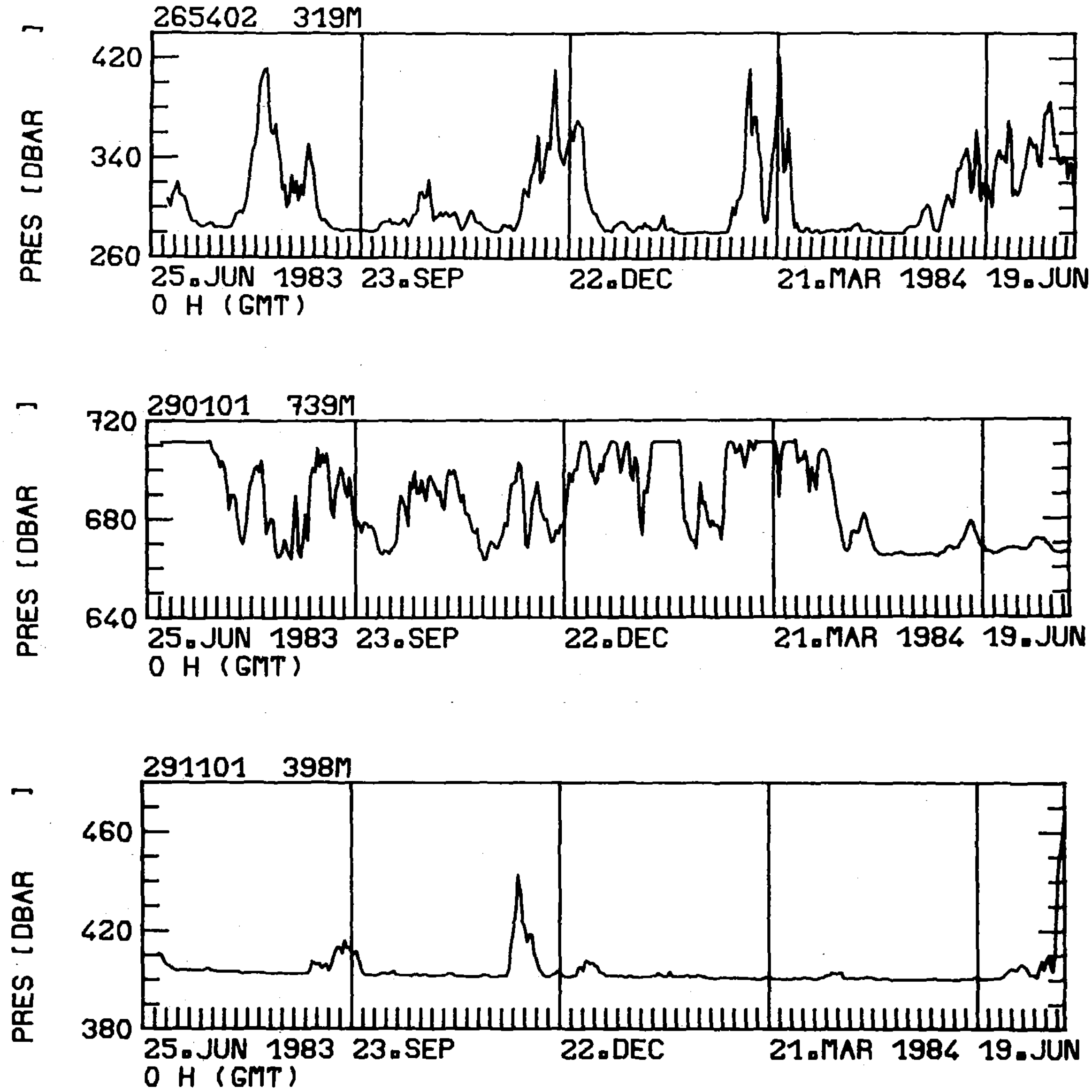
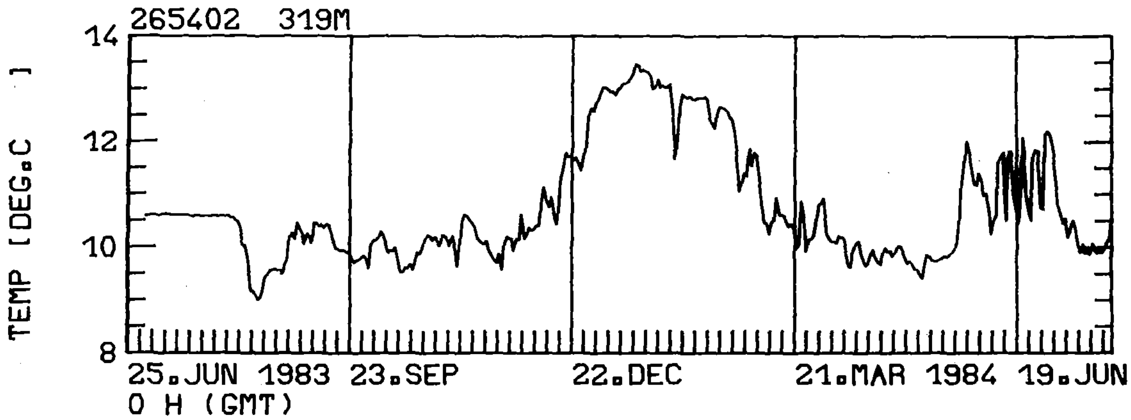
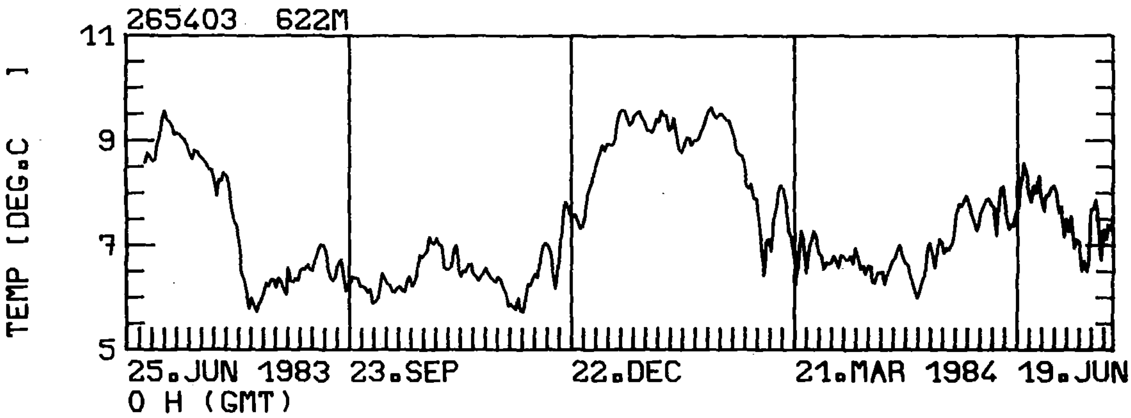


Fig. 12a-j: Time series plots of the moored current meter measurements at the mooring location 265, 290 and 291 shown in figure 2. The plot represent daily averages.


265402 319M
TEMP [DEG.C]
14
12
10
8
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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11
9
7
5
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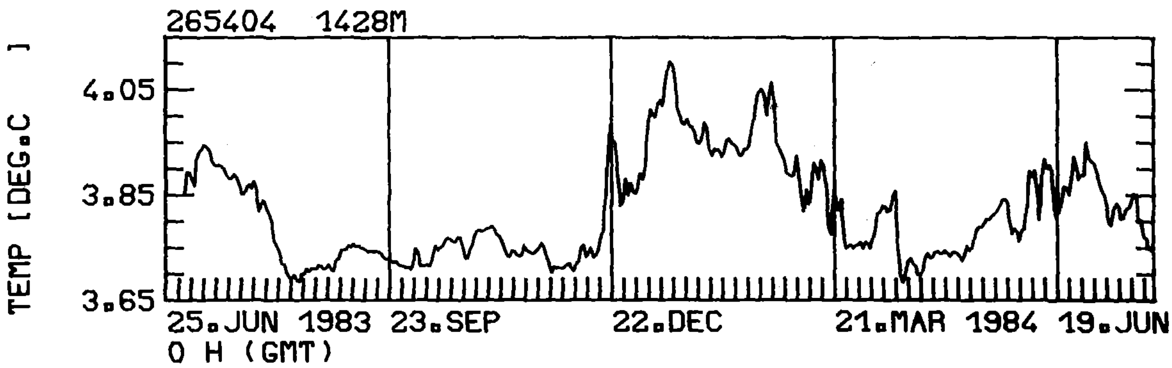
0 H (GMT)


265404 1428M
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3.85
3.65
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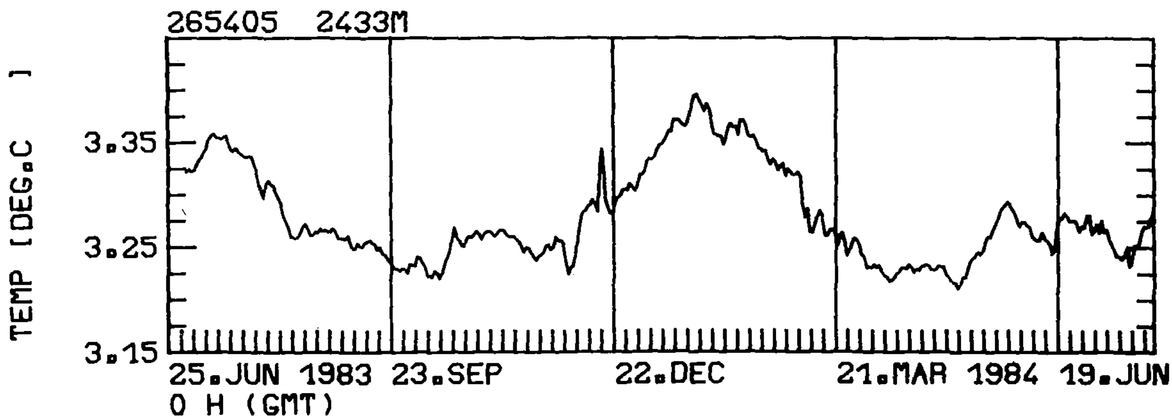
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3.25
3.15
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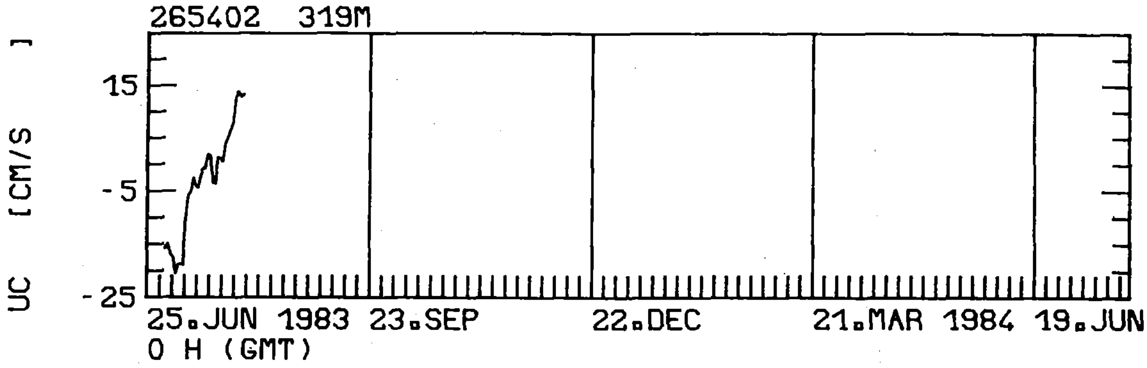
0 H (GMT)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15
-5
-25
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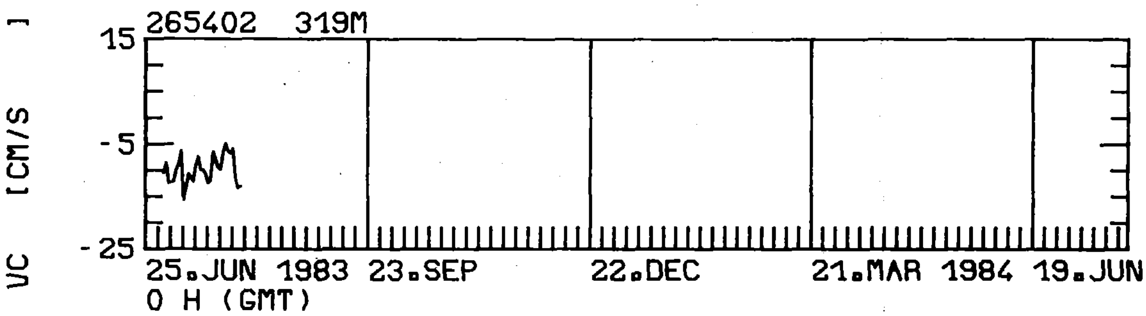
0 H (GMT)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VC [CM/S]
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-5
-25
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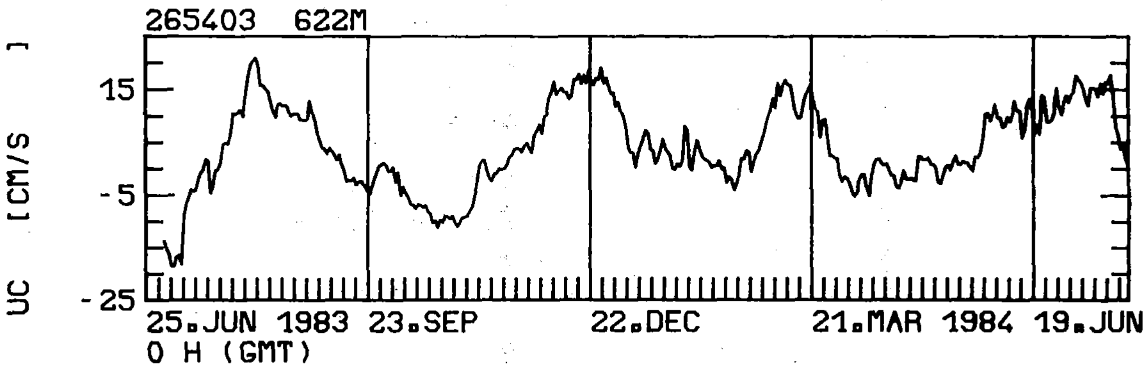
0 H (GMT)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-5
-25
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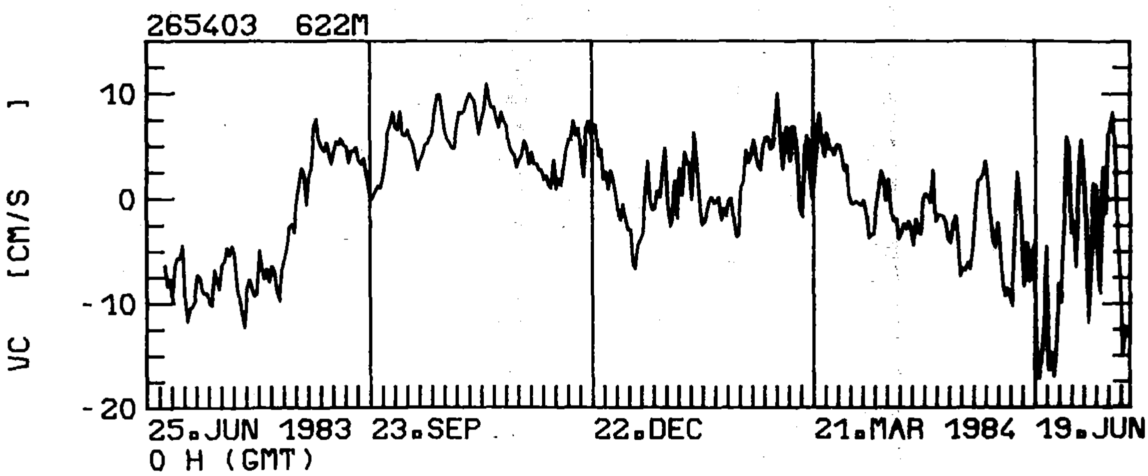
0 H (GMT)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0
-10
-20
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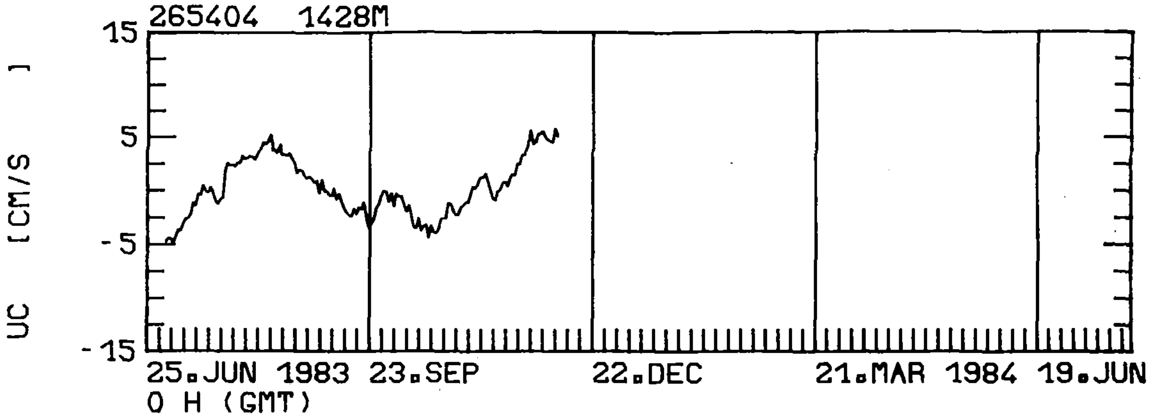
0 H (GMT)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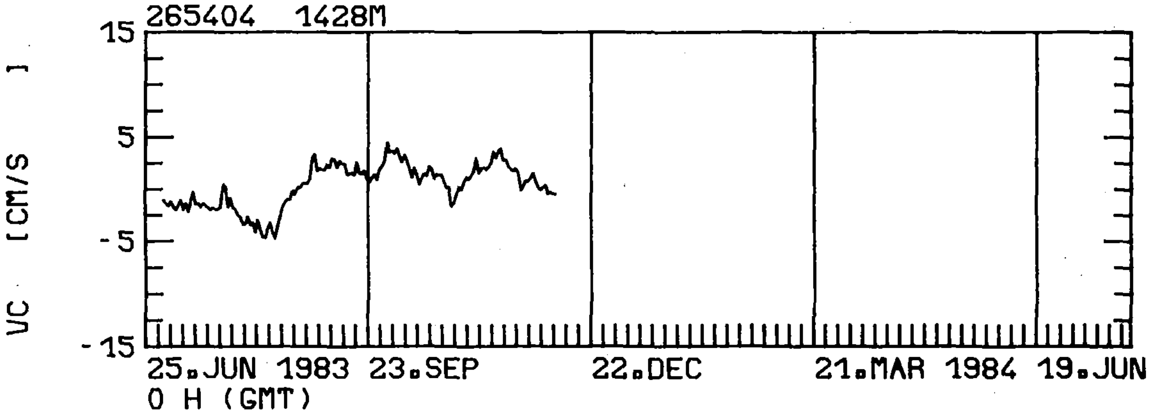
15
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP
22.DEC
21.MAR 1984 19.JUN
0 H (GMT)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-5
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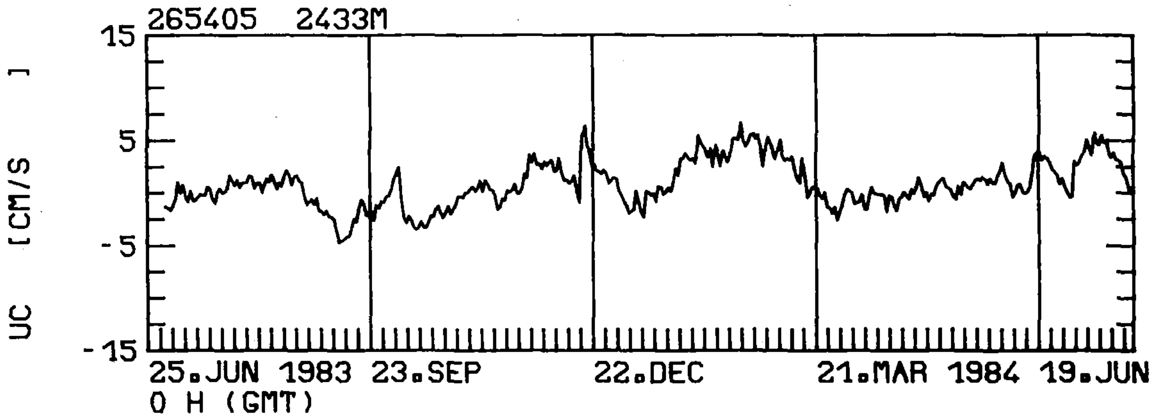
21.MAR 1984 19.JUN
0 H (GMT)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15
5
-5
-15
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25.JUN 1983 23.SEP
22.DEC
21.MAR 1984 19.JUN
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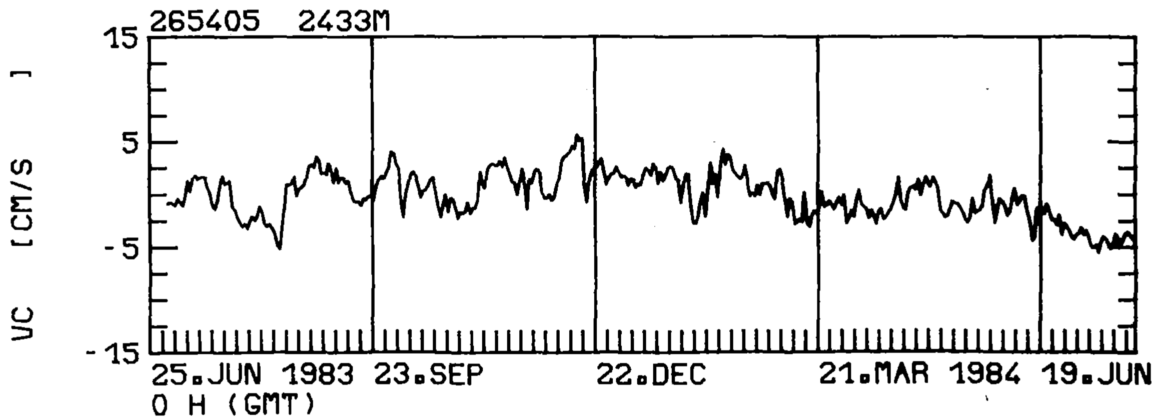
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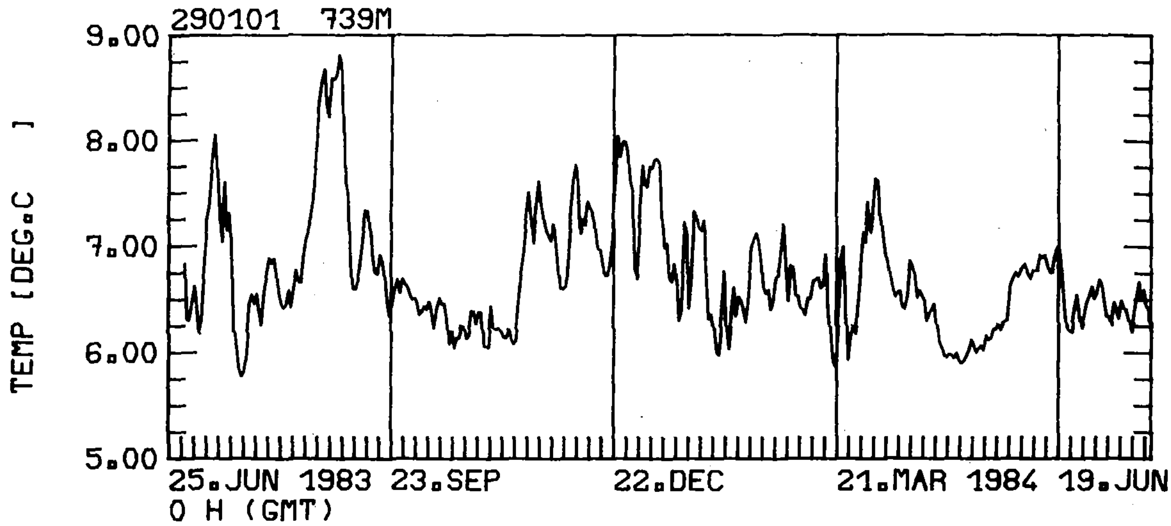
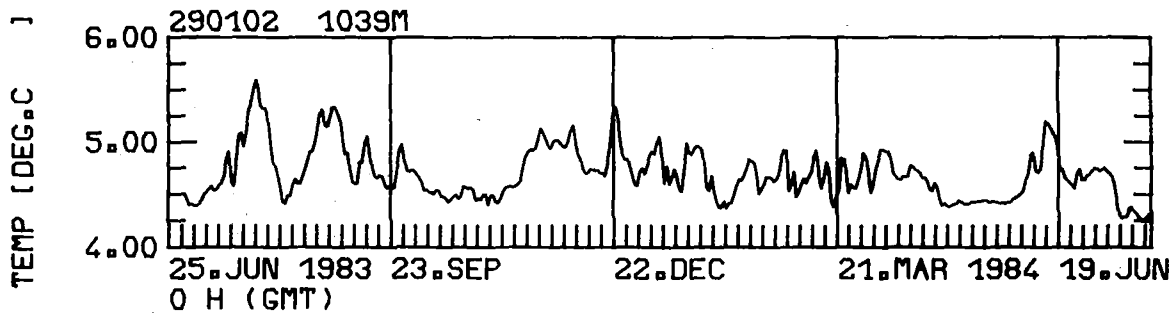
15
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP
22.DEC
21.MAR 1984 19.JUN
0 H (GMT)


290101 739M
9.00
8.00
7.00
6.00
5.00
TEMP [DEG.C]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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5.00
4.00
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25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
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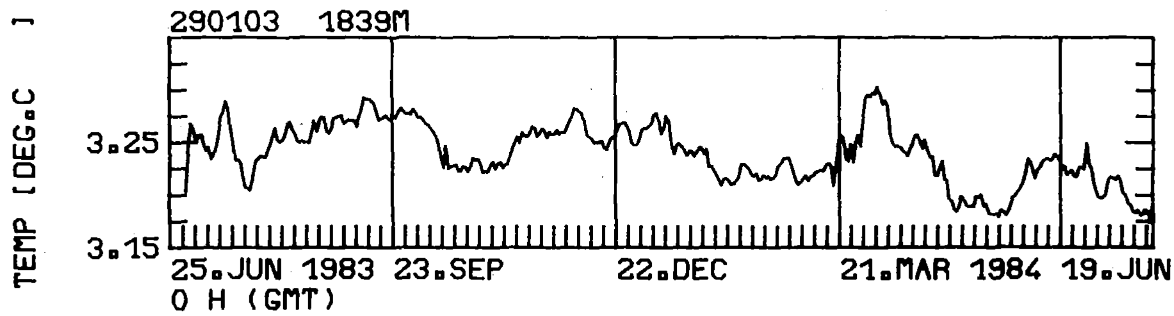
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3.15
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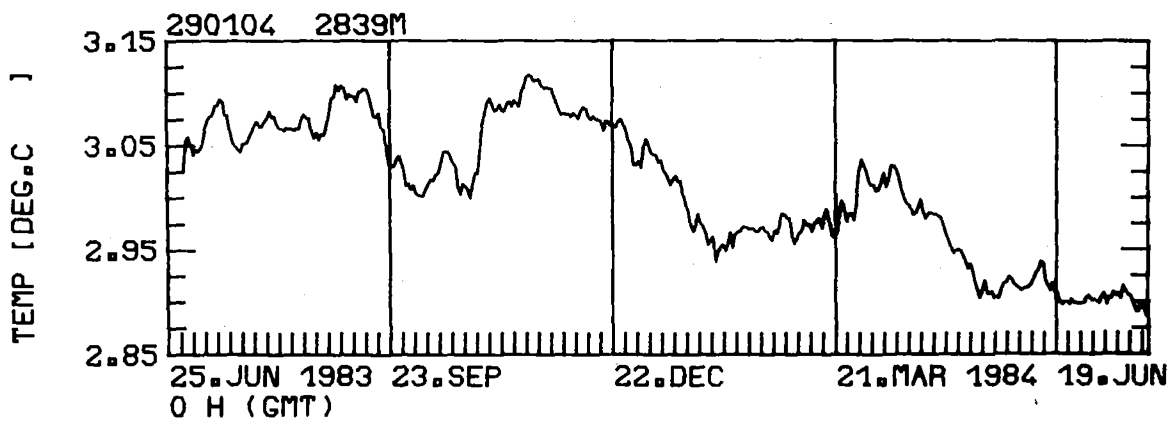
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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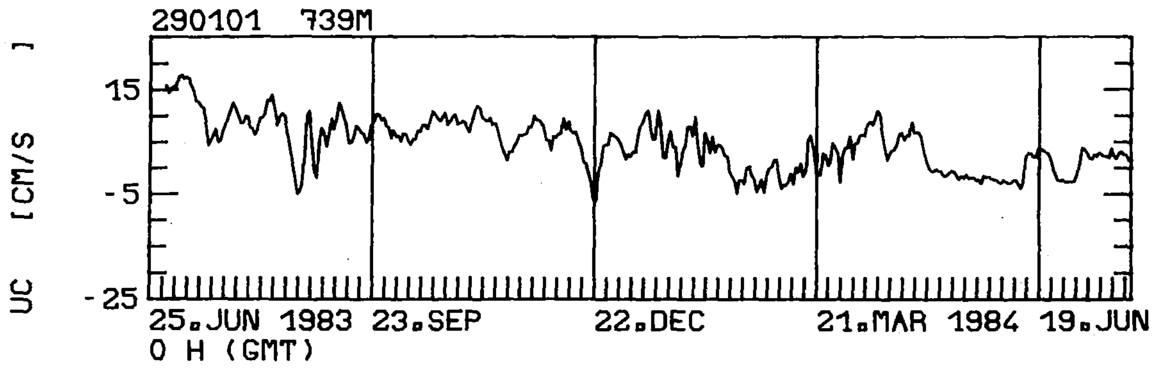
3.05
2.95
2.85
TEMP [DEG.C]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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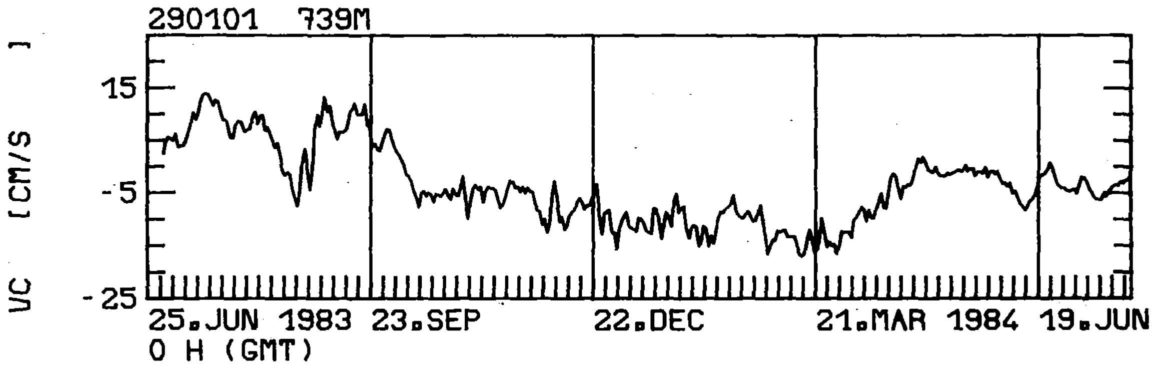
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-5
-25
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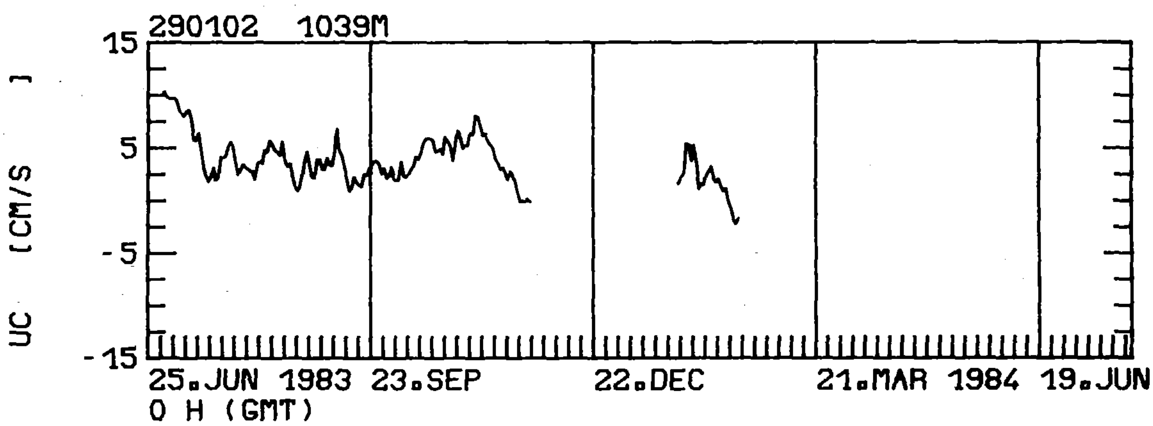
0 H (GMT)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UC [CM/S]
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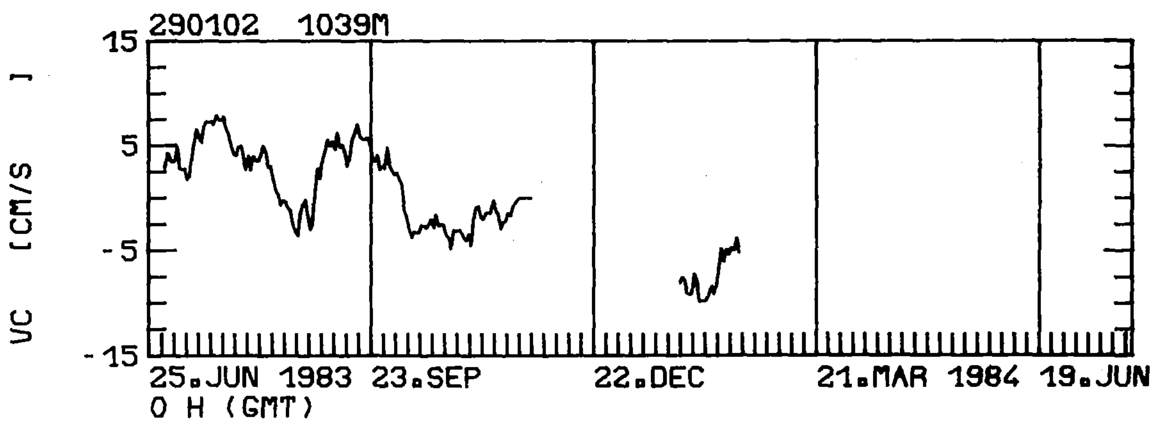
5
-5
-15
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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VC [CM/S]
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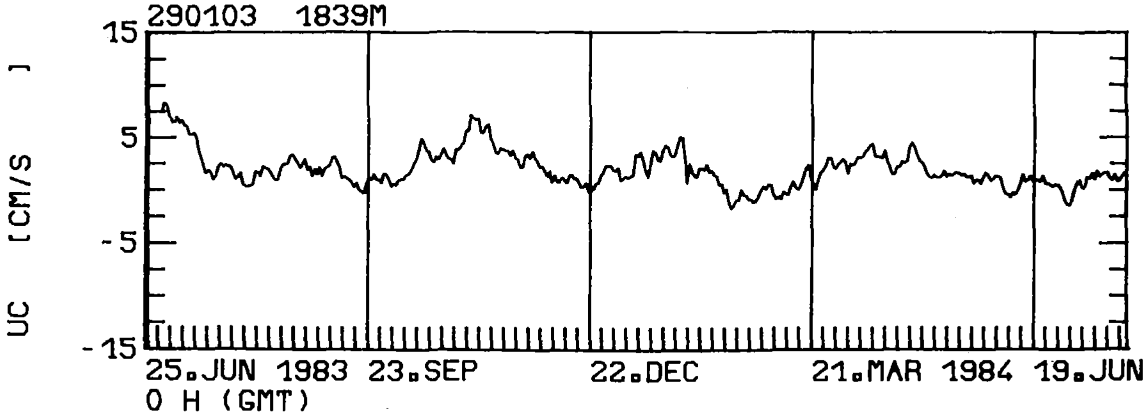
5
-5
-15
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)



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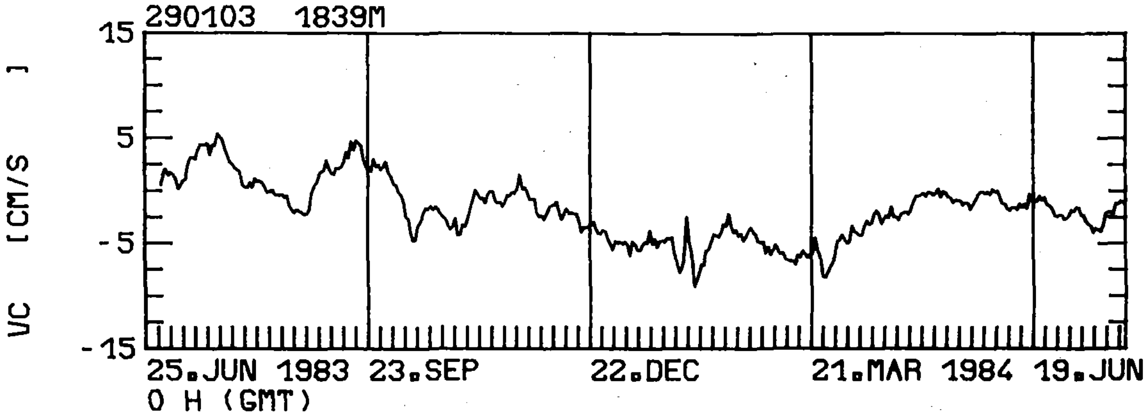
5
-5
-15
UC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)



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VC [CM/S]
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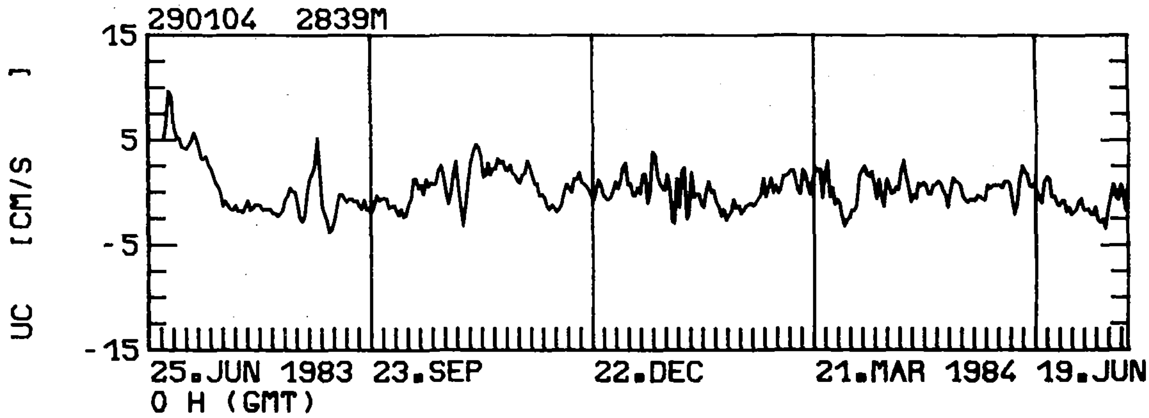
0 H (GMT)



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-5
-15
UC [CM/S]
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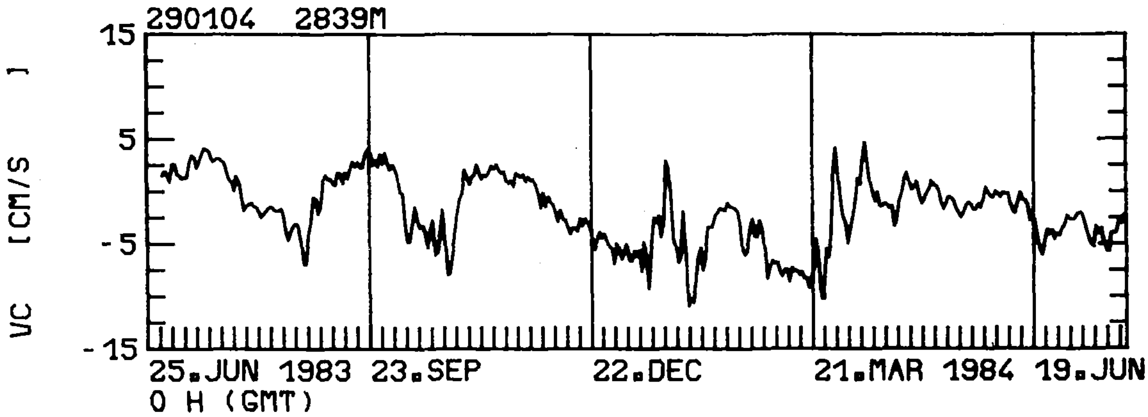
0 H (GMT)



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-15
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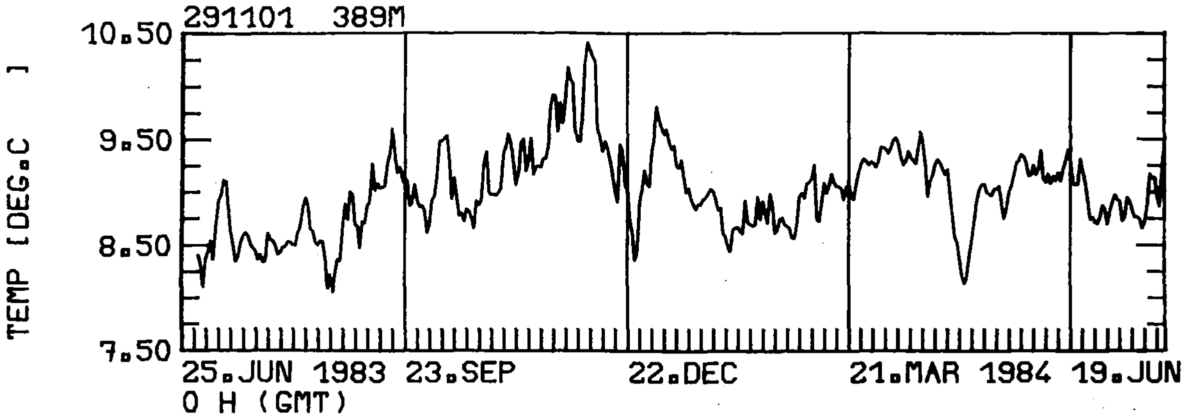
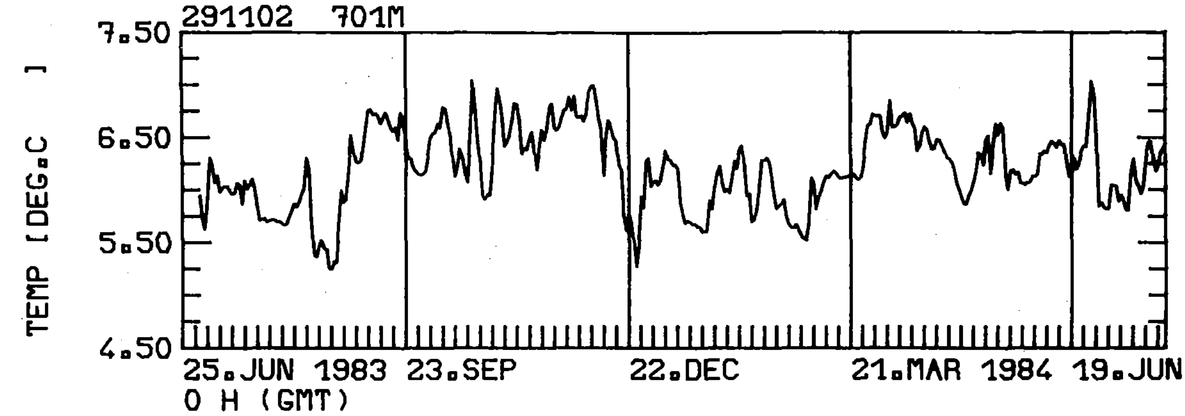

291101 389M
10.50
9.50
8.50
7.50
TEMP [DEG.C]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)


291102 701M
7.50
6.50
5.50
4.50
TEMP [DEG.C]
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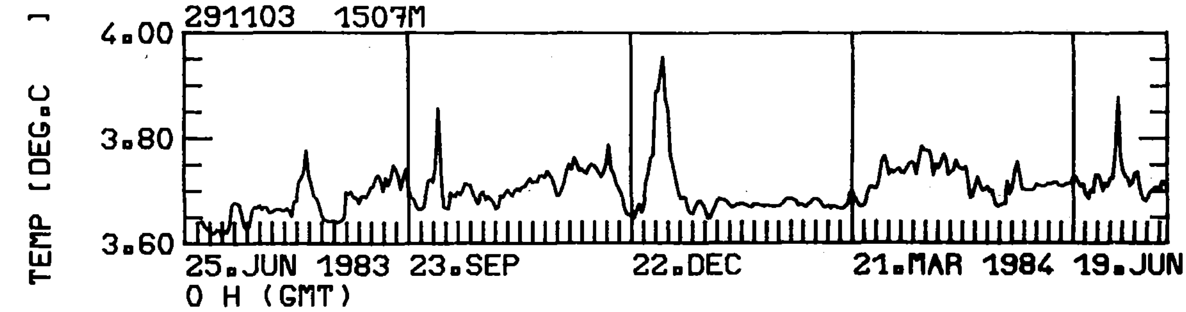
0 H (GMT)


291103 1507M
4.00
3.80
3.60
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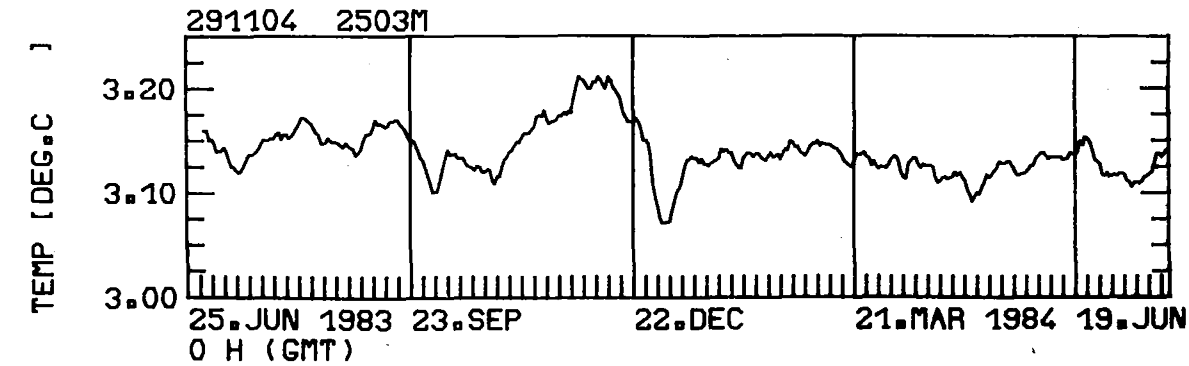
291104 2503M
3.20
3.10
3.00
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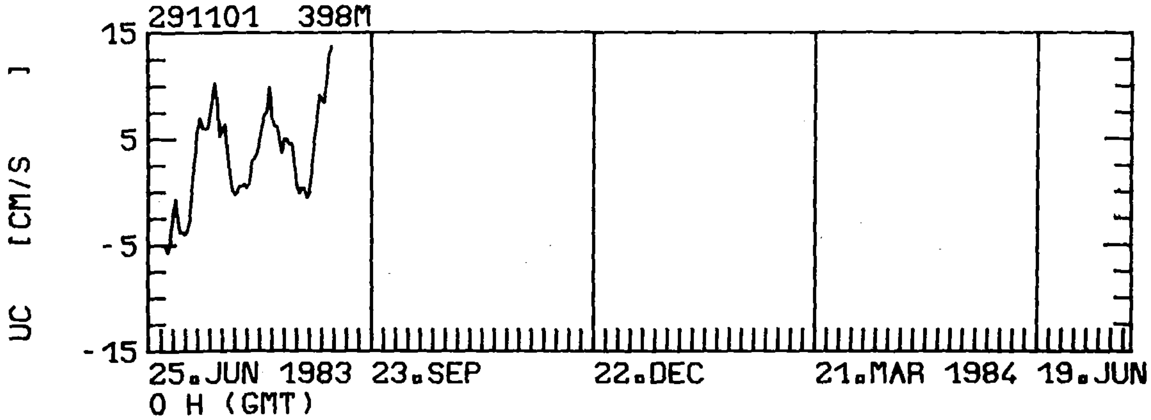
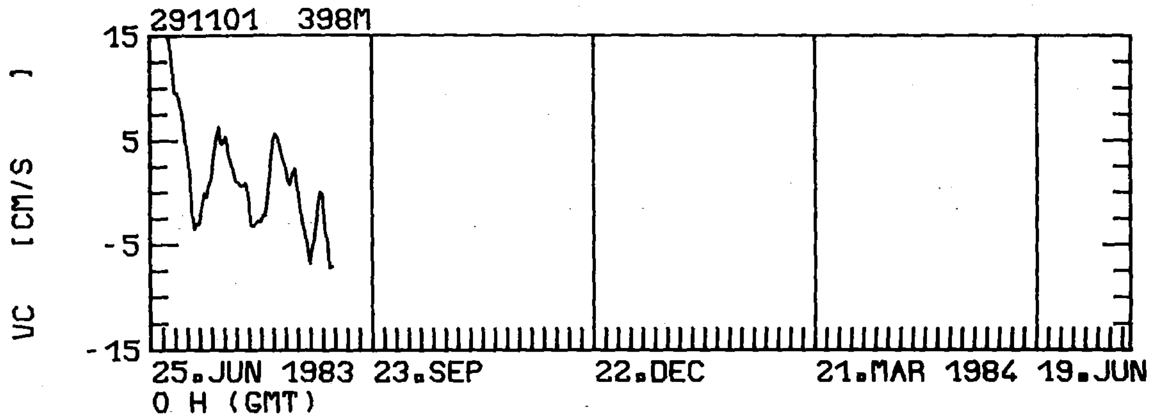
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)


291101 398M
15
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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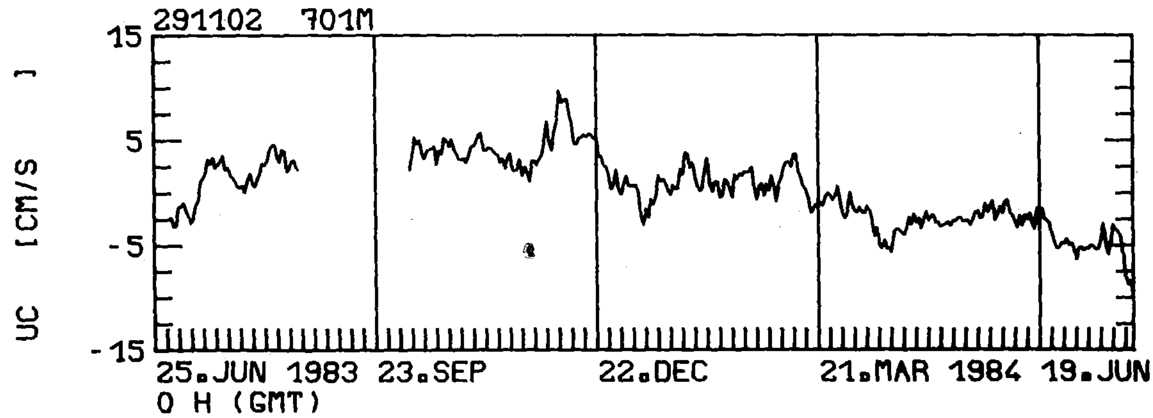
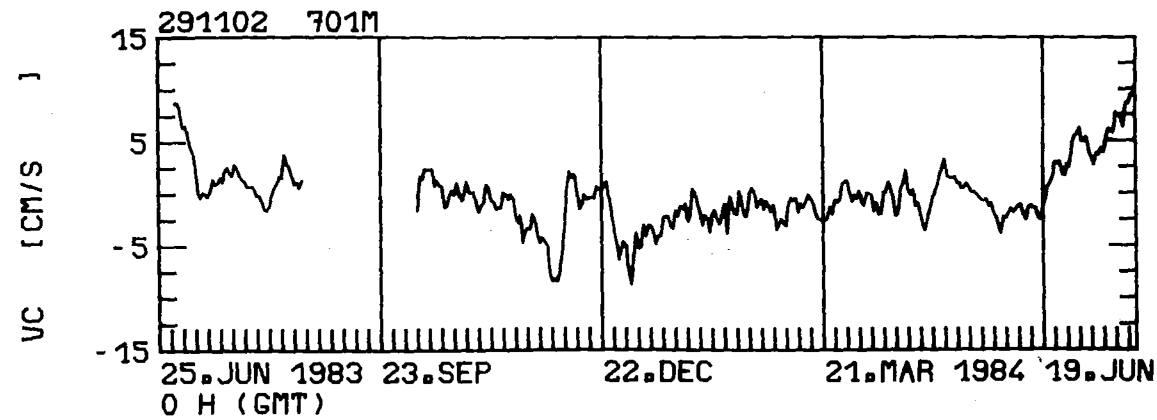
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)


291102 701M
15
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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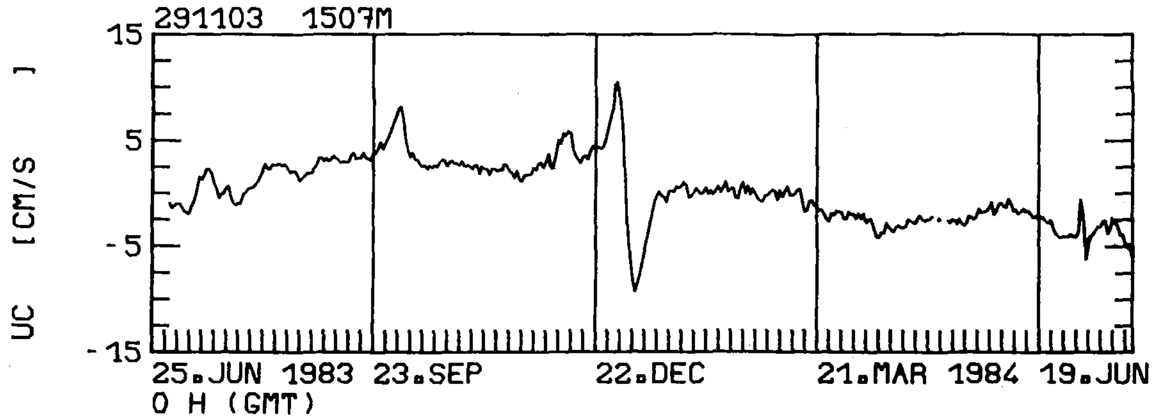
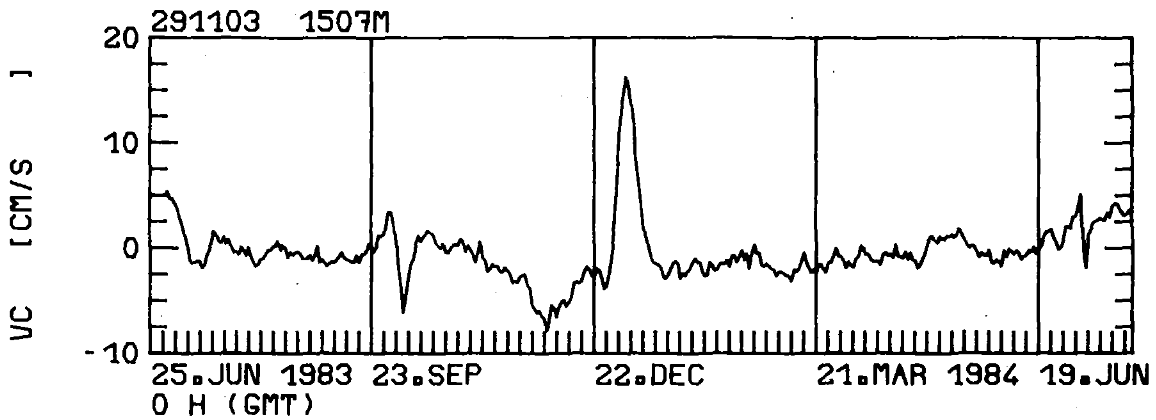
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)


291103 1507M
15
5
-5
-15
UC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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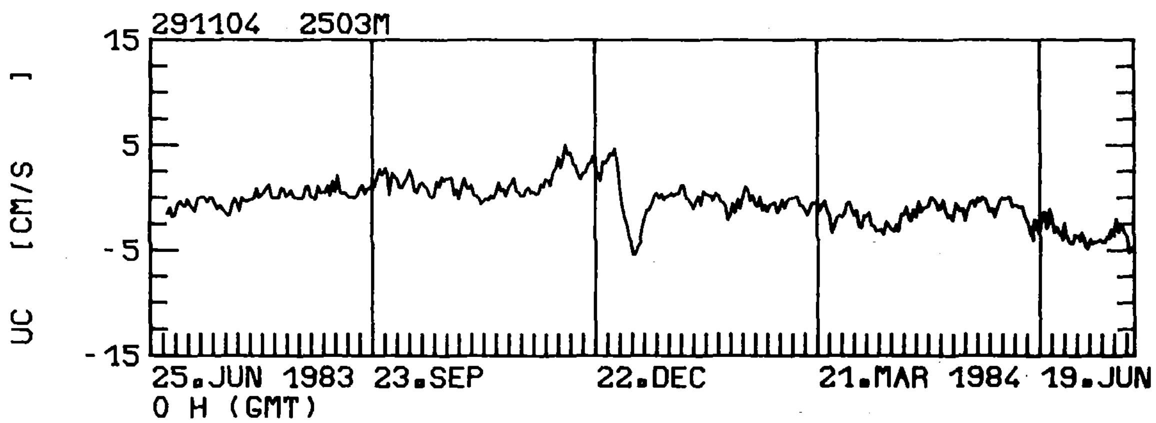
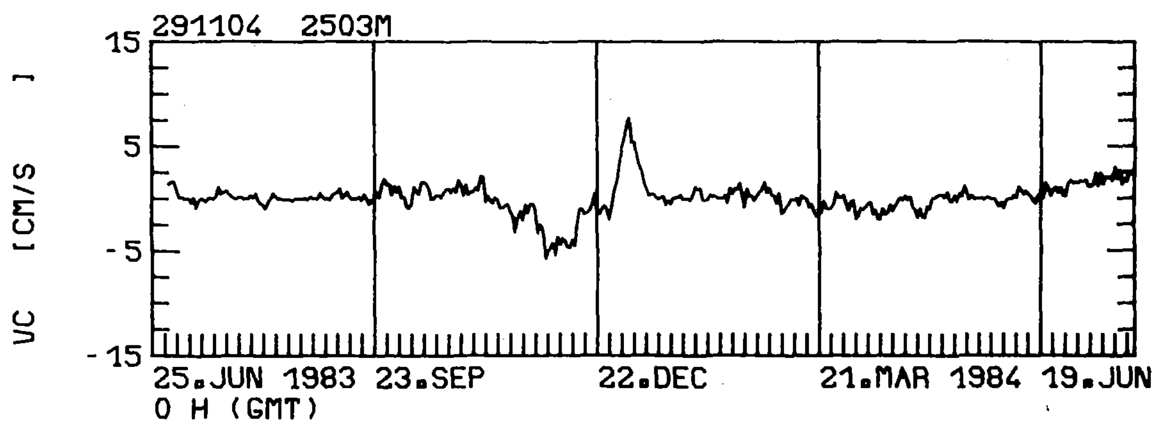
10
0
-10
VC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)


291104 2503M
15
5
-5
-15
UC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)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15
5
-5
-15
VC [CM/S]
25.JUN 1983 23.SEP 22.DEC 21.MAR 1984 19.JUN
0 H (GMT)

6.3 Moored current meter progressive vector diagrams

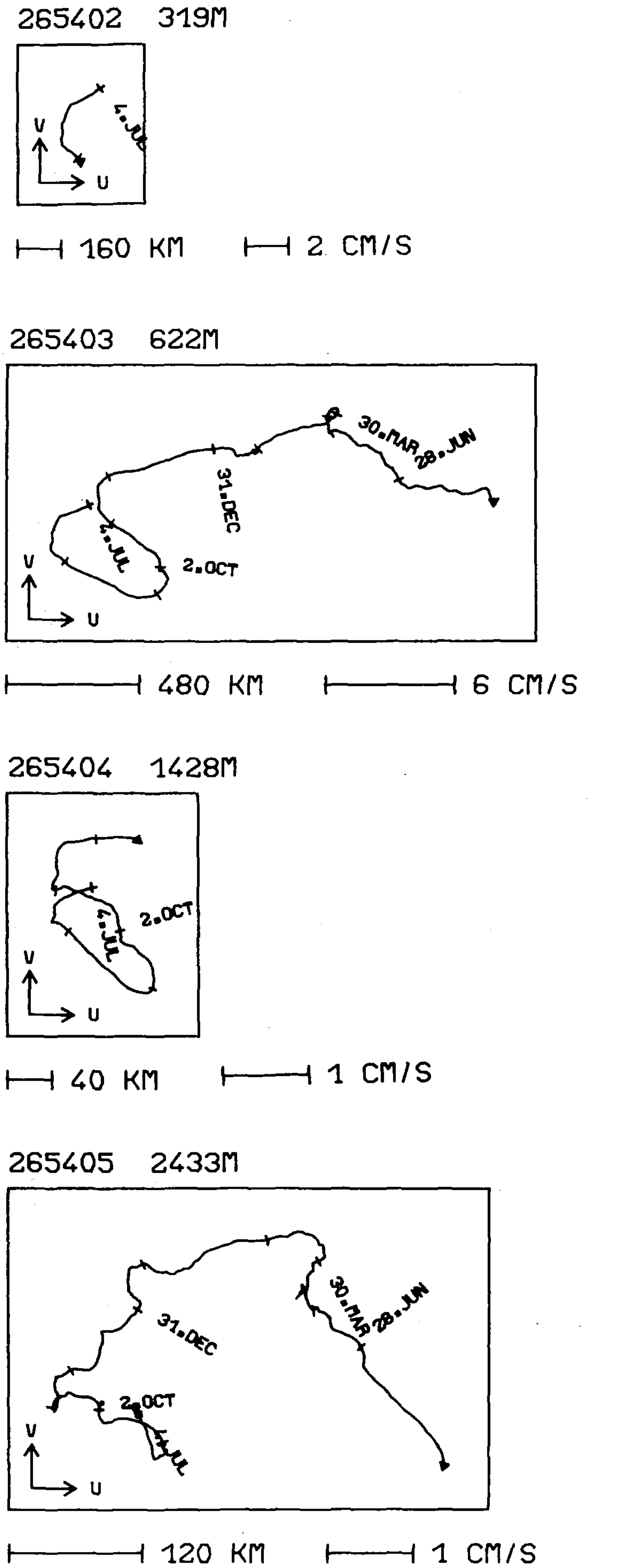
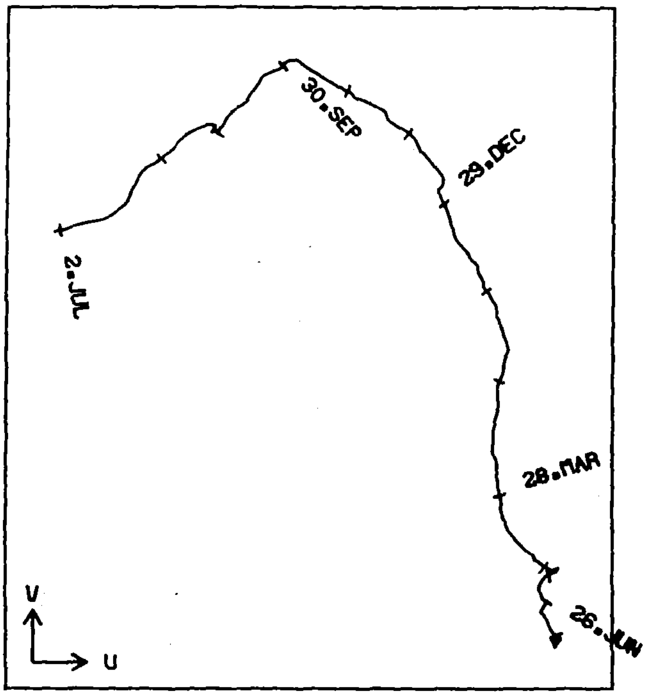


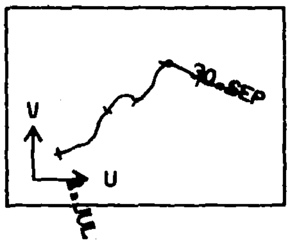
Fig. 13a-c: Progressive Vector diagrams of moored current meter measurements

290101   739M



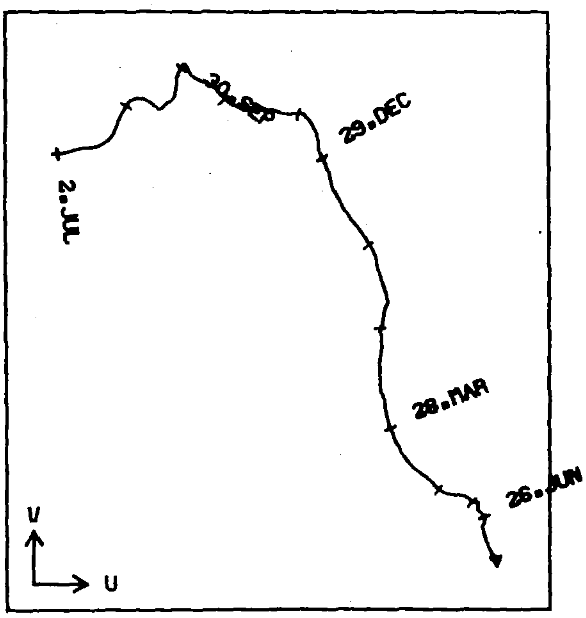
480 KM   6 CM/S

290102   1039M



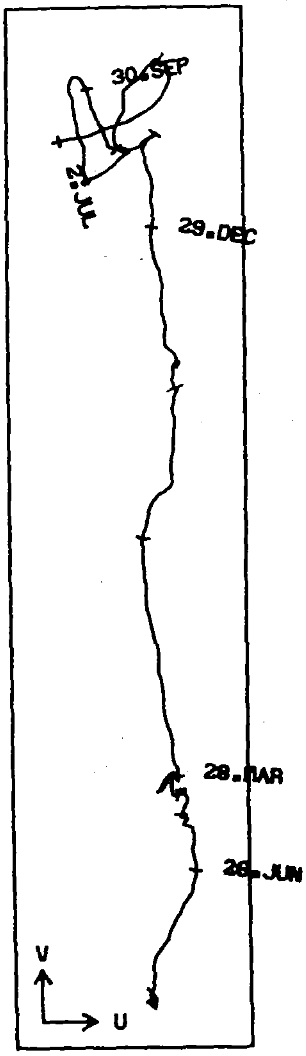
160 KM   2 CM/S

290103   1839M



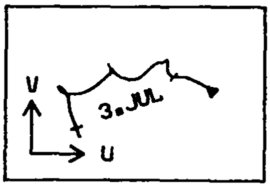
240 KM   3 CM/S

290104   2839M



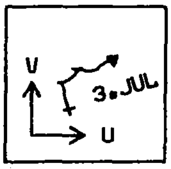
40 KM   1 CM/S

291101 389M



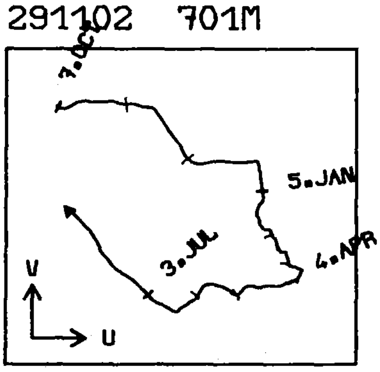
80 KM 1 CM/S

291102 701M



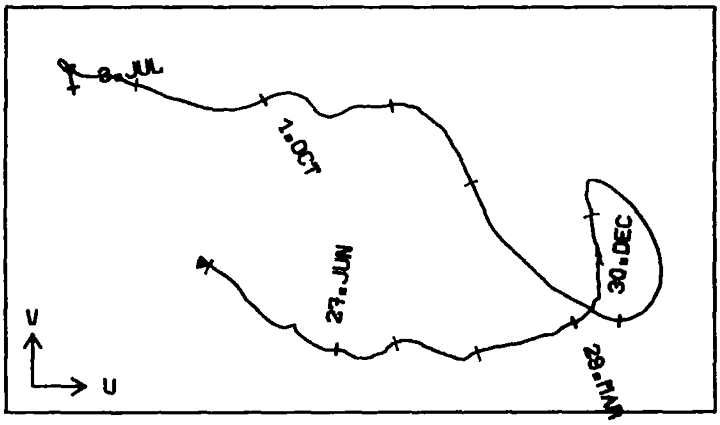
80 KM 1 CM/S

291102 701M



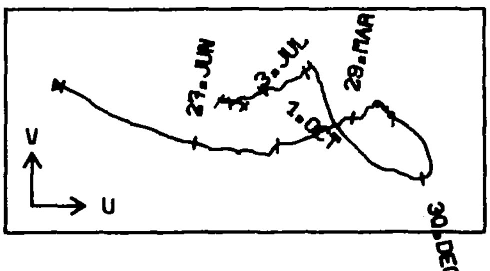
160 KM 2 CM/S

291103 1507M



120 KM 1 CM/S

291104 2503M



80 KM 1 CM/S

7. Acknowledgements

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