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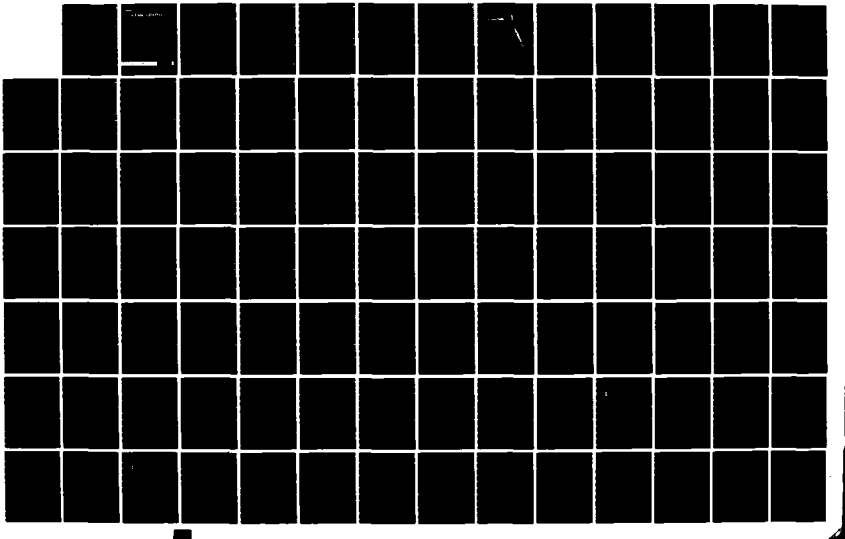

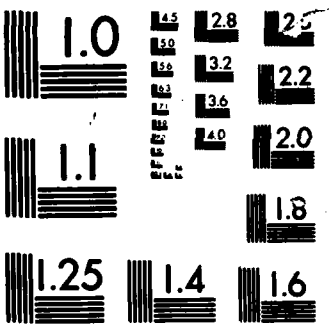

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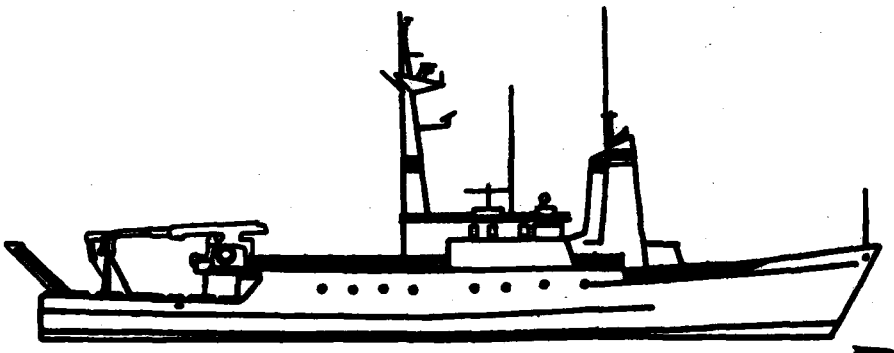

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CURRENT MEASUREMENTS FROM MOORINGS OFF NORTHERN CALIFORNIA: SEPTEMBER 1984 - JULY 1985

by

Robert L. Smith, Glenna Pittock, Jane Fleischbein and Robert Still

Office of Naval Research
N0014-84-C0218
NR-083-102

College of Oceanography
Oregon State University

Data Report 121
Reference 86-6
April 1986

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Three deep-sea subsurface moorings, each equipped with five current meters at depths from 150m below the surface to 200m above the bottom, were deployed off Northern California from September 1984 to July 1985 as part of the OPTOMA program. The triad of moorings, centered near 38.5°N, 125°W, had mutual separations of 100 km. Velocity and temperature were recorded at hourly intervals; statistics and various plots of the data time series are presented in this report.

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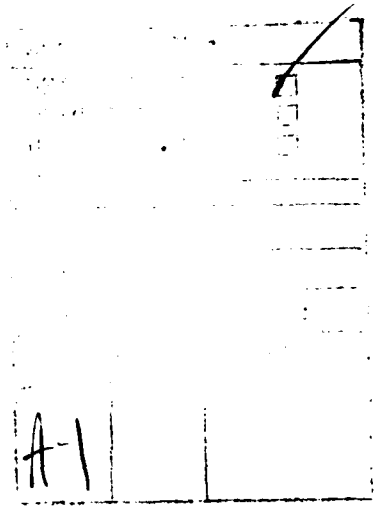

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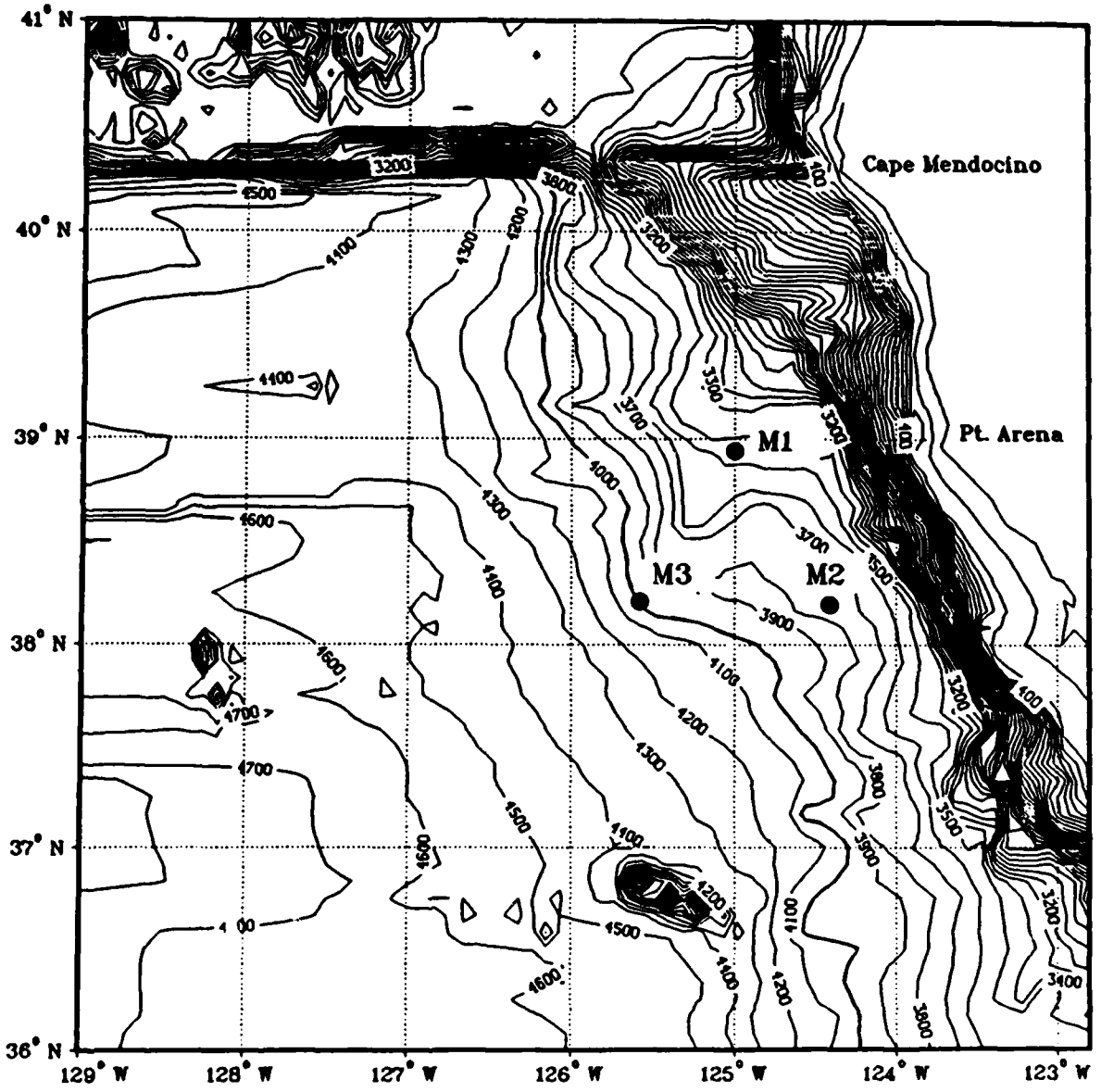

Figure 1. Locations of Moorings M-1, M-2, and M-3.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observations, Modeling and Analysis) Program seeks to understand the mesoscale variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. The Office of Naval Research sponsors the OPTOMA program principally through research contacts to the Naval Postgraduate School and Harvard University. As an adjunct to the hydrographic observations (temperature, salinity, density profiles) and modeling efforts of those institutions, Oregon State University deployed three deep-sea subsurface moorings, each instrumented with 5 current meters, off northern California between 38° and 39°N, 124° and 126°W (Figure 1). The moorings were deployed 25-26 September 1984 from R/V WECOMA (Cruise W8409B) and recovered 13-16 July 1985 by R/V WECOMA (Cruise W8507A).

The senior scientist and party chief on the deployment cruise in September 1984 were Robert L. Smith and Robert E. Still, respectively. The weather during this cruise was good and the winds were moderate, generally about 20 knots from NNW. During this cruise a similar mooring near 39.5°N, 128°W was recovered for the SANDIA Low Level Waste Ocean Disposal Program. A well-known artist, Henk Pander, participated in this cruise and has immortalized it in a large mural depicting the recovery of a deep-sea meter mooring. The mural is located in the Memorial Union Building of Oregon State University.

The senior scientist on the OPTOMA recovery cruise in July 1985 was Robert E. Still. The weather during this cruise was very rough with winds generally in excess of 30 knots. All moorings were

successfully recovered and a CTD cast was made to within 10 meters of the bottom at each mooring site after the recovery of the mooring.

This data report presents the current meter data in a format similar to that used in the series of data reports for the Low Level Waste Ocean Disposal Program (e.g., Pillsbury et al., 1984). Since the LLWODP moorings and their instrumentation were similar to those used in OPTOMA, and the study region only several hundred kilometers (seaward and northwest) from the OPTOMA region, the reader may wish to compare the data from those previous moorings with the data from OPTOMA moorings shown in this report.

The CTD data obtained during the OPTOMA mooring recovery cruise in July 1985 is presented in this report. Hydrographic data was also obtained by Naval Postgraduate School scientists and technicians on a number of occasions while the moorings were deployed (Wittmann et al., 1985a,b,c).

CURRENT METER DATA

On each mooring there were five Aanderaa recording current meters (RCM5) which recorded speed, direction, temperature and, in some cases, pressure and conductivity. The current meters were intended to be at depths of 150m, 350m, 800m, 1250m below the surface and 200m above the bottom. The mooring design used is similar to the intermediate mooring developed at WHOI (Heinmiller and Walden, 1973).

Sampling and Processing Information

The speed record from Aanderaa meters is based on the rotor count during the sampling interval and is the average speed over that interval, which is one hour in this case. The nominal threshold of the Aanderaa speed sensor is 1.5 cm s^{-1}. In processing, a zero in the speed record is set equal to 0.8 cm s^{-1}, i.e., half the threshold. Direction, temperature, pressure and conductivity are instantaneous measurements at the end of the hourly sampling interval. The data are processed into engineering units and the time assigned to each data record is the time (UCT) at the end of the sampling period.

The hourly data were not filtered. To form the LLP (6-hourly) records, the hourly data were filtered with a 60 + 1 + 60 Cosine-Lanczos filter with half-amplitude at 40 hours and half-power at 46.6 hours. The data were then resampled at six-hour intervals.

Depths were obtained by one or two methods. Meters equipped with pressure sensors were assigned depths corresponding to the minimum recorded pressure in decibars. The minimum pressure was determined from unfiltered data. Conversion of decibars to meters

was done with a relationship developed by Professor J. L. Reid of Scripps:

$$z(m) = (0.992446)P - (2.28717 \times 10^{-6})P^2 + (2.08213 \times 10^{-11})P^3$$

This equation is based on a world ocean average density profile. The depths of the meters that did not have pressure sensors were estimated from the bottom depth (in corrected meters) and the mooring line lengths as determined by a computer model that calculates line tension and the amount of stretch. Again, minimum rather than average or maximum depths were estimated.

A few short gaps in the hourly time series (noted on the header page) have been bridged with simulated data. The technique utilizes single-step prediction error filters generated by a method described in Anderson (1974). The filters used with each gap are calculated from the data on both sides of the gap, and produce a time series whose spectral composition is the same as that of the parent series.

Description of the Processed data

Data from each installation are presented separately. A mooring schematic precedes the data from each installation. The header page gives information about the mooring location, instrumentation, data interval, and a statement describing the kind of data and the quality of the record.

Each meter has a serial number assigned to it by the manufacturer. Each successive tape recorded by that machine is numbered with the serial number and the tape number. Thus, 485/10 indicates the tenth tape recorded by machine 485.

The table of statistics following the header page gives arithmetic mean, standard deviation, skewness, kurtosis, maximum value, minimum value, and the number of values (hours) of the record length for each variable measured. In addition, the following calculations were made from hourly data (where bar indicates mean quantity and n is the number of data values):

Eddy kinetic energy (EDDY KE) = $(2n)^{-1} \Sigma(u-\bar{u})^2 + (v-\bar{v})^2$

Eastward heat flux (HEAT FLUX U) = $n^{-1} \Sigma(u-\bar{u})(T-\bar{T})$

Northward heat flux (HEAT FLUX V) = $n^{-1} \Sigma(v-\bar{v})(T-\bar{T})$

Momentum flux = $n^{-1} \Sigma(u-\bar{u})(v-\bar{v})$

For the filtered six-hourly records (LLP), the following statistics are listed: variance of u (MEAN U*U), variance of v (MEAN V*V), and the momentum flux (MEAN U*V), where the u, v series have mean values removed. These quantities are used to compute the principal direction θ_p of each LLP velocity record, following Kundu and Allen (1976):

$$\tan 2\theta_p = \frac{2 \text{ MEAN } U*V}{\text{MEAN } U*U - \text{MEAN } V*V}$$

In this report, the angle noted as PRIN. AXIS (DEG) is $90°-\theta_p$ and is positive counter-clockwise from east, e.g., +82 means the principal axis is aligned along 008°T.

Plots of hourly data follow the statistics. The scatter diagrams show the distribution of hourly values of speed and direction. For clarity, the low speeds (<1.5 cm/sec) have been excluded from these plots. Progressive vector diagrams, histograms for all measured parameters, rotary spectra of velocity, and conventional power spectra follow.

The time series plots of filtered (LLP) data are presented in two combinations: Each variable separately (velocity vectors, u, v, T, p, and c) for all depths on a mooring; and all variables at each depth.

CURRENT METER CALIBRATIONS

Except for the speed sensor (a Savonius rotor), all sensors are calibrated at Oregon State University. Our tests of the Aanderaa current meters in tow tanks have shown that the calibration provided by the manufacturer (Aanderaa Instruments, P.O. Box 160, 5051 Bergen, Norway) for the RCM 4 and 5 current meters equipped with rotor counters are adequate and accurate. The rotor and rotor bearings are replaced prior to each installation. For older-style instruments, with gear-train coupling (instead of rotor counters), a calibration slightly different from the manufacturer's is used and is given in Pillsbury et al. (1974). Only two older-style current meters were used on the OPTOMA moorings: 1245/38 and 408/20.

All other sensors are calibrated prior to each installation and also after each recovery. The prior calibration data is generally used for the processing of the records. The calibration tables or equations used for this report are given at the end of this section.

Direction Calibrations

The compass calibrations are done on a concrete pad away from any significant magnetic influences. The pad has been sighted in with a surveyor's transit and oriented to true north.

An all-aluminum stand with a rotating four-arm cross is attached to the pad. The stand is scribed in ten degree increments through 360 degrees with a hole at each increment so that the cross can be pinned at each setting. This assures repeatability and stability at each position of the cross as it is swung through 360 degrees.

The cross supports one RCM at the end of each 40 inch arm thereby enabling four machines to be calibrated simultaneously. A calibration consists of cycling each RCM at every ten degree mark plus an additional (duplicate) reading at 0, 90 180, and 270 degrees.

A look-up table of raw bit number versus direction is prepared, taking into account the magnetic variations (declination) at the calibration and installation sites. Linear interpolation is used between look-up table values.

Calibration of Temperature Sensors

Laboratory calibrations of the current meter temperature sensors are conducted by immersing several current meters simultaneously in a stirred bath of water. Temperature is measured precisely with a Sea Bird thermistor (Model SB3-0115). This instrument has a guaranteed accuracy of +/- 0.01°C over a six-month period, and is typically stable to be better than +/- 0.003°C. The Sea Bird thermistor is itself calibrated at least once per year using Leeds-Northrup 816303 platinum thermometer and a Mueller resistance bridge traceable to the National Bureau of Standards.

The Aanderaa current meters used in this experiment were calibrated in the 0 to 20 °C temperature range with a calibration point made every degree. A file of bit numbers versus temperatures is created and from it the calibration coefficients, a, b, and c, are calculated by least squares fit, assuming the form $T = a + bN + cN^2$ where N is the bit number recorded by the current meter. Differences between T(N) prior to mooring and after recovery are a measure of the accuracy of the temperature measurement. For the current meters used during OPTOMA, these were < 0.05°C.

Calibration of Conductivity Sensors

The laboratory calibration of the conductivity sensors consists of cycling the current meters through stirred salt water bath in groups of four while the temperature and salinity of the bath are precisely monitored. Each machine is triggered and monitored externally and independently to insure that there is no interference between machines. The current meters are equipped with free-spinning rotors and their cells are brushed just prior to a reading being taken for that machine.

Bath temperature is measured with a Sea-Bird temperature probe; (see section on Calibration of Temperature Sensors). Bath salinity is monitored at frequent intervals by collecting samples that are eventually analyzed on a Guildline Autosal. From using the stated conductivity accuracy of the Sea-Bird probe and the Autosal, we arrive at a bath conductivity accuracy of +/- 0.012 mmhos. Conductivity is varied by dilution with fresh water and/or by varying the bath temperature. This is dependent upon what the

salinity is of the pathogen free seawater initially collected for the calibration.

The resultant pairs of bit numbers versus bath conductivity produce calibration coefficients of a, b, and c from a least square fit:

$$C = a + bN + cN^2.$$

Calibration of Pressure Sensors

An Ashcroft series #1305 Deadweight Tester is used to calibrate the Aanderaa pressure sensors. It is a portable dual range device with a low range of 5-2000 PSIG in 5 PSI increments and a high range of 25-10000 PSIG in 25 PSI increments. This tester has a certified accuracy of +/- 1/10th of 1% and is traceable to the National Bureau of Standards.

Each pressure sensor is both pre and post calibrated with its intended current meter (the data can vary slightly if the sensor is shifted to a different current meter). Sensor/current meter pairs are maintained whenever possible so that long term sensor drift can be more easily detected.

The sensor is calibrated in ten equally spaced increments from zero PSIG to full range. These ten equally spaced data points (zero is not used) are converted from PSIG to decibars. A file of bit numbers versus decibars is created, and from it the calibration coefficients, a, b, and c, are calculated by least squares fit, assuming the form $P = a + bN + cN^2$ where N is the bit number recorded by the current meter.

The sequence of bit numbers for each current meter listed in the OPTOMA direction calibration tables correspond to the following directions, after correcting for magnetic variations (declination) of 17° E.

0	60	120	180	240	300
10	70	130	190	250	310
20	80	140	200	260	320
30	90	150	210	270	330
40	100	160	220	280	340
50	110	170	230	290	350

OPTOMA DIRECTION CALIBRATIONS

MOORING M-1

SERIAL NO. 5647

969	106	275	447	616	792
999	135	303	476	646	822
1022	161	331	502	674	851
23	189	359	529	702	880
50	216	387	557	731	909
77	245	416	587	762	939

SERIAL NO. 1538

971	101	273	448	626	800
999	129	303	477	654	829
1023	158	331	508	682	858
15	187	360	538	711	886
43	215	389	567	742	914
73	243	418	597	769	941

SERIAL NO. 2760

974	109	277	448	624	800
1004	136	305	478	653	831
1023	164	333	506	683	861
23	192	363	535	711	890
52	219	389	565	740	919
80	248	419	595	771	949

SERIAL NO. 5883

976	118	287	453	619	799
1006	144	314	480	648	829
5	172	341	506	676	859
30	199	369	534	706	888
59	228	397	561	737	918
90	257	425	590	768	949

SERIAL NO. 1245

982	120	291	457	628	805
1011	148	319	485	656	835
9	176	346	514	686	864
37	206	372	542	714	892
64	234	401	571	744	923
94	264	429	600	775	952

OPTOMA DIRECTION CALIBRATIONS

MOORING M-2

SERIAL NO.6974

974	115	287	456	630	802
1002	143	315	486	658	831
3	171	343	514	686	860
30	199	370	543	715	887
57	228	399	573	744	916
87	257	428	601	774	945

SERIAL NO. 408

976	121	289	460	625	800
1009	148	320	485	639	831
2	177	347	514	683	859
31	206	375	544	712	891
60	234	404	567	739	918
91	263	430	598	771	949

SERIAL NO. 5211

971	112	281	453	627	800
997	142	310	482	655	830
3	168	338	511	684	859
27	195	365	540	713	887
55	224	396	569	742	917
86	253	425	598	771	945

SERIAL NO. 6590

970	107	274	443	618	797
9 8	136	302	474	647	826
1023	164	329	503	677	855
24	188	357	530	705	884
52	216	385	559	735	913
80	244	414	588	766	942

SERIAL NO. 6974

974	115	287	456	630	802
1002	143	315	486	658	831
3	171	343	514	686	860
30	199	370	543	715	887
57	228	399	573	744	916
87	257	428	601	774	945

OPTOMA DIRECTION CALIBRATIONS

MOORING M-3

SERIAL NO. 5648

974	112	286	454	622	799
1002	139	314	483	651	828
1023	167	340	510	680	857
24	195	368	537	709	885
52	226	396	564	738	914
81	256	424	593	769	944

SERIAL NO. 407

971	97	266	439	621	797
999	126	295	469	649	826
1023	152	322	501	678	856
12	179	350	531	708	883
41	210	378	559	737	912
69	237	408	592	768	941

SERIAL NO. 2759

977	113	279	448	623	799
1004	139	307	477	653	832
1023	166	335	506	681	860
24	194	363	542	711	888
53	222	391	564	740	917
83	250	419	594	770	948

SERIAL NO. 6593

980	121	289	459	633	807
1008	150	318	487	660	836
7	177	346	516	690	864
36	205	374	545	719	893
65	232	401	573	748	922
93	262	430	604	778	951

SERIAL NO. 2280

967	102	282	458	629	797
995	132	312	489	658	826
1023	161	341	517	685	854
13	191	368	544	713	882
42	223	398	573	741	908
72	253	429	601	769	937

OPTOMA TEMPERATURE CALIBRATION COEFFICIENTS

MOORING M-1

RCM5 SERIAL NO.	COEFFICIENTS	RCM5 SERIAL NO.	COEFFICIENTS
5647/20	-0.217747E+01	5883/14	-0.247750E+01
	0.211119E-01		0.232852E-01
	0.178665E-05		-0.256424E-05
1538/28	-0.217228E+01	1245/37	-0.261848E+01
	0.210660E-01		0.803378E-02
	0.183039E-05		0.698915E-08
2760/19	-0.241959E+01		
	0.221539E-01		
	0.712304E-06		

MOORING M-2

5880/14	-0.220310E+01	6590/9	-0.522130E+01
	0.214852E-01		0.499472E-01
	0.214852E-01		-0.577727E-04
408/20	-0.220032E+01	6974/10	-0.217407E+01
	0.209894E-01		0.800320E-02
	0.198191E-05		-0.284665E-08
5211/20	-0.242266E+01		
	0.224307E-01		
	0.120807E-06		

MOORING M-3

5648/20	-0.209017E+01	6593/7	-0.223080E+01
	0.210273E-01		0.216076E-01
	0.182979E-05		0.120877E-05
407/13	-0.224666E+01	2280/33	-0.258052E+01
	0.212053E-01		0.800220E-02
	0.172693E-05		-0.186463E-07
2759/19	-0.241640E+01		
	0.222171E-01		
	0.582948E-06		

OPTOMA PRESSURE CALIBRATION COEFFICIENTS

MOORING M-1

RCM5 SERIAL NO.	COEFFICIENTS	RCM5 SERIAL NO.	COEFFICIENTS
5647/20	-0.384019E+02	5883/14	-0.966022E+02
	0.764005E+00		0.193046E+01
	-0.187702E-04		-0.446497E-04
1538/28	-0.385689E+02		
	0.739402E+00		
	0.720812E-05		

MOORING M-2

5880/14	-0.354365E+02	6590/9	-0.727215E+02
	0.748182E+00		0.180708E+01
	-0.483820E-05		0.548443E-04
408/20	-0.565210E+02		
	0.112581E+01		
	0.511584E-05		

MOORING M-3

5648/18	-0.337253E+02	6593/7	-0.104414E+03
	0.743922E+00		0.187181E+01
	-0.201113E-06		0.194781E-04
407/12	-0.552359E+02		
	0.115760E+01		
	-0.277117E-04		

OPTOMA CONDUCTIVITY CALIBRATION COEFFICIENTS

MOORING M-1

RCM5 SERIAL NO.	COEFFICIENTS
5647/20	0.245605E+02
	0.226286E-01
	-0.396148E-06

MOORING M-3

5648/20	0.246490E+02
	0.221805E-01
	-0.758058E-07

CTD DATA

CTD casts were made following the retrieval of the moorings at OPTOMA mooring sites M-1, M-2 and M-3 during 14-16 July 1985. The maximum sampling depth was approximately 10 m above the bottom. Winds were NNW at 28-30 kts during the three casts. CTD data are summarized in vertical profile plots and listings of the data at standard depths in this report.

A Neil Brown Instruments Mark IIIb conductivity temperature depth probe (CTD) was used to obtained continuous profiles of temperature and salinity versus pressure at each station. Sampling procedures were identical with those described by Fleischbein et al. (1981), except that probe #2561 was used for all stations and the CTD was equipped with a Benthos Model 2110 altimeter. The CTD probe was calibrated by the manufacturer in June 1985. Calibration procedures followed those described by Fleischbein et al. (1985) except only 6 salinity samples at 2 depths were collected and no thermometers were used because of the rough weather. Because of the limited number of sampling points, the results of the calibration data from cruise W8508AA, which used the same CTD probe on 1-8 August 1985, were used in processing. Uncorrected CTD conductivity was multiplied by a correction factor of 0.9997067 and no temperature correction was applied. A pressure correction of -2.8 db determined from the OPTOMA cruise was applied to uncorrected pressure prior to processing. The procedures for data processing were described by Gilbert, Huyer and Schramm (1981). The coefficient for the conductivity filter was 0.880. Station 2 showed a sudden downward shift in conductivity at 1845-1851 db that was

probably due to detritus in the cell and was edited during processing by linearly interpolating processed salinity at 1843-1853 db.

Vertical profiles of temperature, salinity and sigma-theta vs. pressure are shown for each station. Header information for each station is as follows:

STA NO	Consecutive CTD station number on the cruise.
STATION	The CTD station name, which is the same as the nearby mooring.
LAT	Latitude in degrees and minutes north of the equator.
LONG	Longitude in degrees and minutes west of Greenwich.
DATE	Day/Month/Year.

The data listing for each station gives values at standard pressures including observed and calculated parameters at the shallowest and deepest observation levels. Temperature (°C) (TEMP), practical salinity (PSU) (SAL), potential temperature (°C) (POTEN TEMP), sigma-theta (SIGMA-THETA), specific volume anomaly x 10^5 (SVA) and dynamic height (DELD) in dynamic meters are given for each pressure (PRESS) in decibars. Computed parameters are calculated from the complete processed data array.

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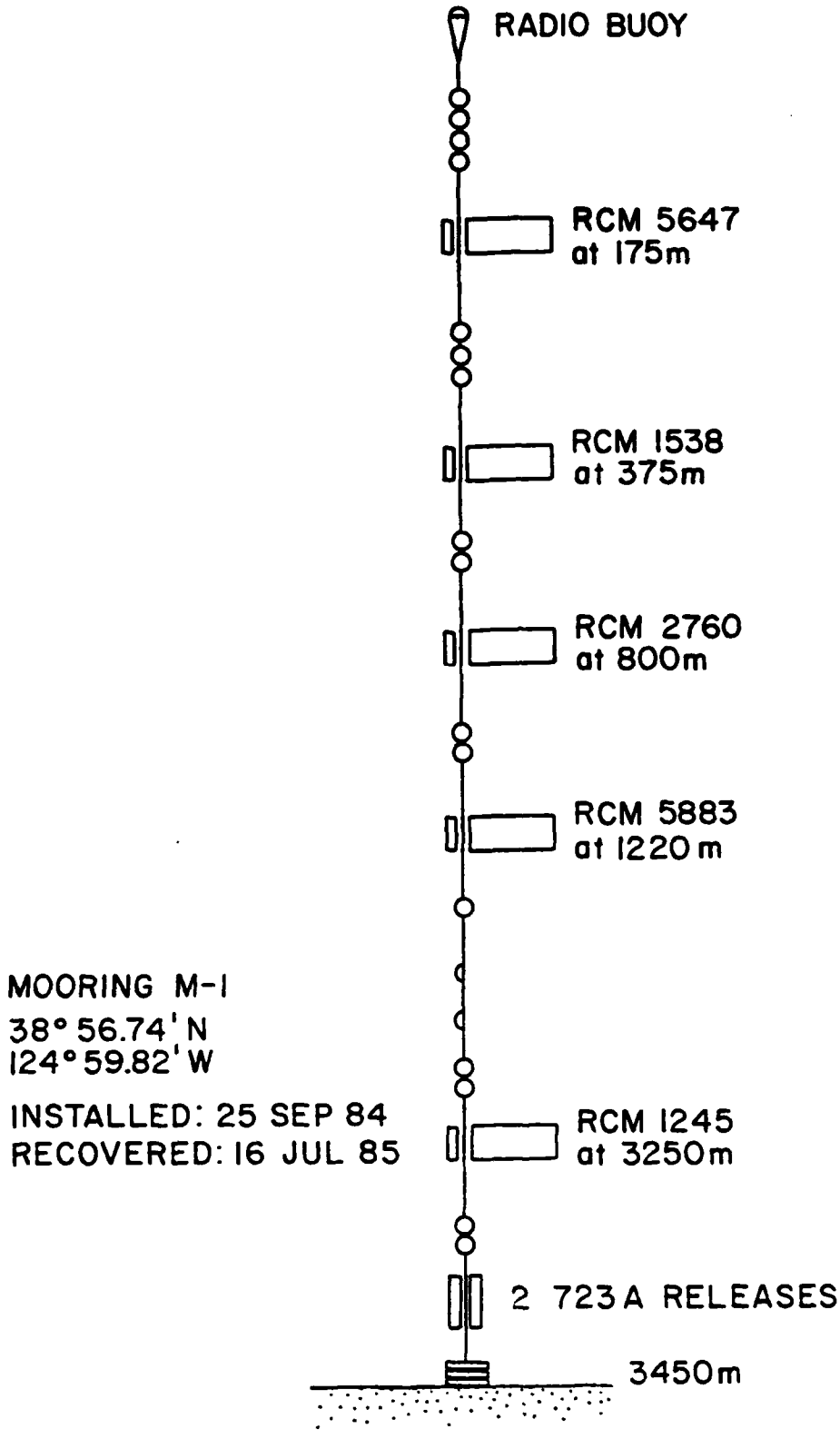
Mooring M-1


RADIO BUOY
RCM 5647
at 175m
RCM 1538
at 375m
RCM 2760
at 800m
RCM 5883
at 1220 m
MOORING M-1
38° 56.74' N
124° 59.82' W
INSTALLED: 25 SEP 84
RECOVERED: 16 JUL 85
RCM 1245
at 3250m
2 723A RELEASES
3450m

M-1

Position: 38° 56.74'N, 124° 59.82'W
Depth of Water: 3450 m
Set at: 2239 UCT 25 SEP 84 by R/V WECOMA
Retrieved at: 1836 UCT 16 JUL 85 by R/V WECOMA
Data Interval: 0027 UCT 26 SEP 84 to 1827 UCT 16 JUL 85

Instrumentation

Depth	RCM 5 Serial No./Tape No.
175 m	5647/20
375 m	1538/28
800 m	2760/19
1220 m	5883/14
3250 m	1245/38

Instrument 5647 recorded speed, direction, temperature, pressure, and conductivity until the instrument was recovered. The speed record has been bridged in four places where the speed sensor appeares to have failed. In each case the speed channel abruptly went to zero for part of a day or longer. The four bridged segments are in lines:

76 - 93	(0327 29 Sep 84 - 2027 29 Sep 84)
513 - 577	(0827 17 Oct 84 - 0027 20 Oct 84)
833 - 910	(1827 1 Mar 84 - 2127 2 Nov 84)
6903 - 6924	(1427 10 Jul 85 - 1127 11 Jul 85)

Instrument 1538 recorded speed, directon, temperature, and pressure until the instrument was recovered.

Instrument 2760 recorded speed, direction, and temperature. Direction and temperature were recorded until the instrument was recovered. The speed sensor failed.

Instrument 5883 recorded speed, direction, temperature, and pressure. At recovery the machine was flooded. The tape jammed after about 3500 lines. This entire record should be viewed critically, since it is not apparent when the leak started. The records for all parameters are given until 12 Feb 85.

Instrument 1245 recorded speed, direction, and temperature. Direction was recorded until 2 JUL 85. Speed and temperature were recorded until the instrument was recovered.

175 M AT M-1. 26 SEP 84 - 16 JUL 85. TAPE 5647/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	10.34	5.55	0.81	3.43	0.80	35.40	7051
U(cm/sec)	-2.61	7.05	-0.01	3.28	-28.10	25.40	7051
V(cm/sec)	-2.23	8.73	-0.11	2.85	-30.10	25.90	7051
T(°C)	8.53	0.46	0.13	1.94	7.59	9.77	7051
P(db)	179.16	2.59	2.22	9.61	175.60	199.60	7051
C(mmho/cm)	34.17	0.32	0.20	3.45	32.88	35.67	7051

EDDY KE =	62.95	(cm^2/sec^2)
HEAT FLUX U =	0.57	(°C cm/sec)
HEAT FLUX V =	-0.41	(°C cm/sec)
MOMENTUM FLUX =	-2.22	(cm^2/sec^2)

LLP FILTERED STATISTICS. 175 M AT M-1. TAPE 5647/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-2.63	4.83	-0.09	3.42	-16.91	13.42	1167
V(cm/sec)	-2.27	6.66	-0.02	2.58	-22.04	14.43	1167
T(°C)	8.53	0.44	0.08	1.77	7.74	9.38	1167
P(db)	179.11	2.28	1.89	7.39	176.26	191.13	1167
C(mmho/cm)	34.17	0.31	0.19	3.42	33.44	35.34	1167

BEGINNING TIME 0600 27 09 84
MEAN U = -0.2631D+01
MEAN V = -0.2273D+01
PRIN. AXIS (DEG.)=0.8232D+02

ENDING TIME 1800 15 07 85
MEAN U*V = 0.2893E+01
MEAN U*U = 0.2333D+02
MEAN V*V = 0.4438D+02

375 M AT M-1. 26 SEP 84 - 16 JUL 85. TAPE 1538/28.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	6.67	4.31	0.54	2.94	0.80	24.20	7051
U(cm/sec)	-1.03	5.07	-0.13	3.25	-22.10	17.00	7051
V(cm/sec)	-1.01	5.93	-0.21	3.41	-23.30	20.40	7051
T(°C)	6.32	0.26	0.00	2.36	5.63	6.95	7051
P(db)	385.16	1.95	1.12	5.26	380.00	395.70	7051

EDDY KE =	30.44	(cm^2/sec^2)
HEAT FLUX U =	0.14	(°C cm/sec)
HEAT FLUX V =	-0.17	(°C cm/sec)
MOMENTUM FLUX =	-3.71	(cm^2/sec^2)

LLP FILTERED STATISTICS. 375 M AT M-1. TAPE 1538/28.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-1.03	2.55	-0.04	3.84	-8.53	6.45	1167
V(cm/sec)	-1.05	3.08	-0.19	2.53	-8.11	8.74	1167
T(°C)	6.32	0.24	-0.03	2.38	5.77	6.83	1167
P(db)	385.13	1.72	0.98	4.57	381.78	392.55	1167

BEGINNING TIME 0600 27 9 84
MEAN U = -0.1030D+01
MEAN V = -0.1046D+01
PRIN. AXIS (DEG.)=0.6387D+02

ENDING TIME 1800 15 7 85
MEAN U*V = 0.1897D+01
MEAN U*U = 0.6525D+01
MEAN V*V = 0.9462D+01

800 M AT M-1. 26 SEP 84 - 16 JUL 85. TAPE 2760/19.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
T(°C)	4.19	0.13	0.27	2.65	3.88	4.56	7051

LLP FILTERED STATISTICS. 800 M AT M-1. TAPE 2760/19.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
T(°C)	4.19	0.12	0.29	2.67	3.97	4.48	1167

1220 M AT M-1. 26 SEP 84 - 12 FEB 85. TAPE 5883/14.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	3.61	3.19	0.76	2.32	0.80	15.10	3352
U(cm/sec)	0.82	3.18	-0.03	4.48	-11.40	11.80	3352
V(cm/sec)	0.15	3.51	0.01	4.37	-13.10	15.10	3352
T(°C)	3.11	0.04	-0.56	3.27	2.92	3.23	3352
P(db)	1238.96	3.90	0.05	3.01	1231.00	1257.10	3352

EDDY KE = 11.23 (cm^2/sec^2)
HEAT FLUX U = 0.00 (°C cm/sec)
HEAT FLUX V = 0.00 (°C cm/sec)
MOMENTUM FLUX = -0.58 (cm^2/sec^2)

LLP FILTERED STATISTICS. 1220 M AT M-1. TAPE 5883/14.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	0.83	1.25	-0.75	3.69	-2.95	3.37	550
V(cm/sec	0.16	1.12	-0.49	3.08	-2.70	2.76	550
T(°C)	3.11	0.03	-1.07	3.64	3.00	3.17	550
P(db)	1238.92	3.69	-0.11	2.60	1230.99	1248.29	550

BEGINNING TIME 0600 27 9 84
MEAN U = 0.8301D+00
MEAN V = 0.1617D+0
PRIN. AXIS (DEG.) = 0.2844D+02

ENDING TIME 1200 11 2 85
MEAN U*V = 0.2382D+00
MEAN U*U = 0.1566D+01
MEAN V*V = 0.1255D+01

3250 M AT M-1. 26 SEP 84 - 16 JUL 85. TAPE 1245/38.

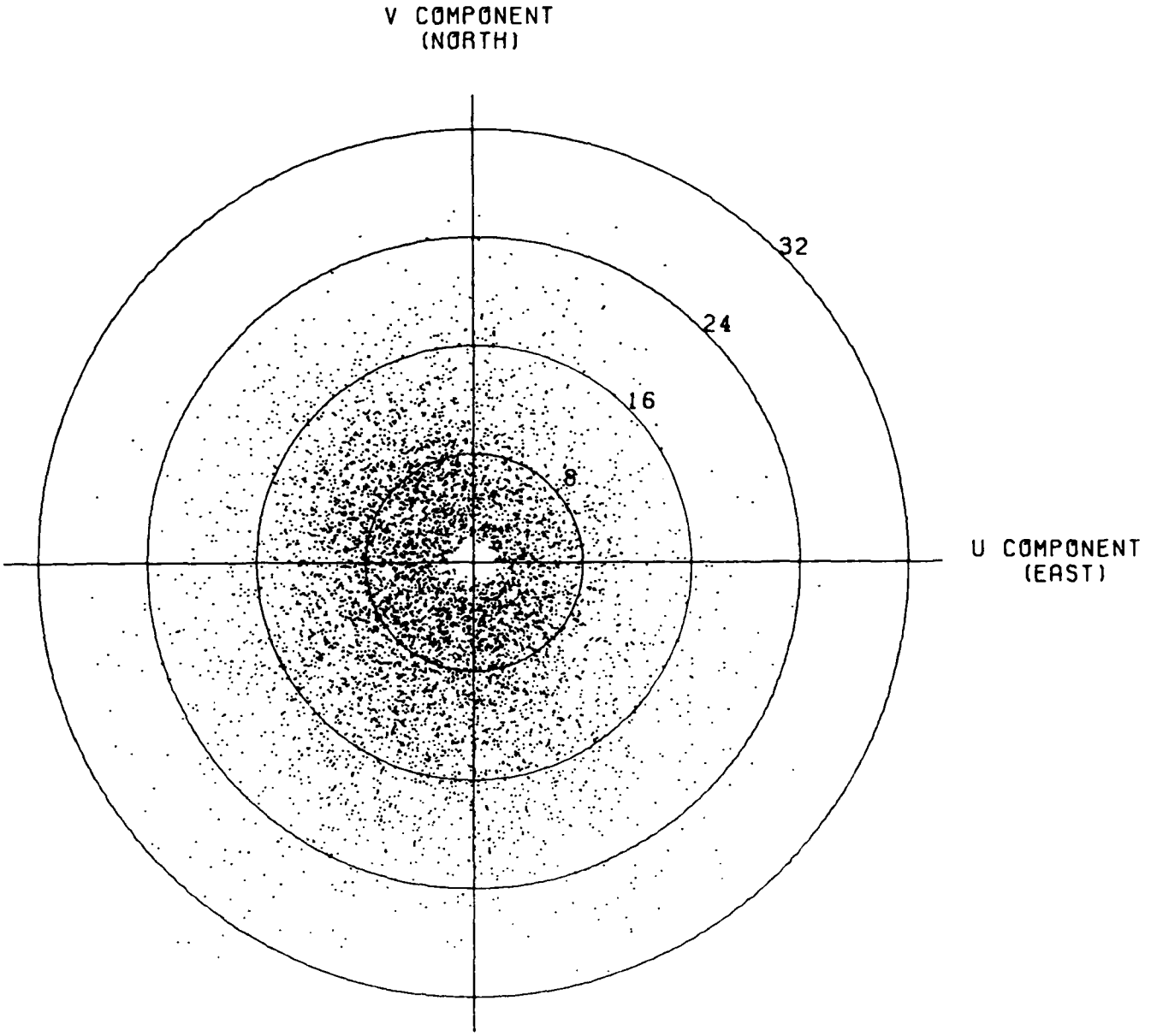
	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	3.94	2.04	0.27	2.87	0.70	14.30	7050
U(cm/sec)	0.31	2.45	-0.08	2.81	-8.50	8.70	6718
V(cm/sec)	0.44	3.63	-0.13	2.52	-11.80	14.30	6718
T(°C)	1.58	0.01	-1.33	5.52	1.54	1.60	7050

EDDY KE = 9.58 (cm^2/sec^2)
HEAT FLUX U = 0.00 (°C cm/sec)
HEAT FLUX V = 0.00 (°C cm/sec)
MOMENTUM FLUX = -1.77 (cm^2/sec^2)

LLP FILTERED STATISTICS. 3250 M AT M-1. TAPE 1245/38.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	0.31	1.28	0.20	2.70	-3.54	3.36	1111
V(cm/sec)	0.43	1.48	0.91	5.92	-3.01	7.19	1111
T(°C)	1.58	0.01	-1.38	5.36	1.56	1.60	1166

BEGINNING TIME 0600 27 9 84 ENDING TIME 1800 1 7 85
MEAN U = 0.3064D+00 MEAN U*V = -0.4068D+00
MEAN V = 0.4334D+00 MEAN U*U = 0.1645D+01
PRIN. AXIS (DEG.) = 0.1181D+03 MEAN V*V = 0.2189D+01



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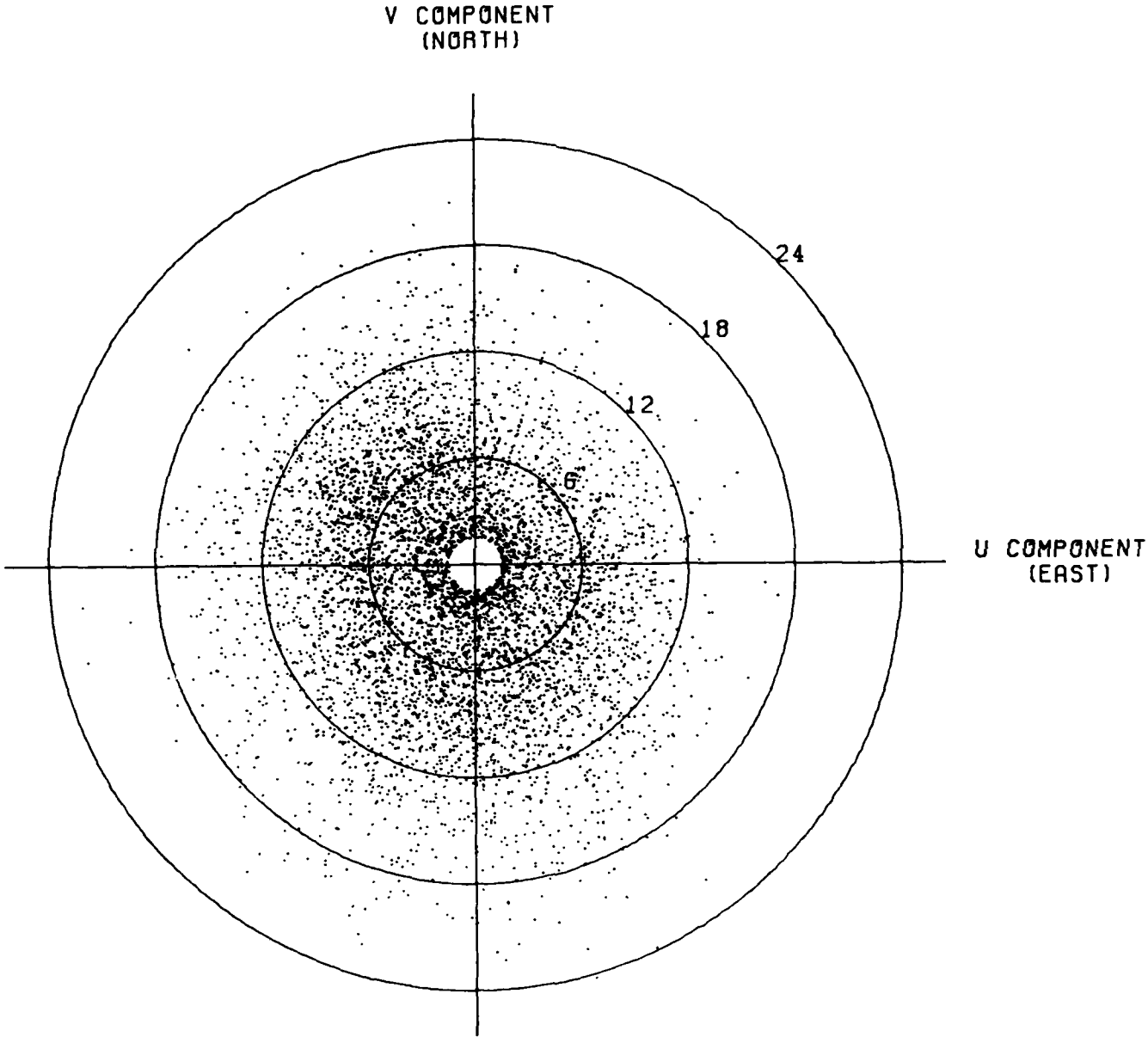

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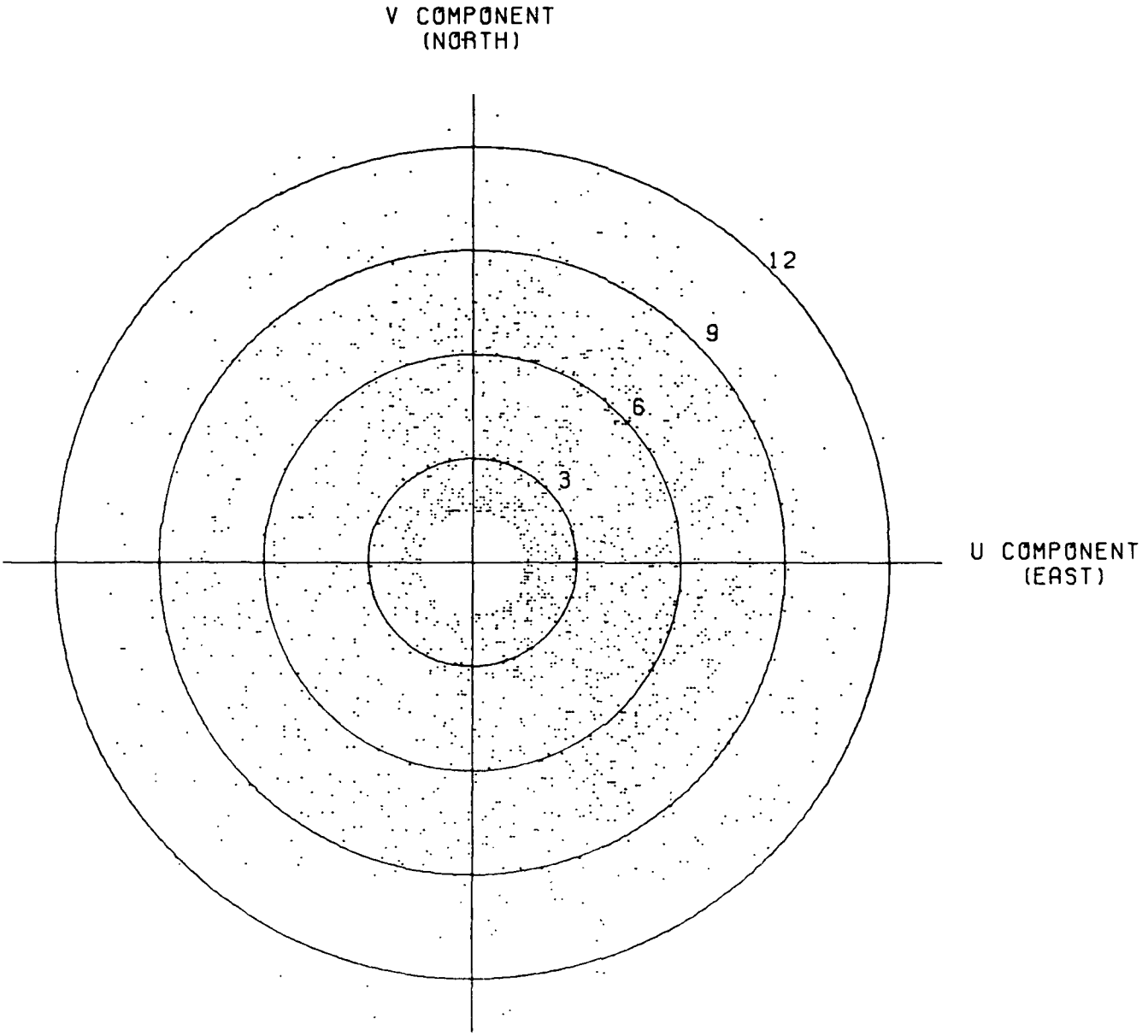

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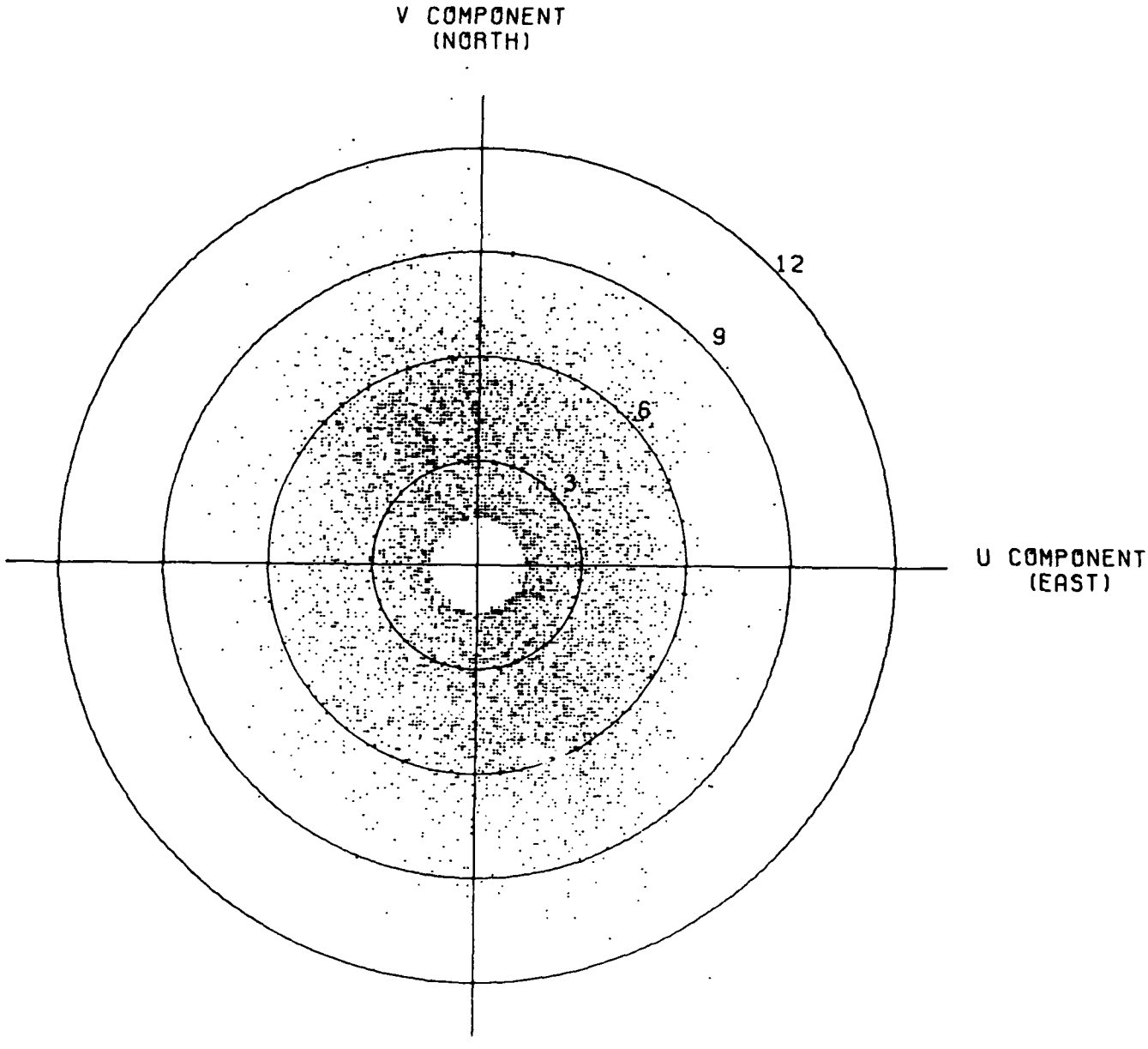

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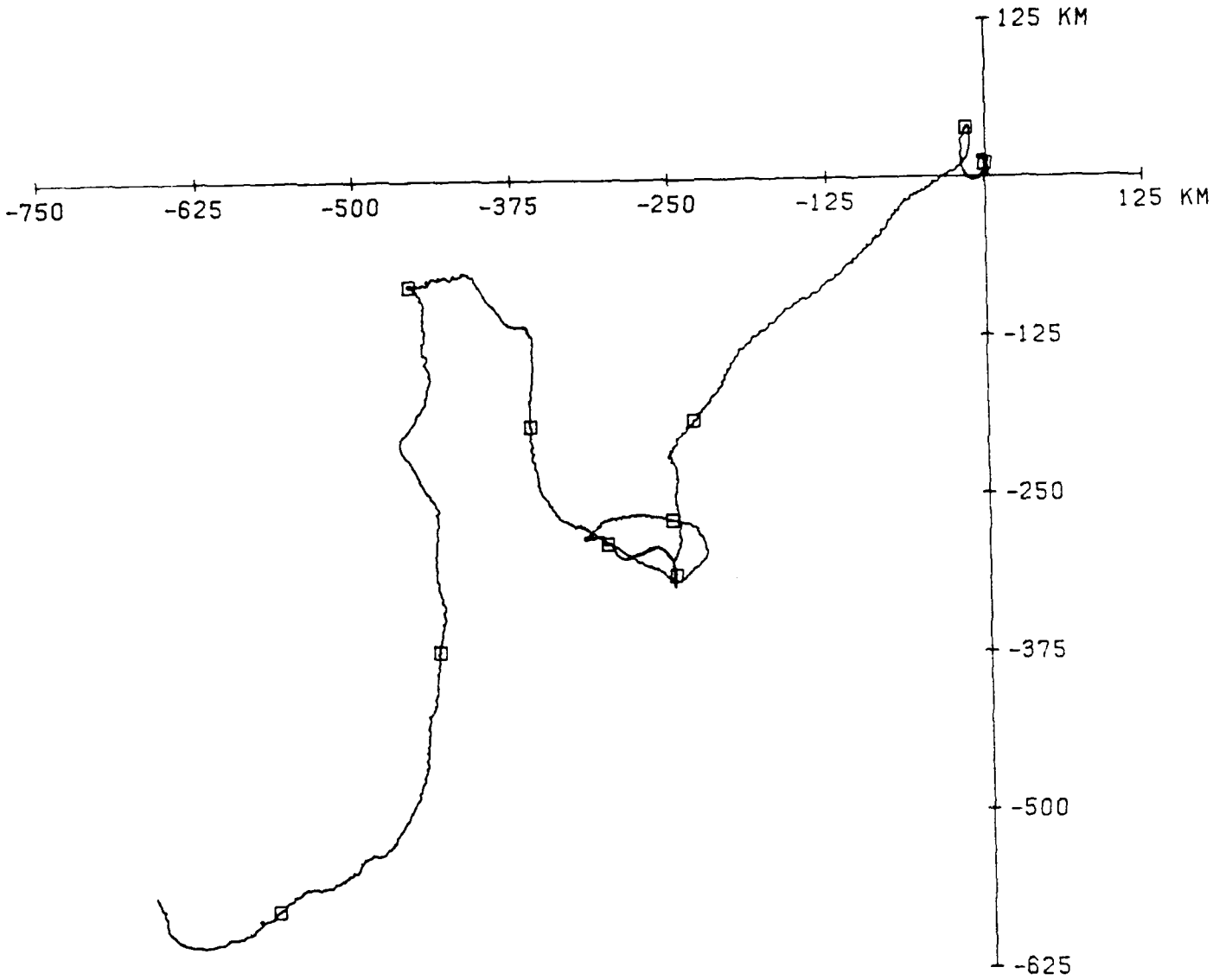
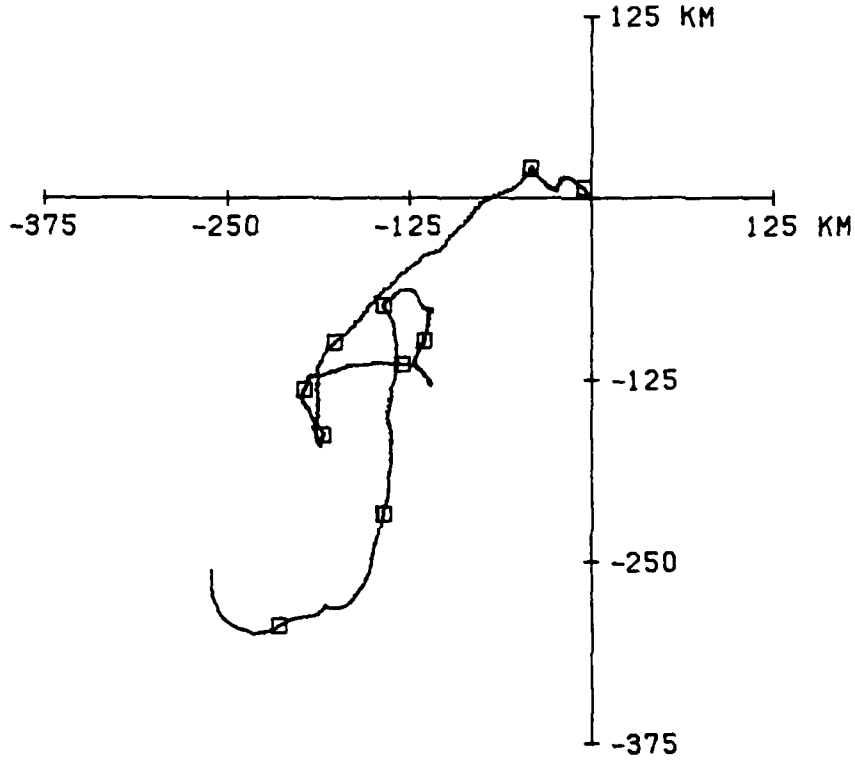


175 M AT M1. 293.8 DAYS STARTING 0027 26 SEP 84.



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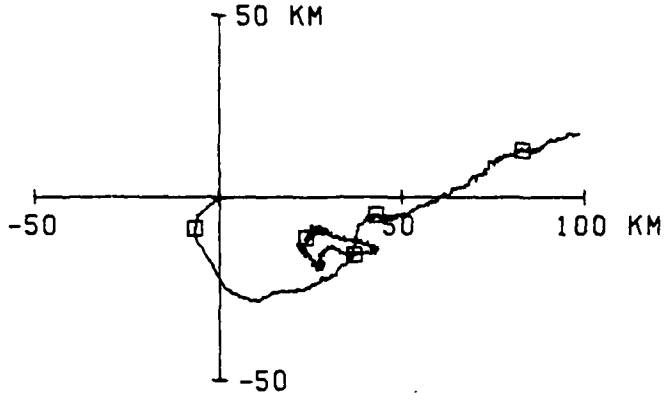

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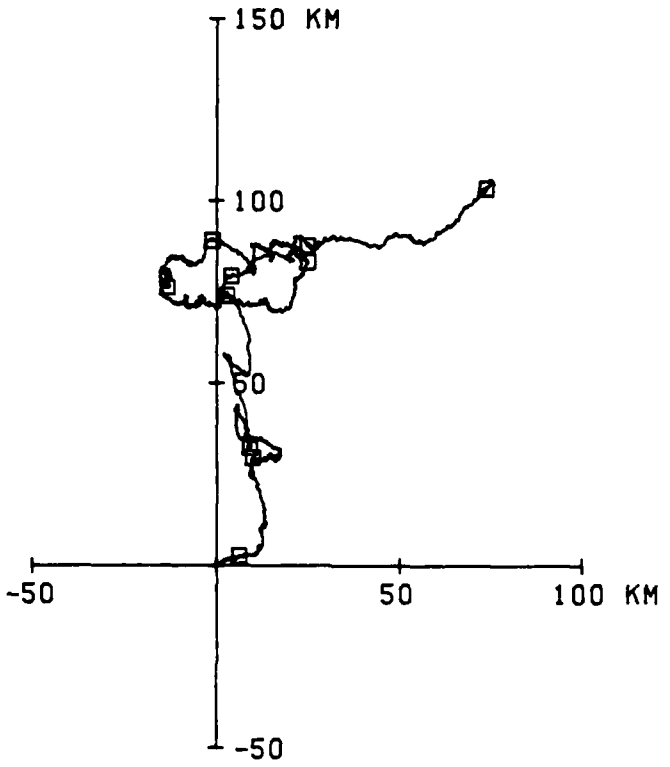
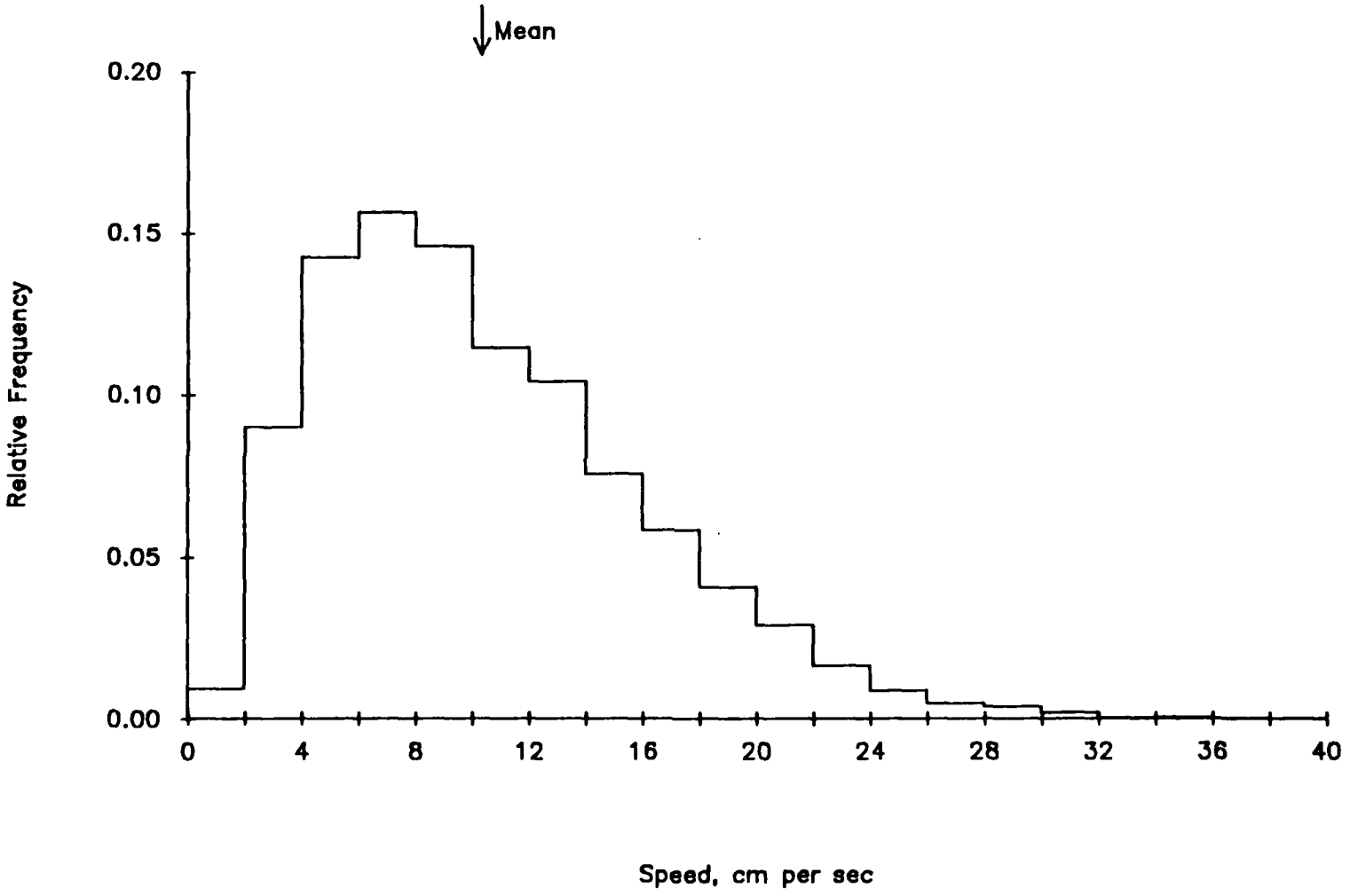


3250 M AT M1. 279.9 DAYS STARTING 0126 26 SEP 84.

175 M at M1. 26 Sep 84 – 16 Jul 85. Tape 5647/20.



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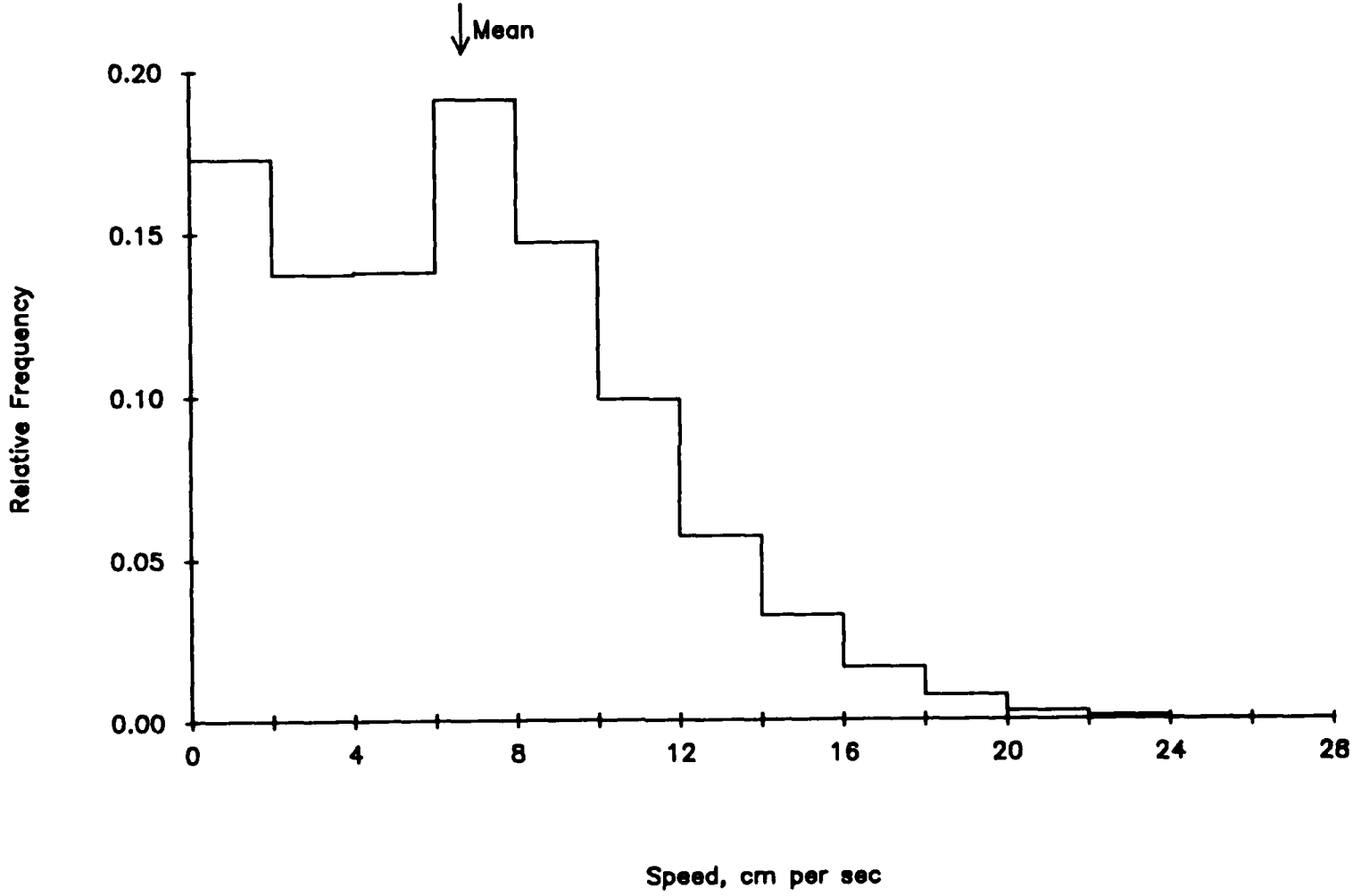

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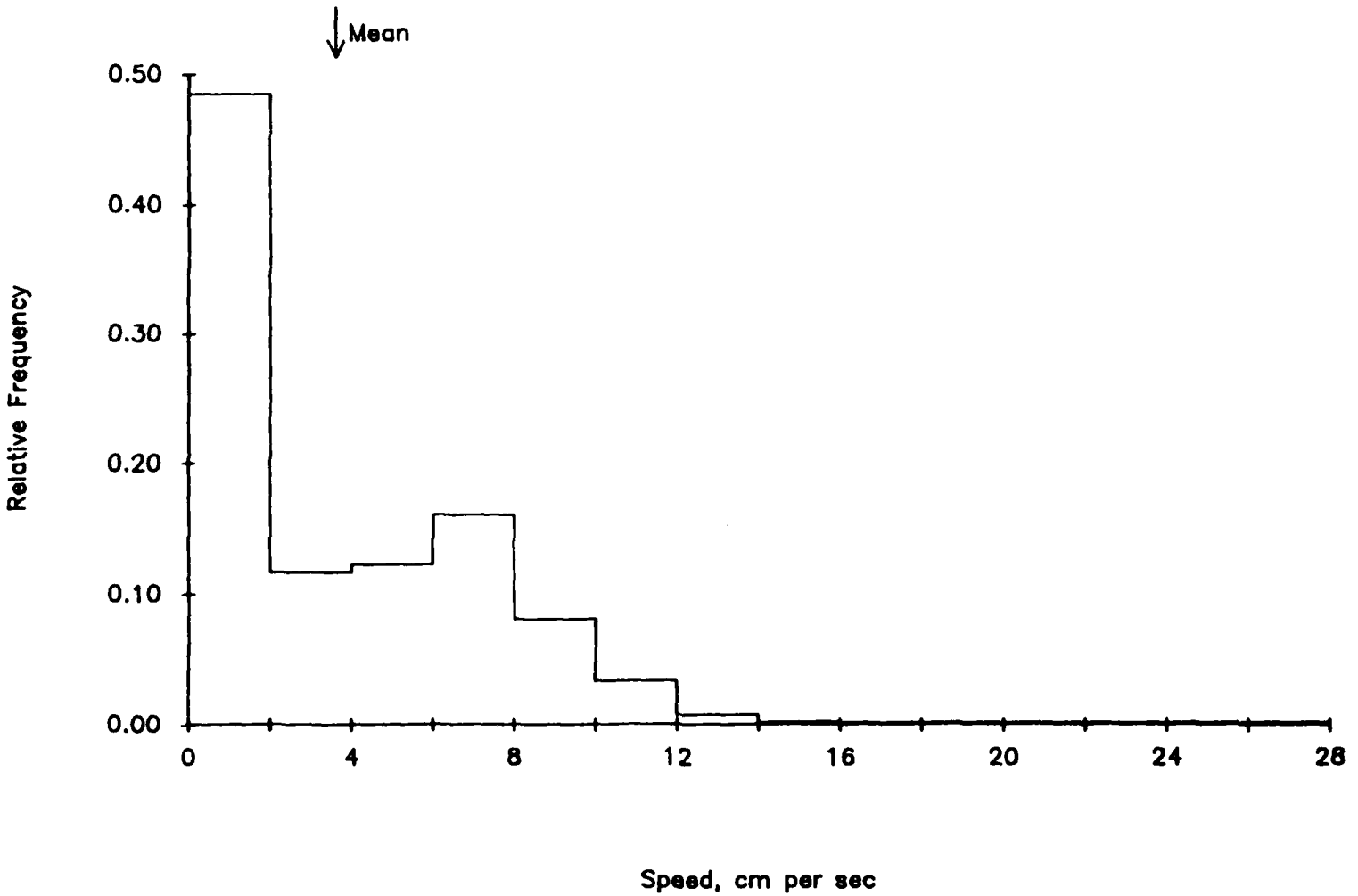

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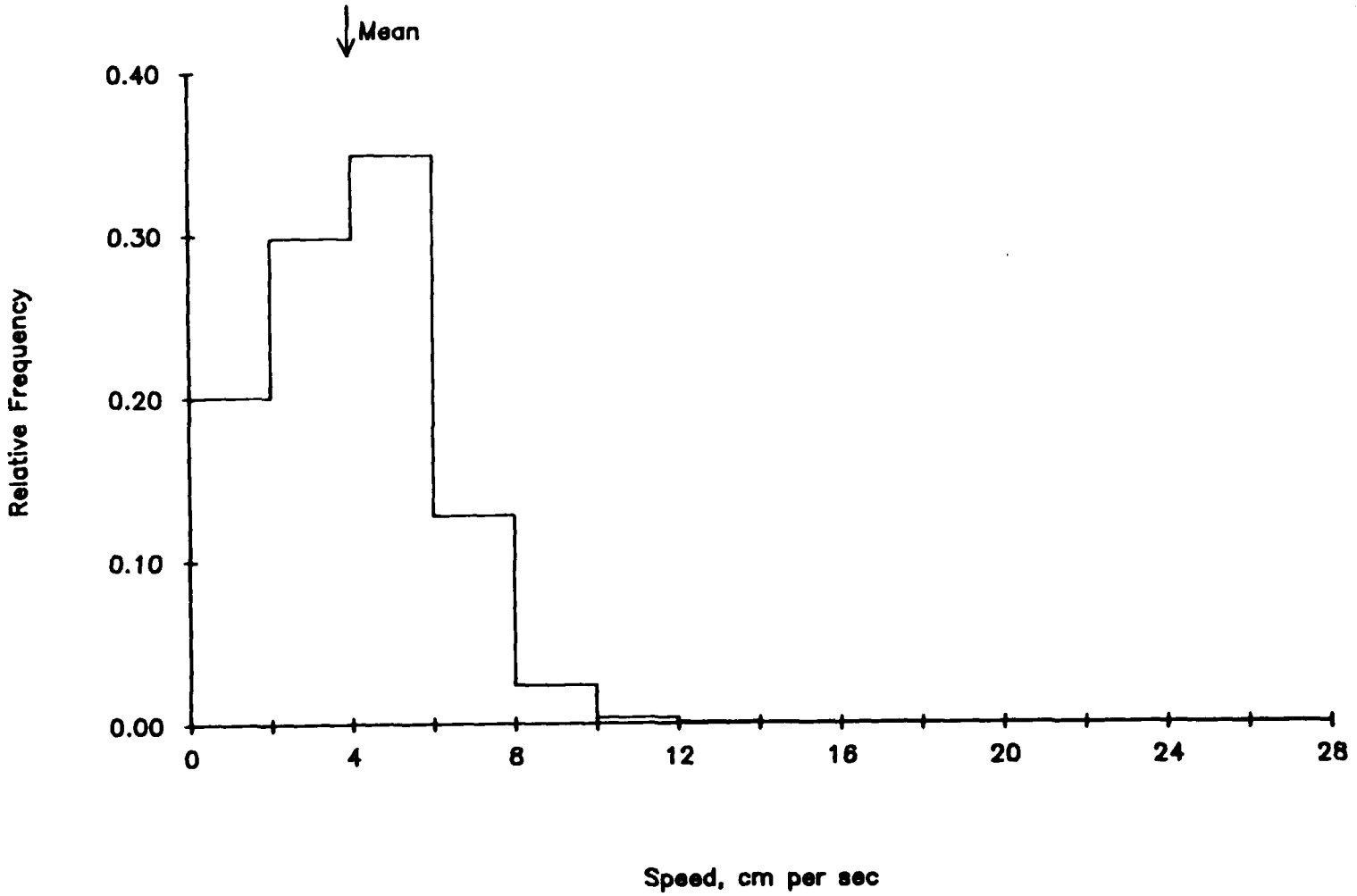

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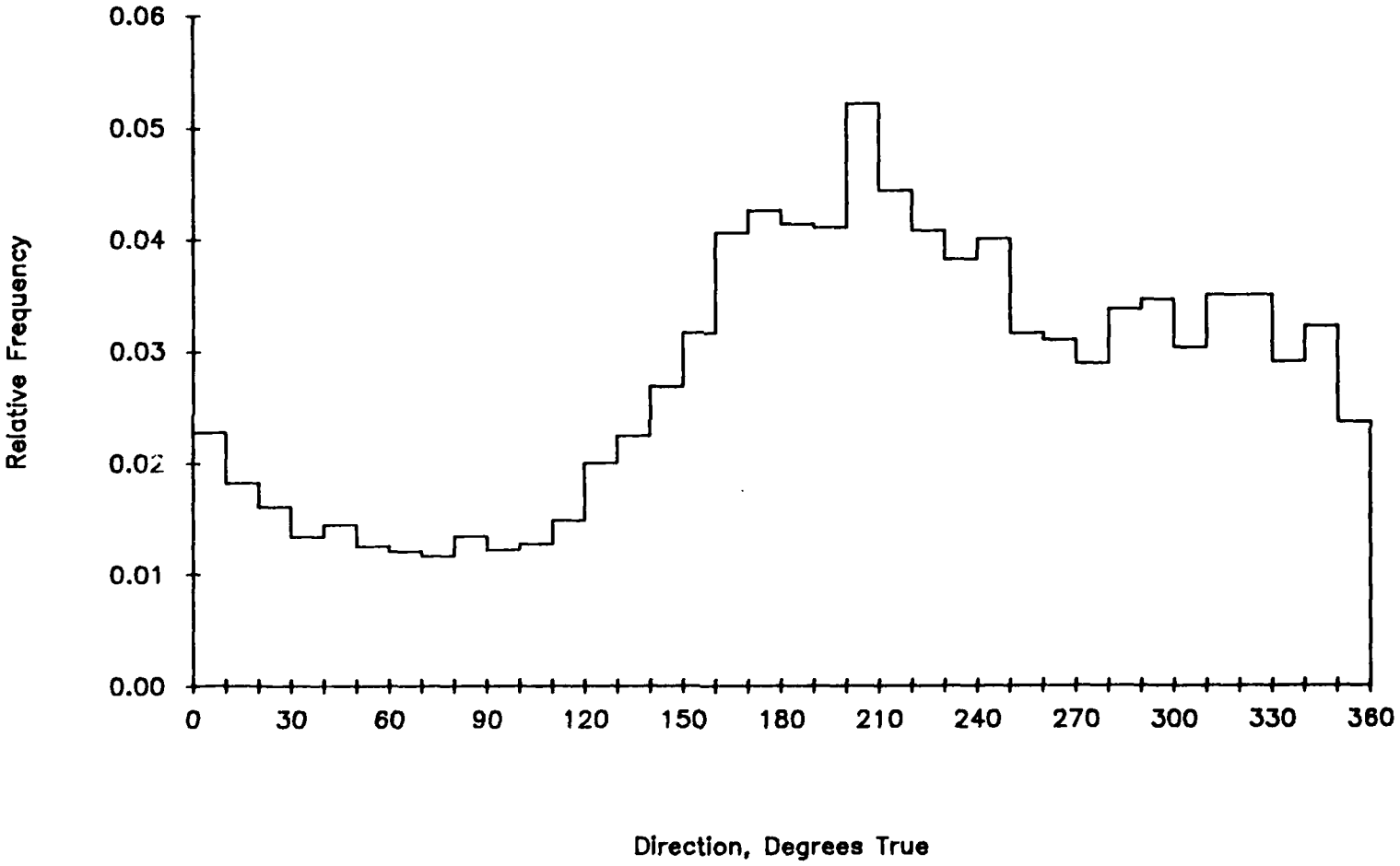
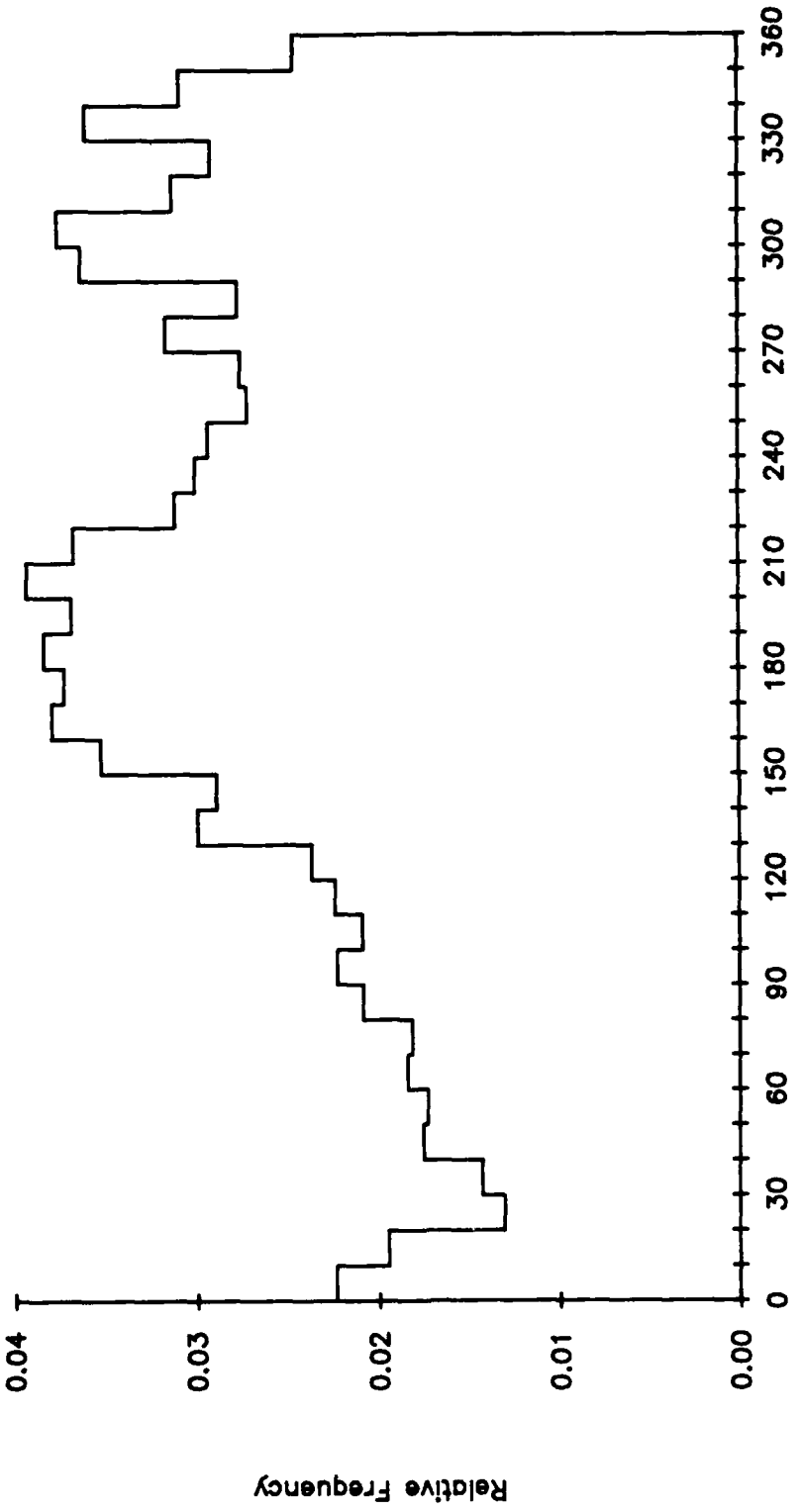
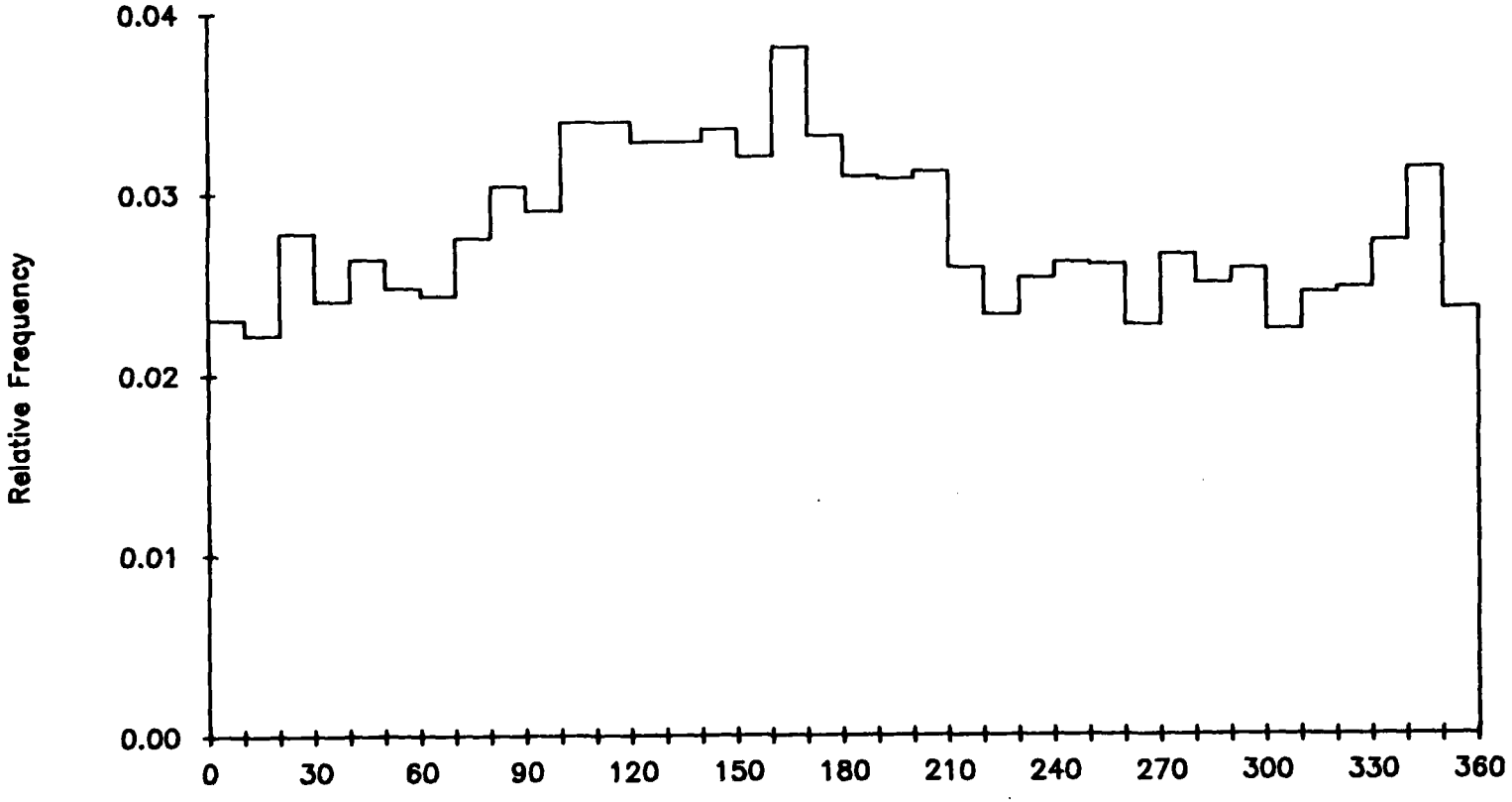



375 M at M1. 26 Sep 84 – 16 Jul 85. Tape 1538/28.
Relative Frequency
0.04
0.03
0.02
0.01
0.00
0
30
60
90
120
150
180
210
240
270
300
330
360
Direction, Degrees True

800 M at M-1. 26 Sep 84 - 16 Jul 85. Tape 2760/19.



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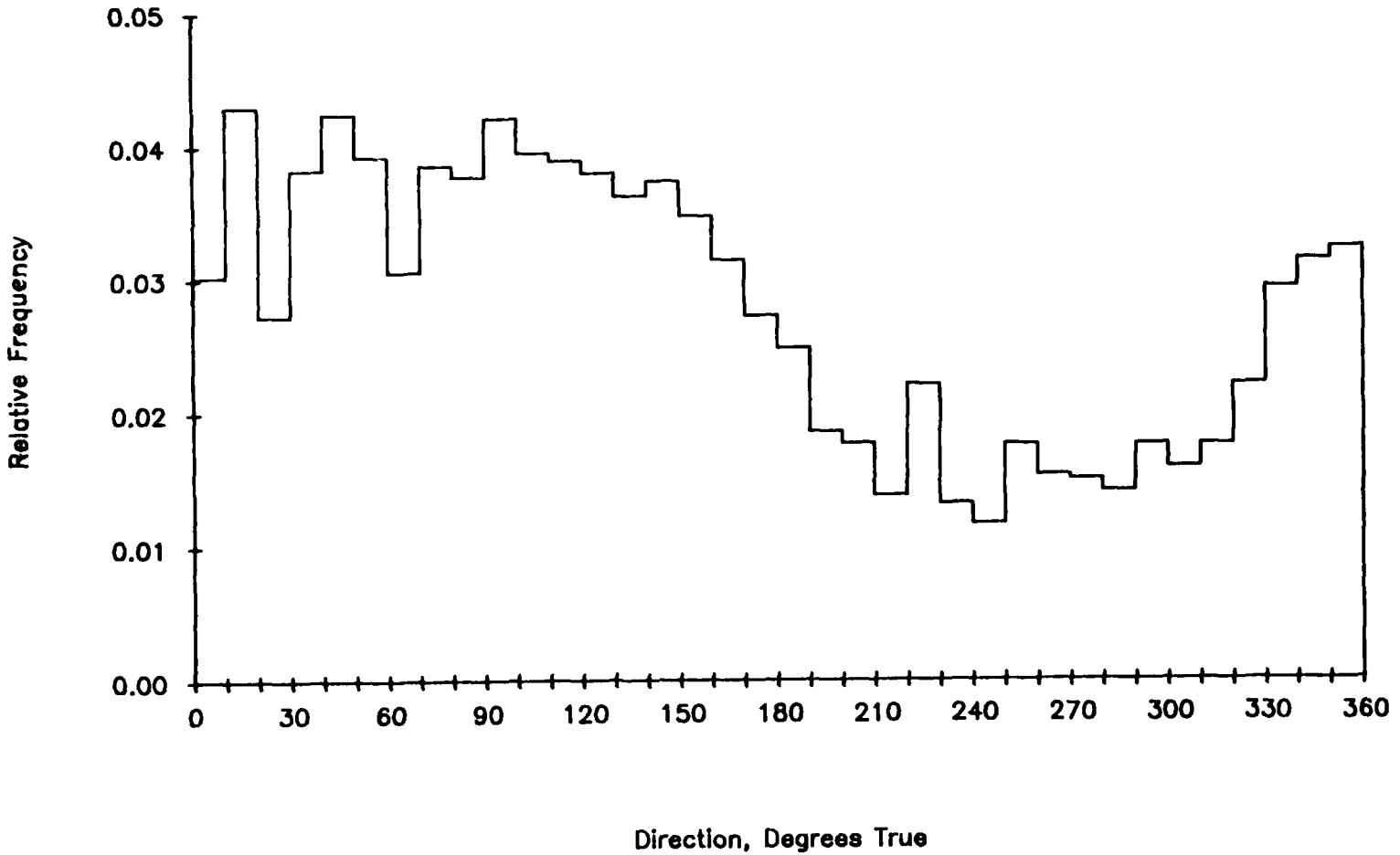

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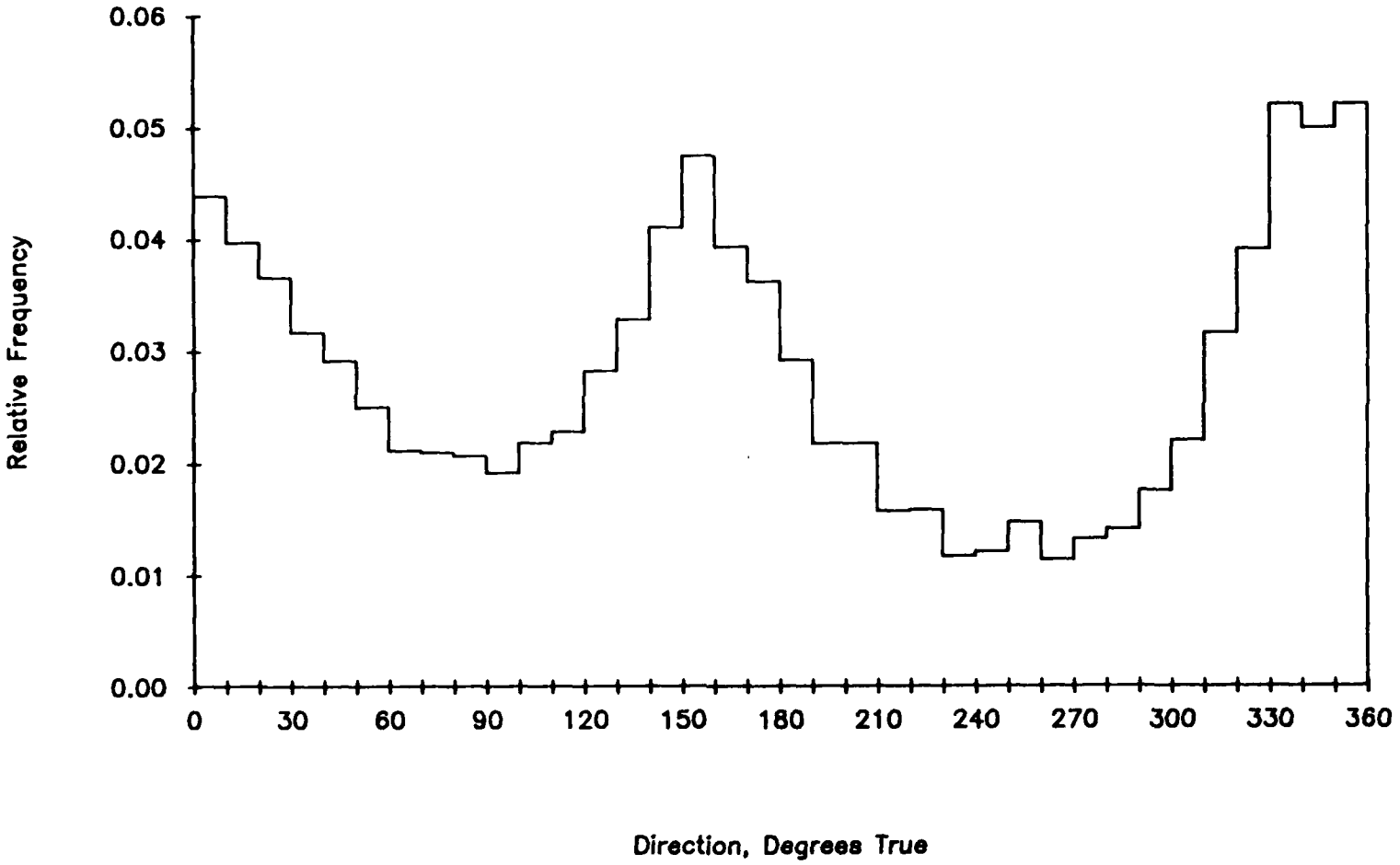

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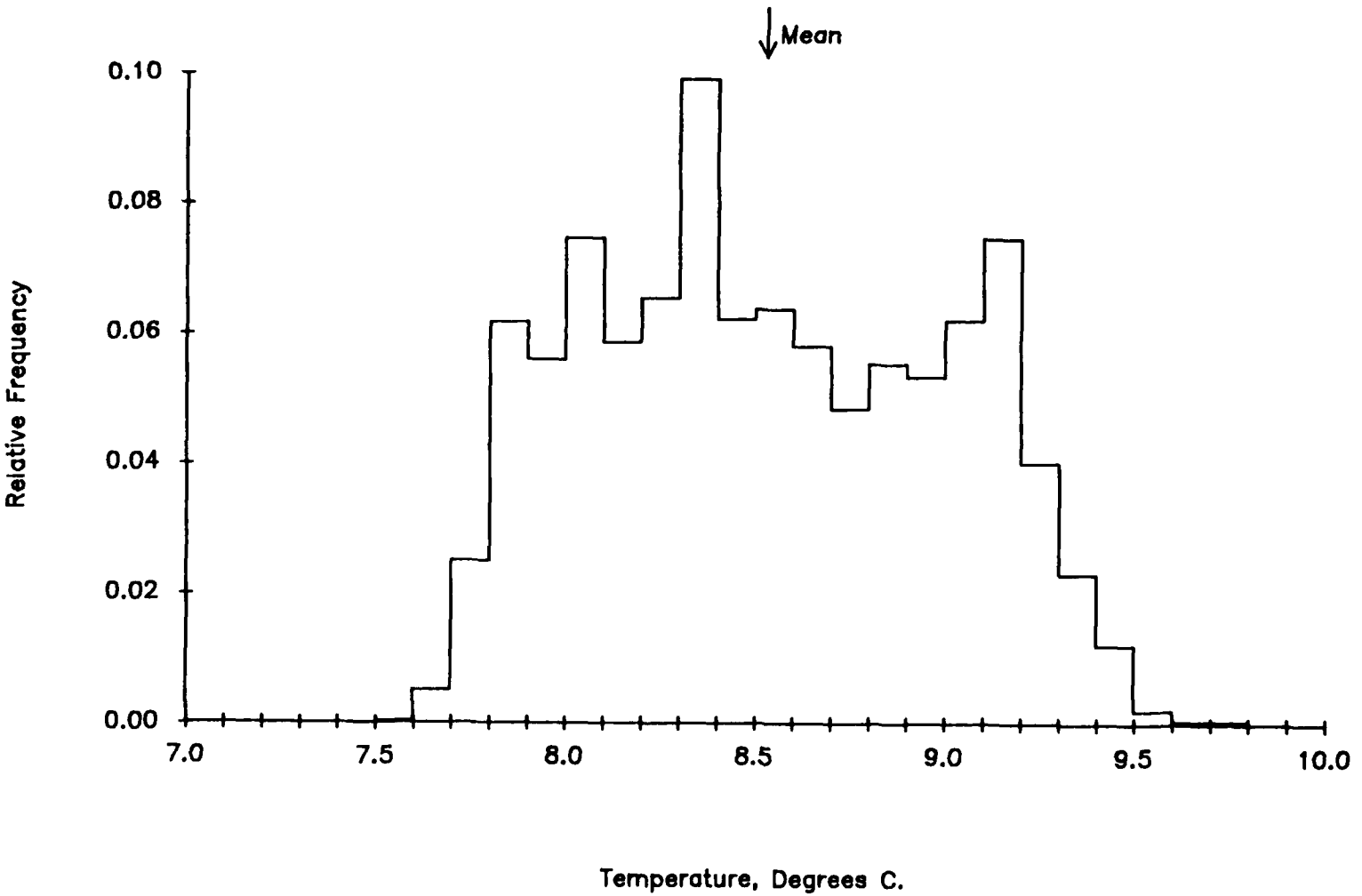

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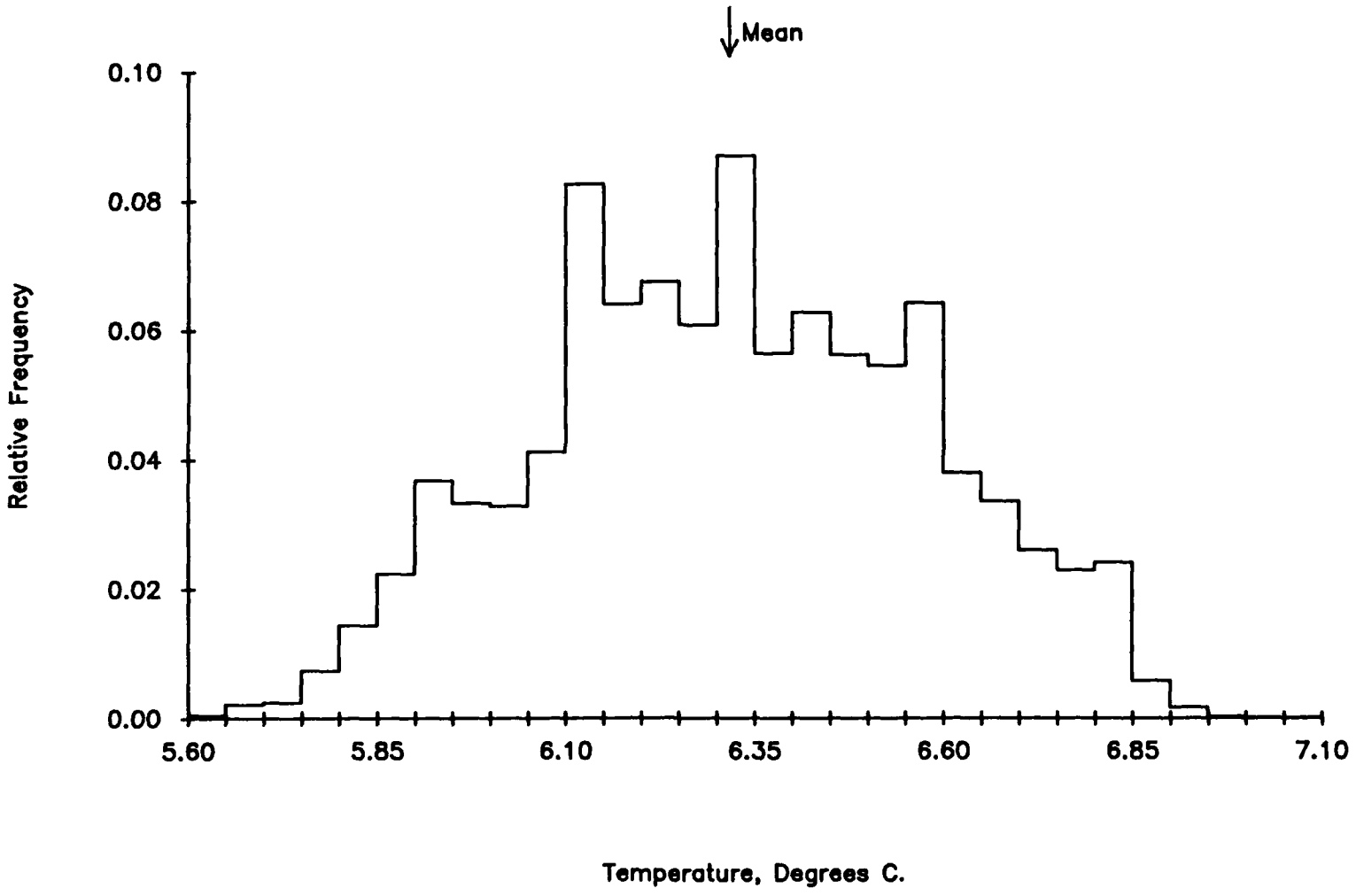
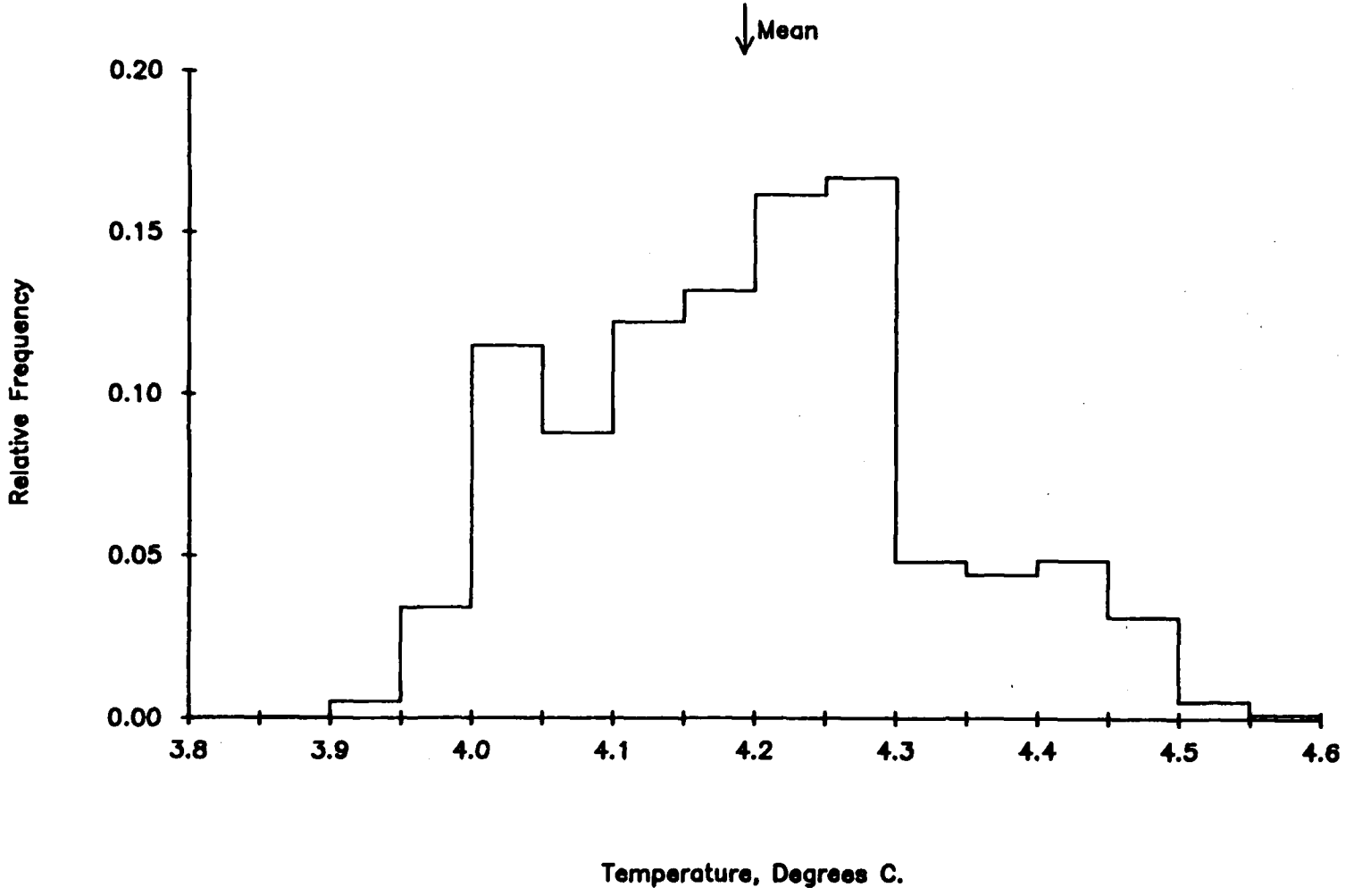
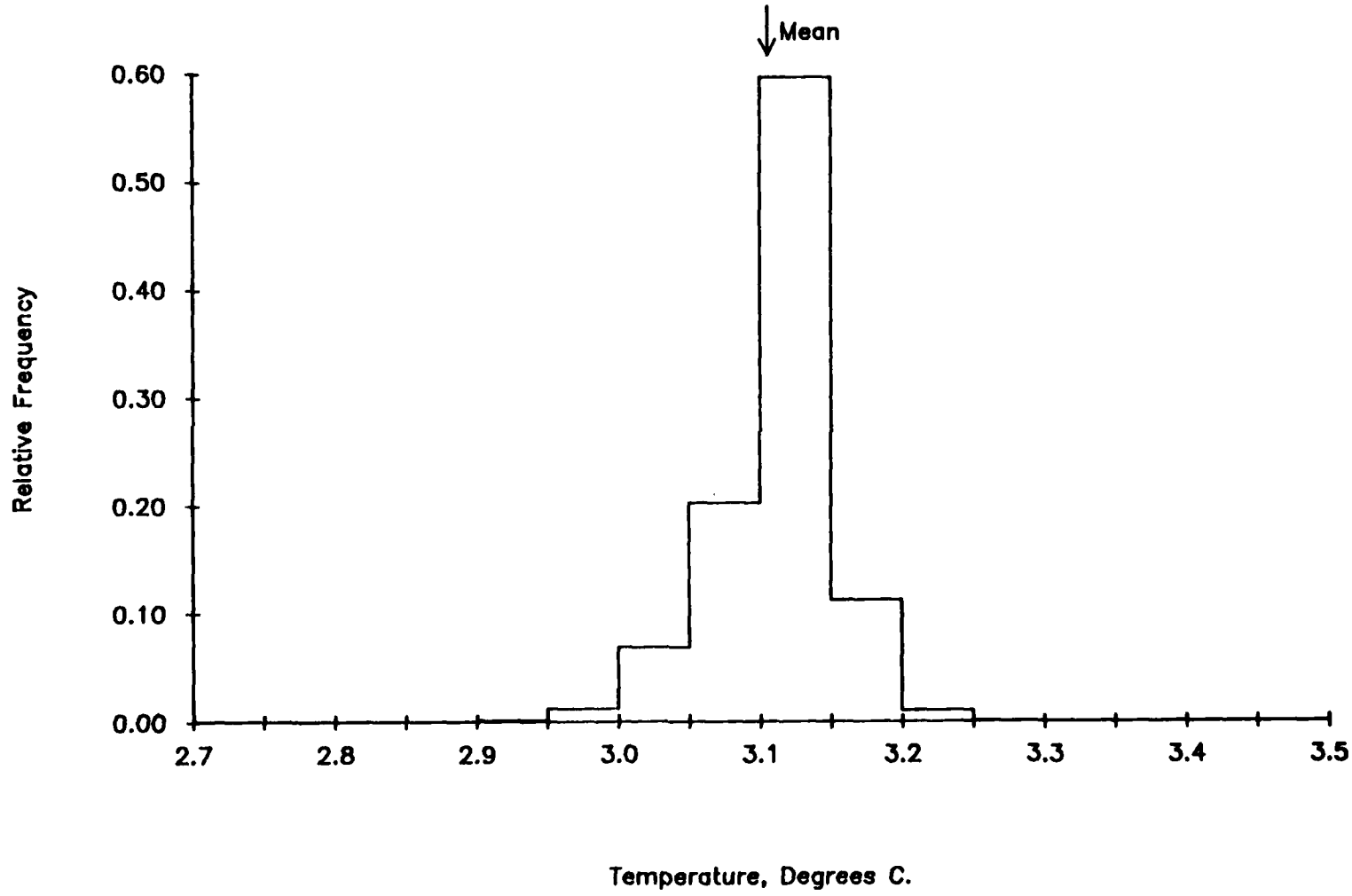


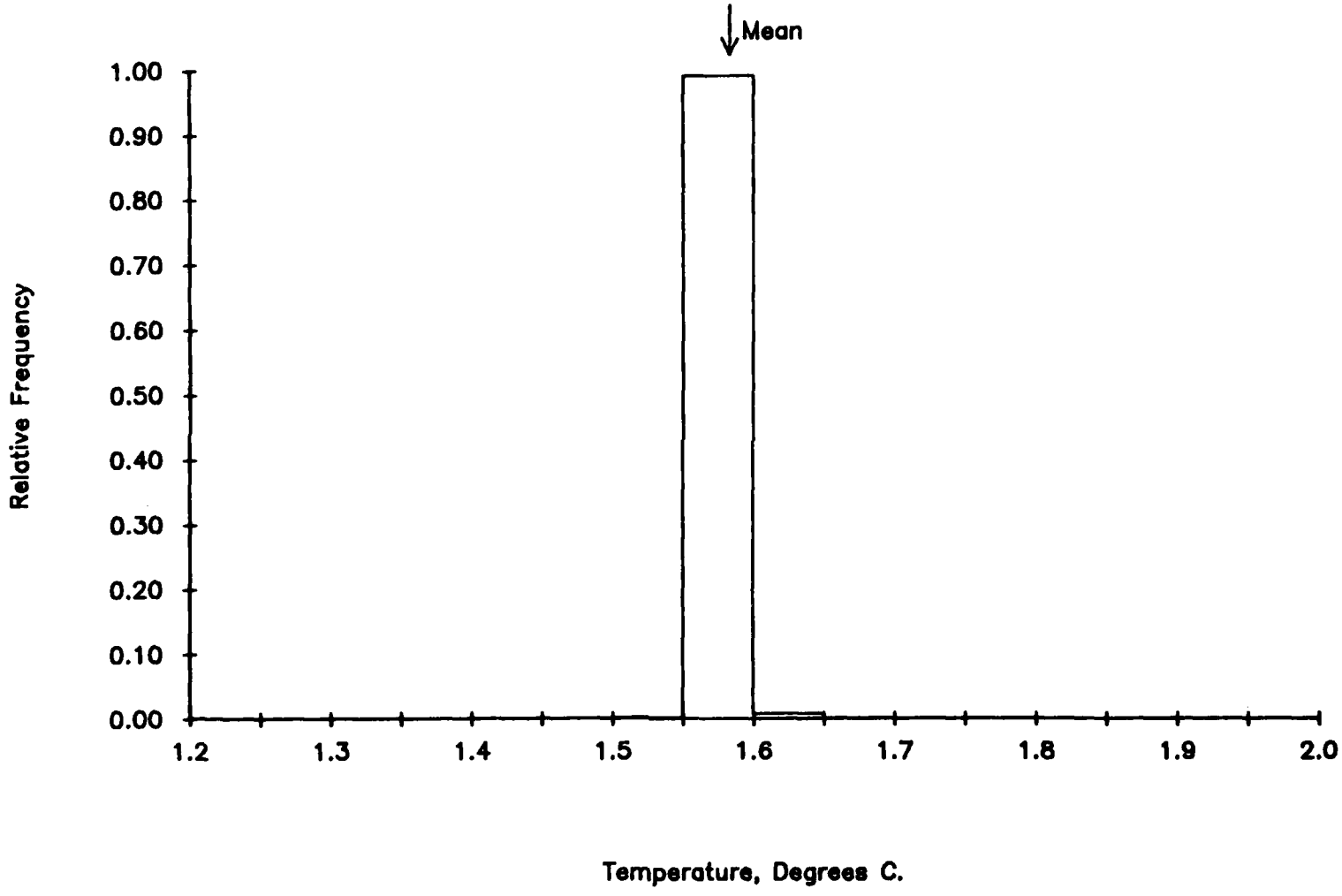
800 M at M-1. 26 Sep 84 - 16 Jul 85. Tape 2760/19.



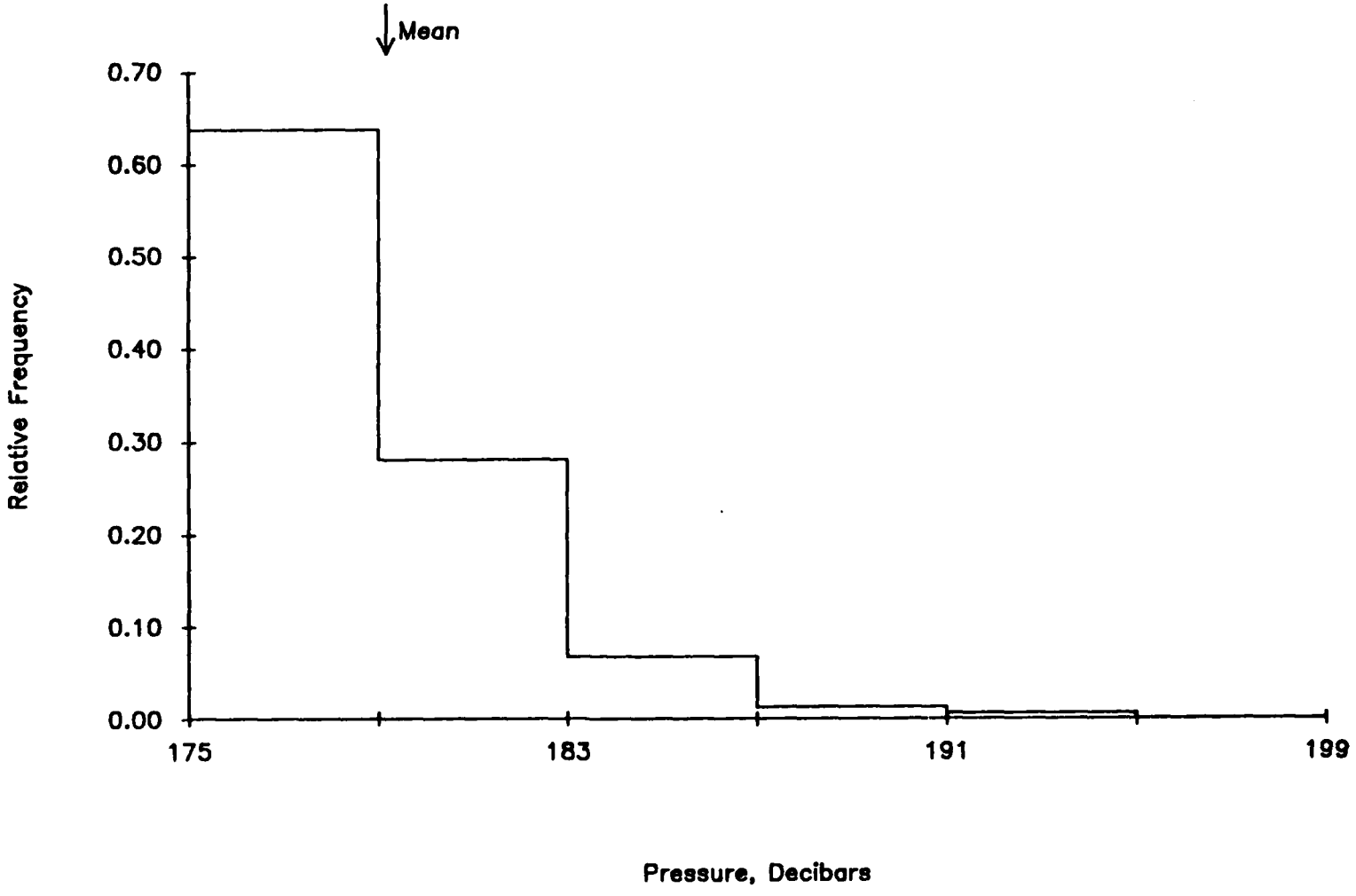
1220 M at M-1. 26 Sep 84 - 12 Feb 85. Tape 5883/14.

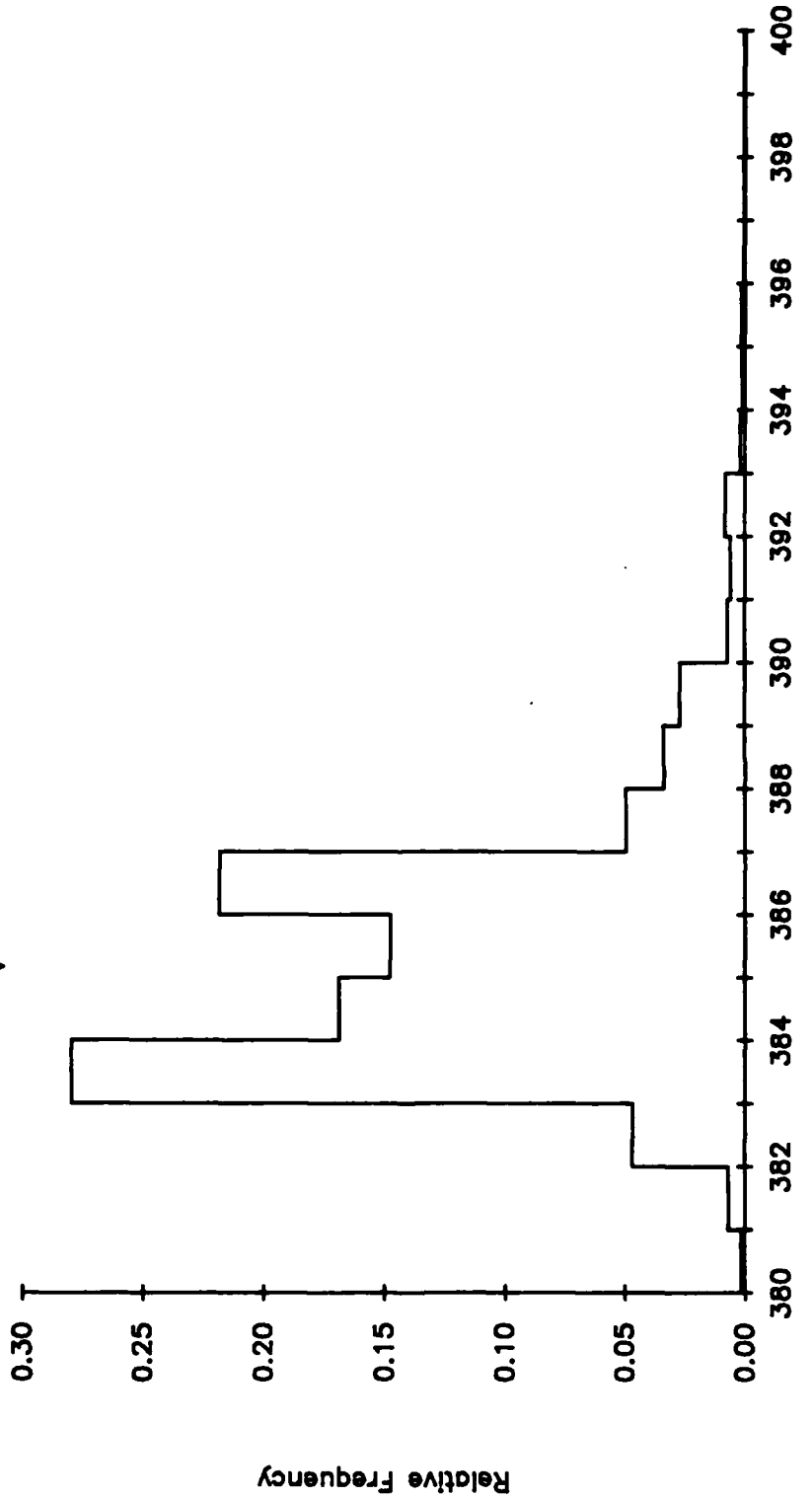


3250 M at M-1. 26 Sep 84 - 16 Jul 85. Tape 1245/38.

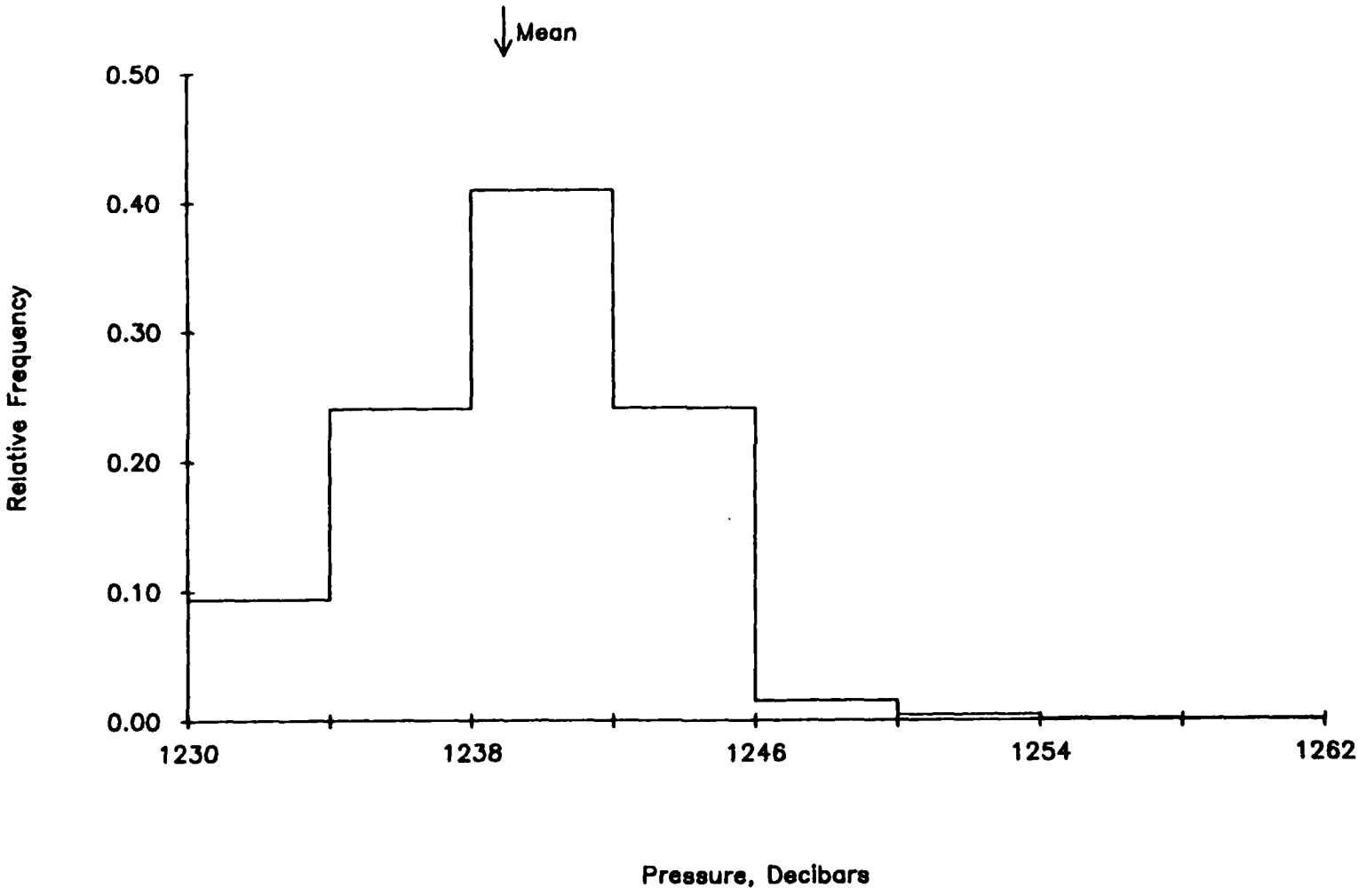


175 M at M1. 26 Sep 84 – 16 Jul 85. Tape 5647/20.

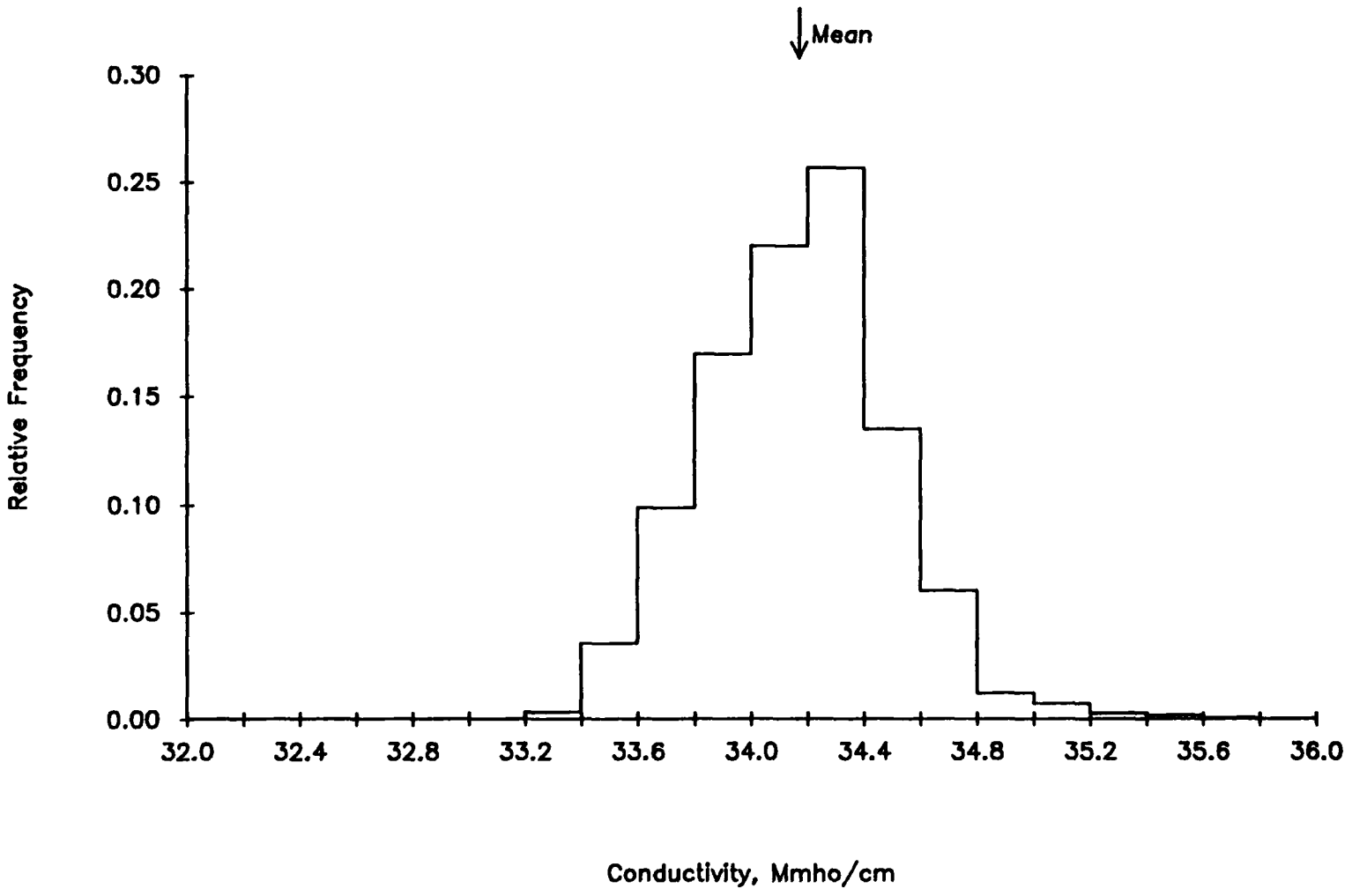


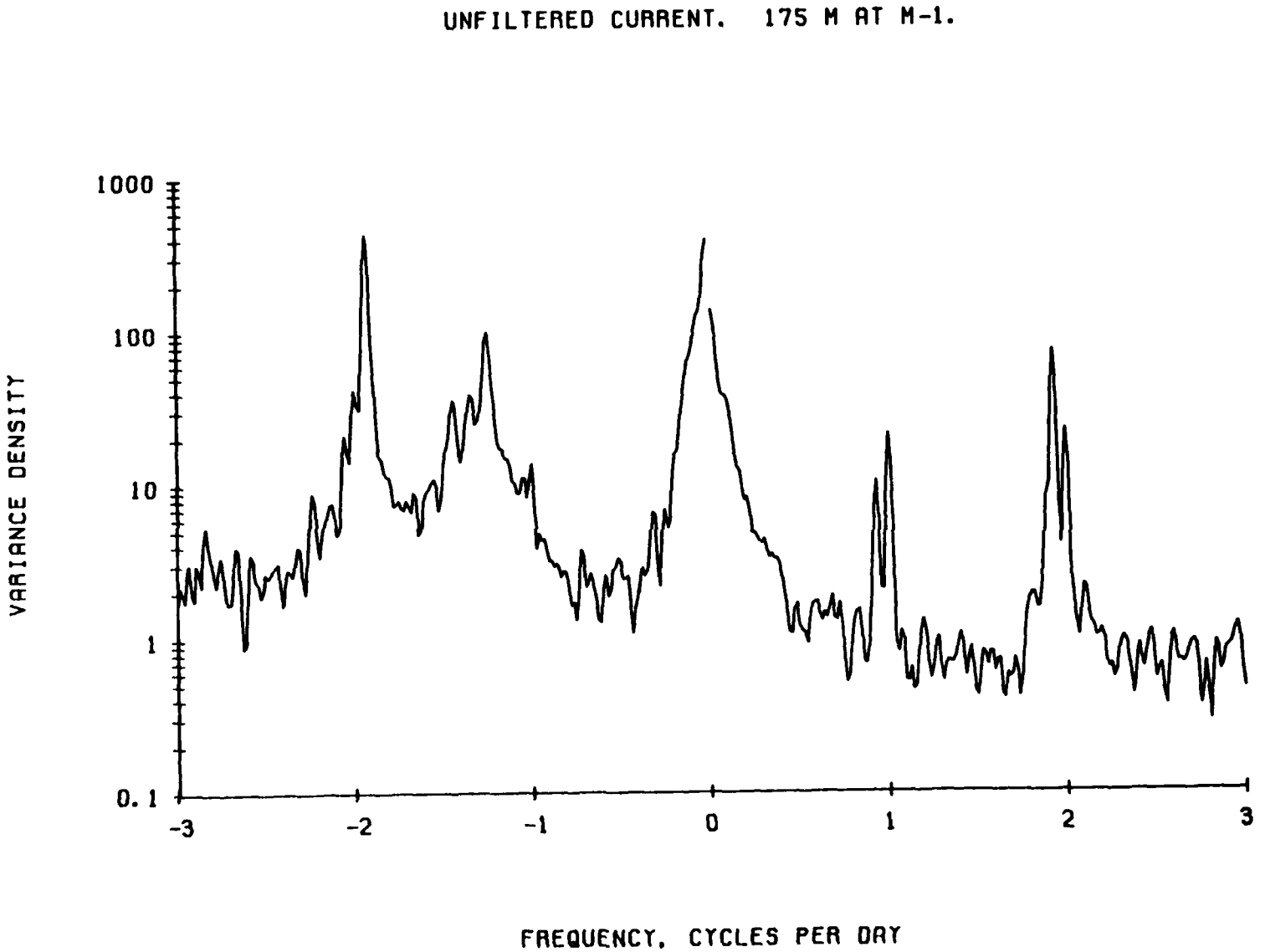

375 M at M1. 26 Sep 84 – 16 Jul 85. Tape 1538/28.
Mean
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Relative Frequency
380
382
384
386
388
390
392
394
396
398
400
Pressure, Decibars

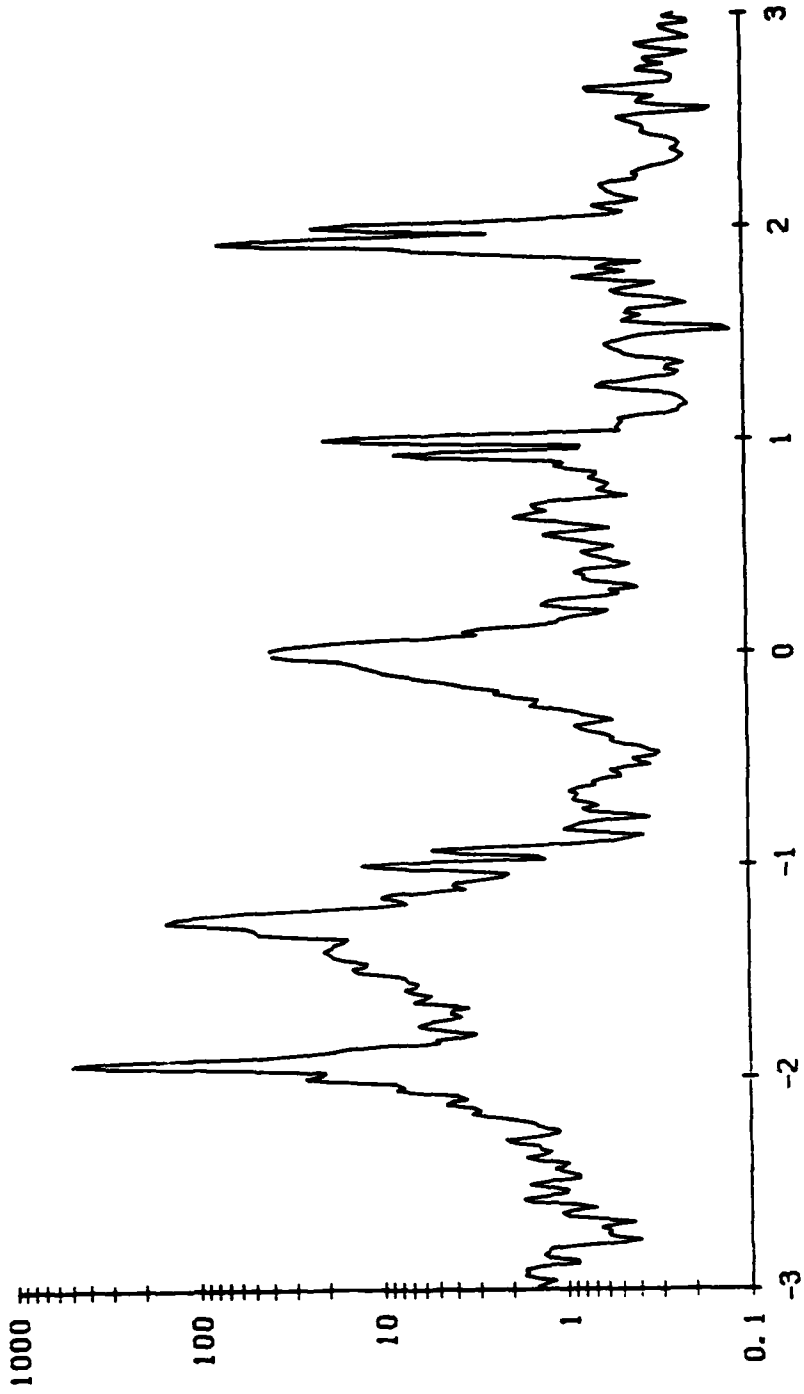
1220 M at M–1. 26 Sep 84 – 12 Feb 85. Tape 5883/14.



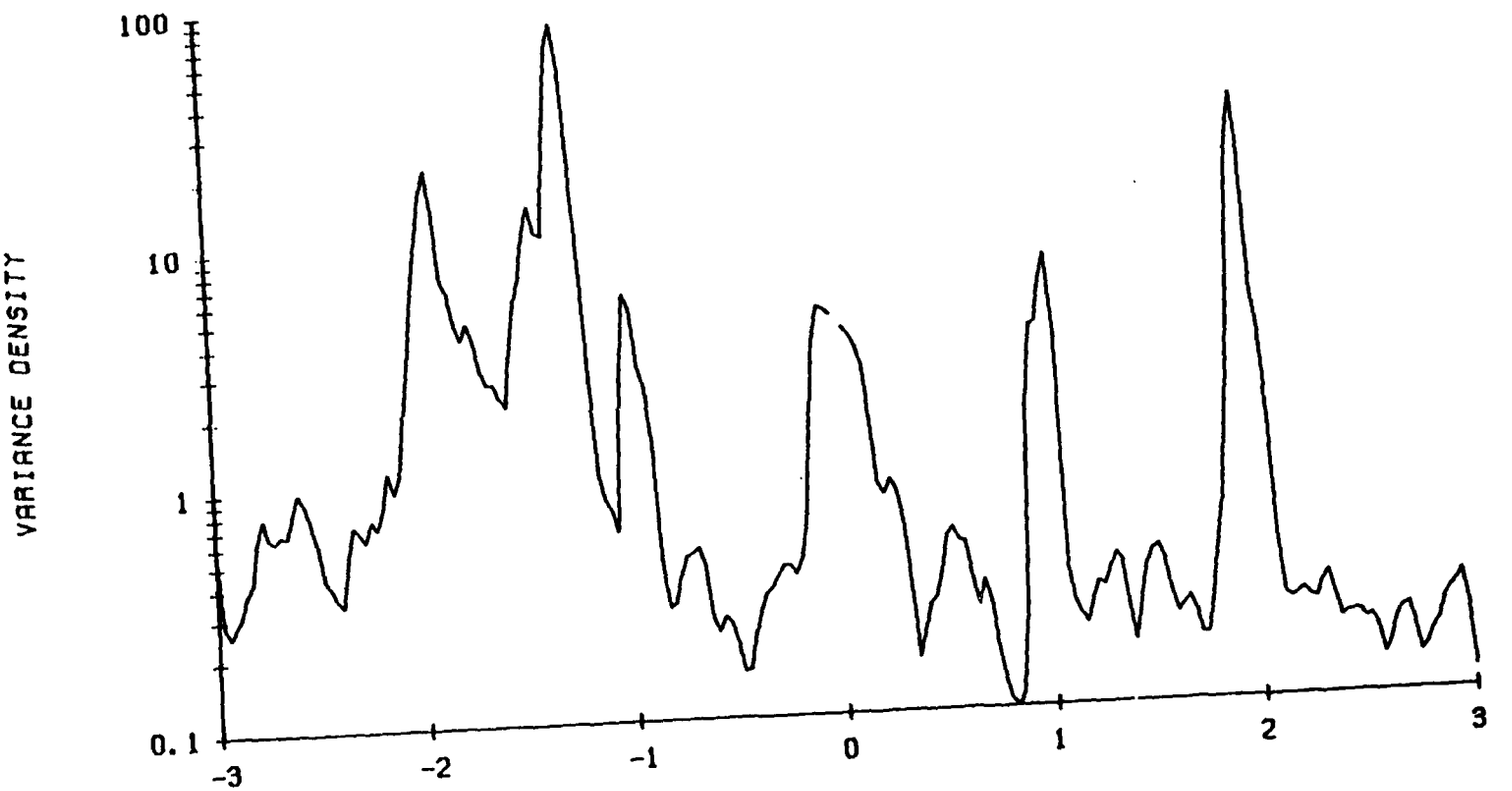
175 M at M1. 26 Sep 84 – 16 Jul 85. Tape 5647/20.

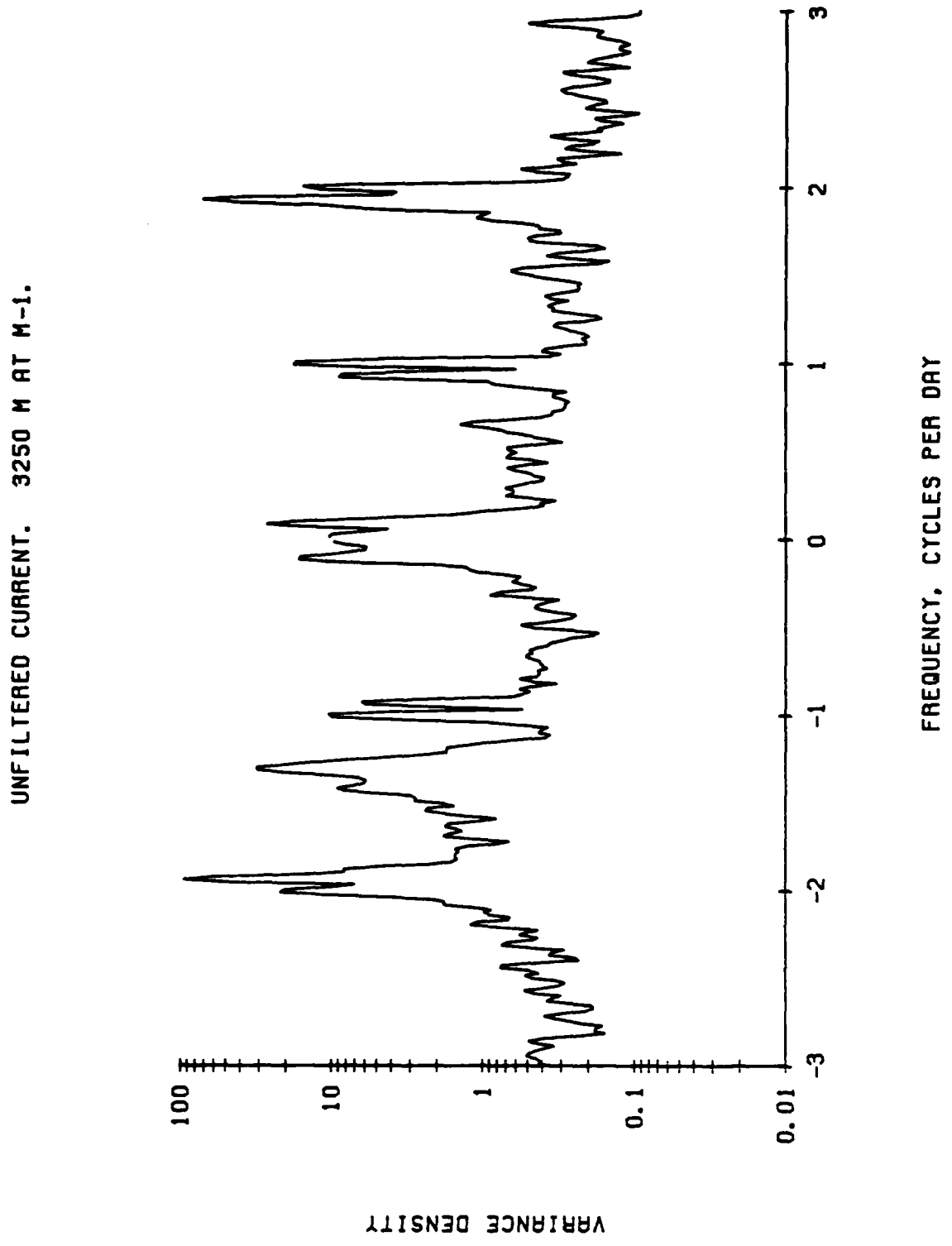



UNFILTERED CURRENT. 175 M AT M-1.
VARIANCE DENSITY
1000
100
10
1
0.1
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

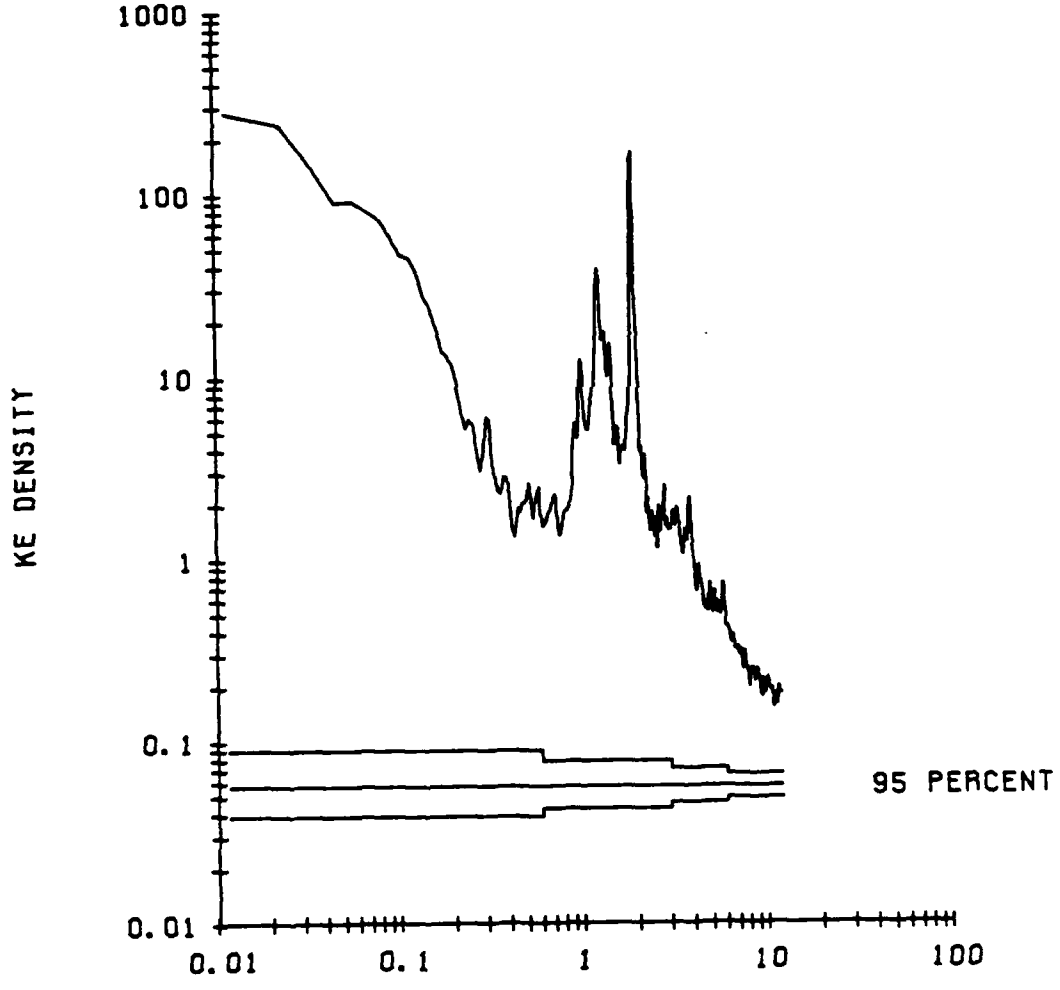

UNFILTERED CURRENT. 375 M AT M-1.
VARIANCE DENSITY
1000
100
10
1
0.1
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

UNFILTERED CURRENT. 1220 M AT M-1.

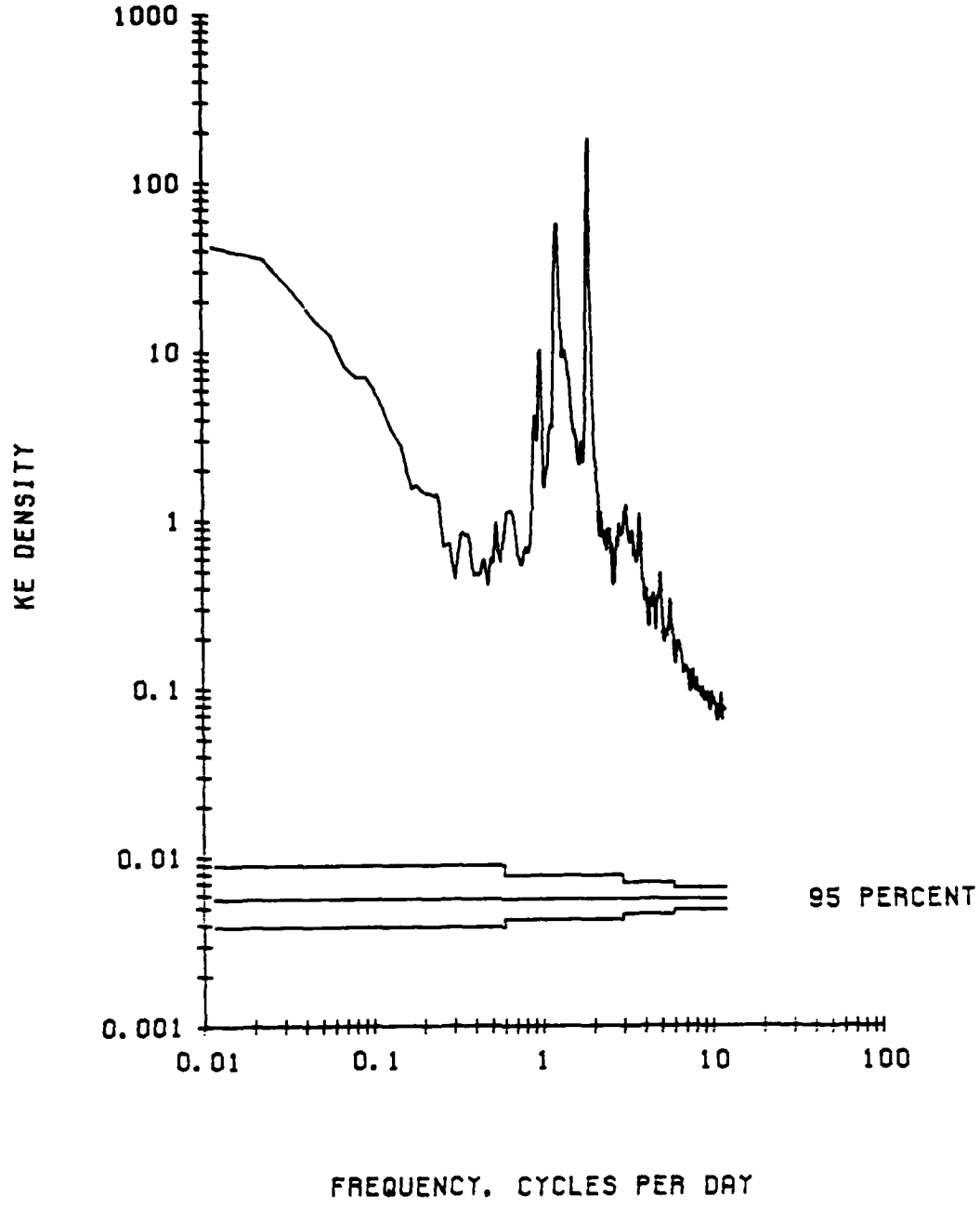



UNFILTERED CURRENT. 3250 M AT M-1.
VARIANCE DENSITY
100
10
1
0.1
0.01
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

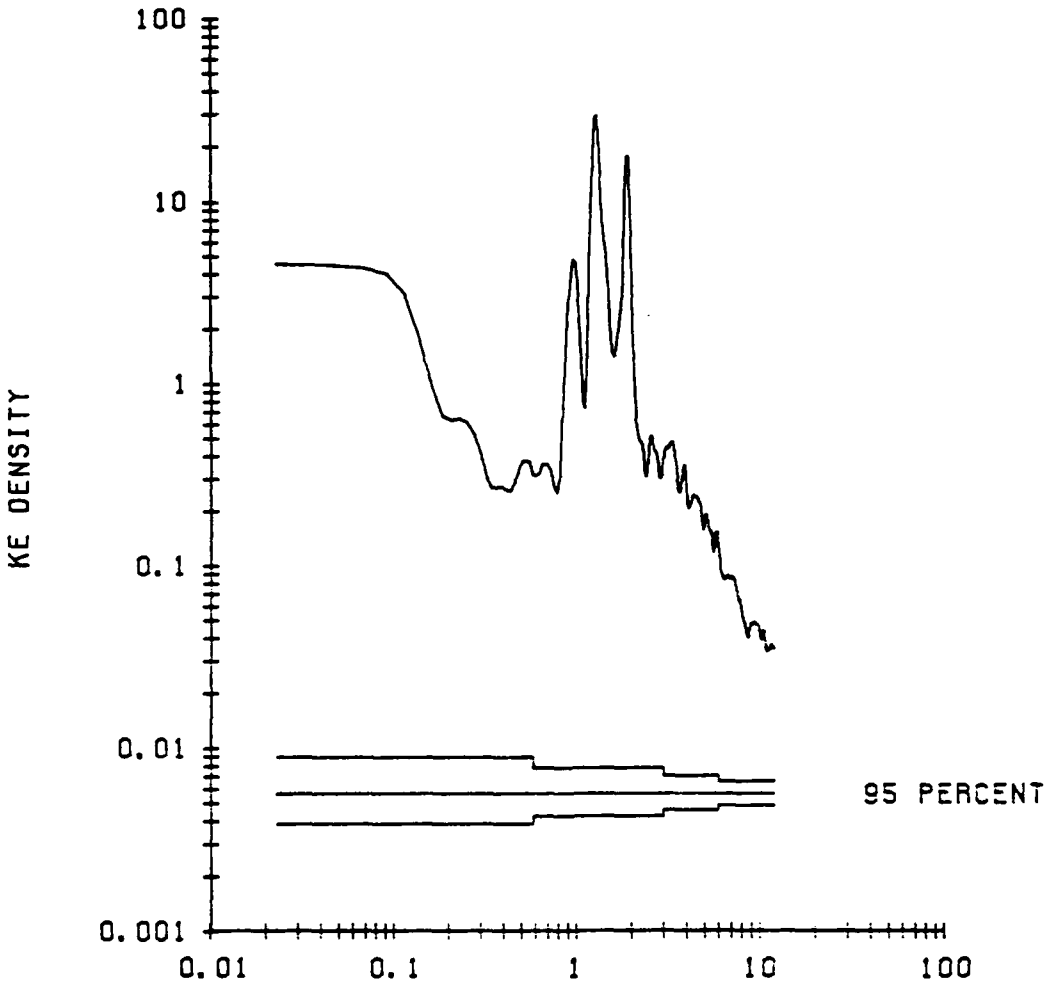
UNFILTERED CURRENT. 175 M AT M-1.



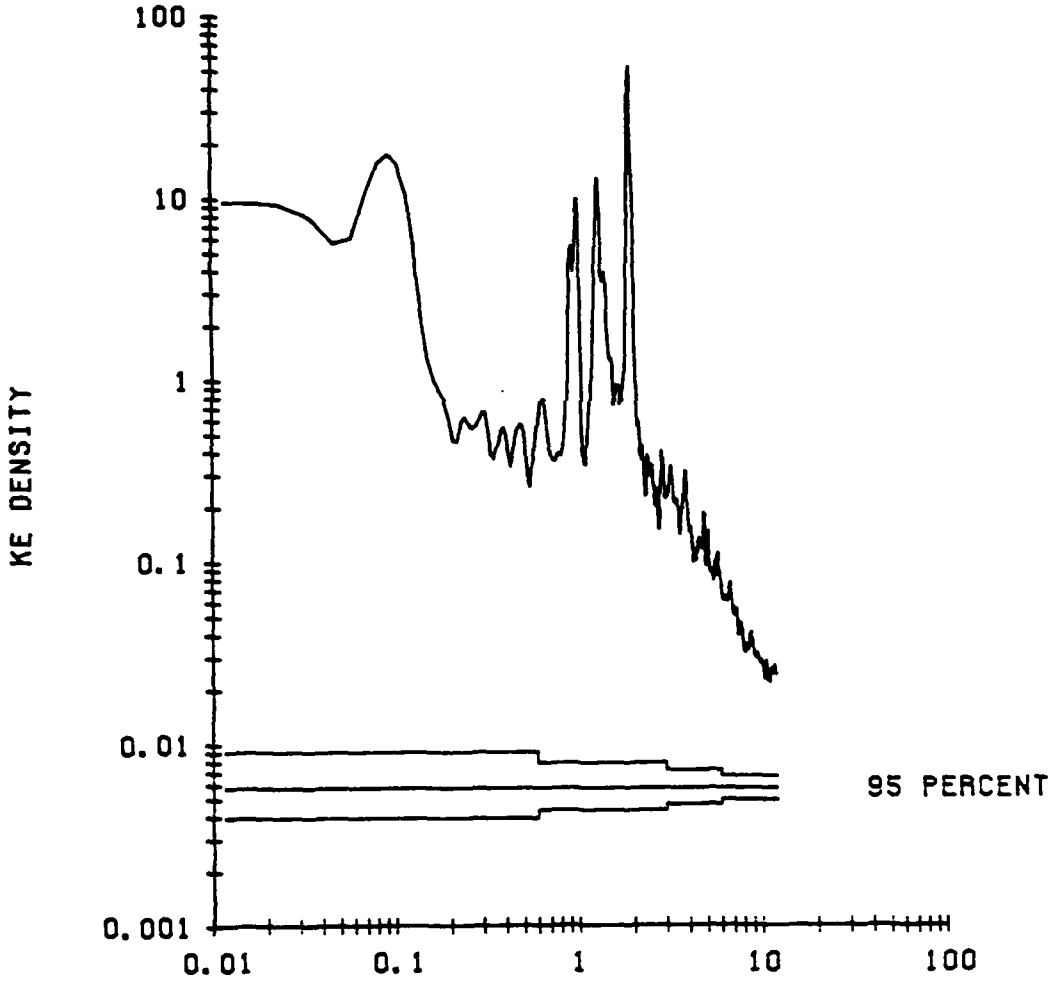
UNFILTERED CURRENT. 375 M AT M-1.



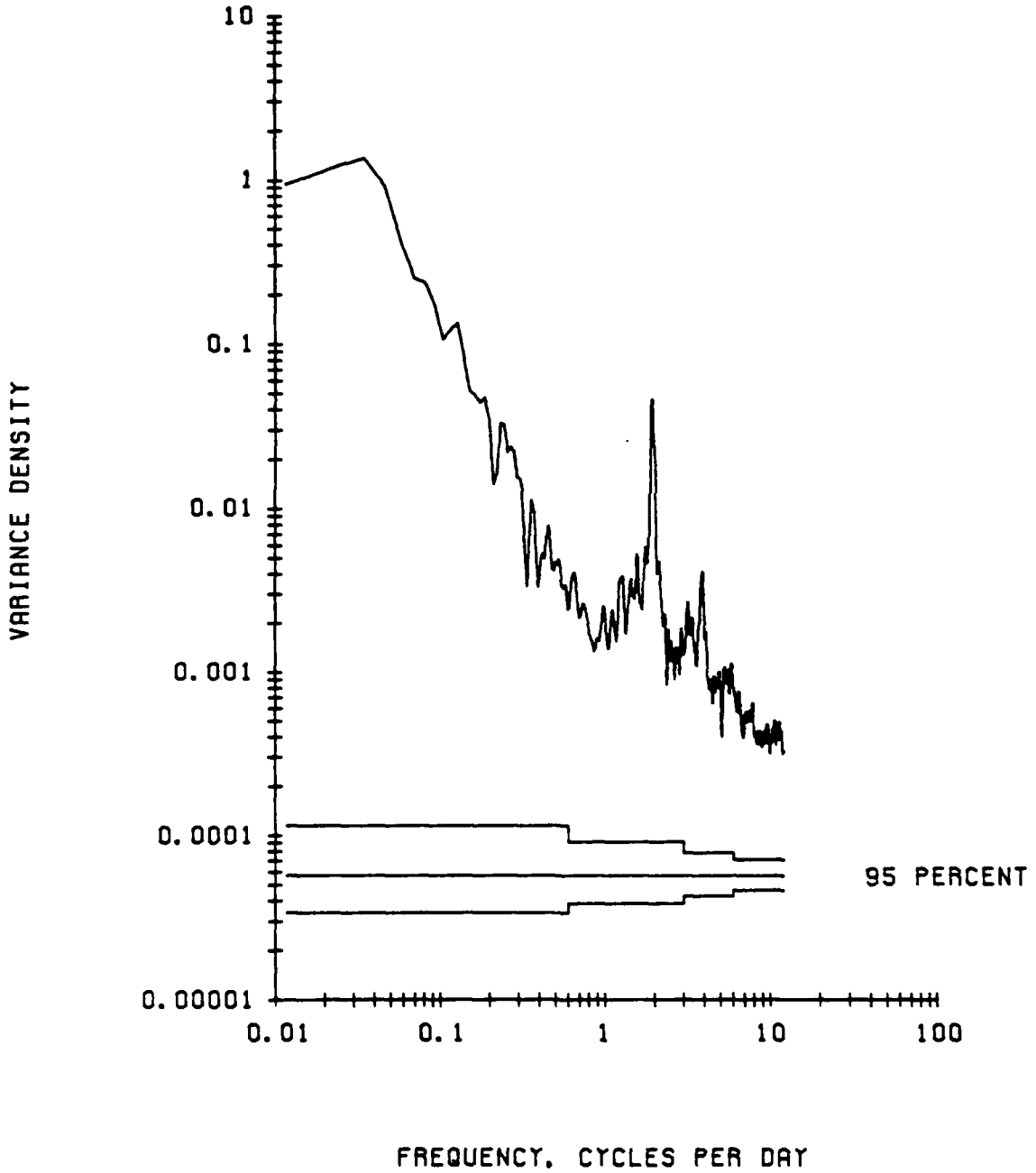
UNFILTERED CURRENT. 1220 M AT M-1.



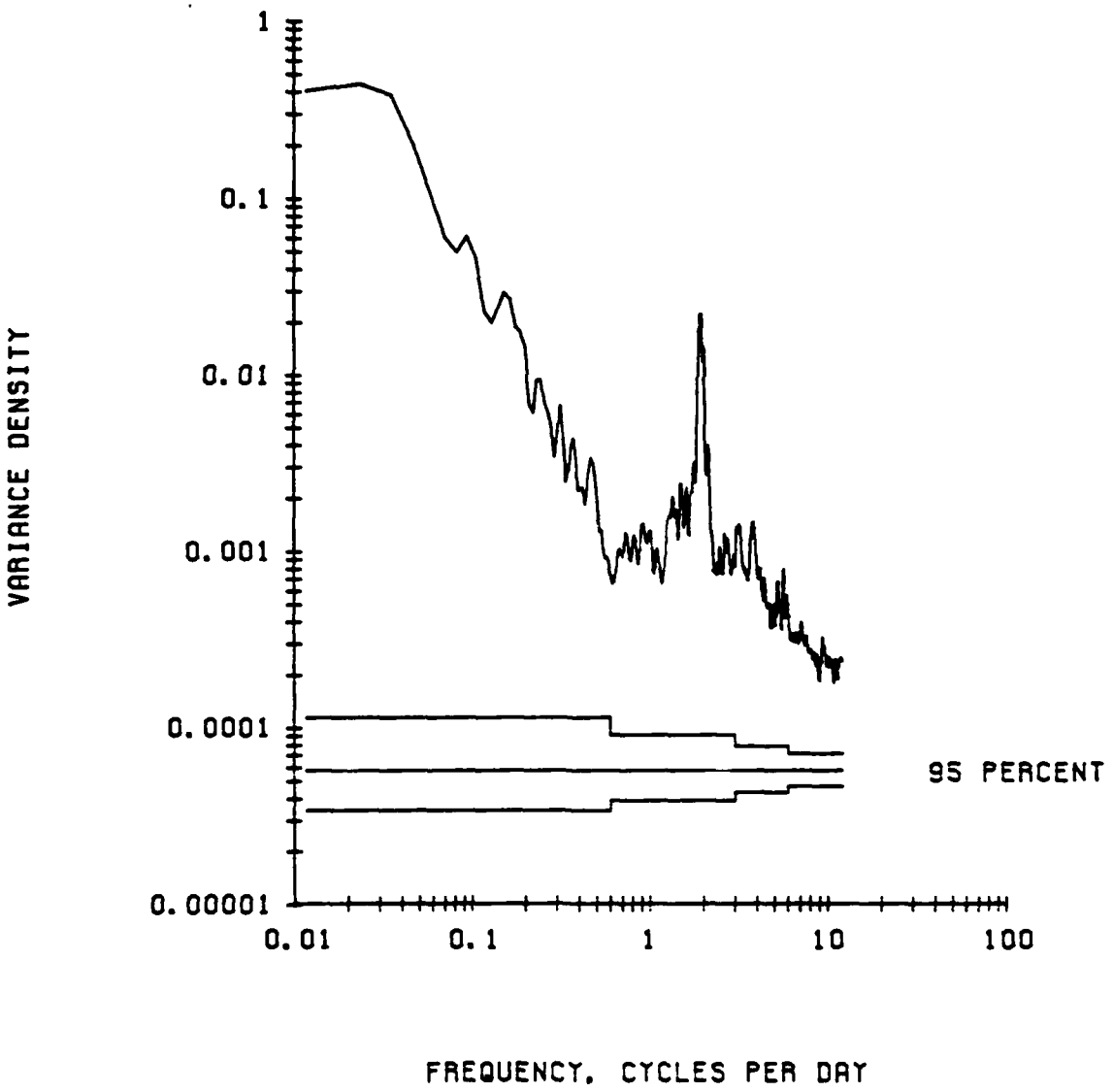
UNFILTERED CURRENT. 3250 M AT M-1.



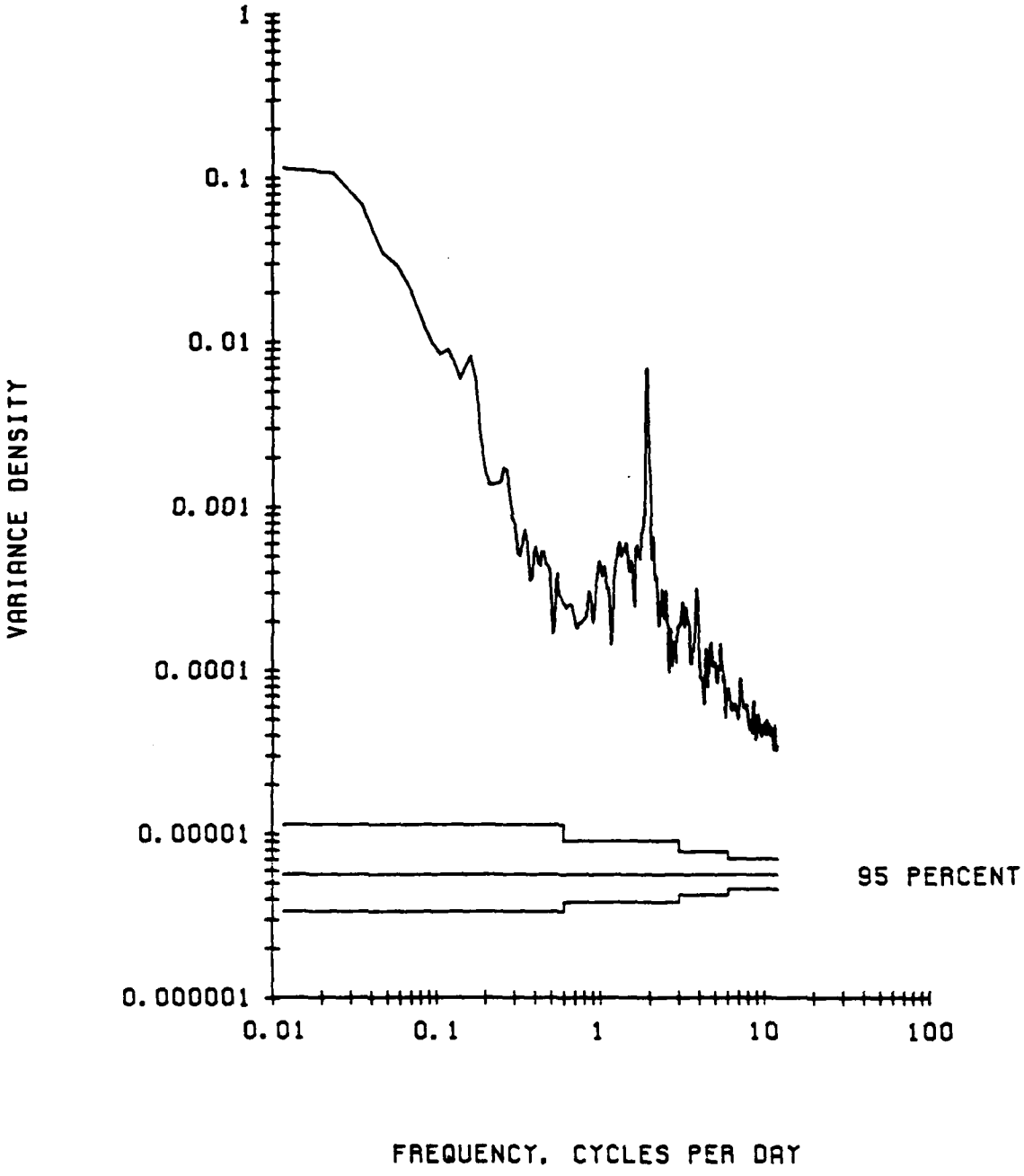
UNFILTERED TEMPERATURE. 175 M AT M-1.



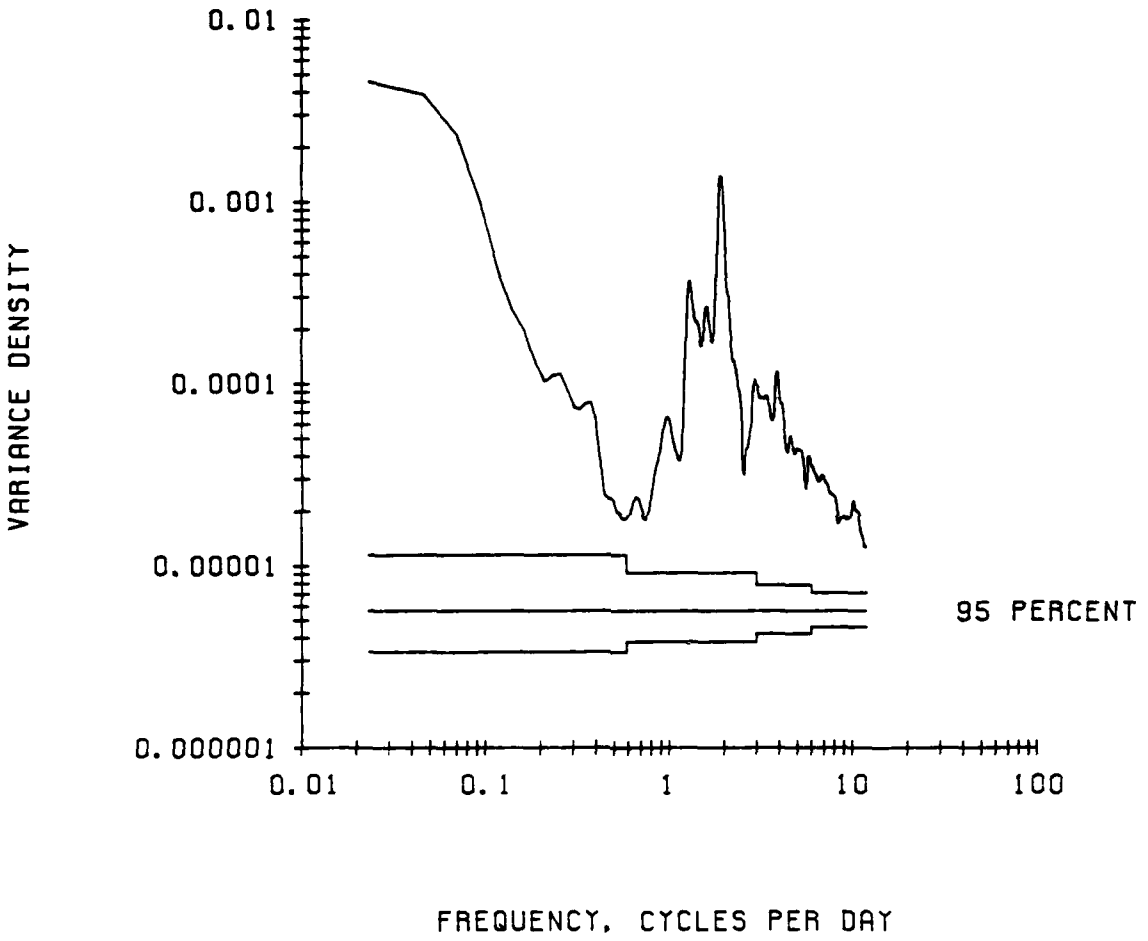
UNFILTERED TEMPERATURE. 375 M AT M-1.



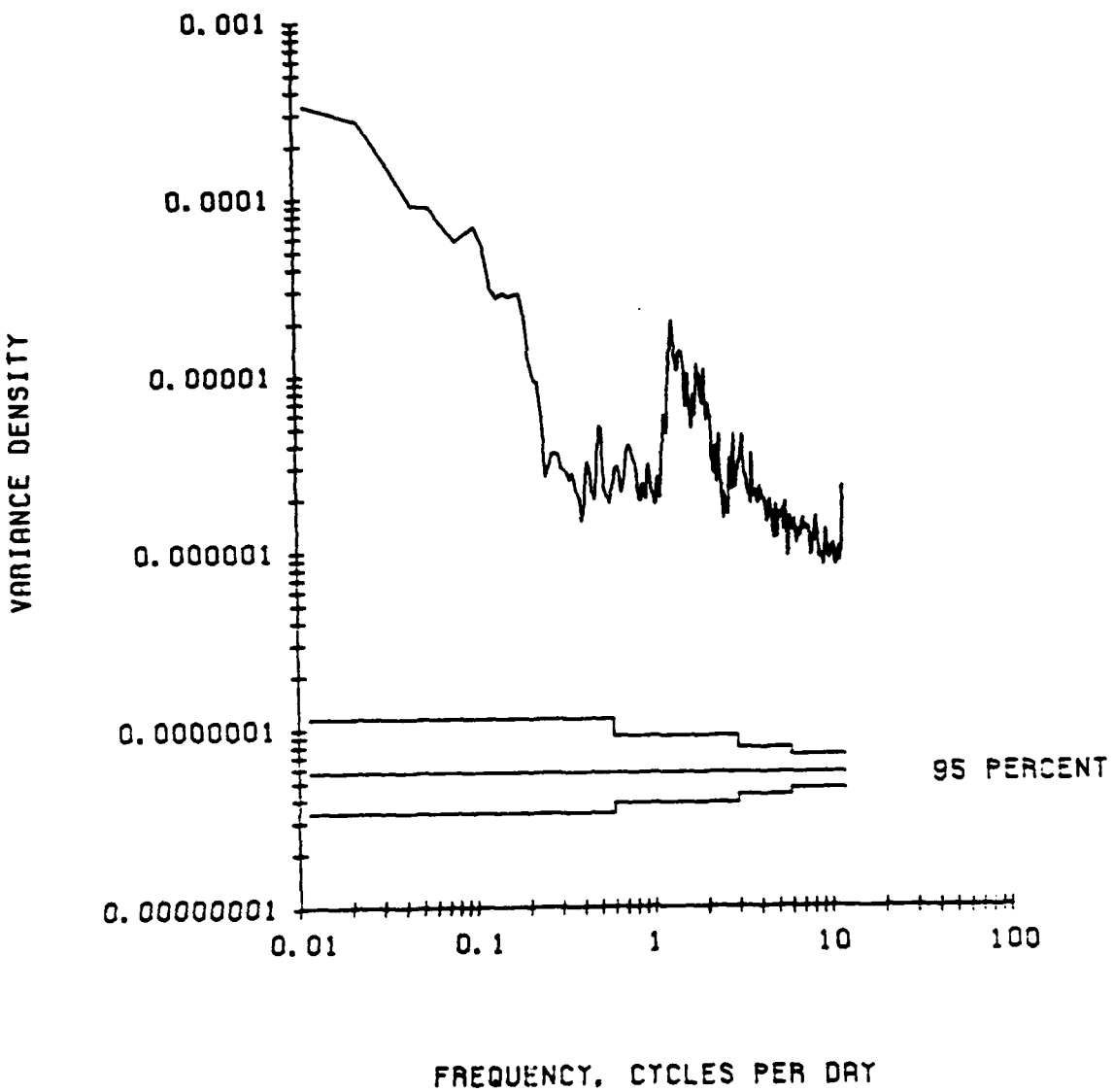
UNFILTERED TEMPERATURE. 800 M AT M-1.



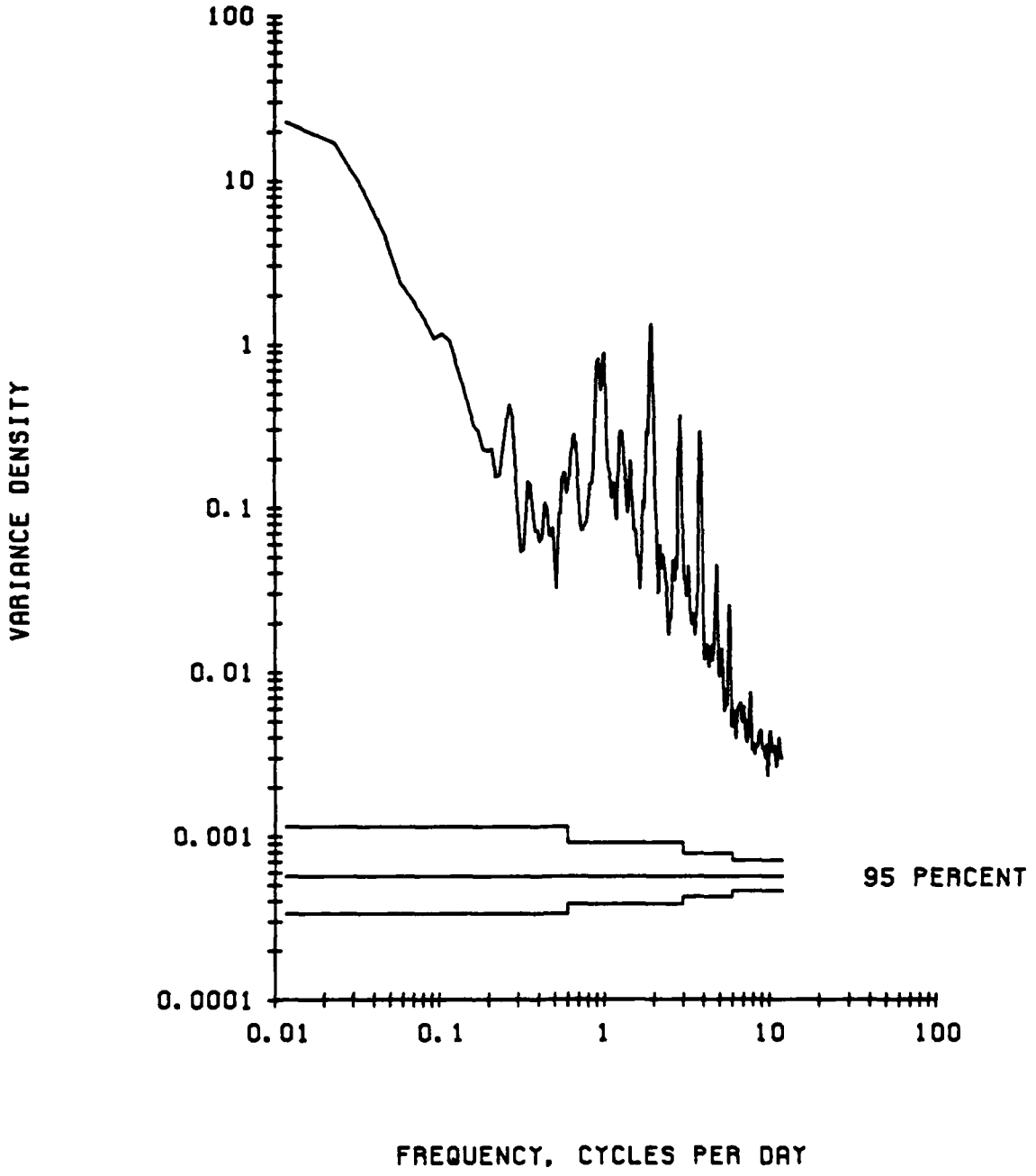
UNFILTERED TEMPERATURE. 1220 M AT M-1.



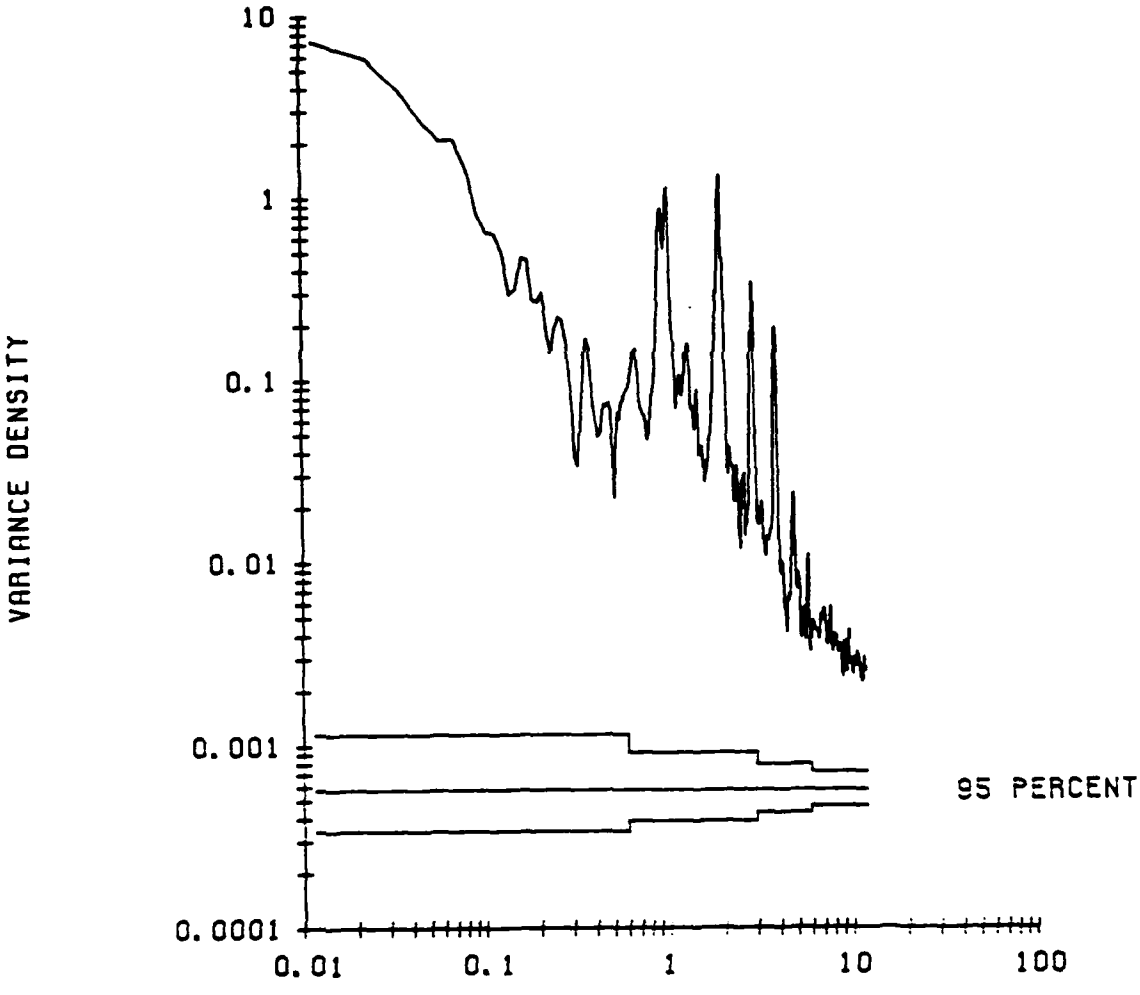
UNFILTERED TEMPERATURE. 3250 M AT M-1.

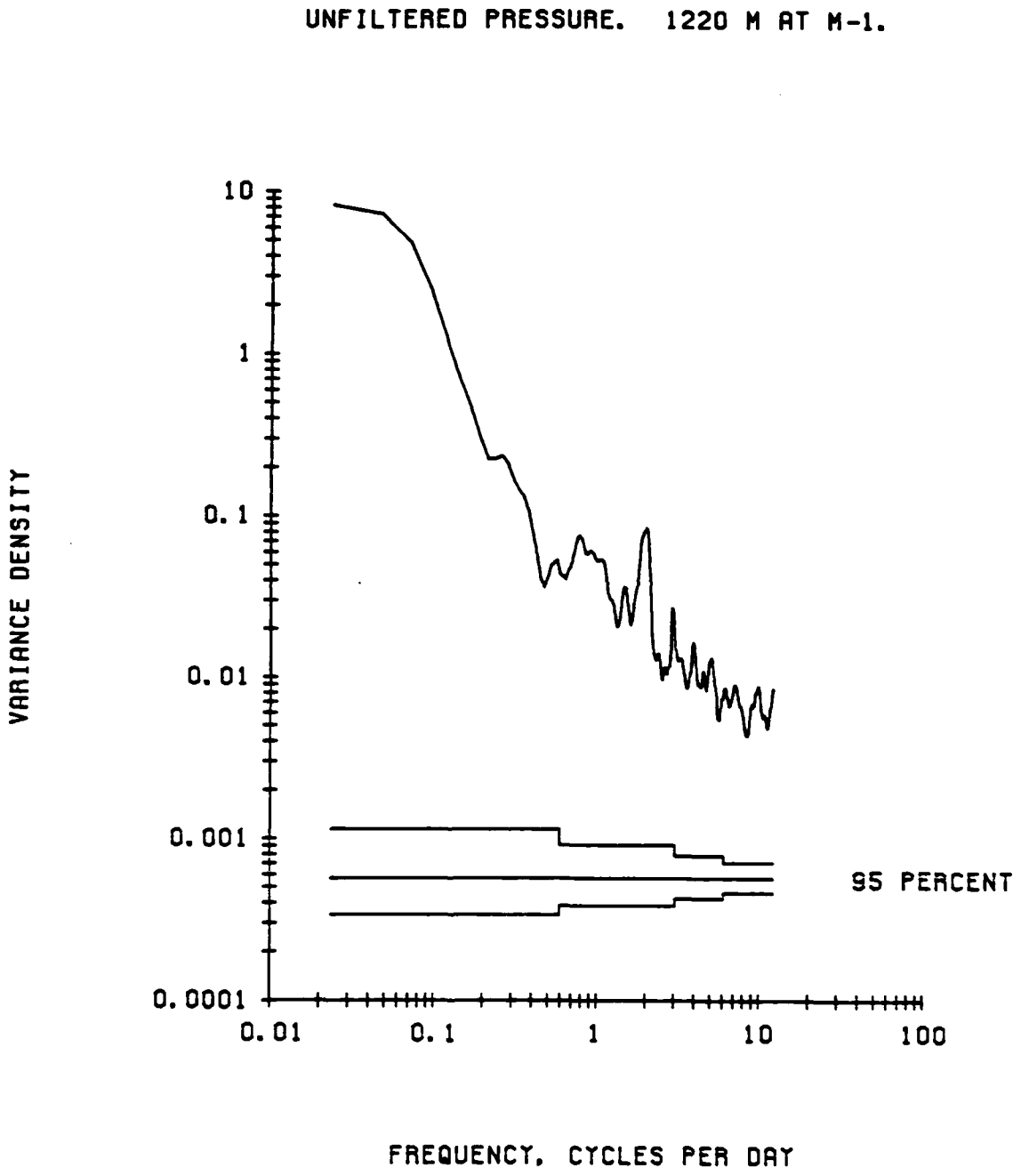


UNFILTERED PRESSURE. 175 M AT M-1.

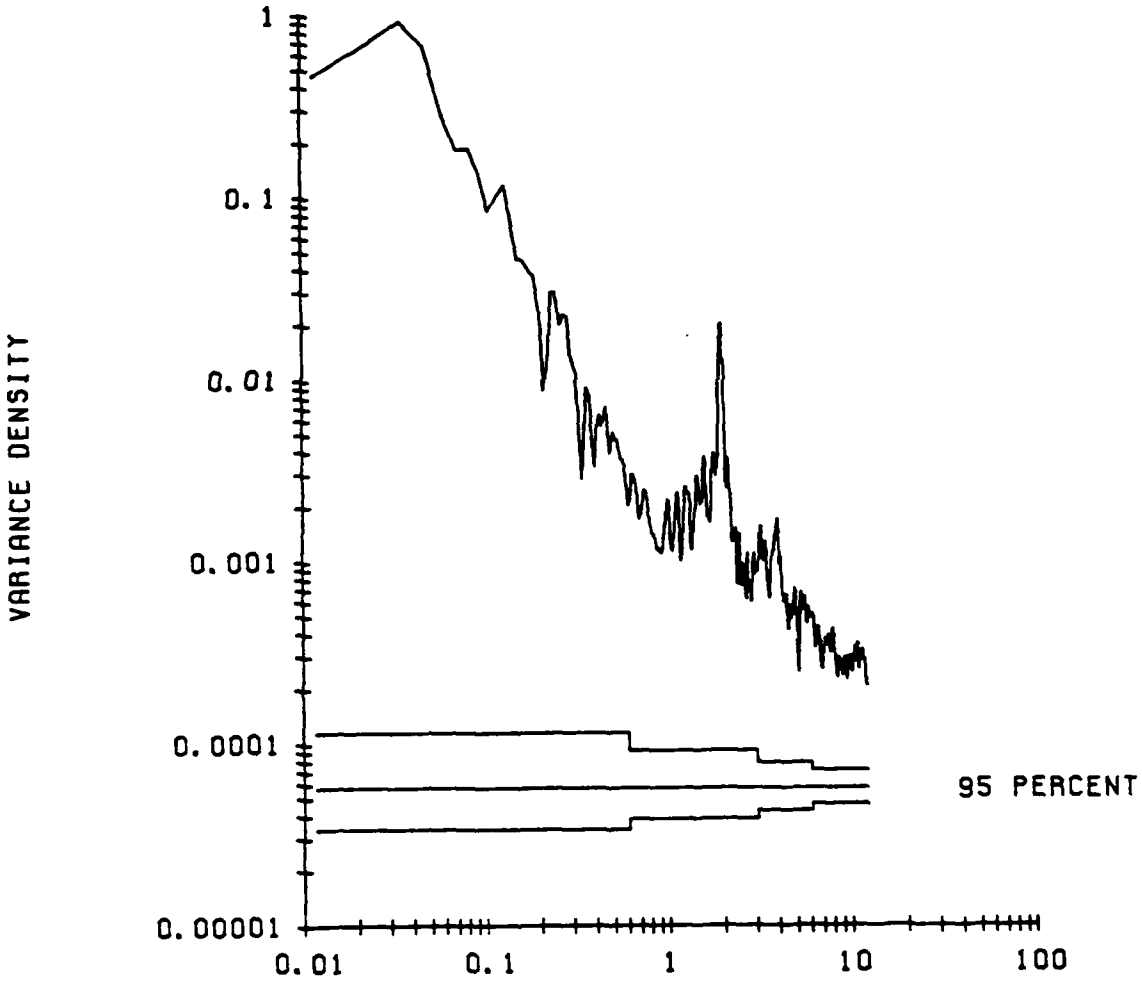


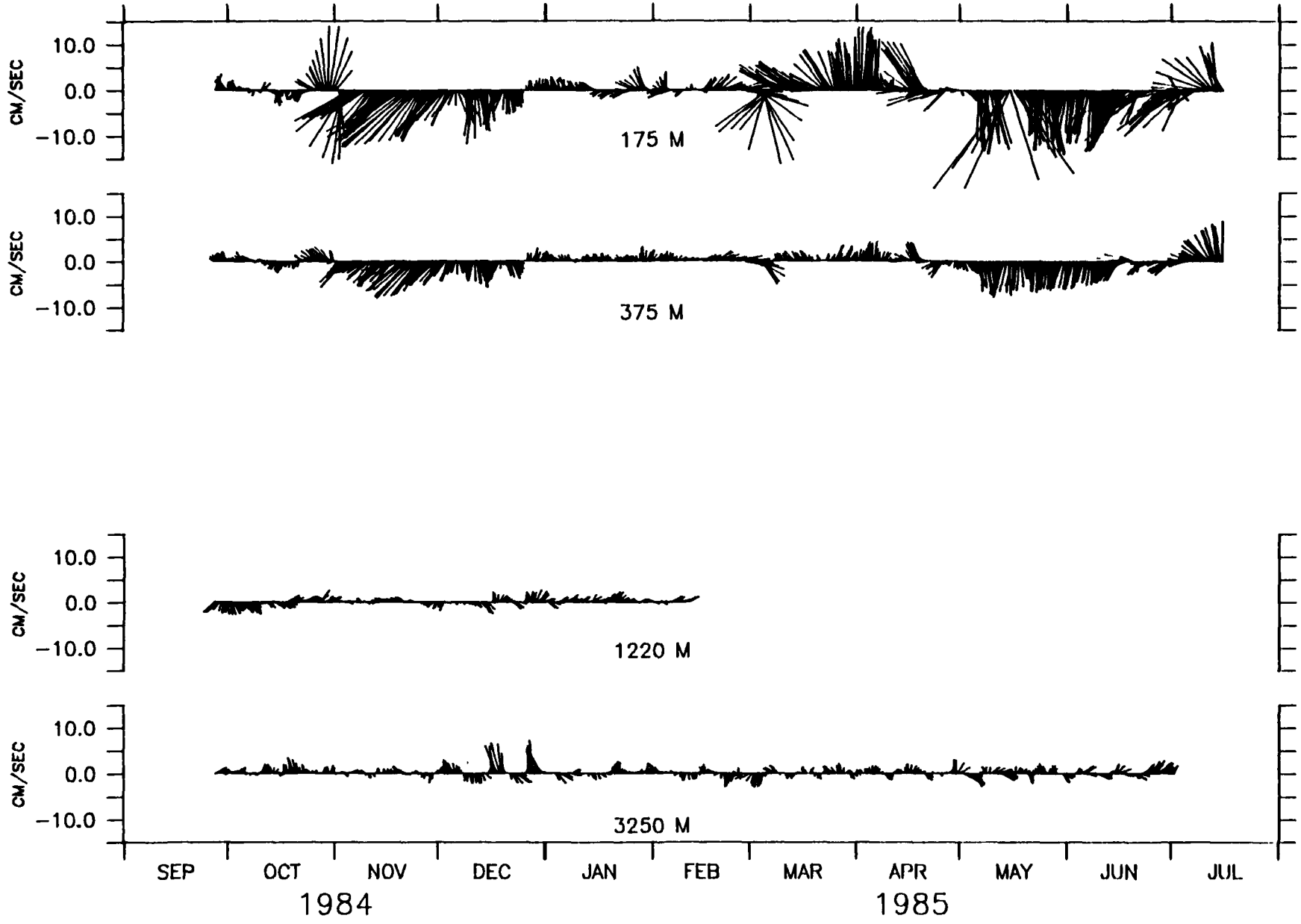
UNFILTERED PRESSURE. 375 M AT M-1.



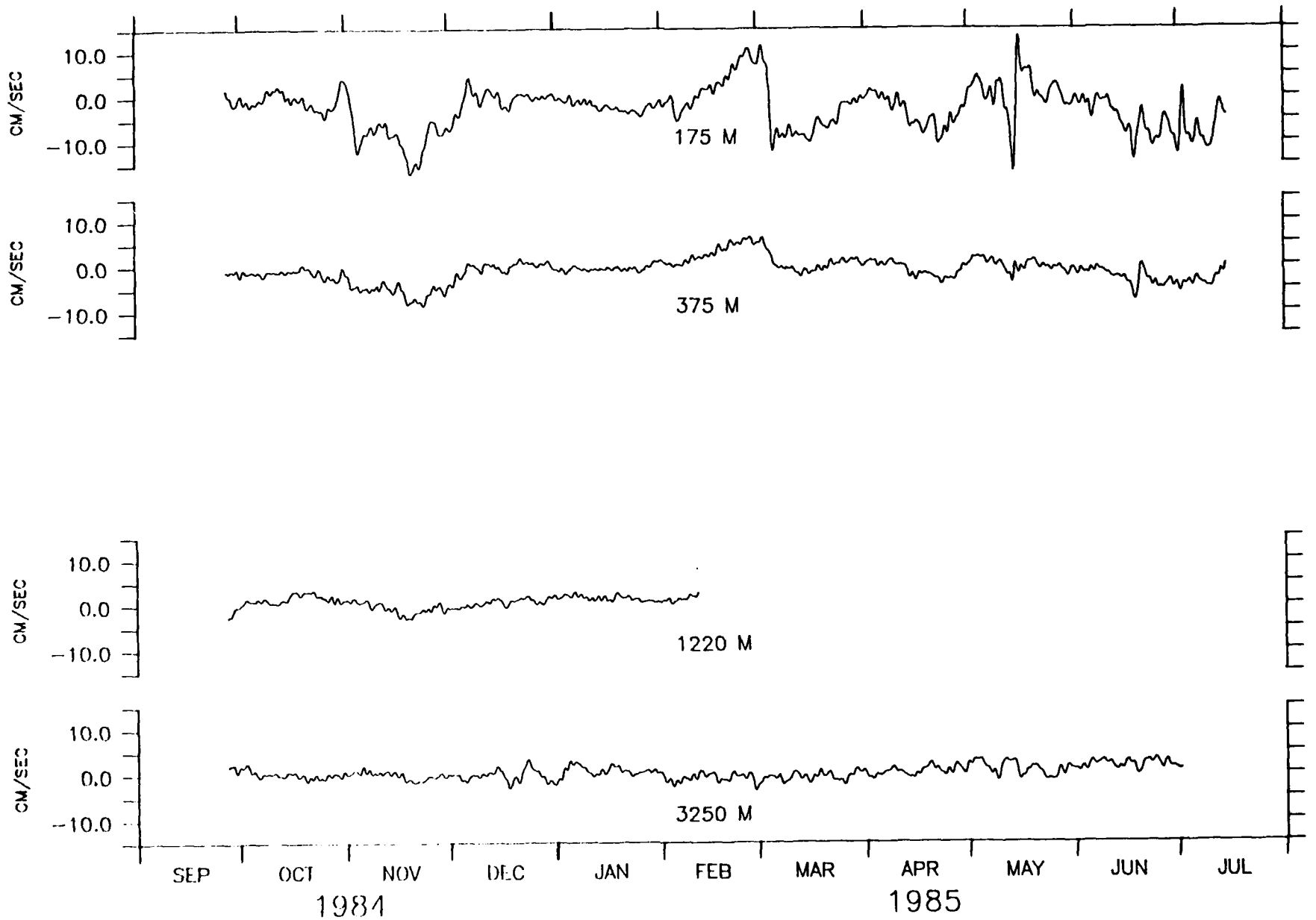

UNFILTERED PRESSURE. 1220 M AT M-1.
VARIANCE DENSITY
10
1
0.1
0.01
0.001
0.0001
0.01
0.1
1
10
100
95 PERCENT
FREQUENCY, CYCLES PER DAY

UNFILTERED CONDUCTIVITY. 175 M AT M-1.

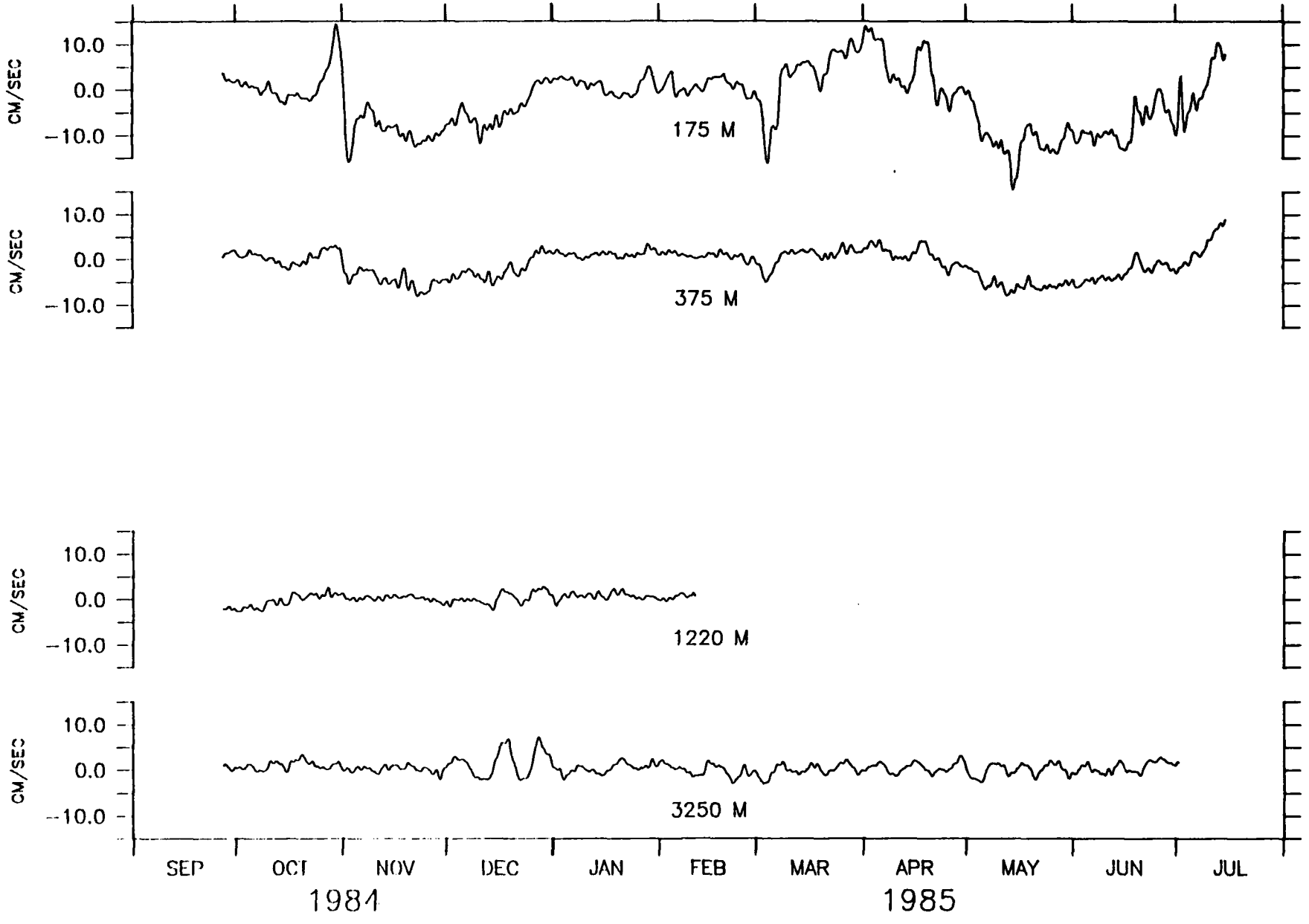




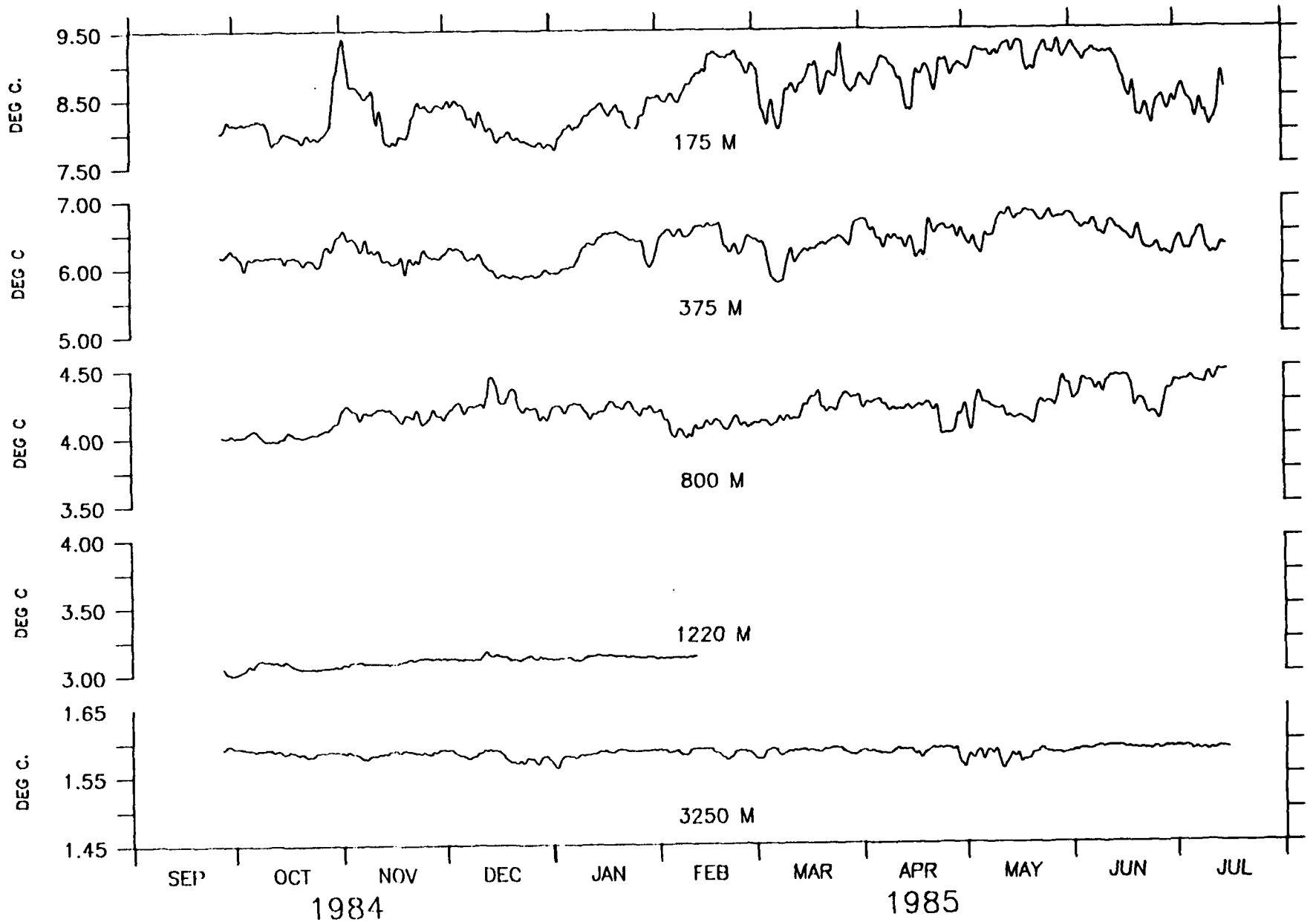
VELOCITY VECTORS, M−1.



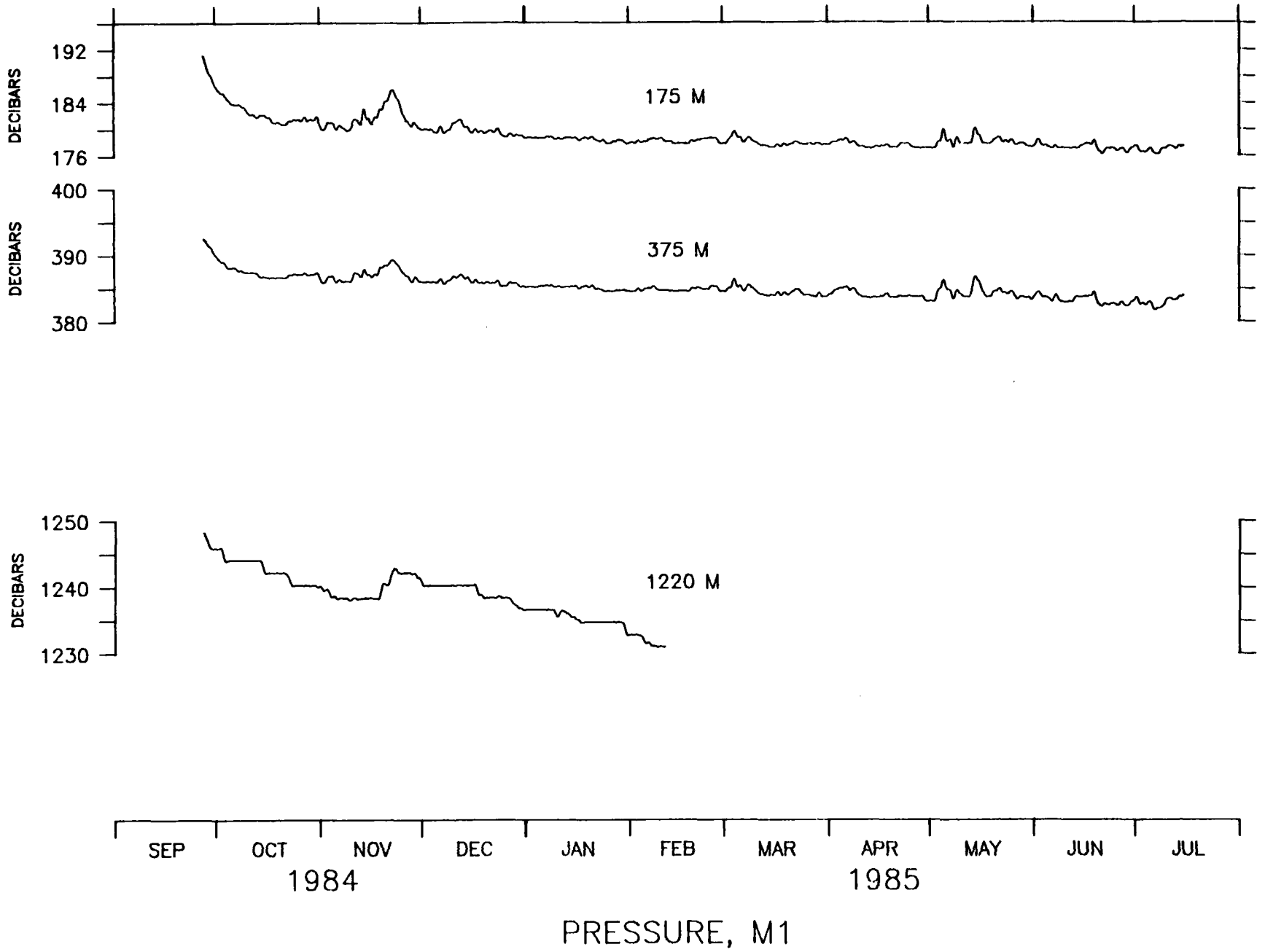
U COMPONENT, M−1.



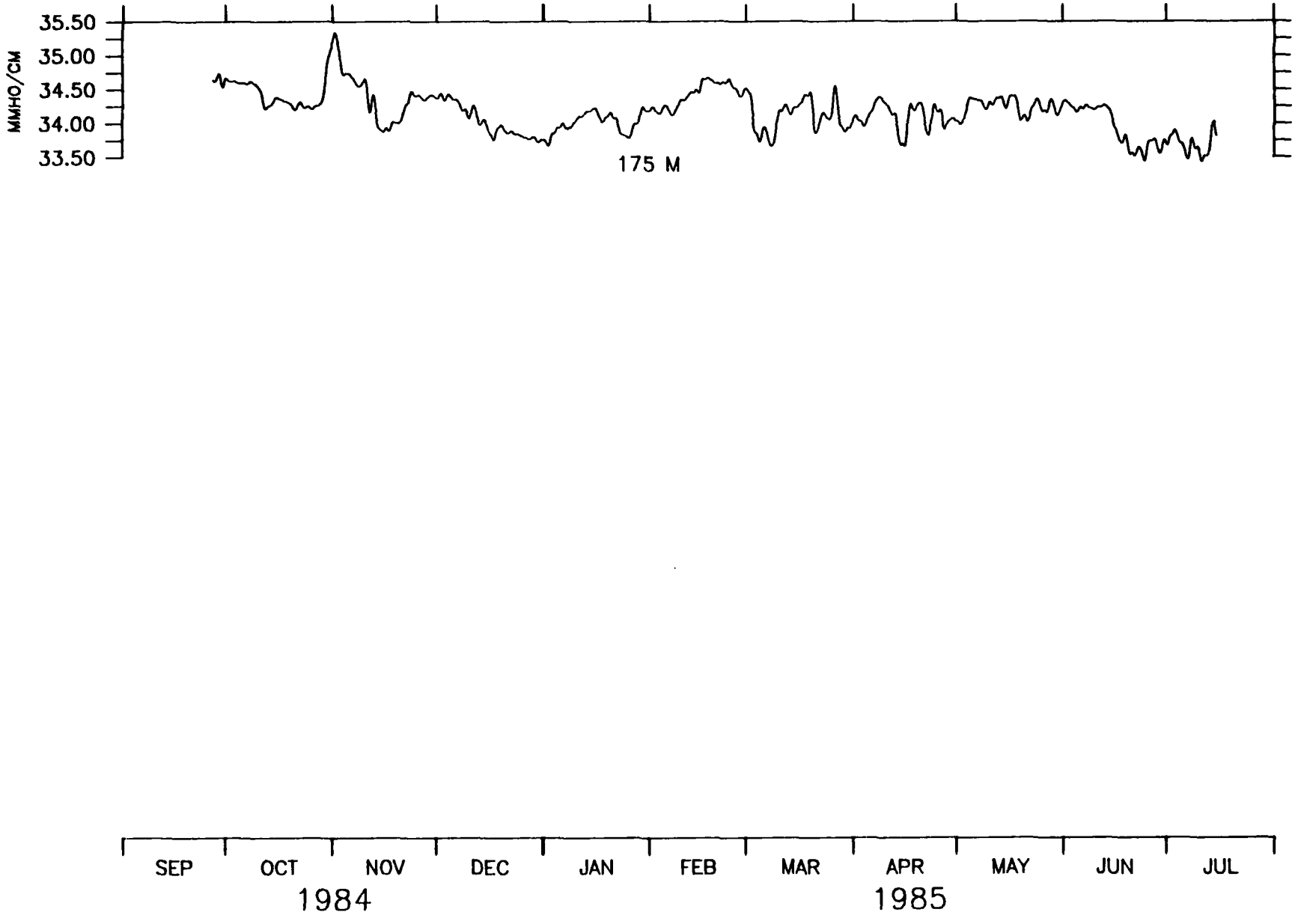
V COMPONENT, M-1.



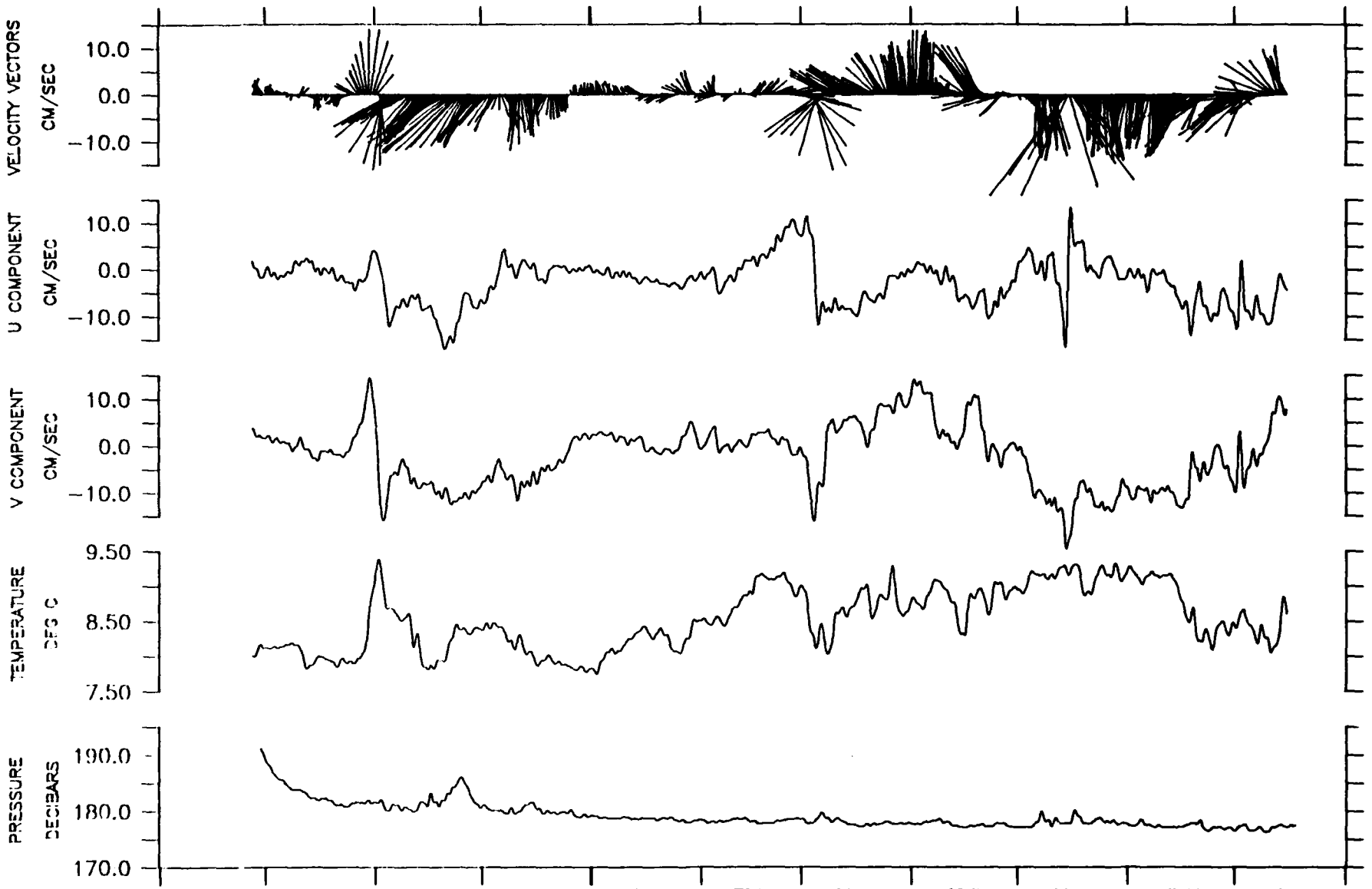
TEMPERATURE, M-1.


DECIBARS
192
184
176
175 M
DECIBARS
400
390
380
375 M
DECIBARS
1250
1240
1230
1220 M
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
1984
1985

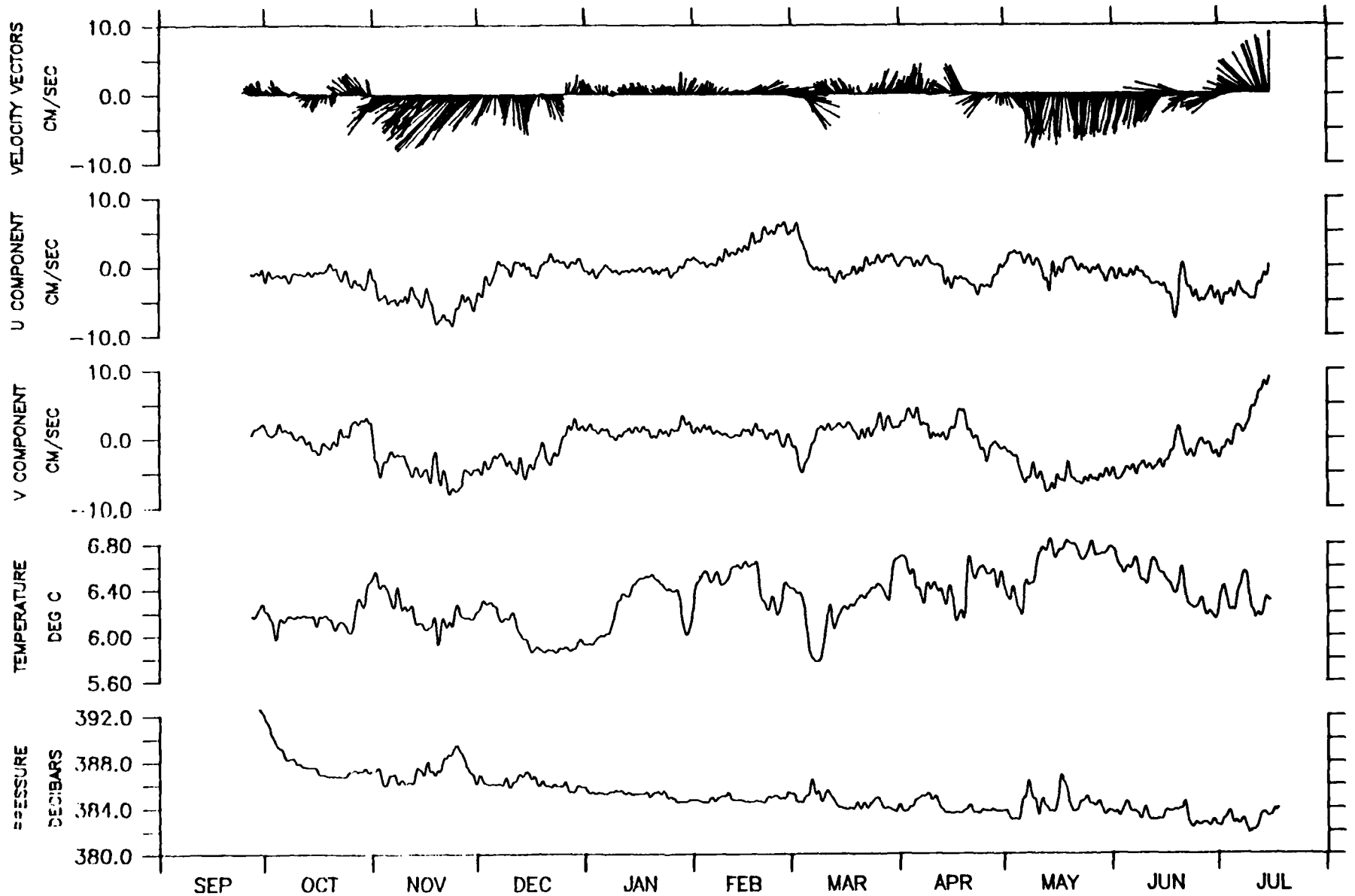
PRESSURE, M1



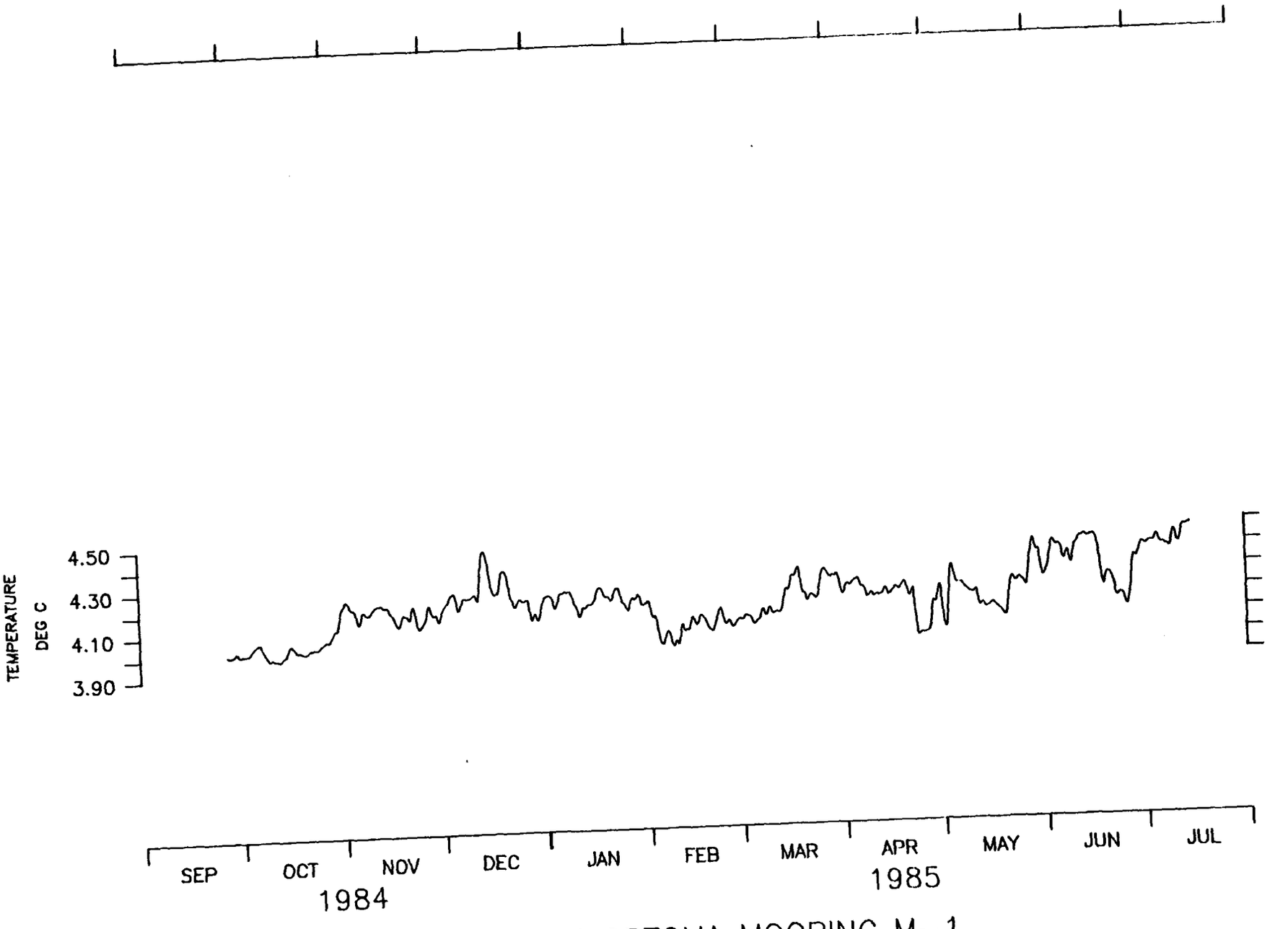
CONDUCTIVITY, M–1.



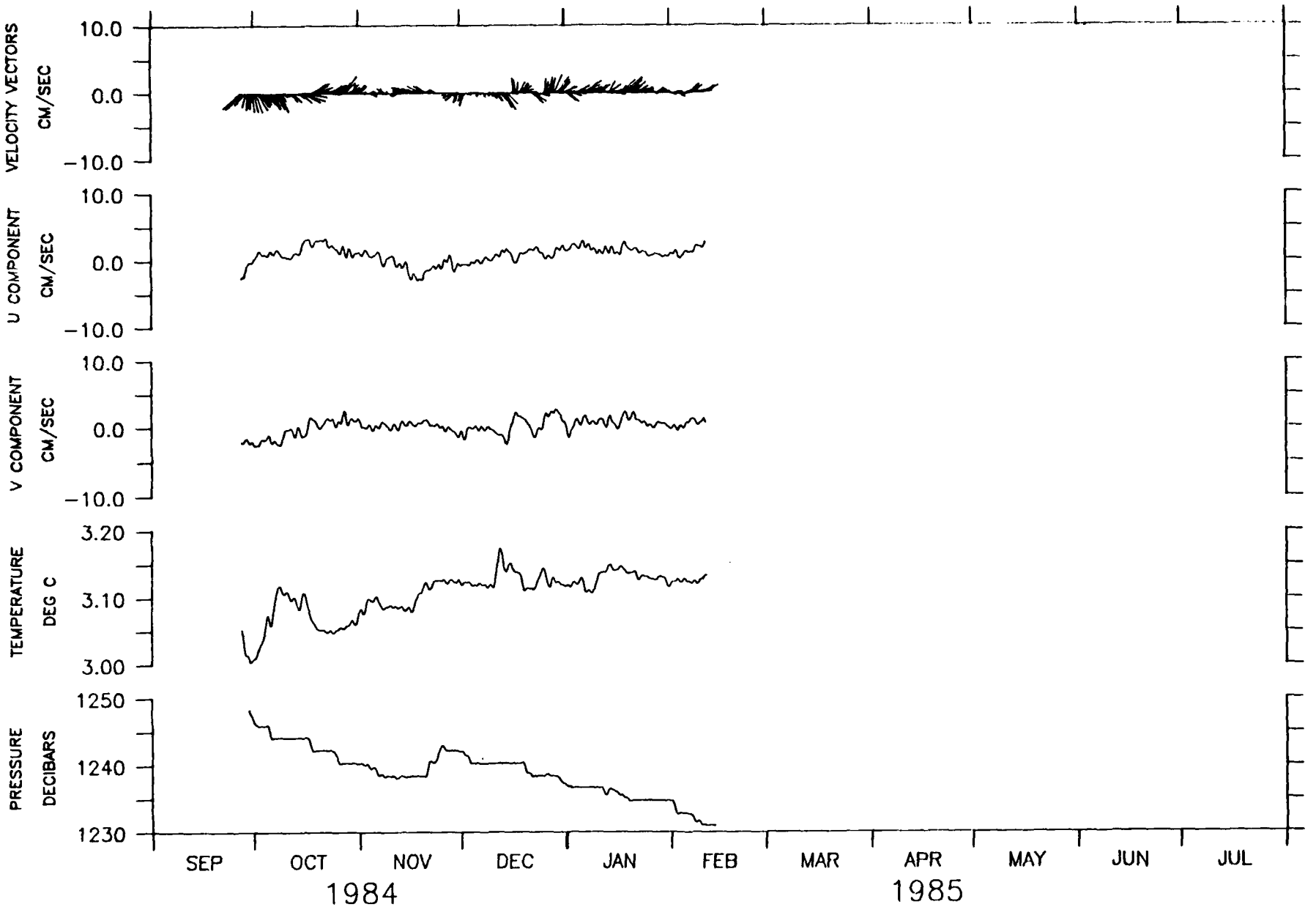
175 M AT OPTOMA MOORING M1.



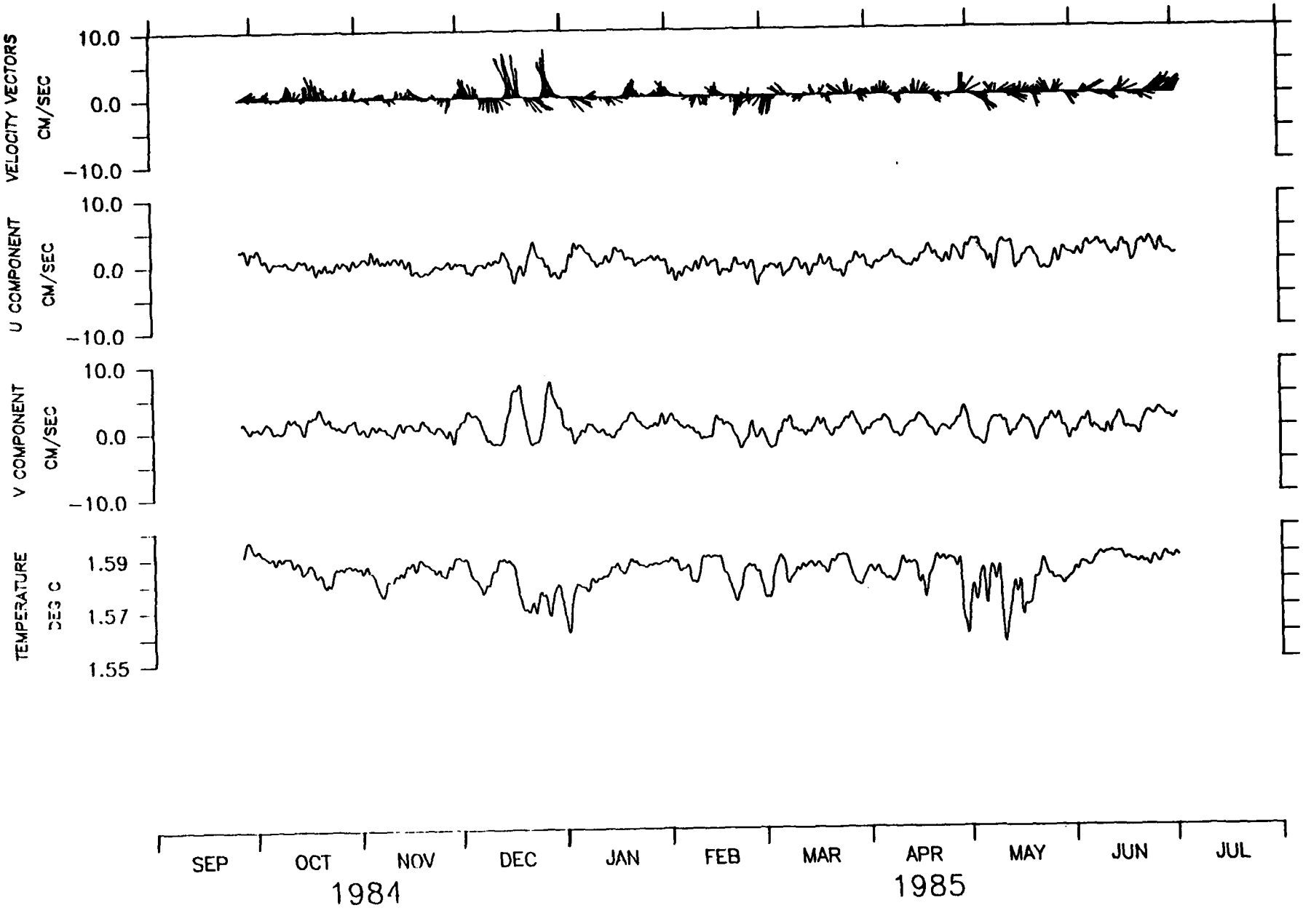
375 M AT OPTOMA MOORING M1.



800 M AT OPTOMA MOORING M–1.

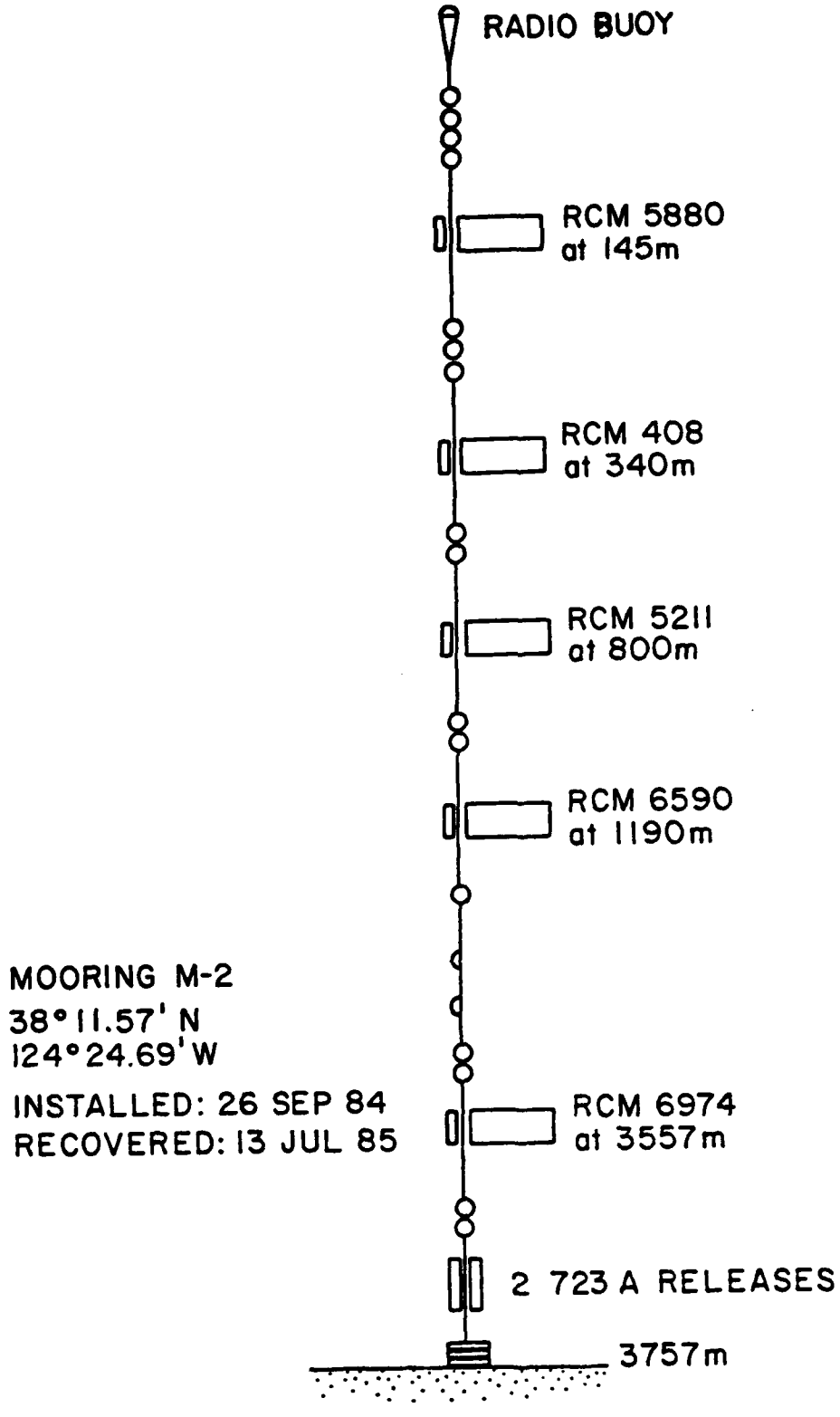


1220 M AT OPTOMA MOORING M1.



3250 M AT OPTOMA MOORING M1.

Mooring M-2


RADIO BUOY
RCM 5880
at 145m
RCM 408
at 340m
RCM 5211
at 800m
RCM 6590
at 1190m
RCM 6974
at 3557m
2 723 A RELEASES
3757m
MOORING M-2
38°11.57' N
124°24.69' W
INSTALLED: 26 SEP 84
RECOVERED: 13 JUL 85

M-2

Position: 38° 11.57N, 124° 24.69'W
Depth of Water: 3757 m
Set at: 1706 UCT 26 SEP 84 by R/V WECOMA
Retrieved at: 2310 UCT 13 JUL 85 BY R/V WECOMA
Data Interval: 2112 UCT 26 SEP 84 to 2219 UCT 13 JUL 85

Instrumentation

Depth	RCM 5 Serial No./Tape No.
145 m	5880/14
340 m	408/20
800 m	5211/20
1190 m	6590/9
3357 m	6974/10

Instrument 5880 recorded speed, direction, temperature, and pressure. Fourteen days of data are missing at the beginning of the record due to a tape transport problem. Fifteen percent of the speeds, 16% of the directions, 7% of the temperatures, and 21% of the pressures were replaced by linear interpolation.

Instrument 408 recorded speed, direction, temperature, and pressure until the instrument was recovered.

Instrument 5211 recorded speed, direction, and temperature until the instrument was recovered. Three sections of the temperature record were bridged:
Lines 2628 - 2813 (0812 14 Jan 85 - 0012 22 Jan 85);
Lines 2996 - 3102 (1412 29 Jan 85 - 0212 3 Feb 85);
Lines 3475 - 3517 (1612 18 Feb 85 - 0912 20 Feb 85).

Instrument 6590 recorded speed, direction, temperature, and pressure until the the instrument was recovered.

Instrument 6974 recorded speed, direction, and temperature until the instrument was recovered. There is a suspicious section of temperature data from mid-February to mid-March. This section contained several large spikes which were removed by interpolation. A number of smaller spikes remain which may or may not be real.

145 M AT M-2. 2 OCT 84 - 13 JUL 85. TAPE 5880/14.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	11.15	5.74	0.78	3.46	0.90	38.80	6835
U(cm/sec)	-1.42	6.51	0.07	3.38	-33.50	27.10	6835
V(cm/sec)	1.24	10.56	-0.42	2.87	-37.90	29.40	6835
T(°C)	8.47	0.46	0.20	2.76	7.30	9.98	6835
P(db)	151.88	2.30	0.90	4.40	147.60	164.70	6835

EDDY KE = 76.91 (cm^2/sec^2)
HEAT FLUX U = 0.04 (°C cm/sec)
HEAT FLUX V = -0.88 (°C cm/sec)
MOMENTUM FLUX = -6.68 (cm^2/sec^2)

LLP FILTERED STATISTICS. 145 M AT M-2. TAPE 5880/14.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-1.43	3.94	-0.20	3.58	-16.61	8.05	1131
V(cm/sec)	1.21	8.77	-0.67	3.04	-21.93	21.25	1131
T(°C)	8.47	0.45	0.16	2.73	7.48	9.78	1131
P(db)	151.86	1.98	0.47	2.79	148.40	159.05	1131

BEGINNING TIME 0600 3 10 84 ENDING TIME 1800 12 7 85
MEAN U = -0.1432D+01 MEAN U*V = -0.6833D+01
MEAN V = 0.1215D+01 MEAN U*U = 0.1554D+02
PRIN. AXIS (DEG.)=0.9629D+02 MEAN V*V = 0.7683D+02

340 M AT M-2. 26 SEP 84 - 13 JUL 85. TAPE 408/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	7.71	3.98	0.62	2.99	0.70	25.20	6962
U(cm/sec)	-0.95	4.66	0.09	2.93	-16.50	13.90	6962
V(cm/sec)	1.66	7.07	-0.18	2.82	-22.40	25.10	6962
T(°C)	6.29	0.35	0.19	1.99	5.52	7.17	6962
P(db)	346.82	2.87	1.38	6.55	341.50	367.50	6962

EDDY KE =	35.85	(cm^2/sec^2)
HEAT FLUX U =	0.01	(°C cm/sec)
HEAT FLUX V =	-0.31	(°C cm/sec)
MOMENTUM FLUX =	-5.56	(cm^2/sec^2)

LLP FILTERED STATISTICS. 340 M AT M-2. TAPE 408/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-0.96	2.69	0.56	4.44	-9.33	8.92	1152
V(cm/sec)	1.65	5.35	-0.37	2.48	-9.75	12.67	1152
T(°C)	6.29	0.33	0.24	1.87	5.75	6.99	1152
P(db)	346.78	2.36	0.91	4.27	343.45	356.24	1152

BEGINNING TIME 0000 28 9 84 ENDING TIME 1800 12 7 85

MEAN U = -0.9609D+00	MEAN U*V = -0.3765D+01
MEAN V = 0.1649D+01	MEAN U*U = 0.7232D+01
PRIN. AXIS (DEG.)=0.9971D+02	MEAN V*V = 0.2860D+02

800 M AT M-2. 26 SEP 84 - 13 JUL 85. TAPE 5211/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	5.53	2.75	0.65	3.34	0.80	16.90	6963
U(cm/sec)	-0.52	3.75	0.39	2.96	-10.80	15.40	6963
V(cm/sec)	1.21	4.72	-0.19	2.91	-16.30	15.80	6963
T(°C)	4.25	0.11	-0.11	2.48	3.98	4.61	6963

EDDY KE =	18.19	(cm^2/sec^2)
HEAT FLUX U =	0.06	(°C cm/sec)
HEAT FLUX V =	-0.11	(°C cm/sec)
MOMENTUM FLUX =	-5.23	(cm^2/sec^2)

LLP FILTERED STATISTICS. 800 M AT M-2. TAPE 5211/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-0.53	1.87	0.83	3.43	-3.81	5.04	1152
V(cm/sec)	1.21	2.60	-0.45	2.76	-5.28	6.53	1152
T(°C)	4.25	0.10	-0.23	2.45	4.03	4.49	1152

BEGINNING TIME 0000 28 9 84 ENDING TIME 1800 12 7 85

MEAN U = -0.5341D+00	MEAN U*V = -0.1921D+01
MEAN V = 0.1210D+01	MEAN U*U = 0.3482D+01
PRIN. AXIS (DEG.)=0.1147D+03	MEAN V*V = 0.6770D+01

1190 M AT M-2. 26 SEP 84 - 13 JUL 85. TAPE 6590/9.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	4.97	2.19	0.73	3.79	0.80	15.70	6963
U(cm/sec)	-0.07	3.74	-0.03	2.39	-11.00	13.60	6963
V(cm/sec)	0.71	3.87	-0.10	2.74	-13.50	14.50	6963
T(°C)	3.67	0.06	-0.34	3.04	3.48	3.84	6963
P(db)	1208.98	3.51	1.00	3.86	1204.00	1226.60	6963

EDDY KE = 14.48 (cm^2/sec^2)
HEAT FLUX U = 0.01 (°C cm/sec)
HEAT FLUX V = 0.00 (°C cm/sec)
MOMENTUM FLUX = -4.74 (cm^2/sec^2)

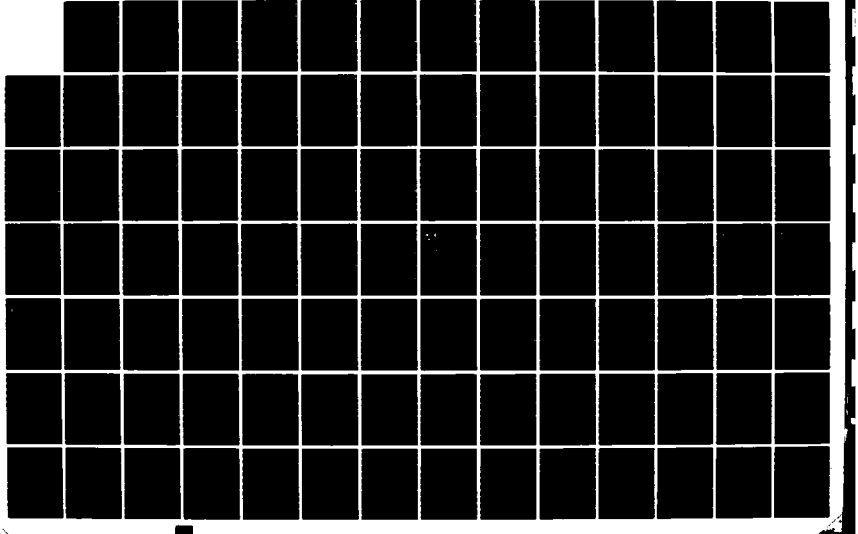
LLP STATISTICS 1190 M AT M-2. TAPE 6590/9.

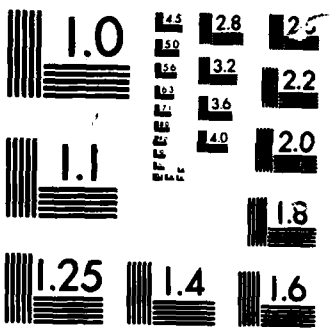
	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-0.07	1.50	0.19	2.23	-3.07	3.61	1152
V(cm/sec)	0.70	1.73	-0.55	3.13	-4.01	4.63	1152
T(°C)	3.67	0.05	-0.43	3.34	3.54	3.79	1152
P(db)	1208.95	3.34	0.93	3.35	1204.03	1221.37	1152

BEGINNING TIME 0000 28 9 84 ENDING TIME 1800 12 7 85
MEAN U = -0.6720D-01 MEAN U*V = -0.1090D+01
MEAN V = 0.7041D+00 MEAN U*U = 0.2257D+01
PRIN. AXIS (DEG=0.1258D+03 MEAN V*V = 0.2981D+01

AD-A167 776 CURRENT MEASUREMENTS FROM MOORINGS OFF NORTHERN CALIFORNIA: SEPTEMBER 198.(U) OREGON STATE UNIV CORVALLIS COLL OF OCEANOGRAPHY R L SMITH ET AL. APR 86 2/3

UNCLASSIFIED DATA-121 N00014-84-C-0218 F/G 8/3 NL





MICROCOPY CHART

3557 M AT M-2. 26 SEP 84 - 13 JUL 85. TAPE 6974/10.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	3.37	1.86	0.45	2.81	0.80	11.60	6963
U(cm/sec)	0.02	2.07	0.03	2.79	-6.00	7.90	6963
V(cm/sec	-0.36	3.21	-0.15	2.51	-11.10	9.60	6963
T(°C)	1.55	0.01	-0.58	7.27	1.50	1.58	6963

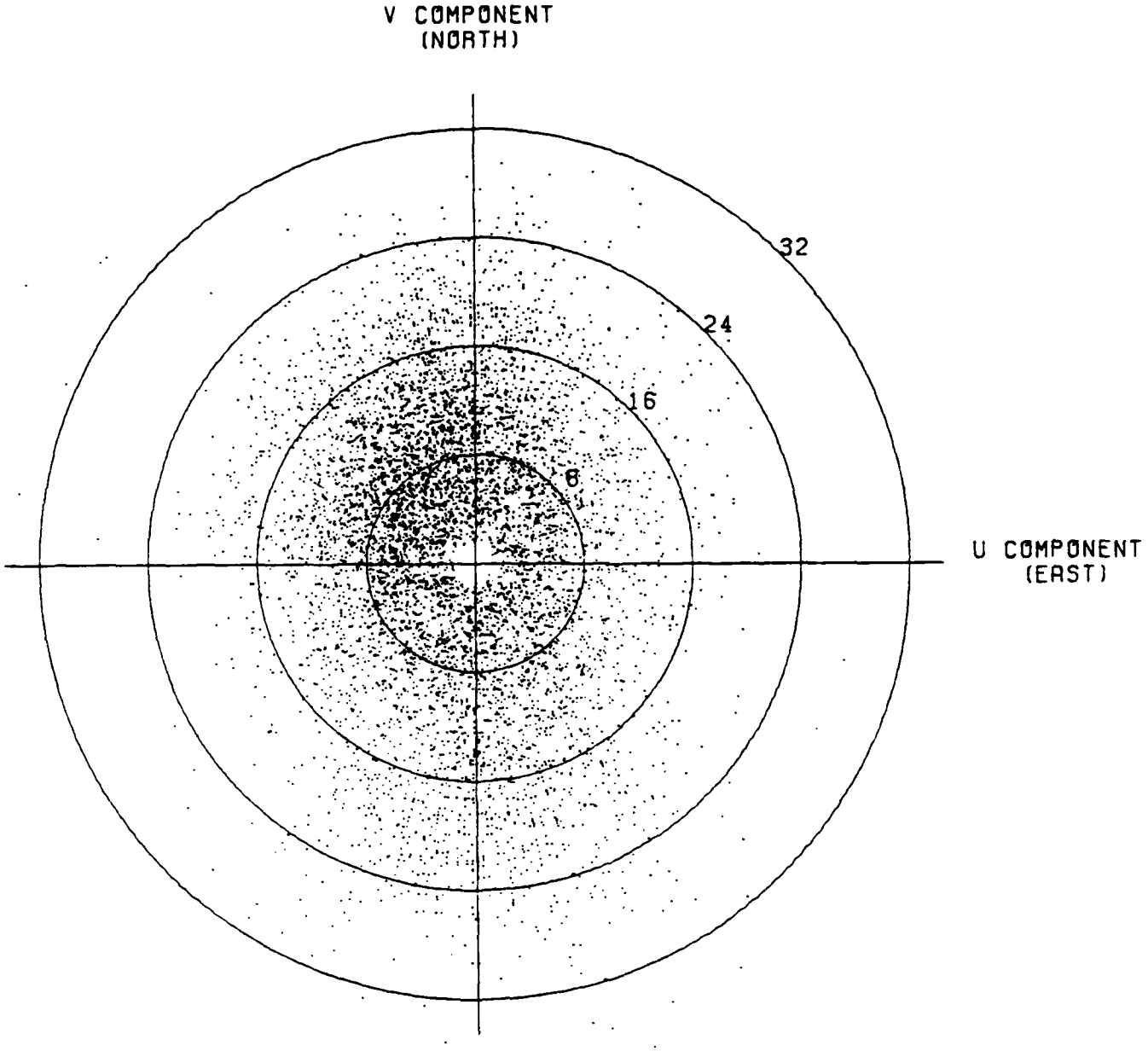
EDDY KE =	7.31	(cm^2/sec^2)
HEAT FLUX U =	0.00	(°C cm/sec)
HEAT FLUX V =	0.00	(°C cm/sec)
MOMENTUM FLUX =	-2.60	(cm^2/sec^2)

LLP FILTERED STATISTICS. 3557 M AT M-2. TAPE 6974/10.

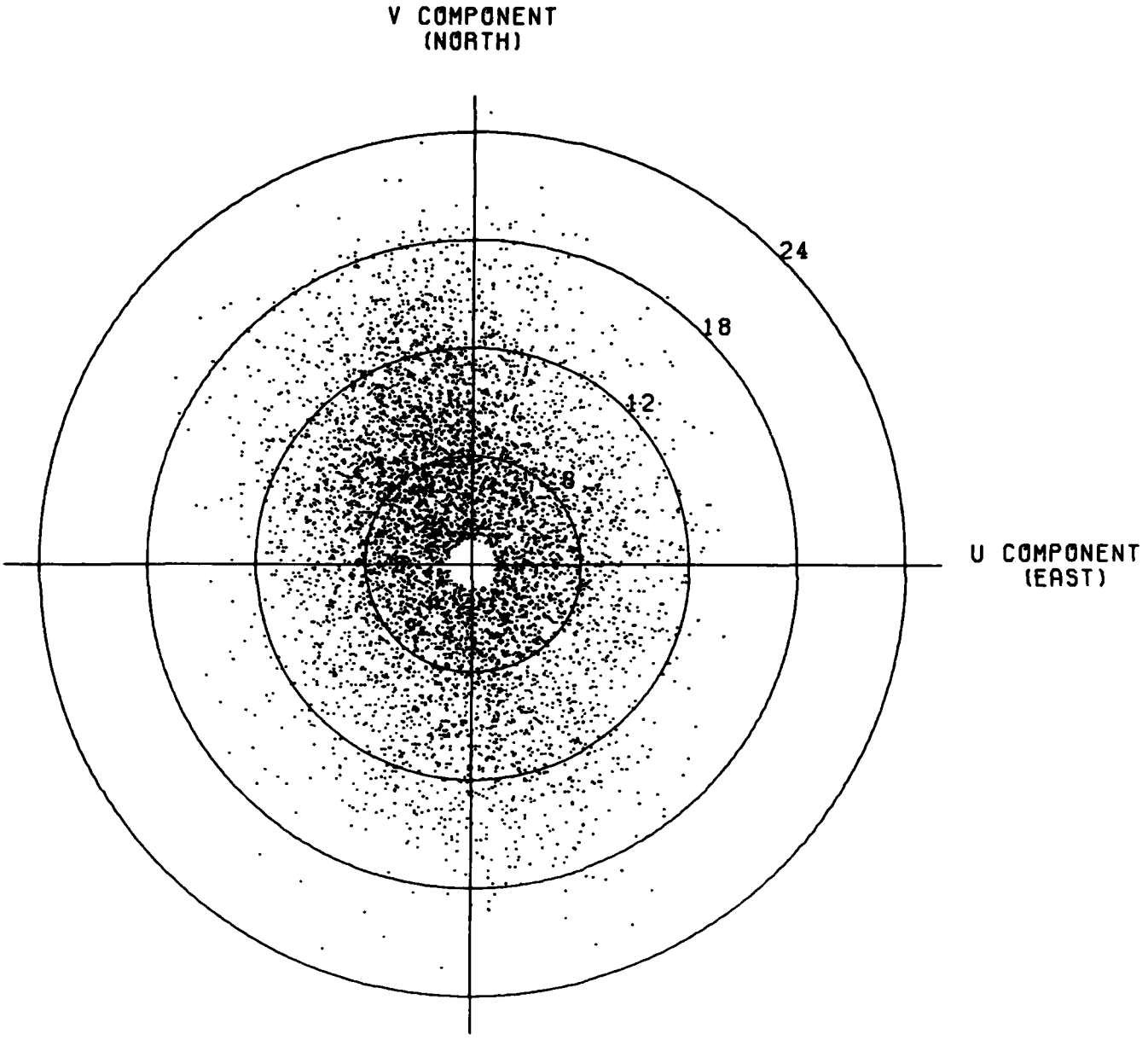
	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	0.02	0.87	0.57	3.46	1.94	3.51	1152
V(cm/sec)	-0.36	1.06	-0.21	4.38	-3.96	4.07	1152
T(°C)	1.55	0.01	0.48	5.57	1.52	1.57	1152

BEGINNING TIME 0000 28 9 84 ENDING TIME 1800 12 7 85

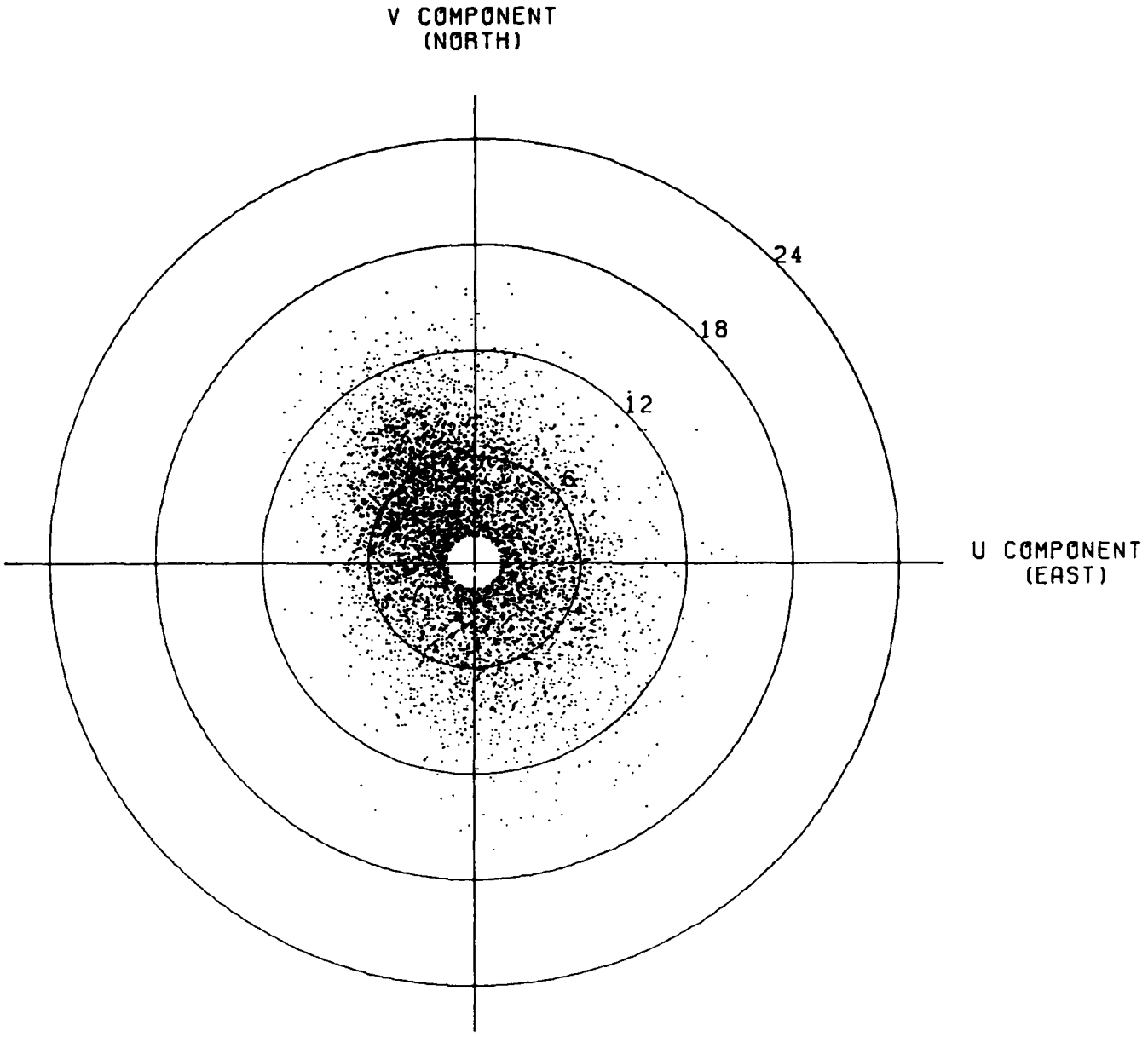
MEAN U = 0.2002D-01	MEAN U*V = 0.6877D-01
MEAN V = -0.3567D+00	MEAN U*U = 0.7608D+00
PRIN. AXIS (DEG.)=0.7949D+02	MEAN V*V = 0.1119D+01



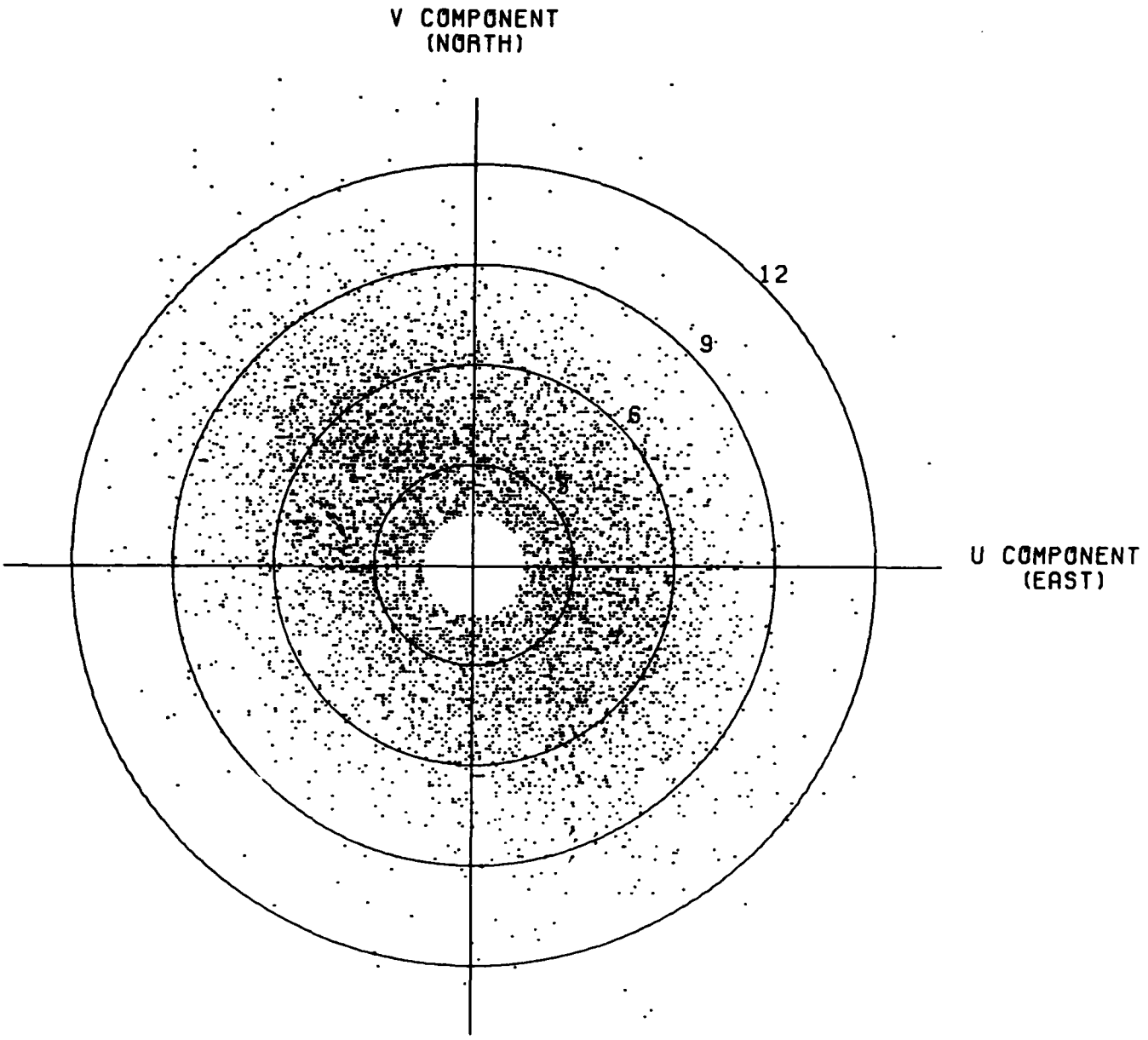
UNFILTERED CURRENT. 145 M AT M-2. TAPE 5880/14.



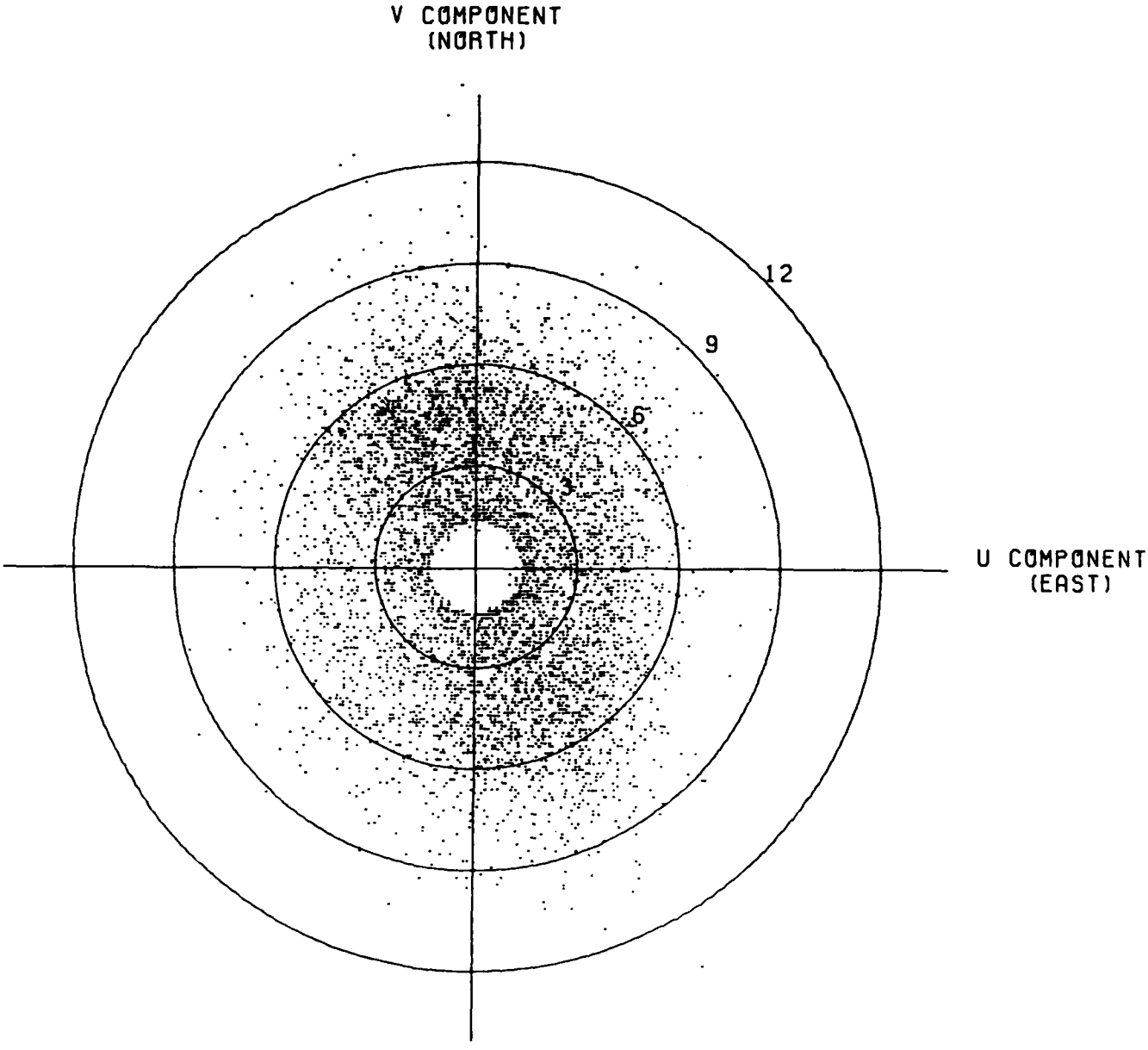
UNFILTERED CURRENT. 340 M AT M-2. TAPE 408/20.



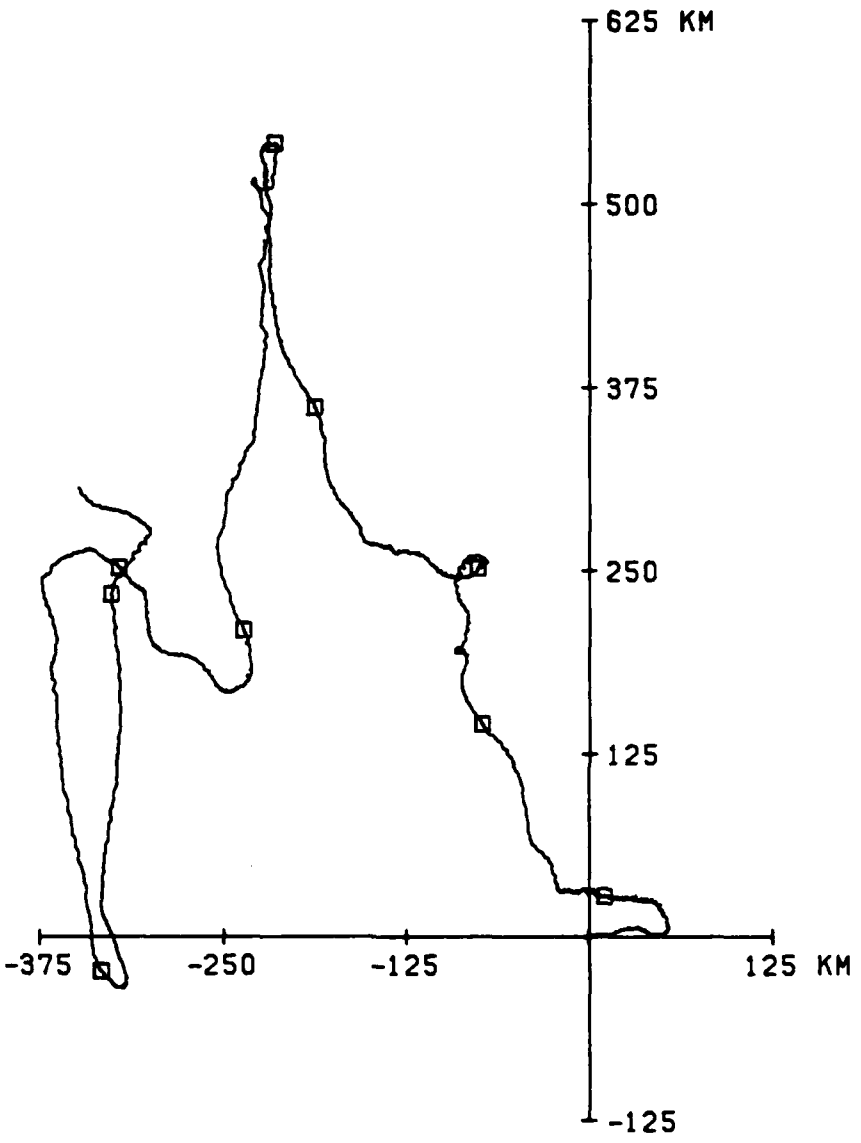
UNFILTERED CURRENT. 800 M AT M-2. TAPE 5211/20.



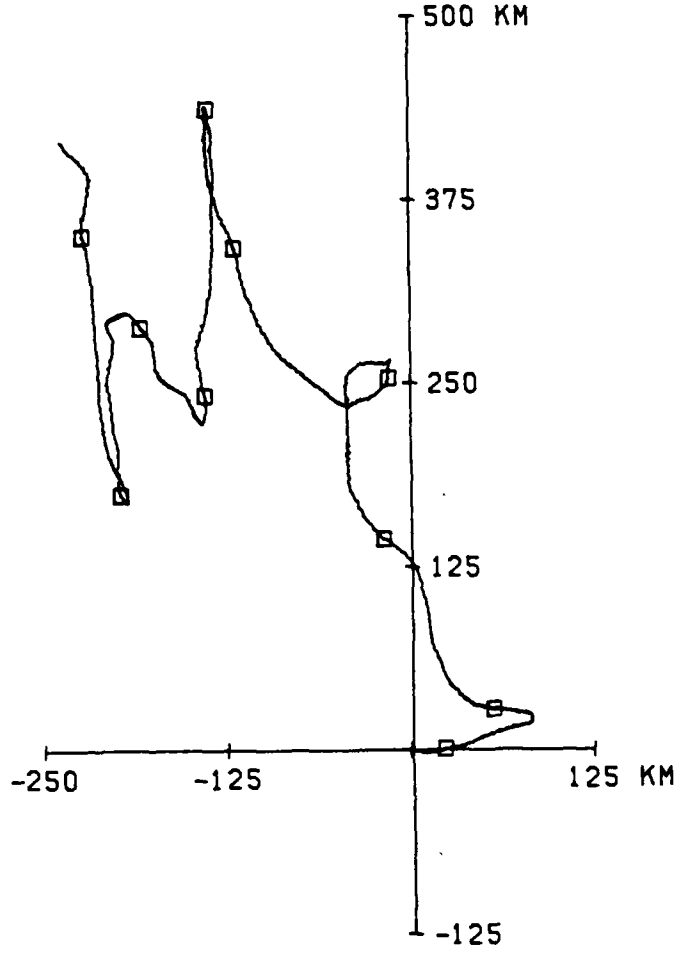
UNFILTERED CURRENT. 1190 M AT M-2. TAPE 6590/9



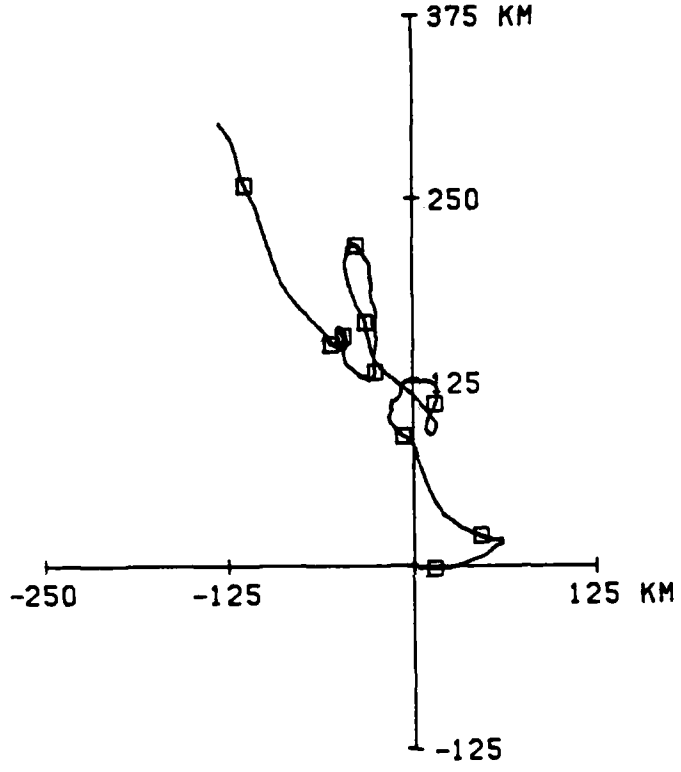
UNFILTERED CURRENT. 3557 M AT M-2. TAPE 6974/10.



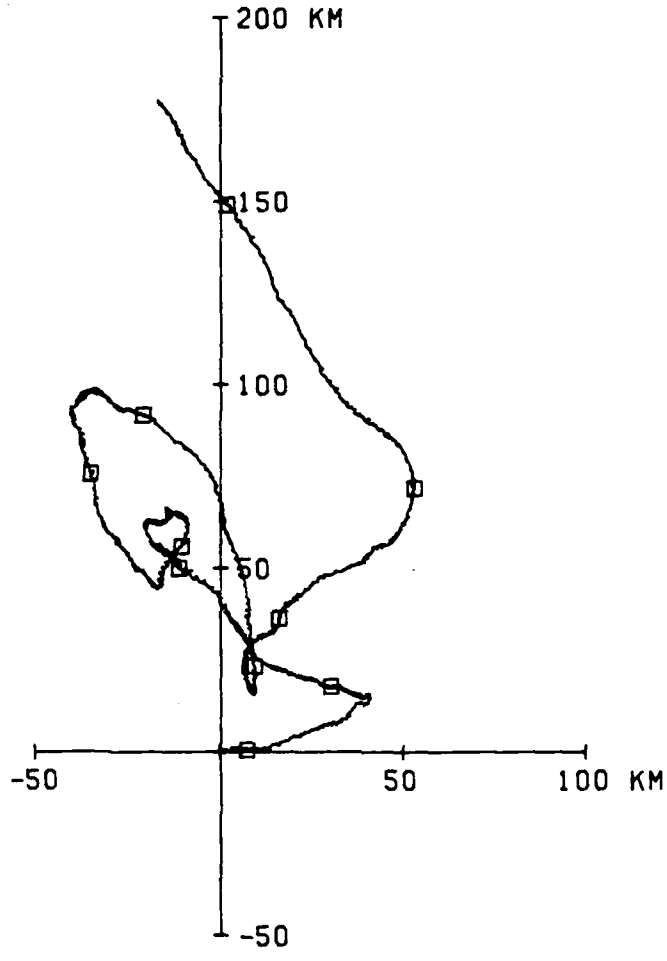
145 M AT M2. 284.8 DAYS STARTING 0410 2 OCT 84.



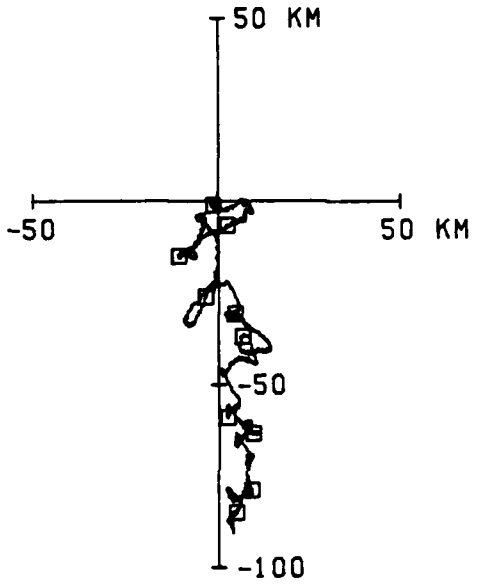
340 M AT M2. 290.0 DAYS STARTING 2119 26 SEP 84.



800 M AT M2. 290.1 DAYS STARTING 2112 26 SEP 84.

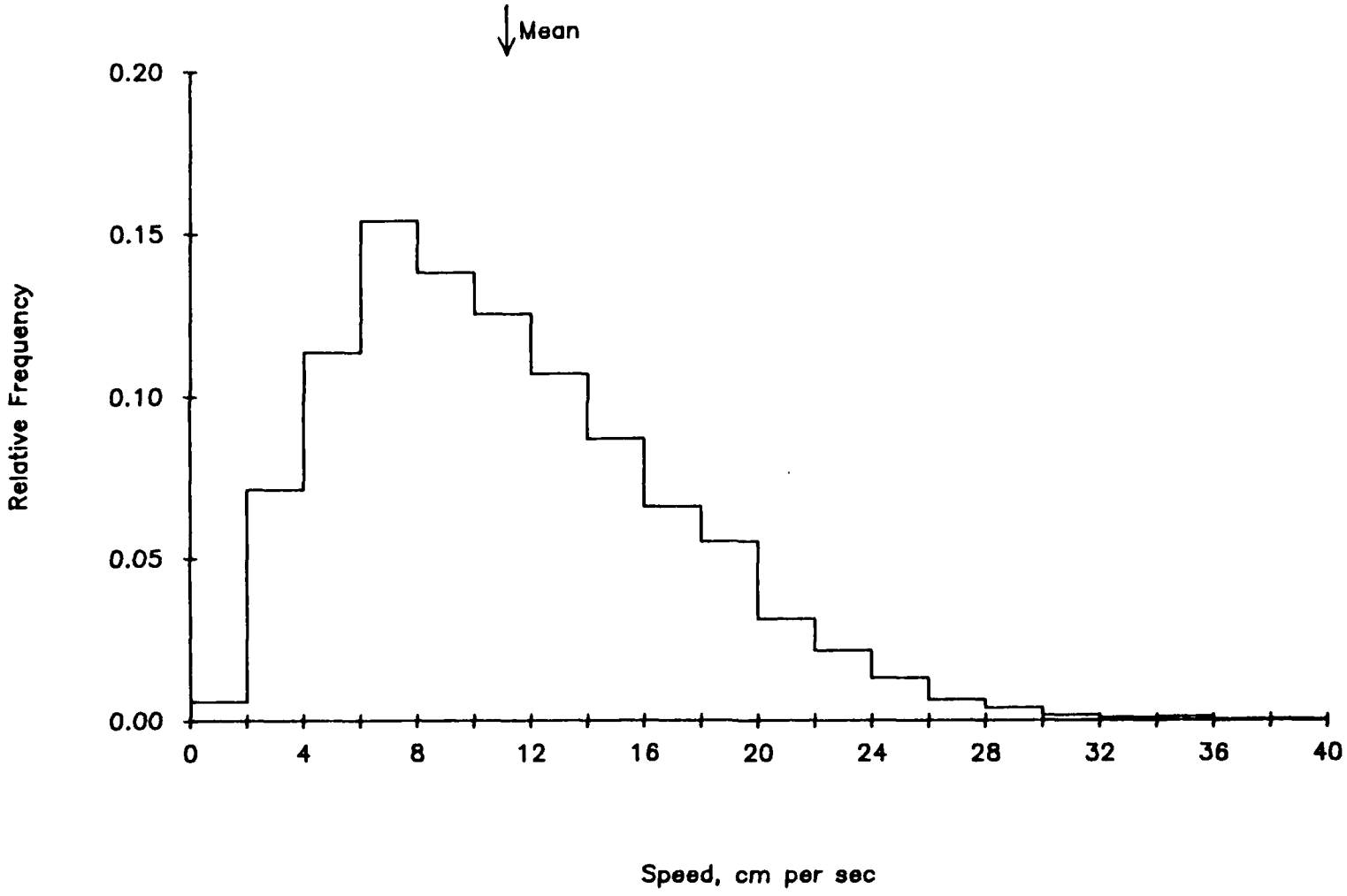


1190 M AT M2. 290.1 DAYS STARTING 2020 26 SEP 84.

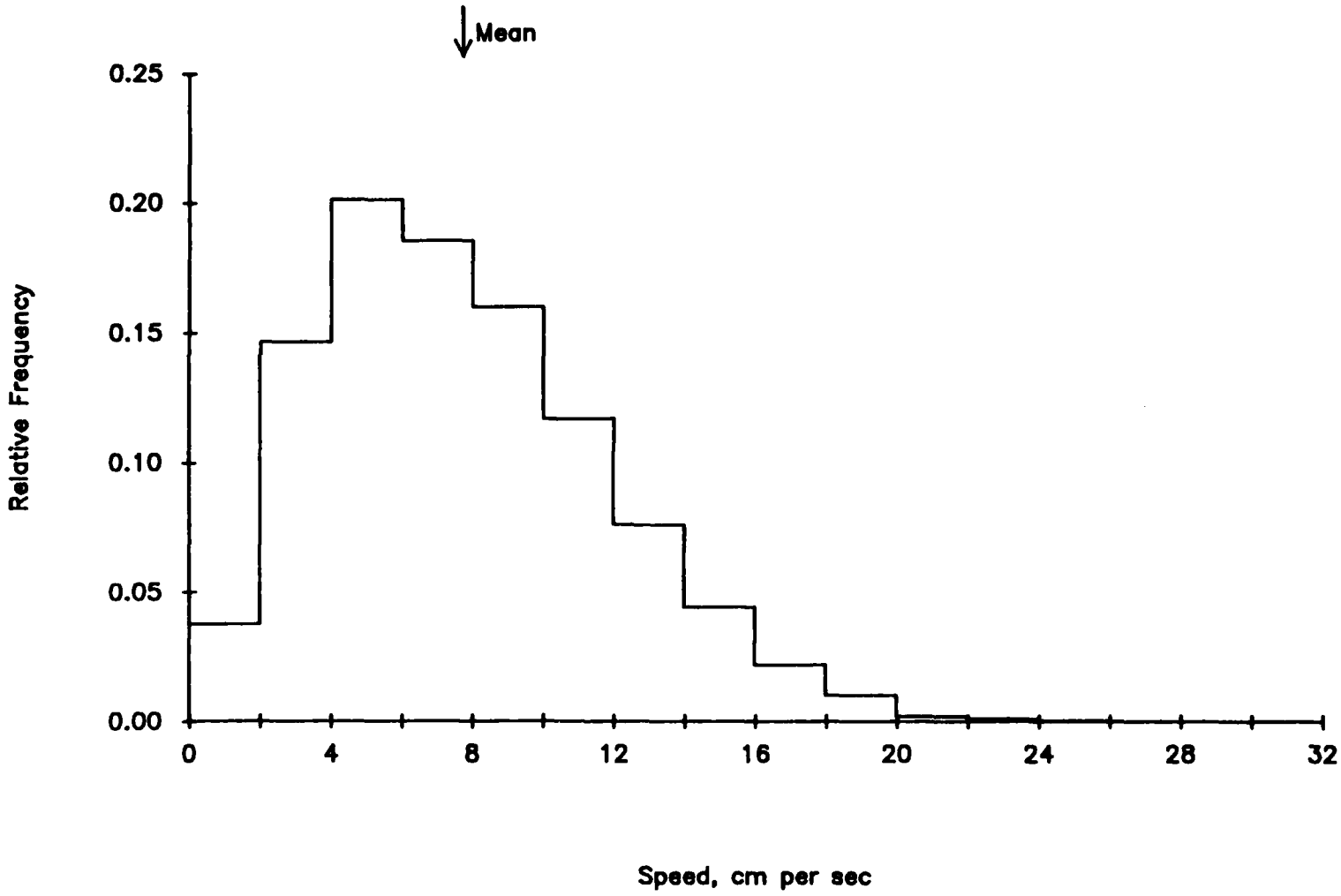


3557 M AT M2. 290.1 DAYS STARTING 2015 26 SEP 84.

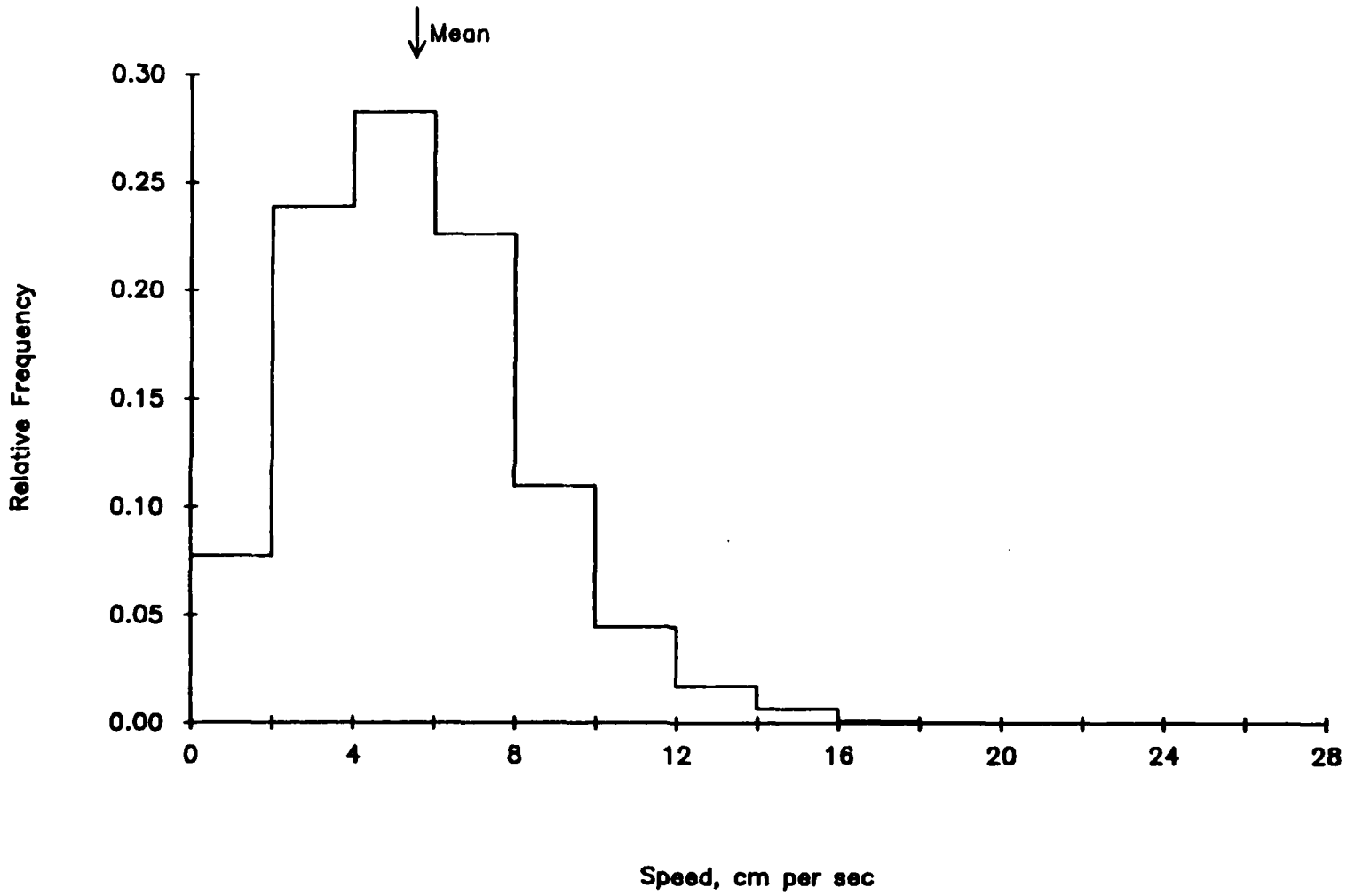
145 M at M2. 2 Oct 84 – 13 Jul 85. Tape 5880/14.



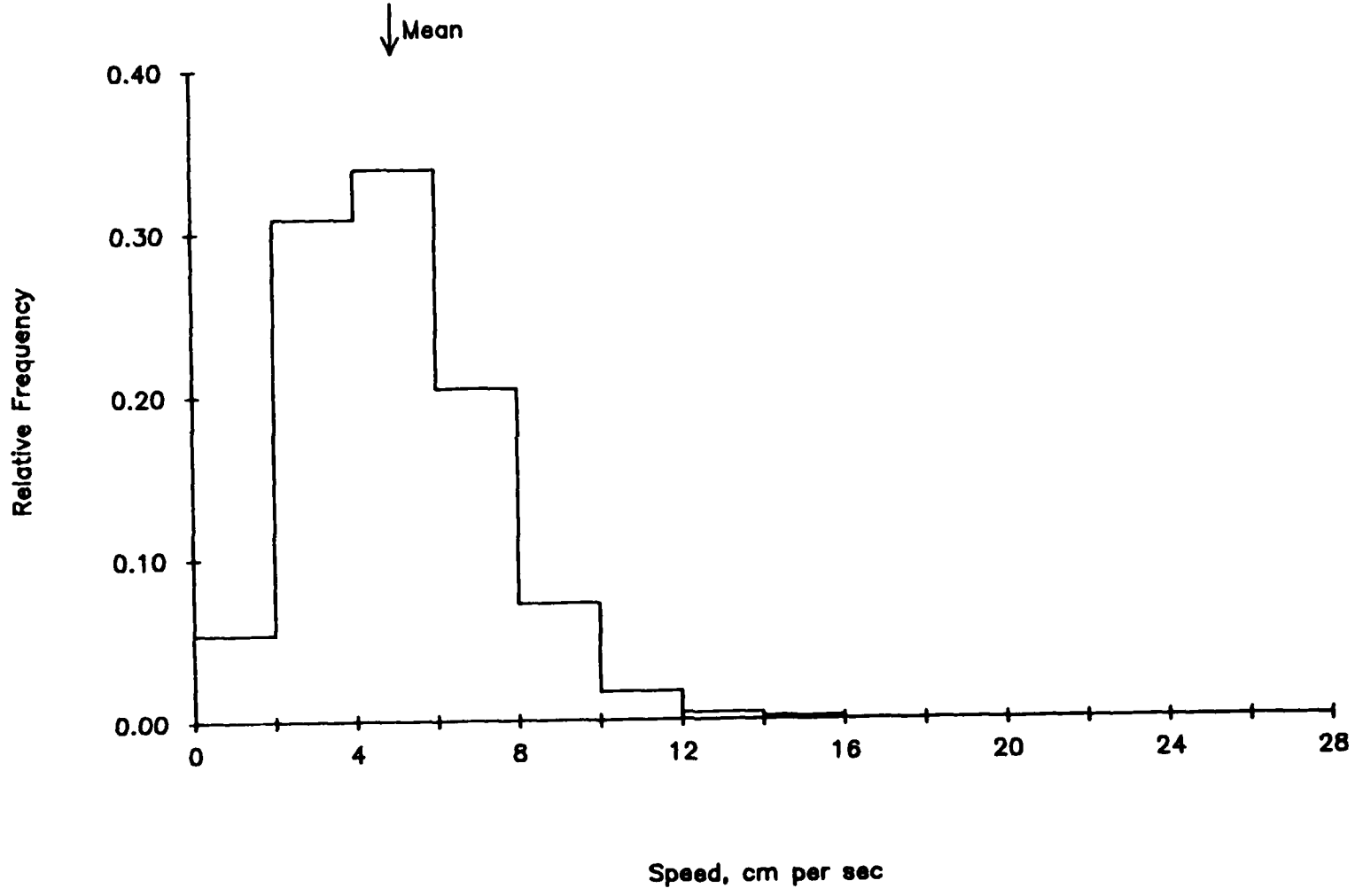
340 M at M2. 26 Sep 84 – 13 Jul 85. Tape 408/20.



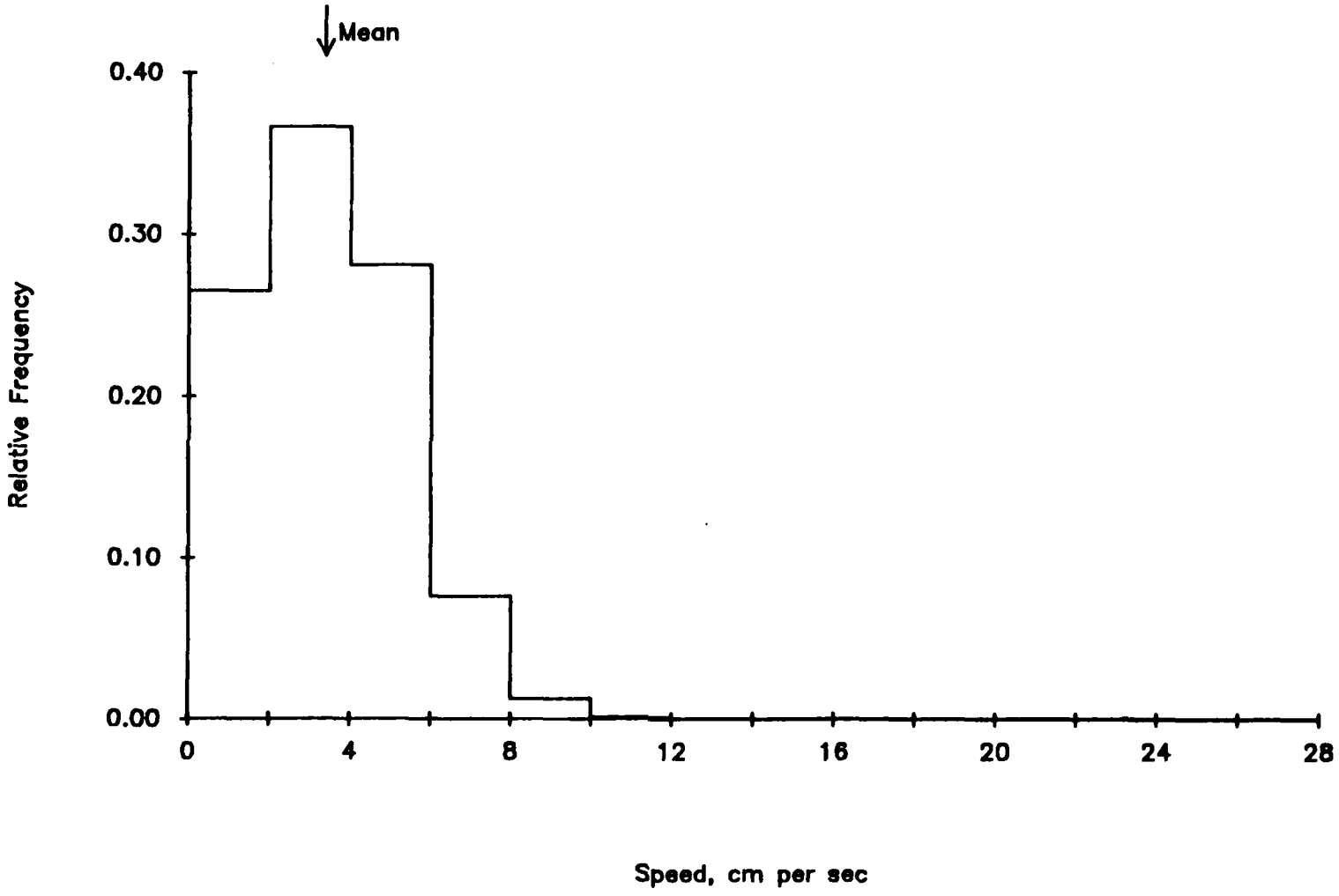
800 M at M−2. 26 Sep 84 − 13 Jul 85. Tape 5211/20.



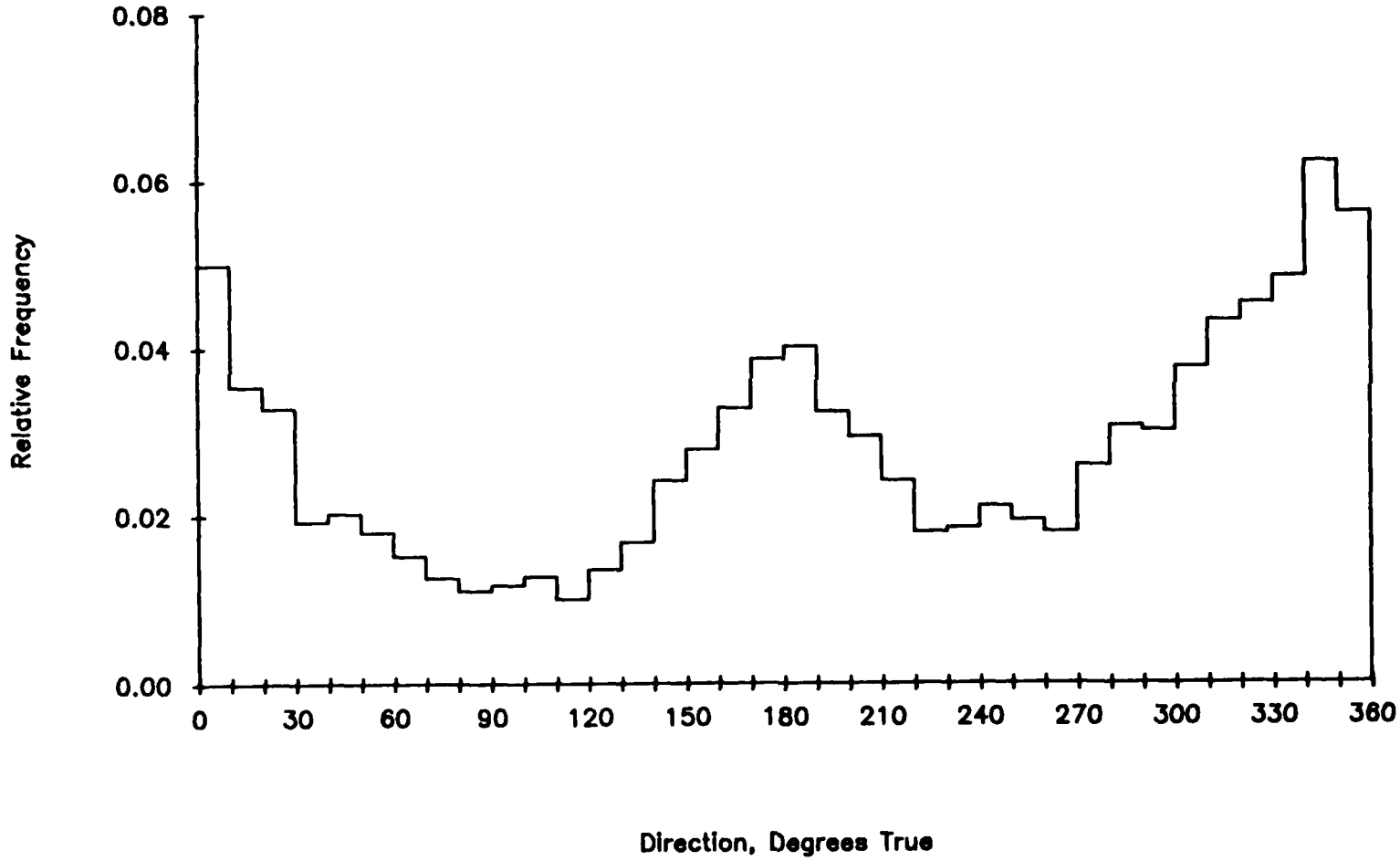
1190 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 6590/9.



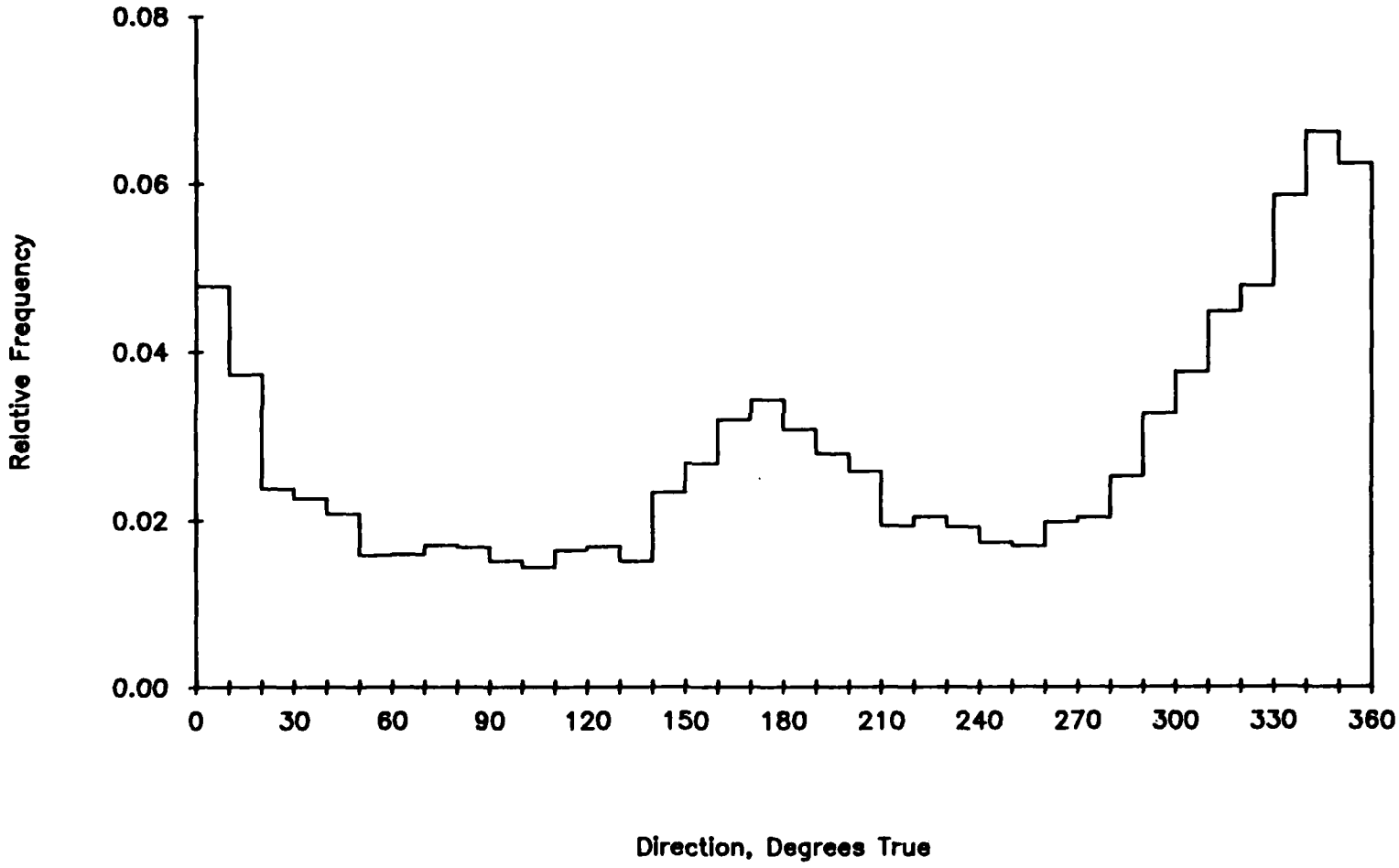
3557 M at M–2. 26 Sep 84 – 13 Jul 85. Tape 6974/10.

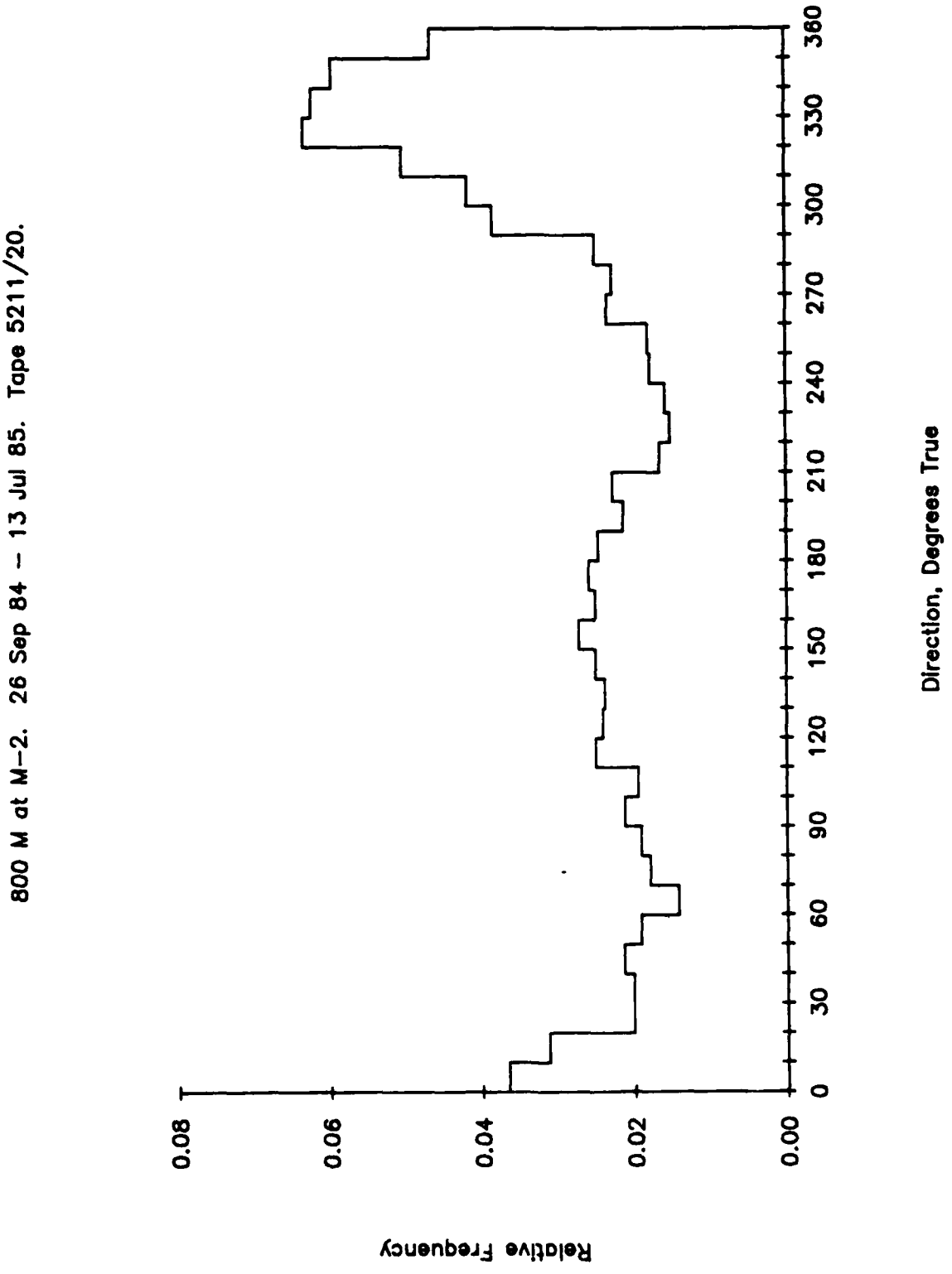


145 M at M2. 2 Oct 84 – 13 Jul 85. Tape 5880/14.

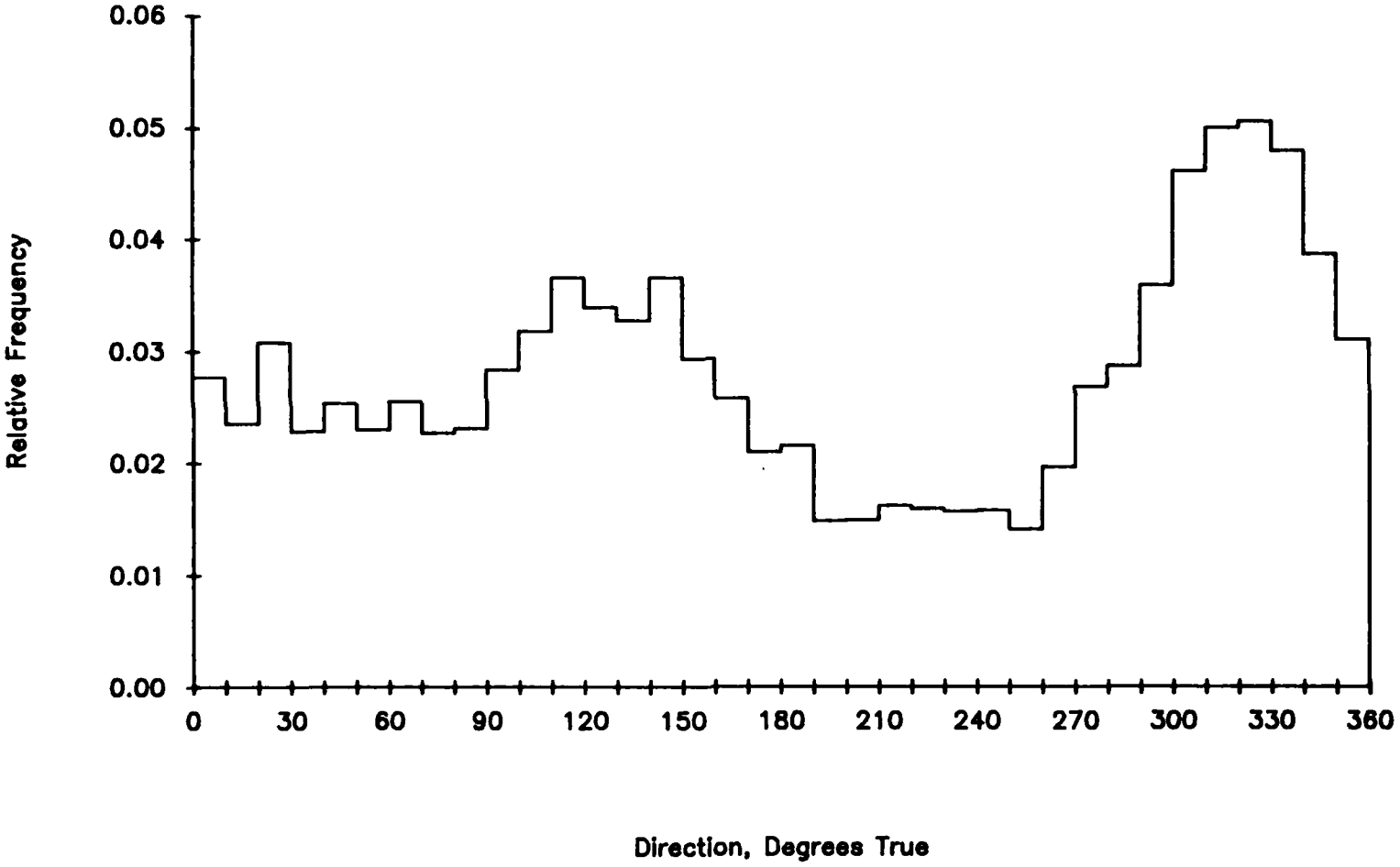


340 M at M2. 26 Sep 84 – 13 Jul 85. Tape 408/20.

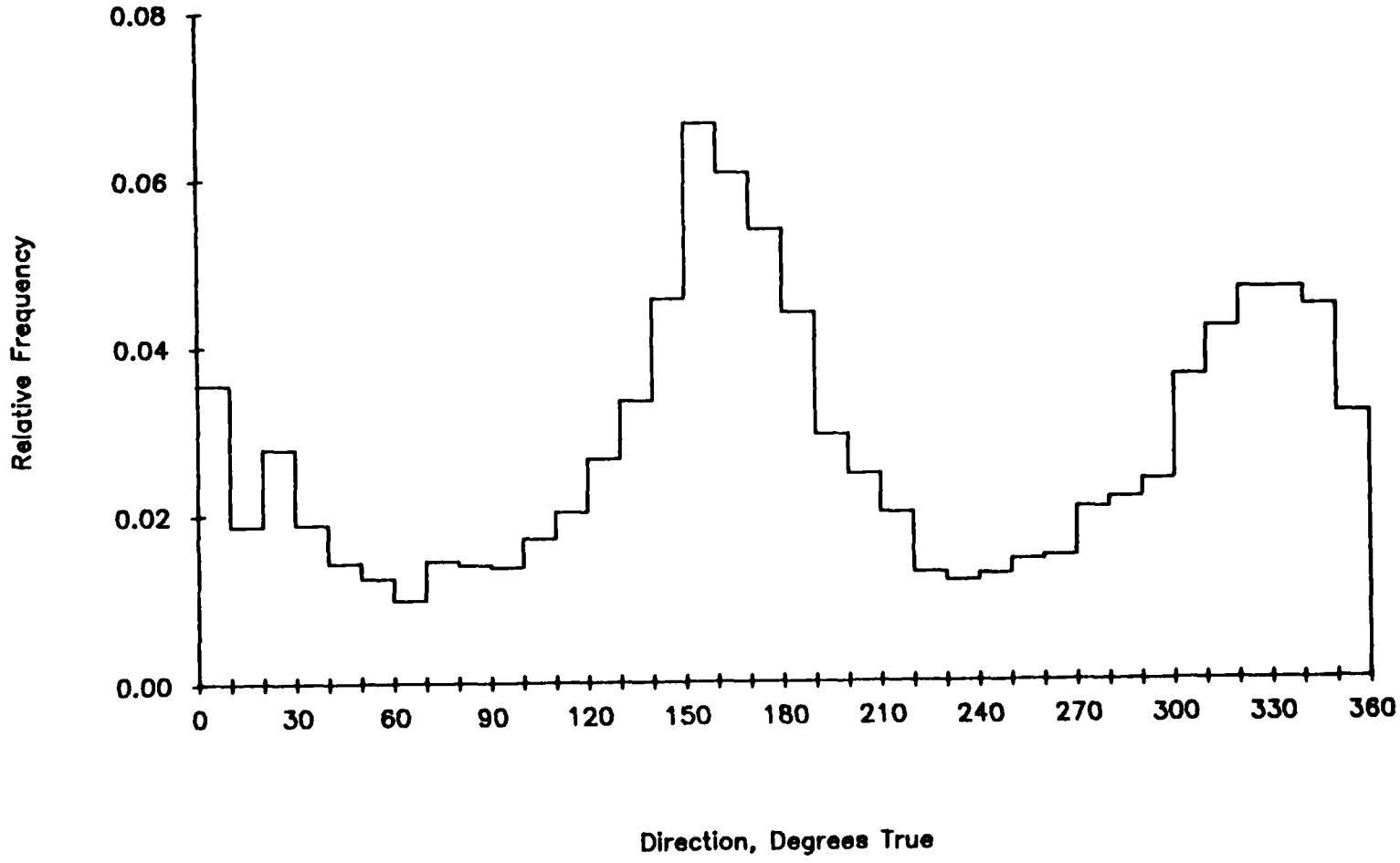



800 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 5211/20.
Relative Frequency
0.00
0.02
0.04
0.06
0.08
0
30
60
90
120
150
180
210
240
270
300
330
360
Direction, Degrees True

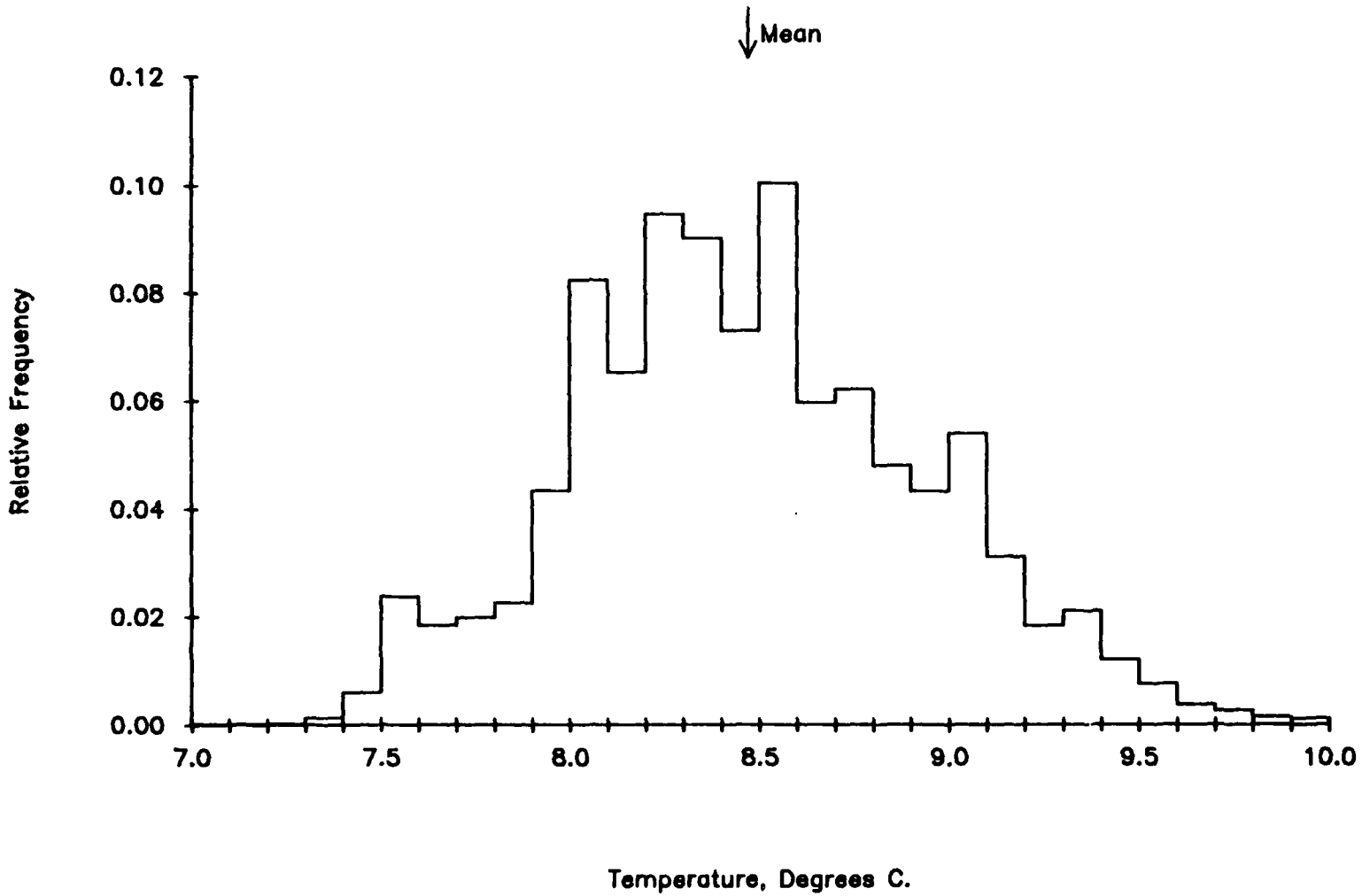
1190 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 6590/9.



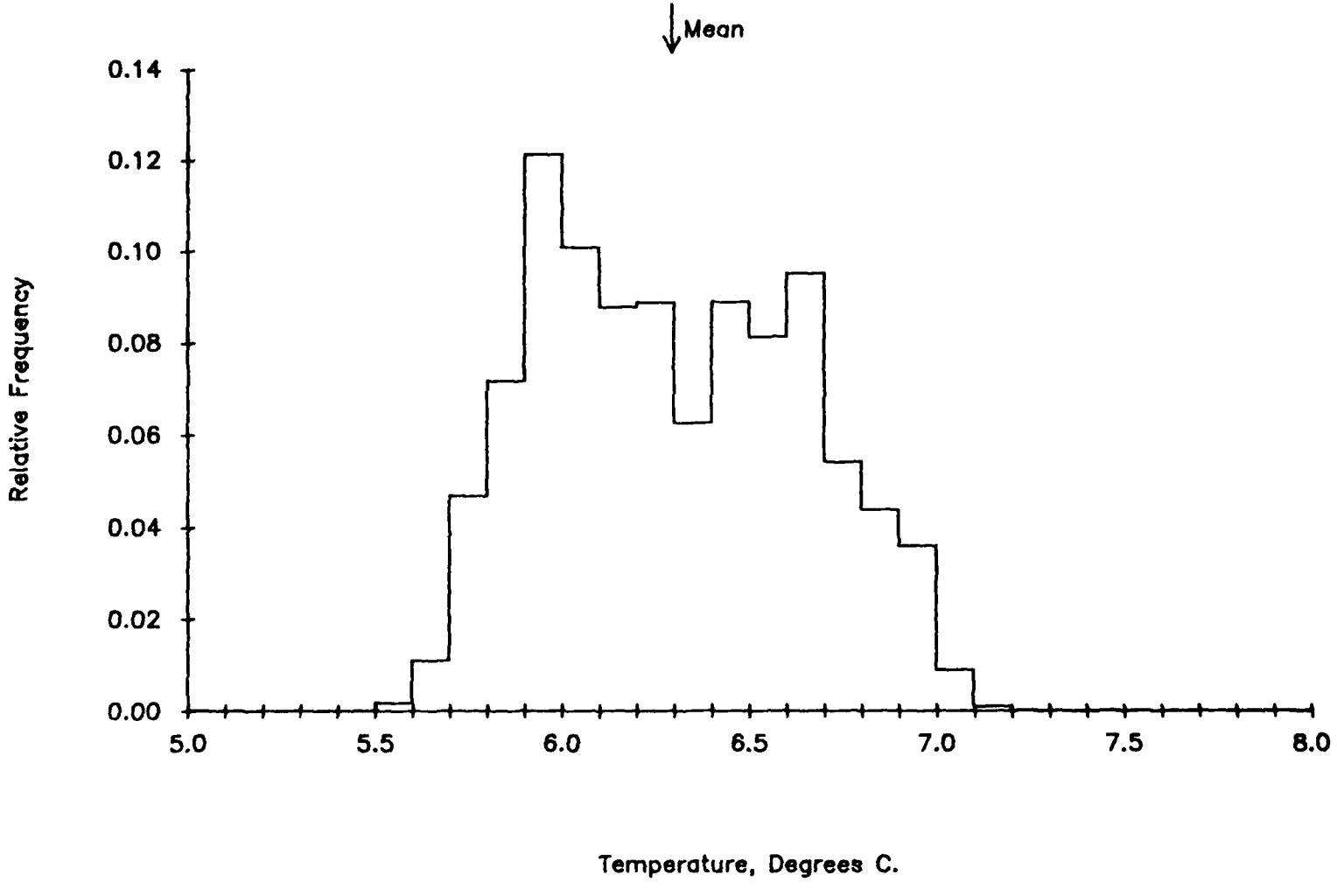
3557 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 6974/10.



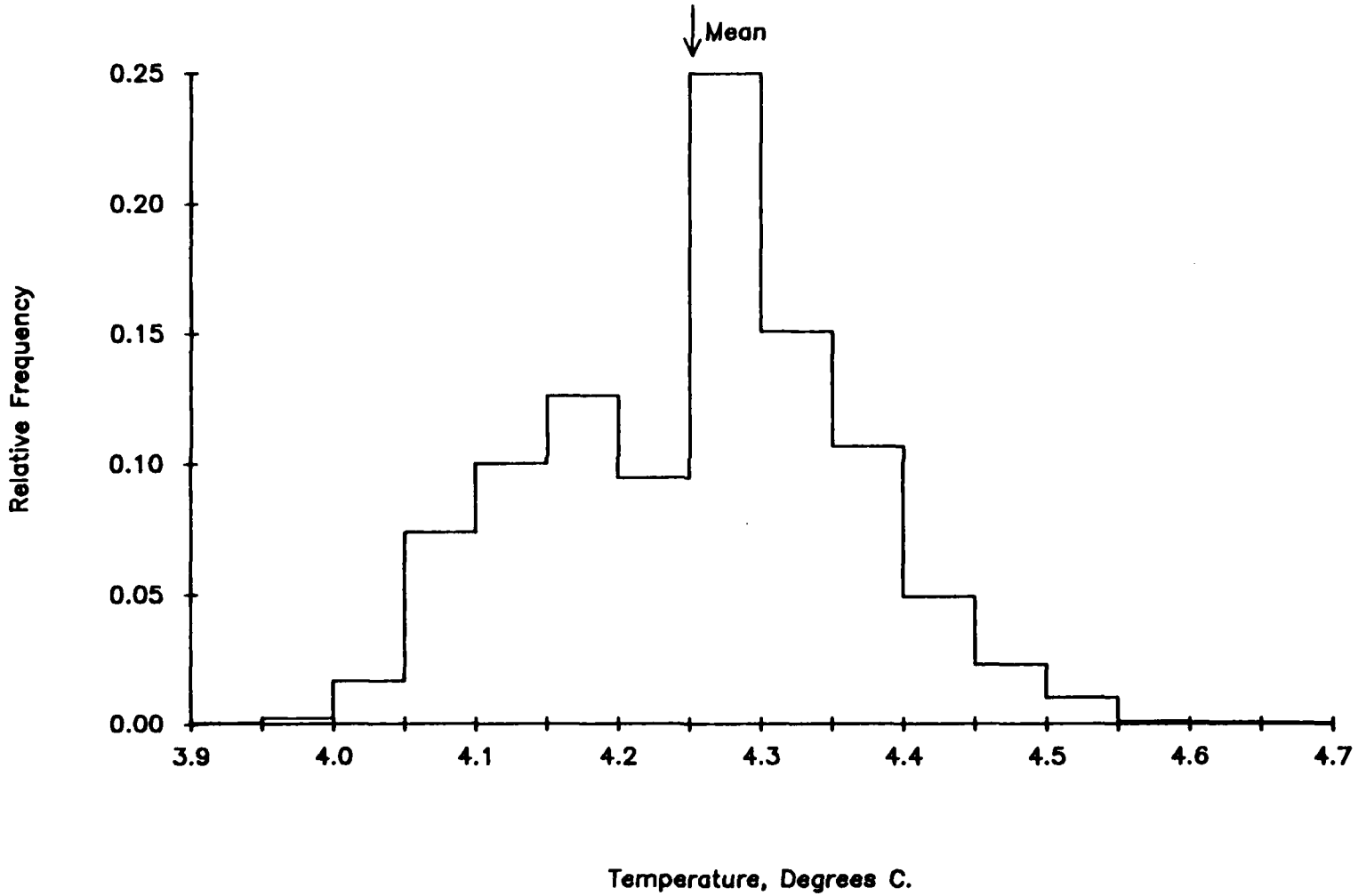
145 M at M2. 2 Oct 84 – 13 Jul 85. Tape 5880/14.



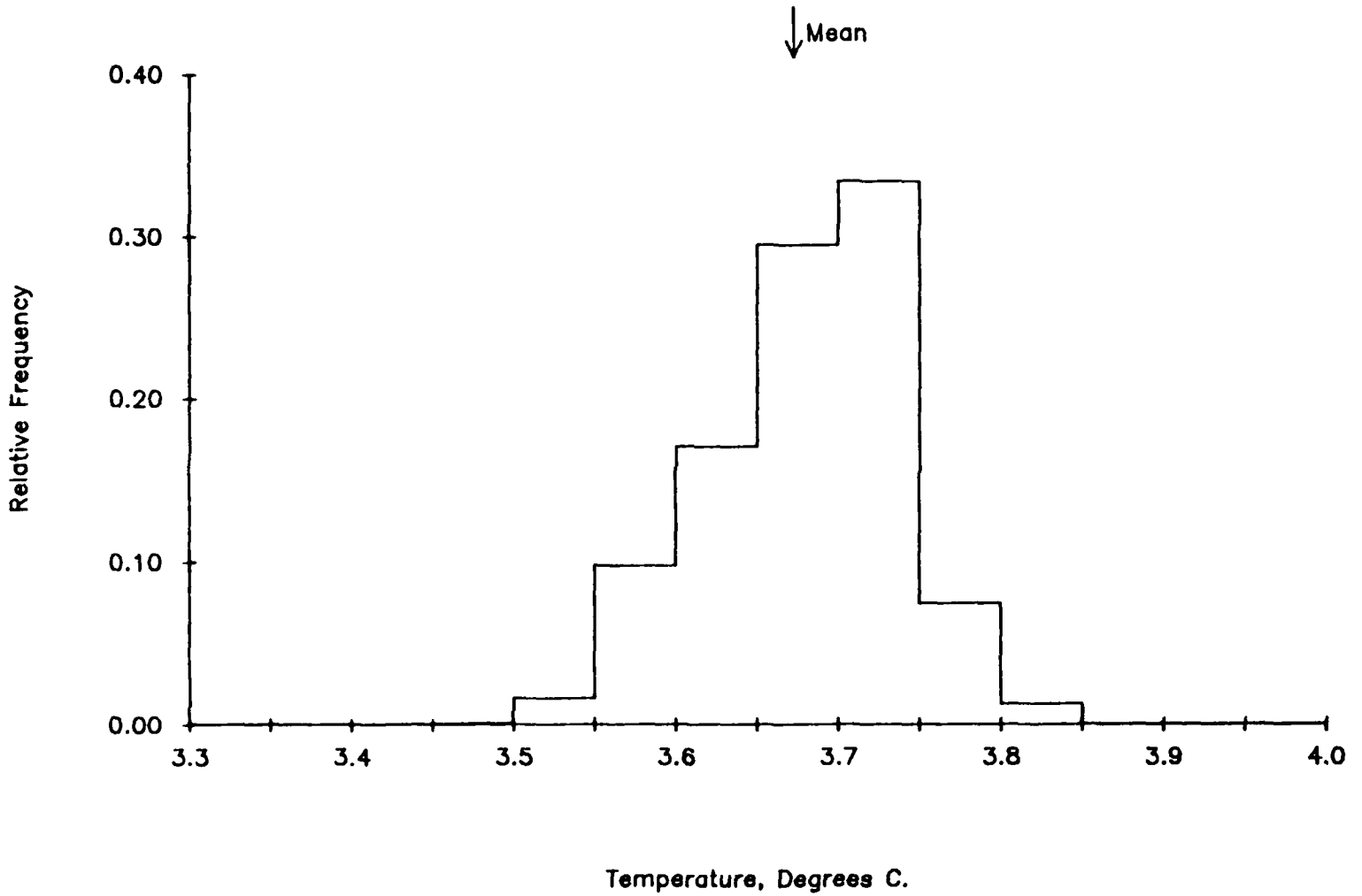
340 M at M2. 26 Sep 84 – 13 Jul 85. Tape 408/20.



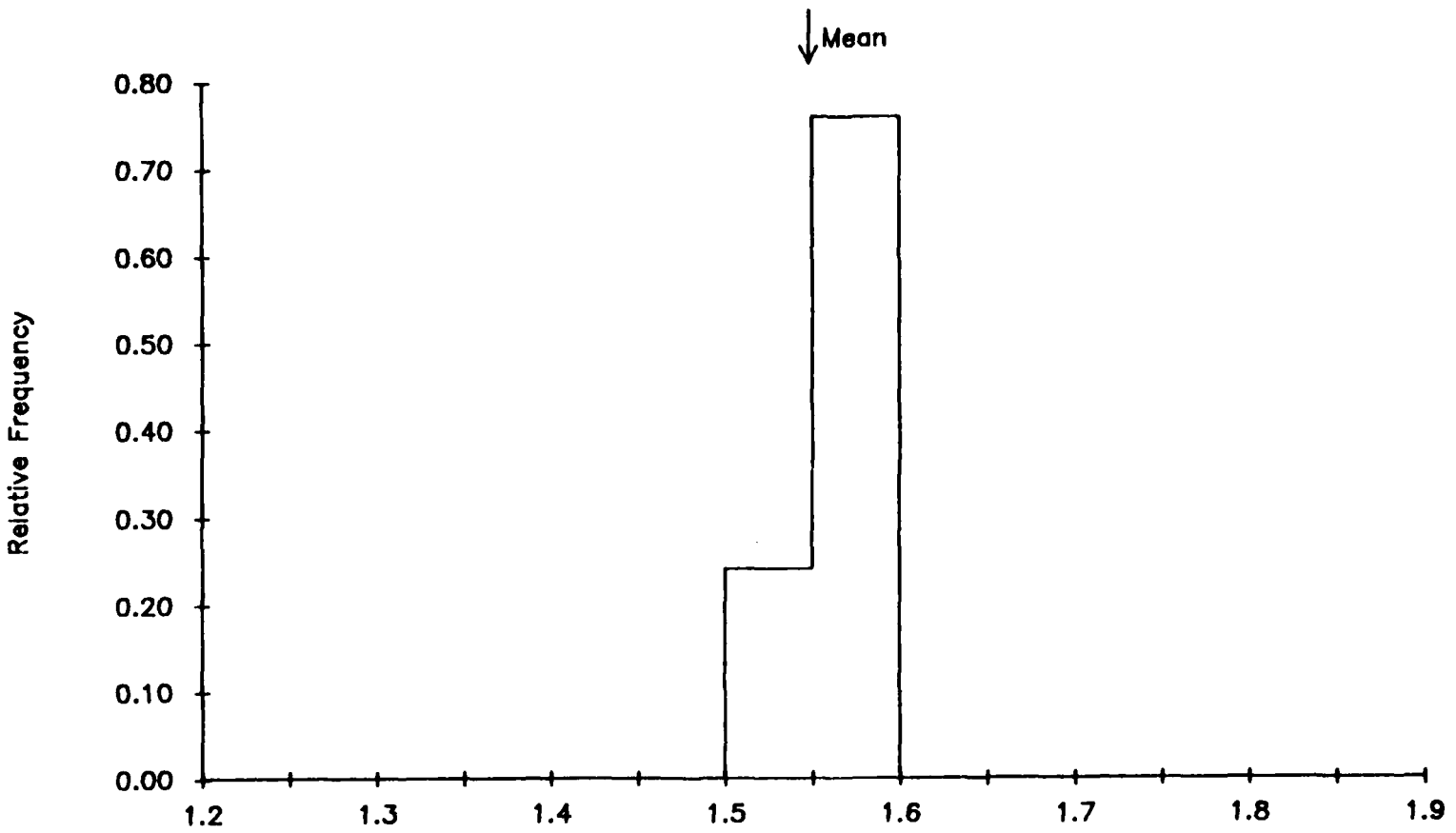
800 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 5211/20.



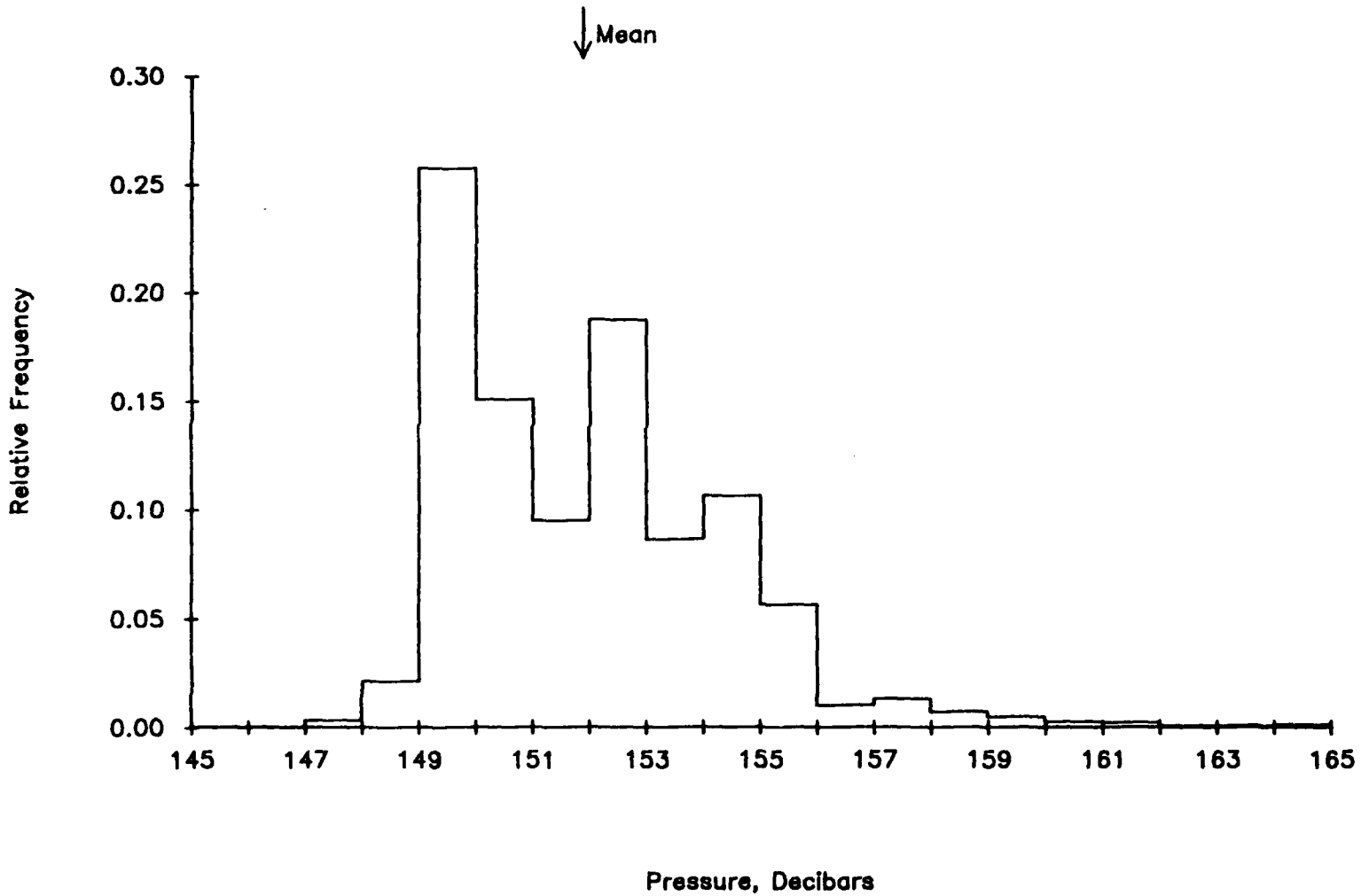
1190 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 6590/9.



3557 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 6974/10.



145 M at M2. 2 Oct 84 – 13 Jul 85. Tape 5880/14.



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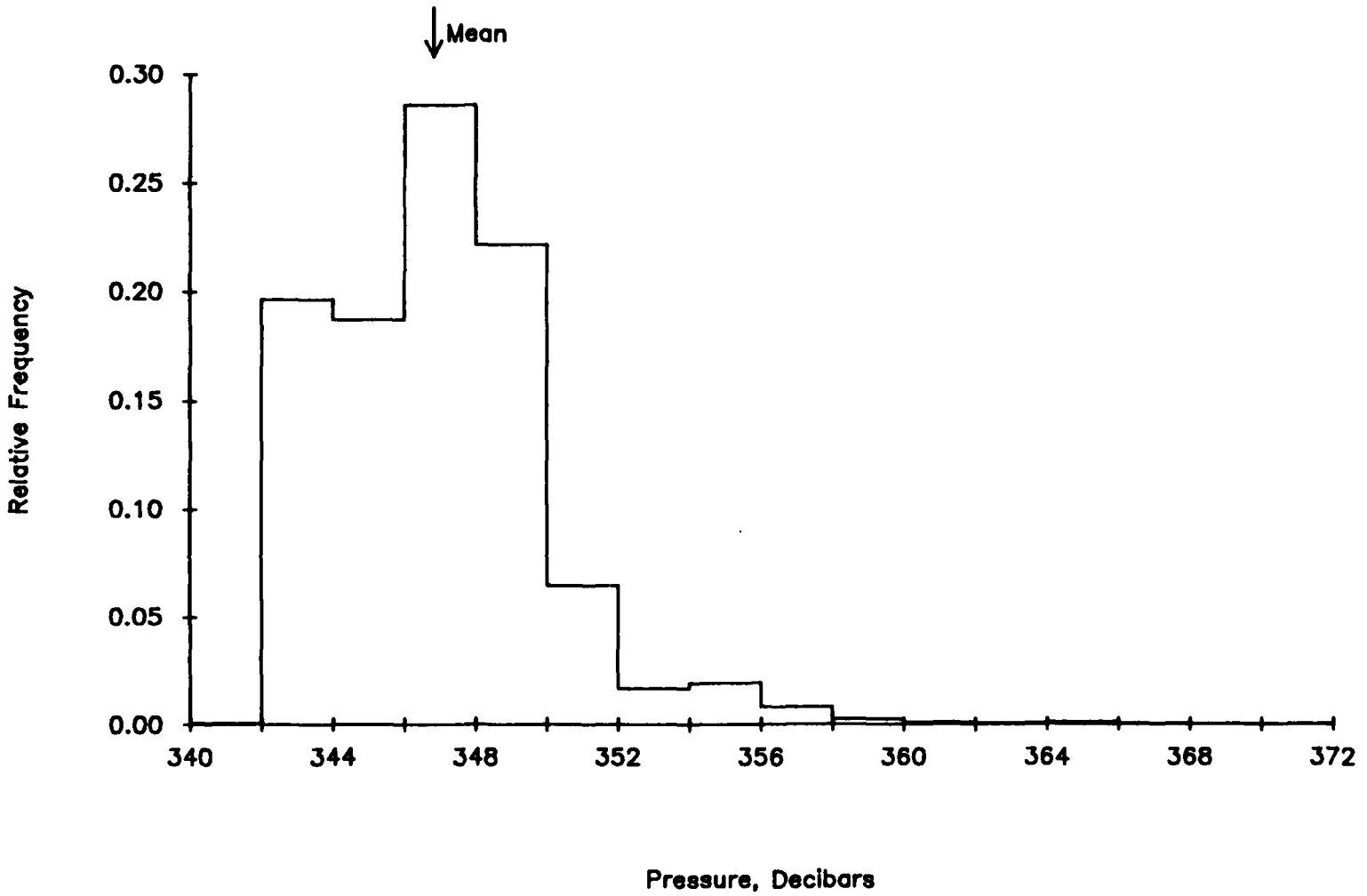
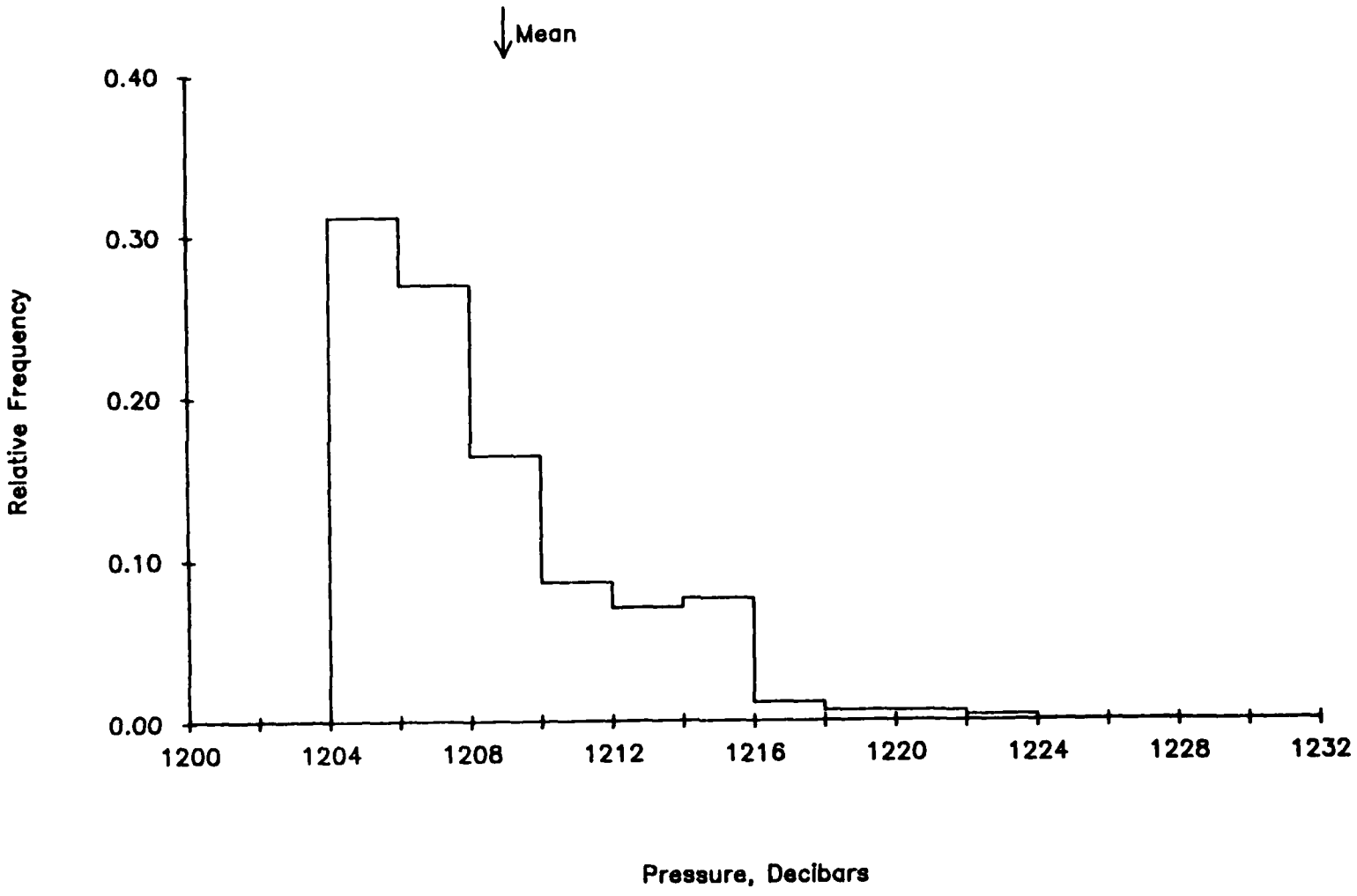
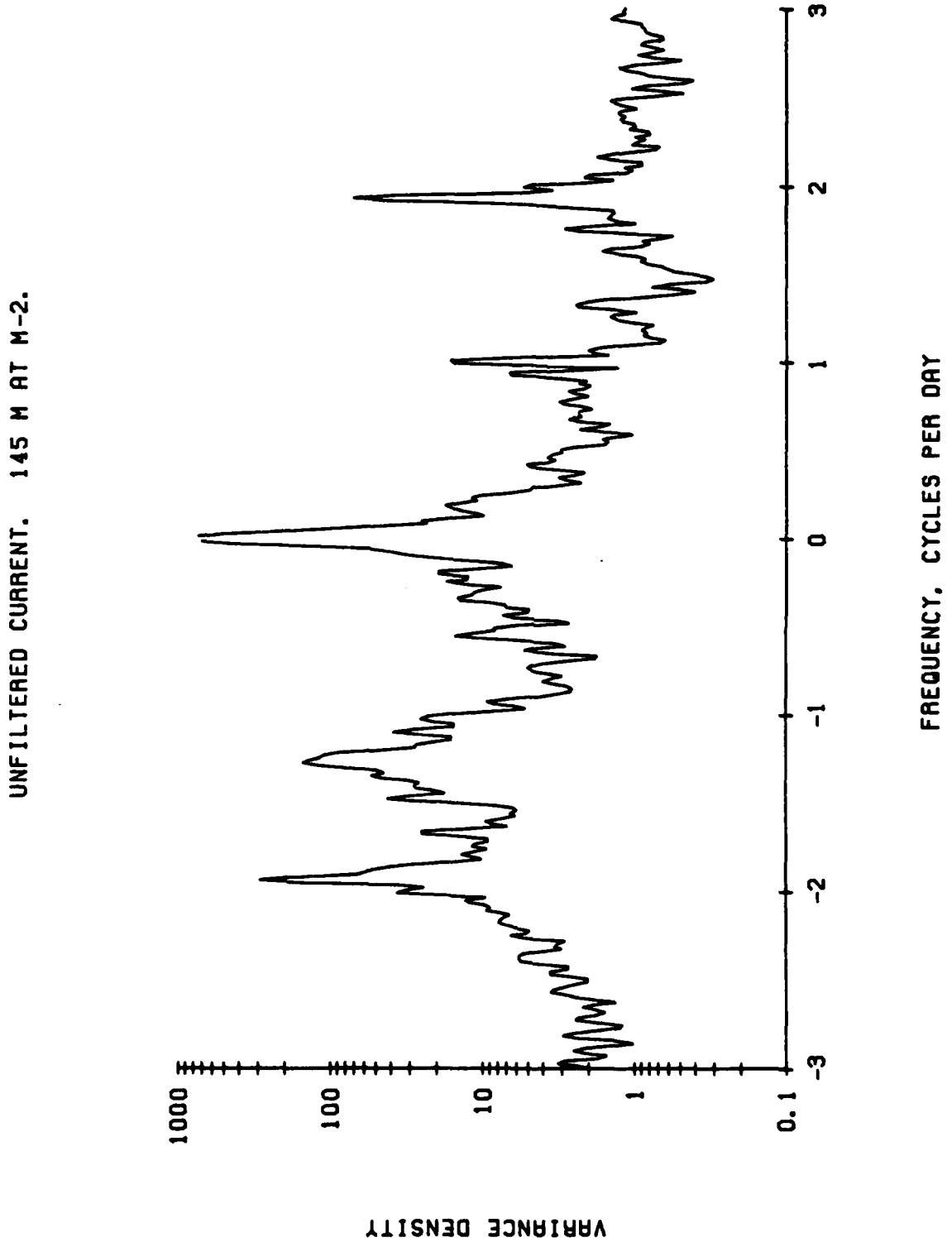
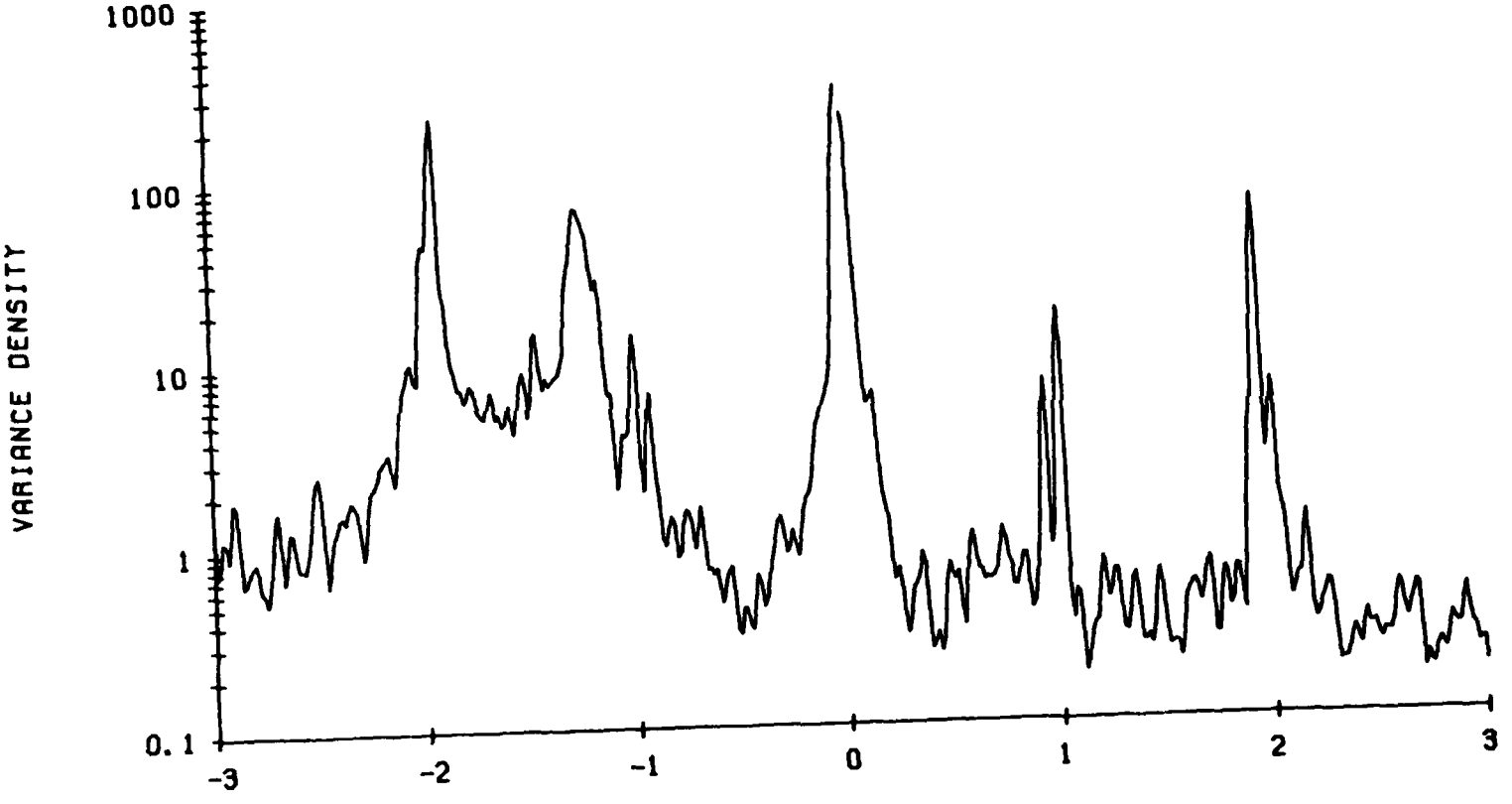


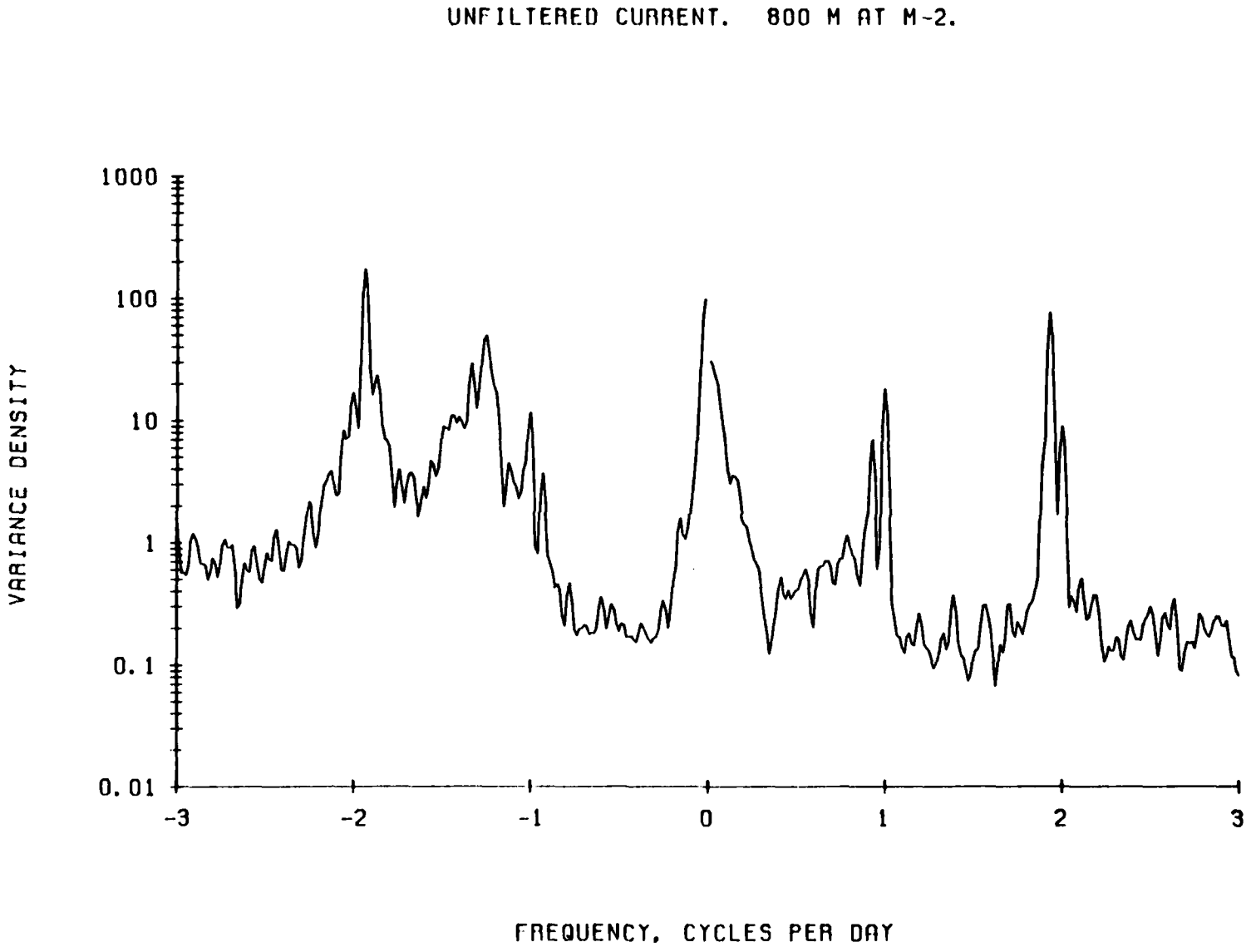
1190 M at M-2. 26 Sep 84 - 13 Jul 85. Tape 6590/9.

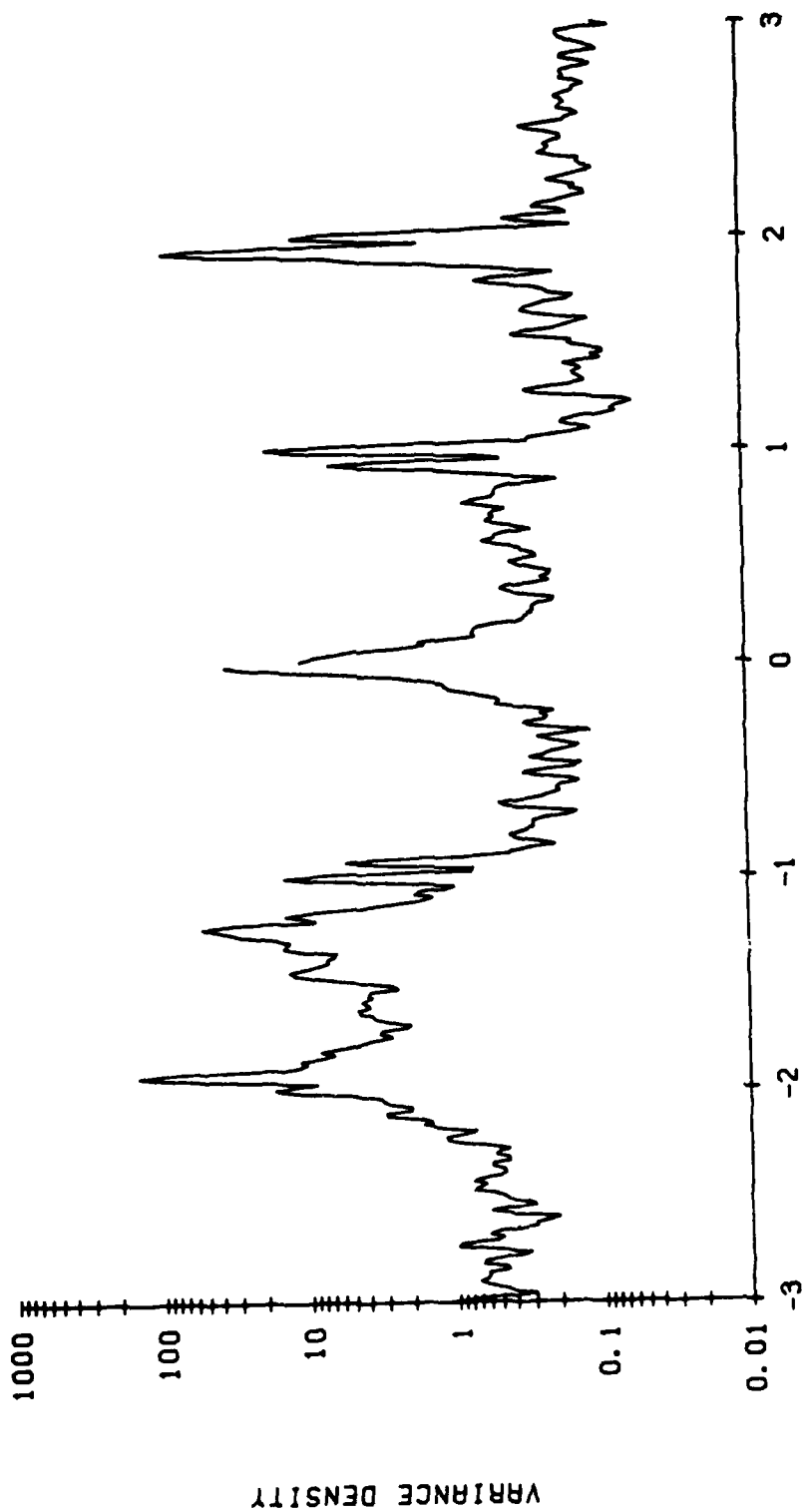


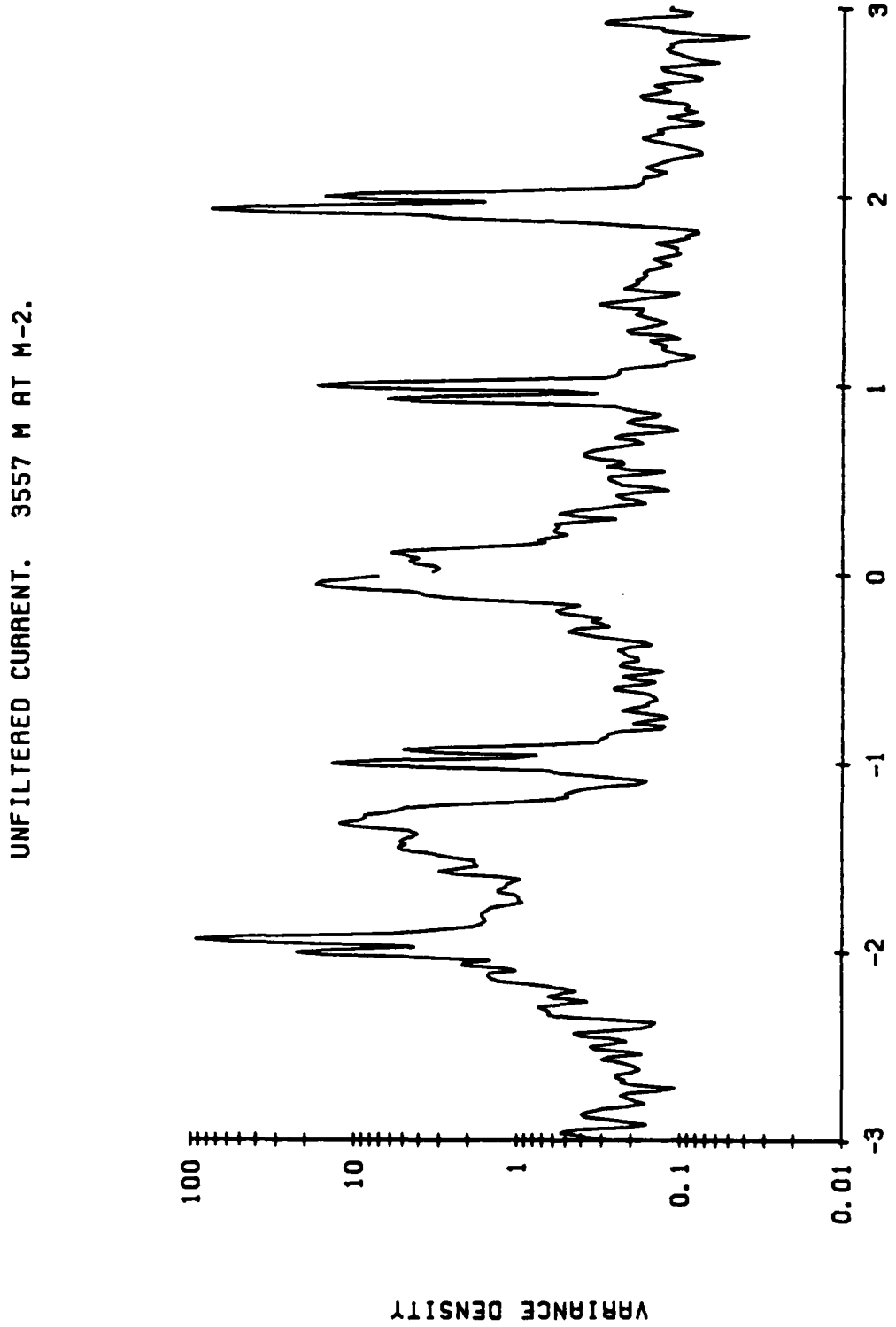

UNFILTERED CURRENT. 145 M AT M-2.
VARIANCE DENSITY
1000
100
10
1
0.1
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

UNFILTERED CURRENT. 340 M AT M-2.

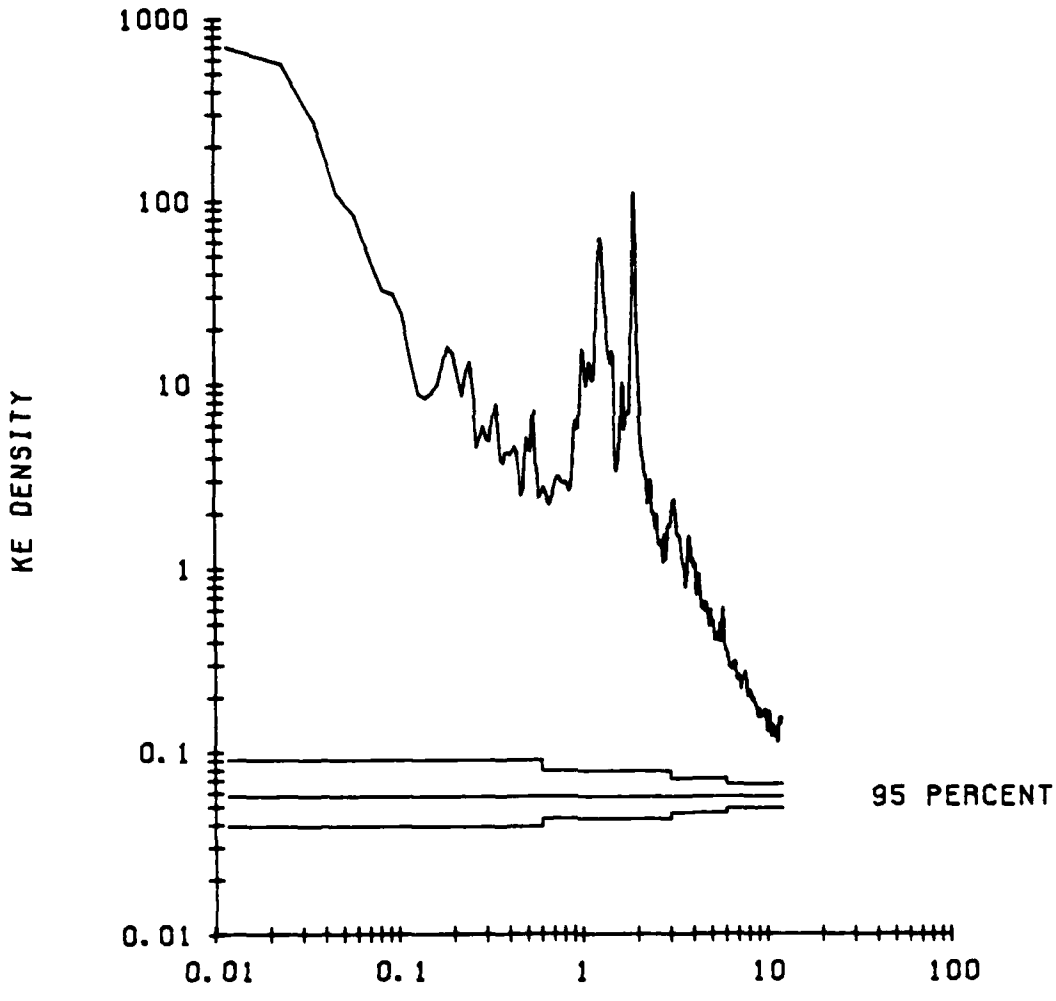



UNFILTERED CURRENT. 800 M AT M-2.
VARIANCE DENSITY
1000
100
10
1
0.1
0.01
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

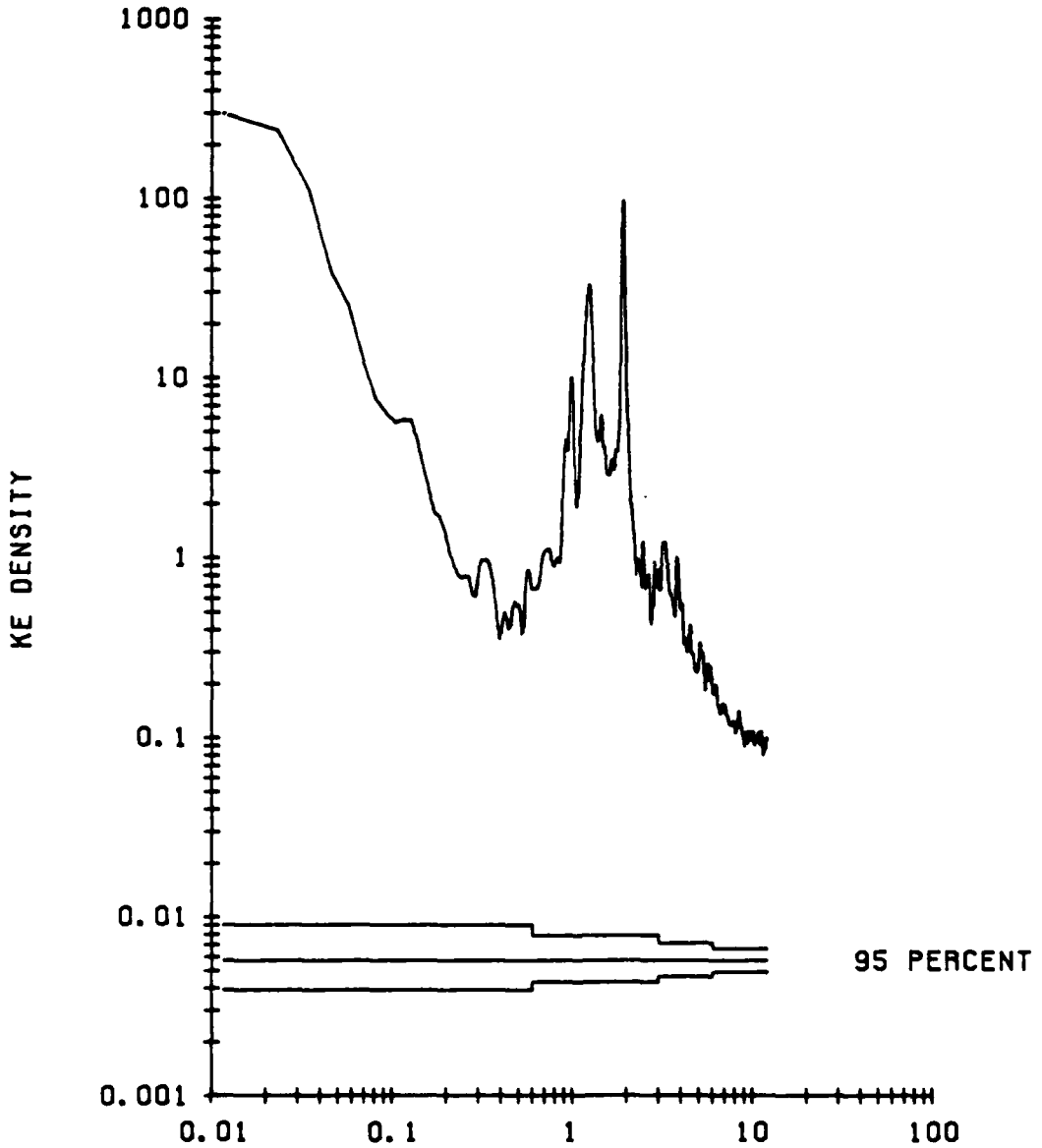

UNFILTERED CURRENT. 1190 M AT M-2.
VARIANCE DENSITY
1000
100
10
1
0.1
0.01
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY


UNFILTERED CURRENT. 3557 M AT M-2.
VARIANCE DENSITY
100
10
1
0.1
0.01
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

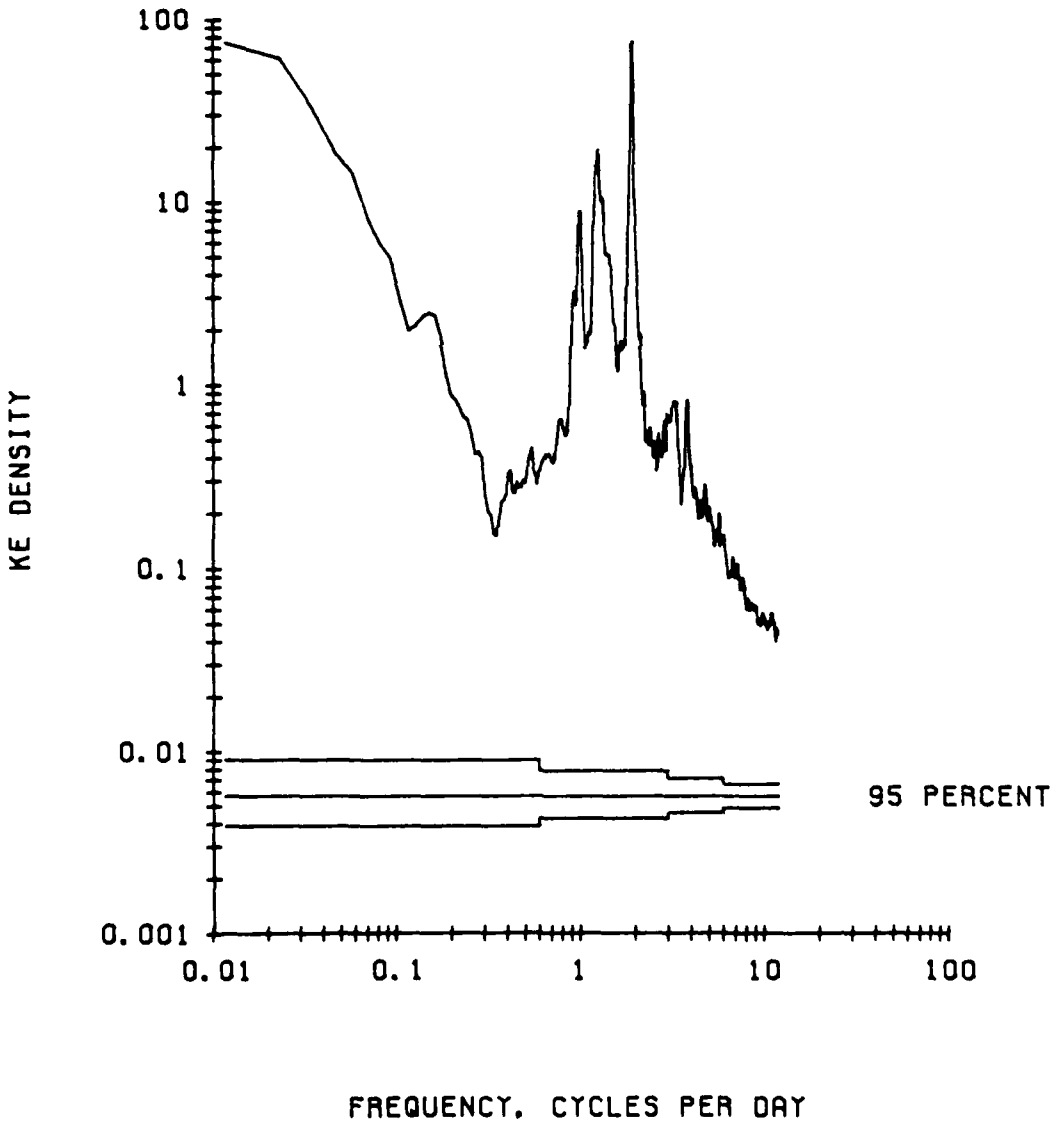
UNFILTERED CURRENT. 145 M AT M-2.



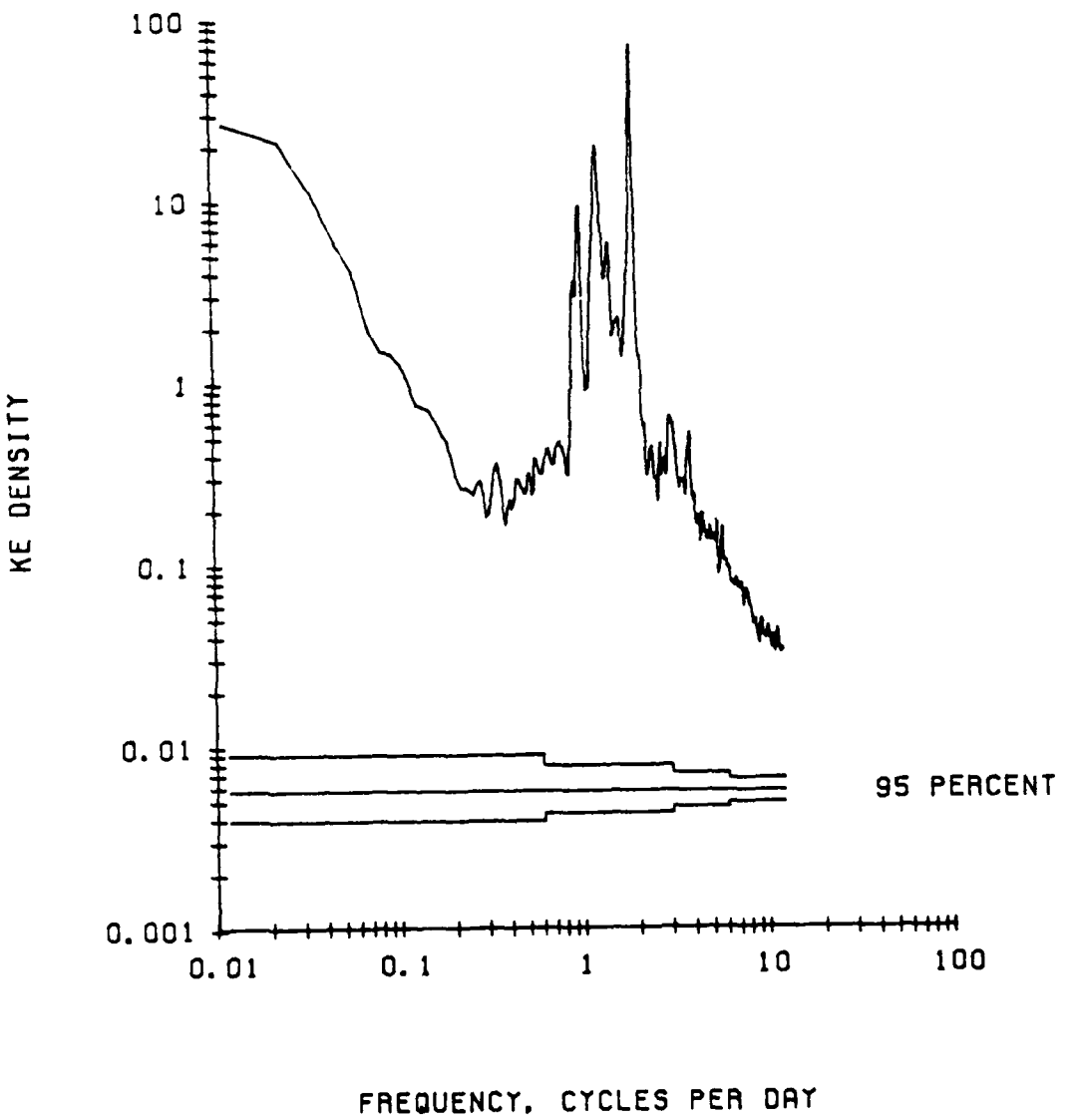
UNFILTERED CURRENT. 340 M AT M-2.



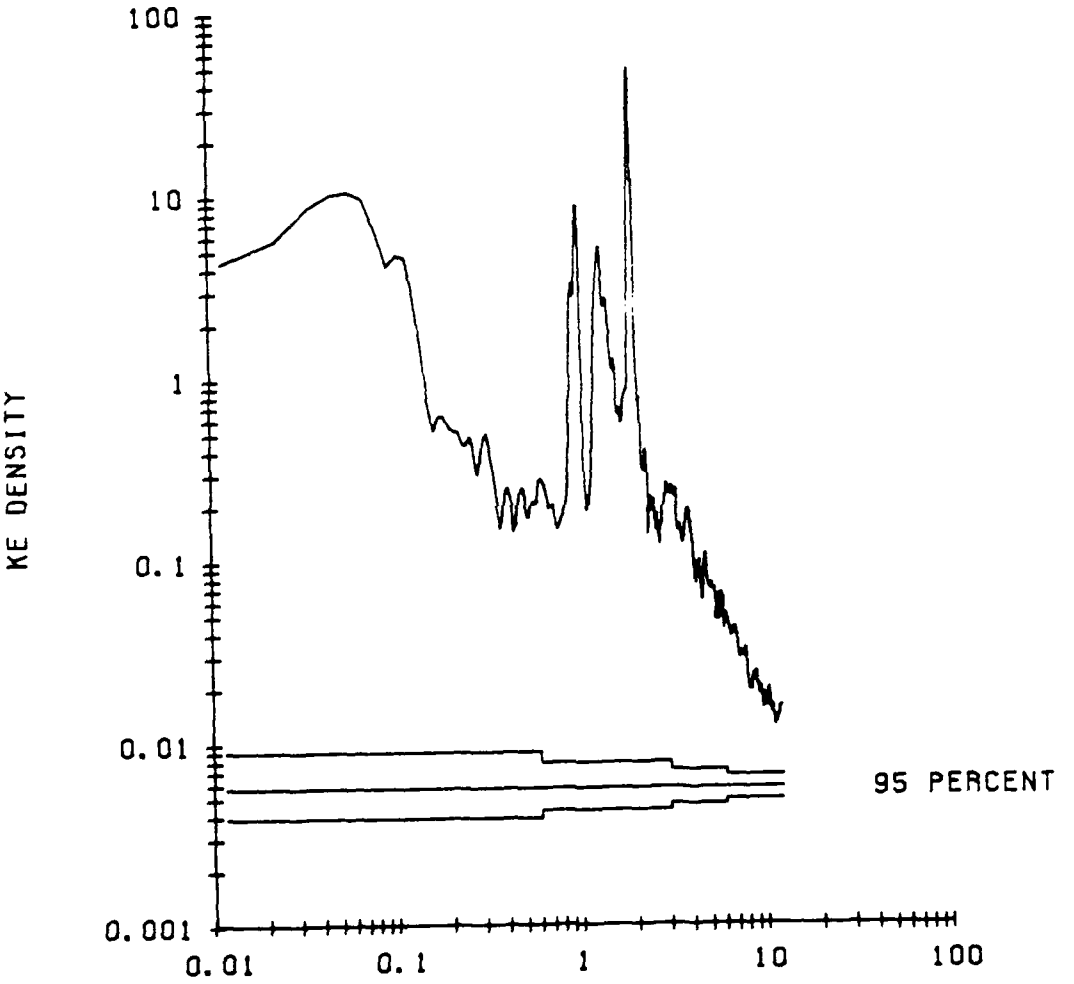
UNFILTERED CURRENT. 800 M AT M-2.



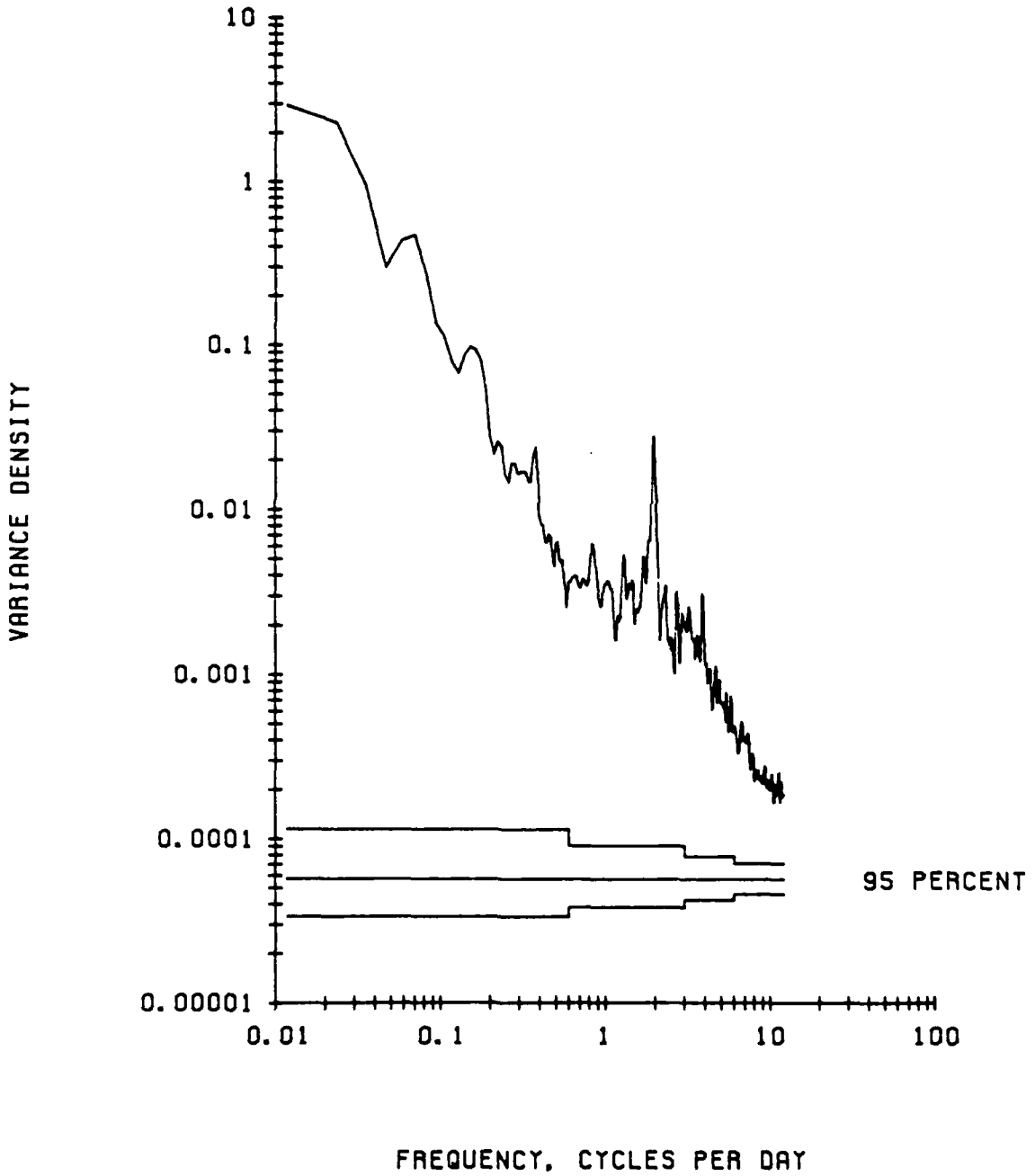
UNFILTERED CURRENT. 1190 M AT M-2.



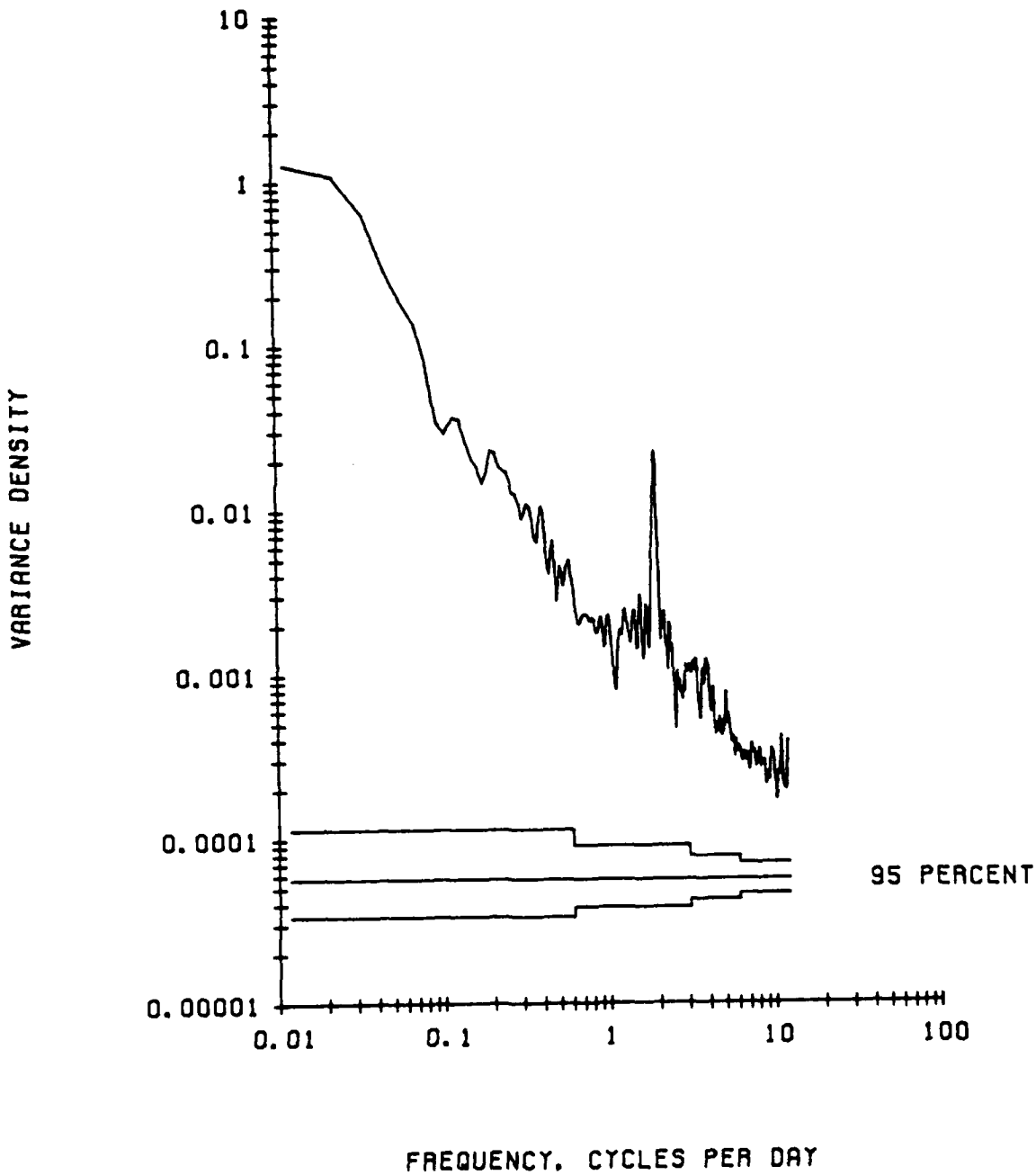
UNFILTERED CURRENT. 3557 M AT M-2.



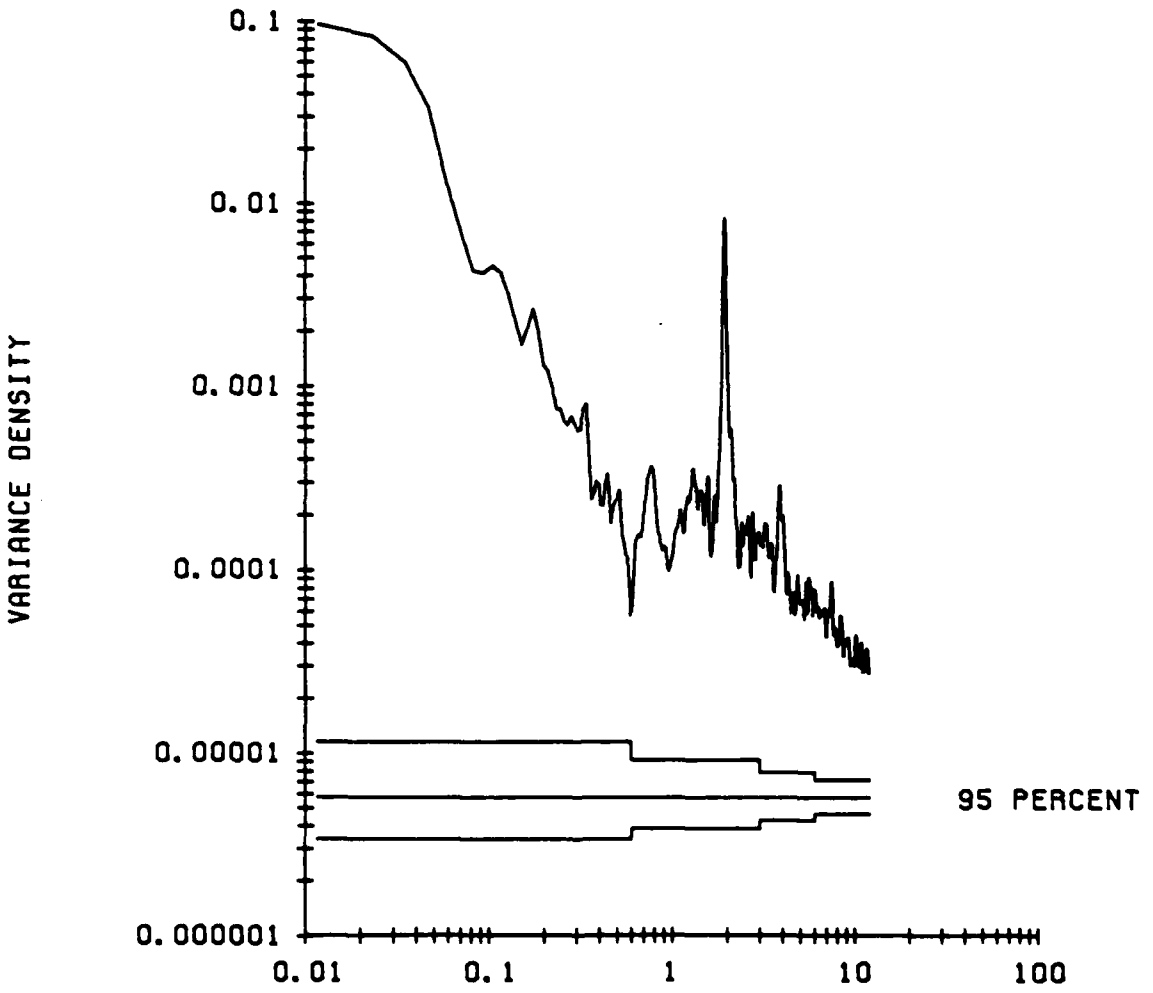
UNFILTERED TEMPERATURE. 145 M AT M-2.



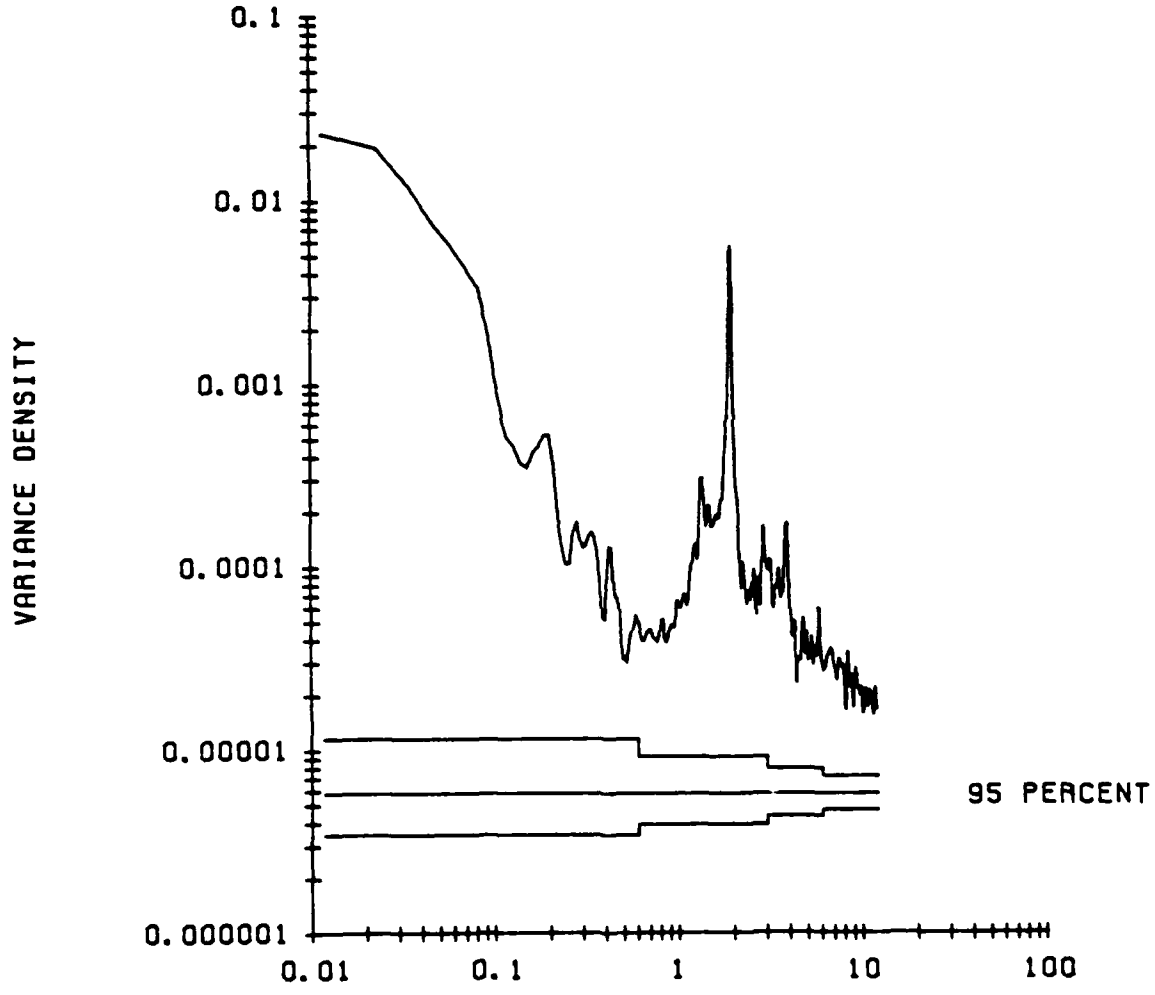
UNFILTERED TEMPERATURE. 340 M AT M-2.



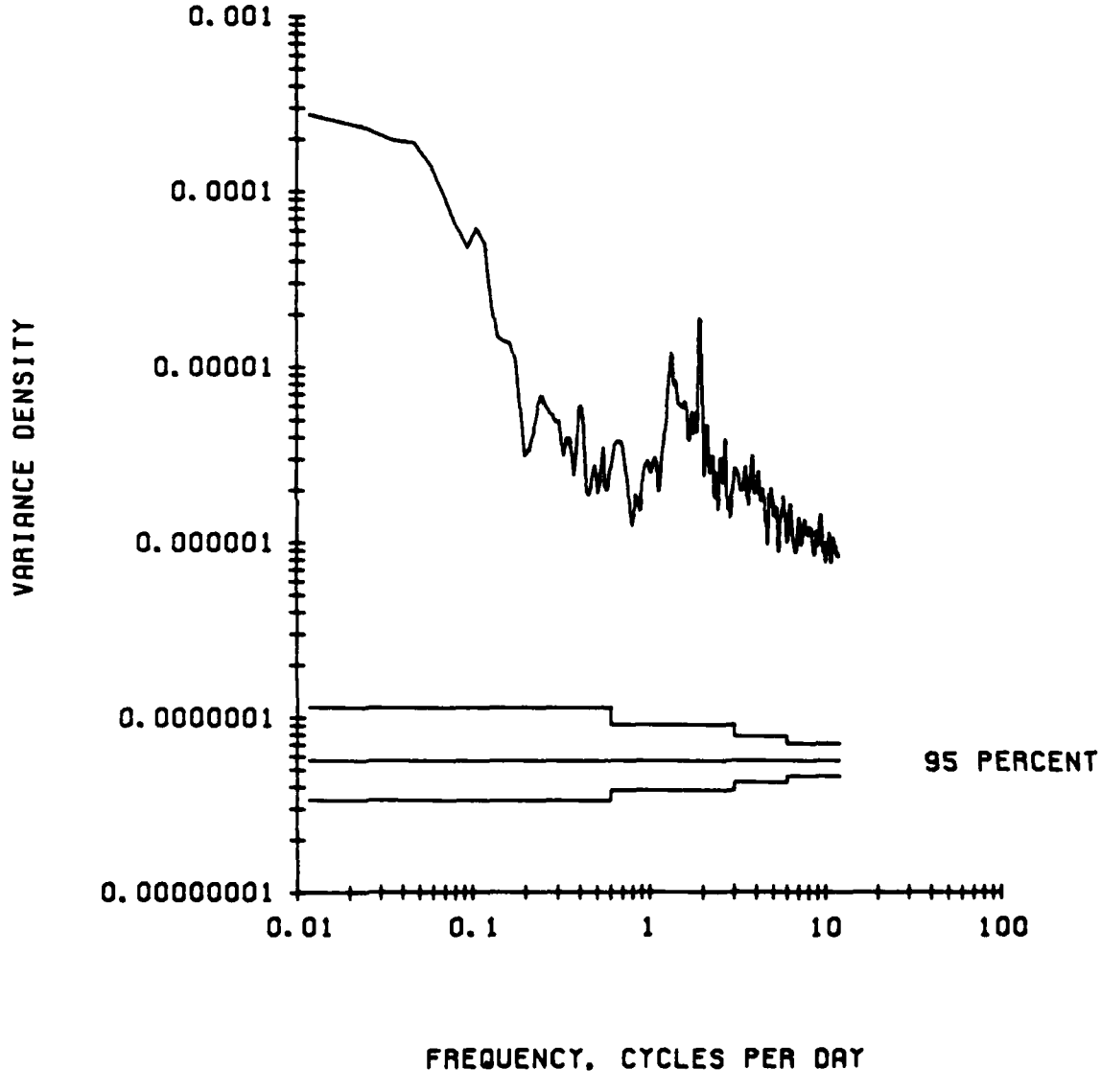
UNFILTERED TEMPERATURE. 800 M AT M-2.



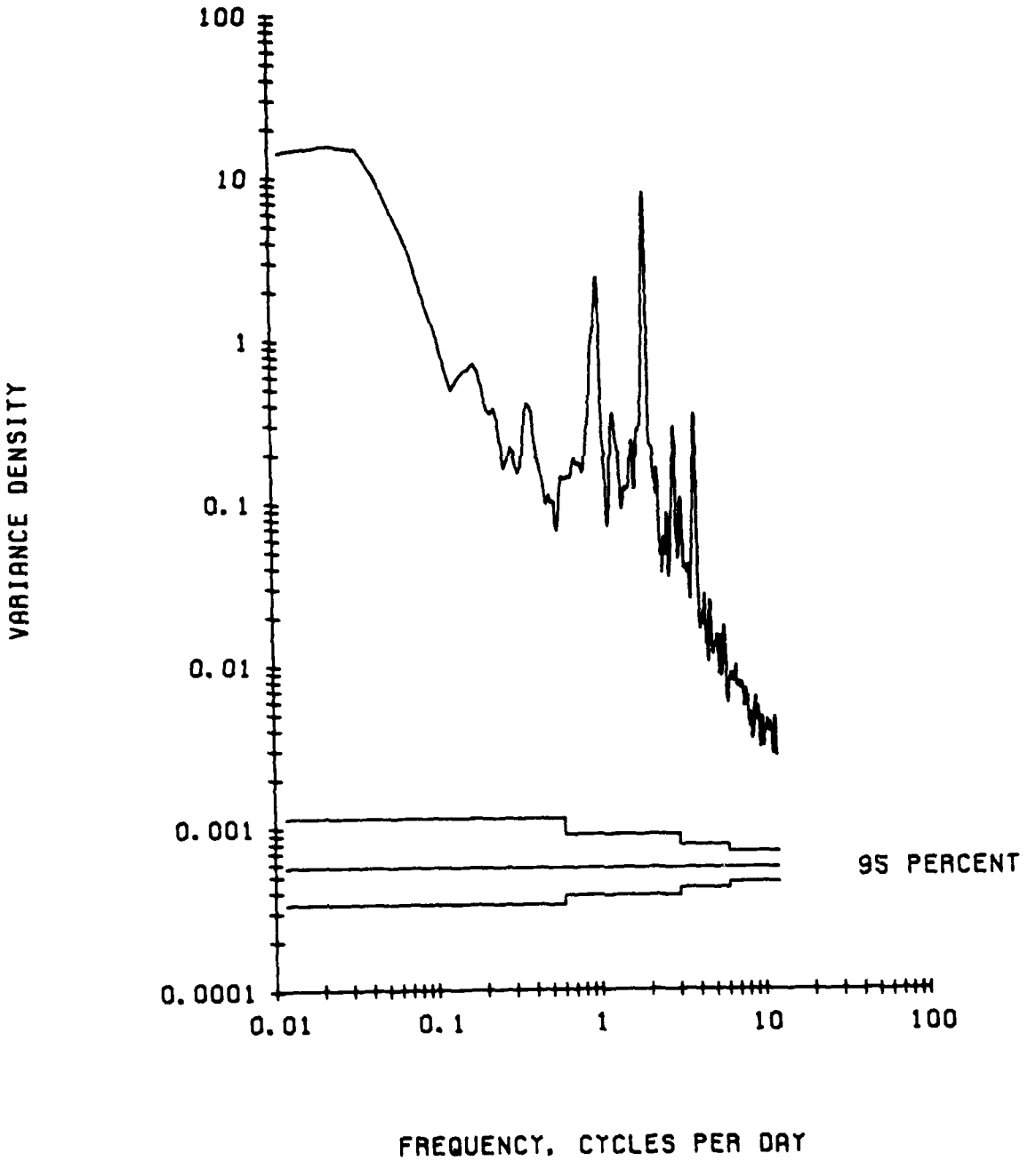
UNFILTERED TEMPERATURE. 1190 M AT M-2.



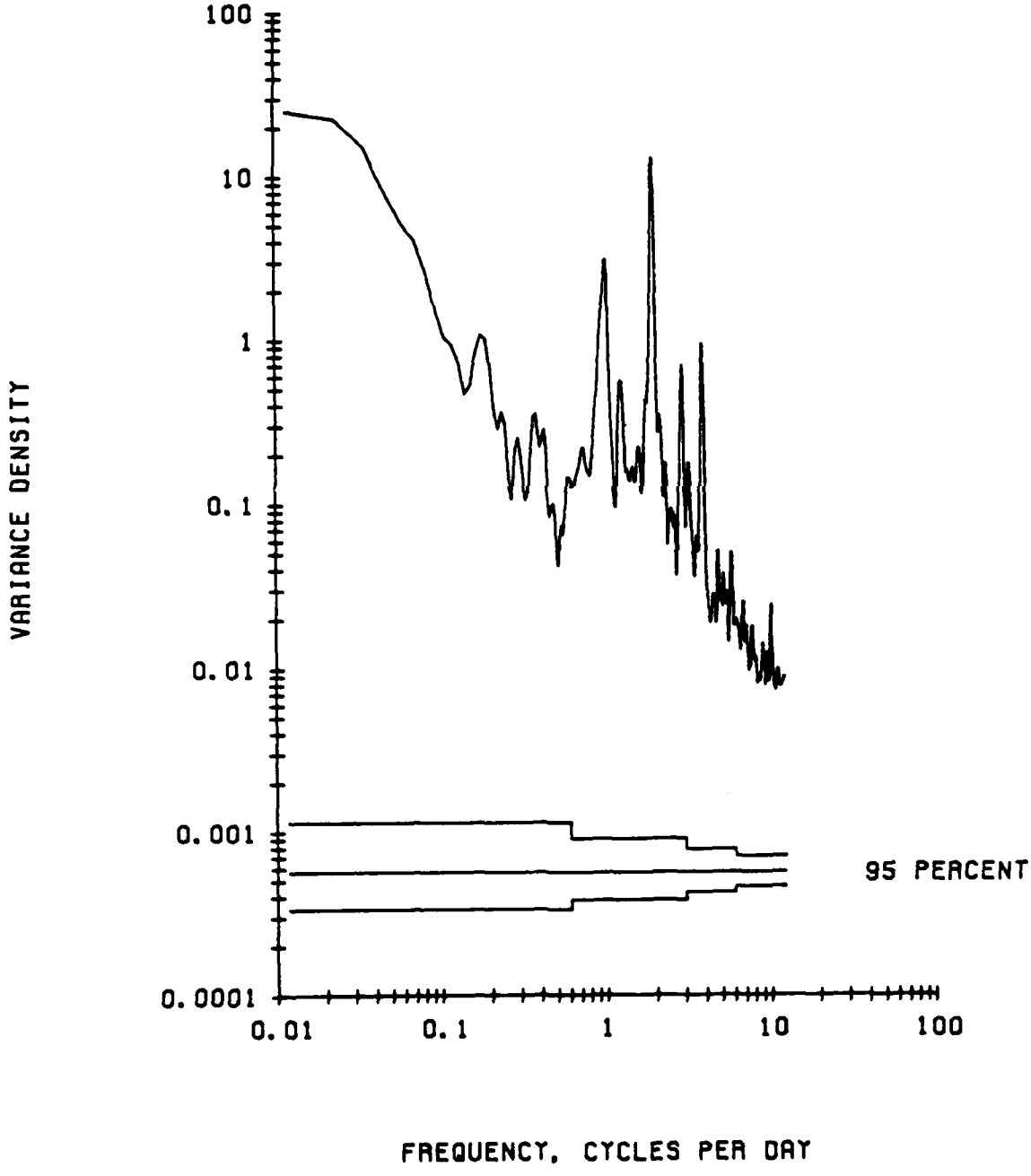
UNFILTERED TEMPERATURE. 3557 M AT M-2.



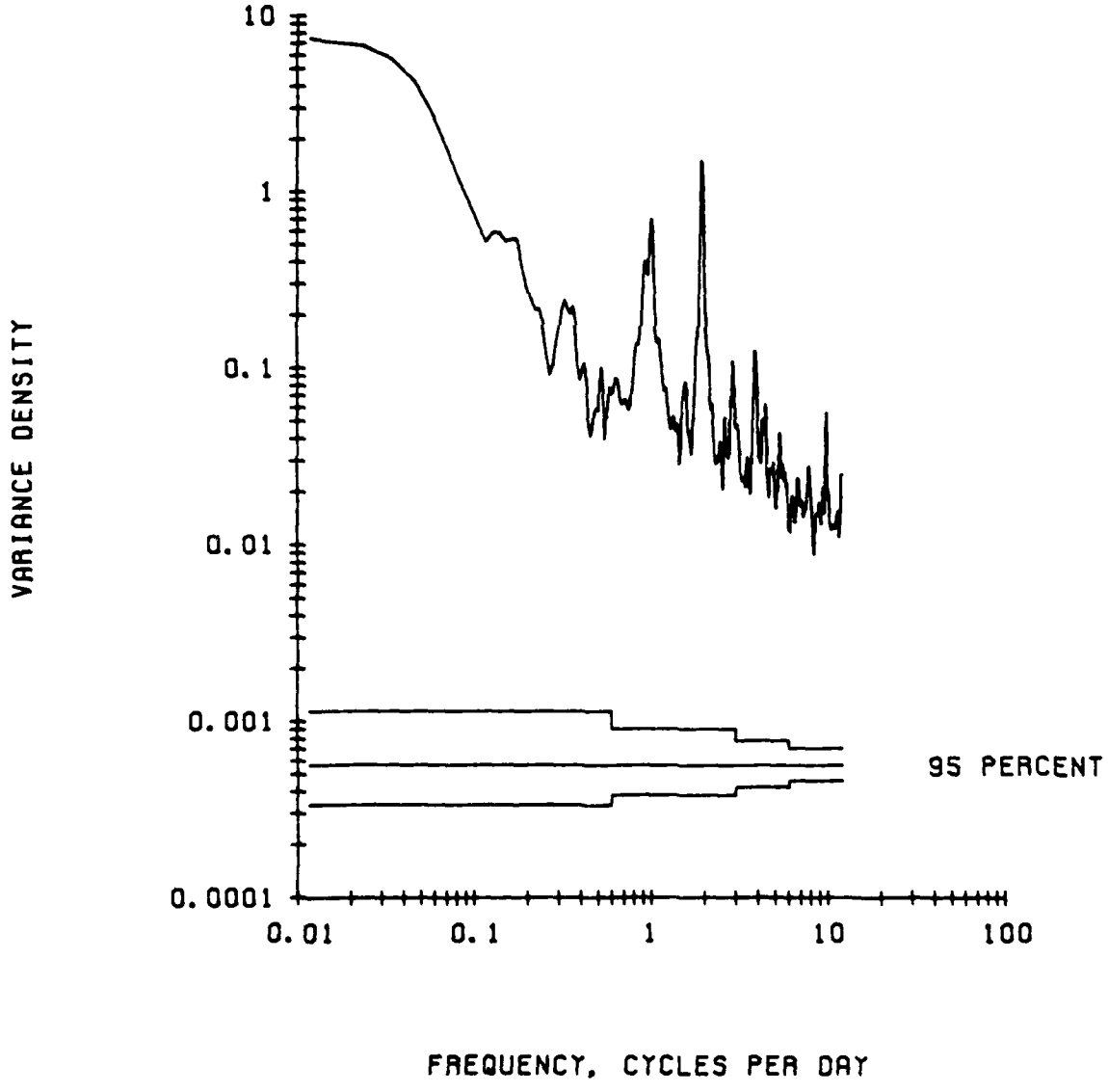
UNFILTERED PRESSURE. 145 M AT M-2.

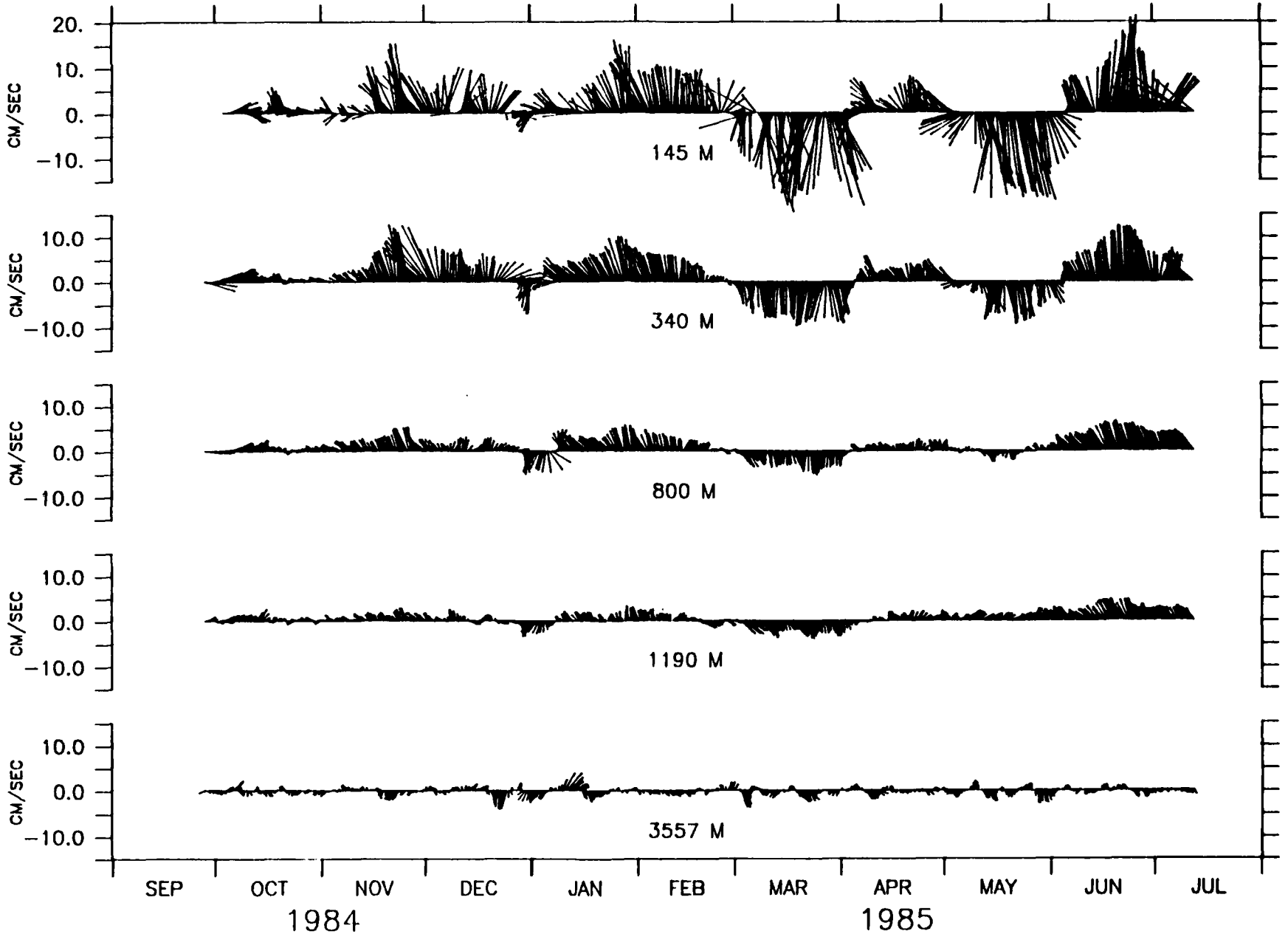


UNFILTERED PRESSURE. 340 M AT M-2.

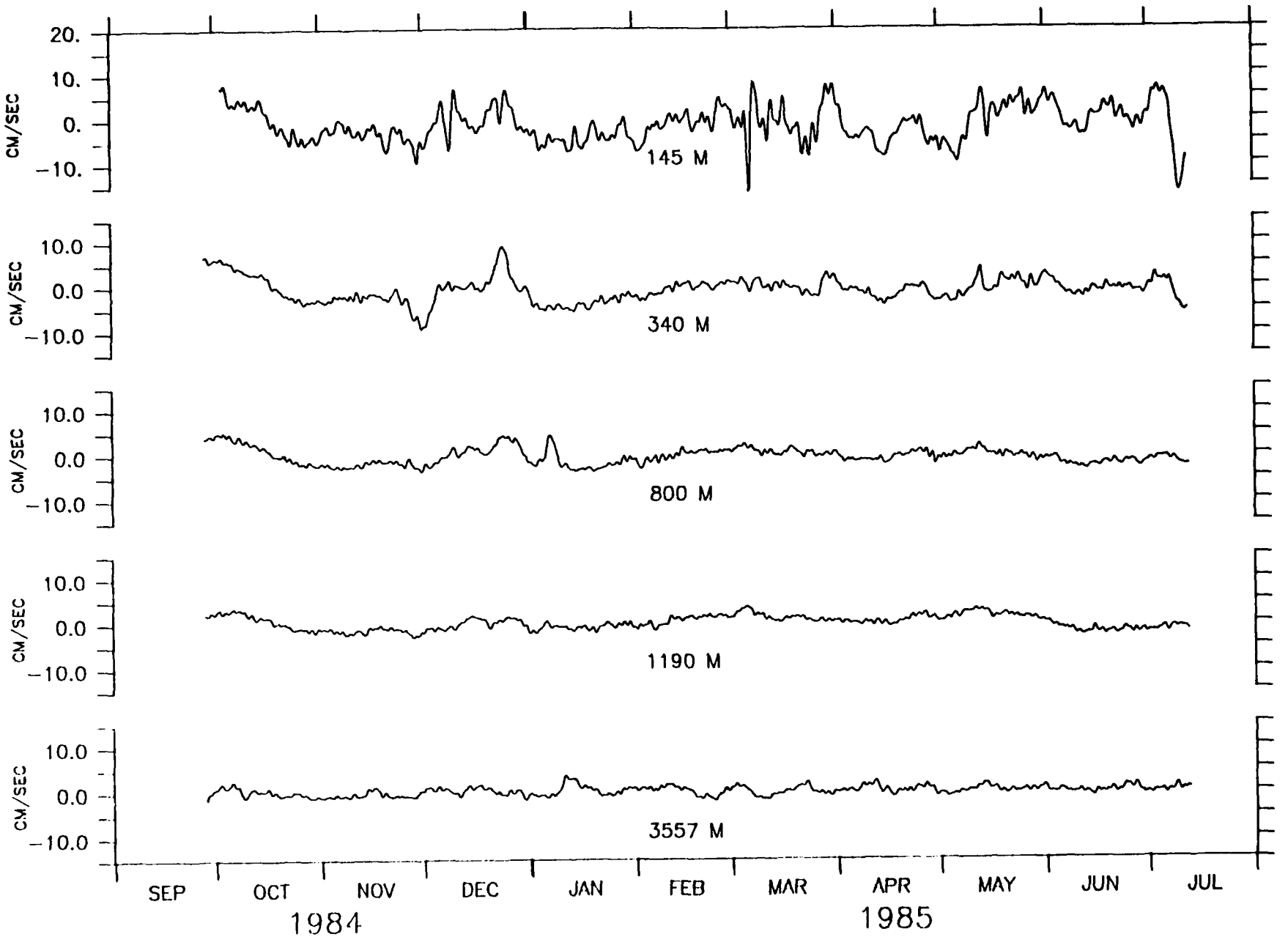


UNFILTERED PRESSURE. 1190 M AT M-2.

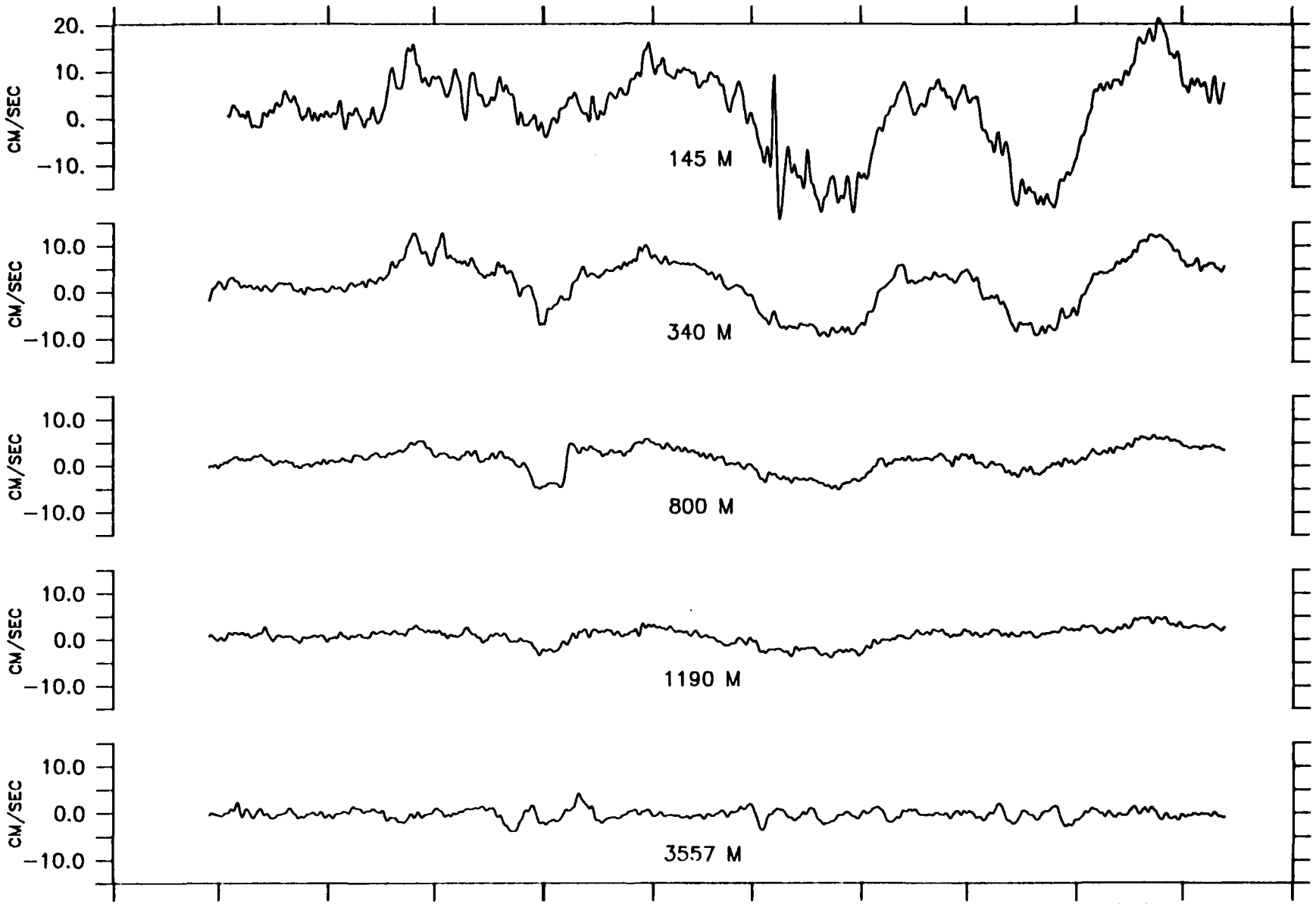




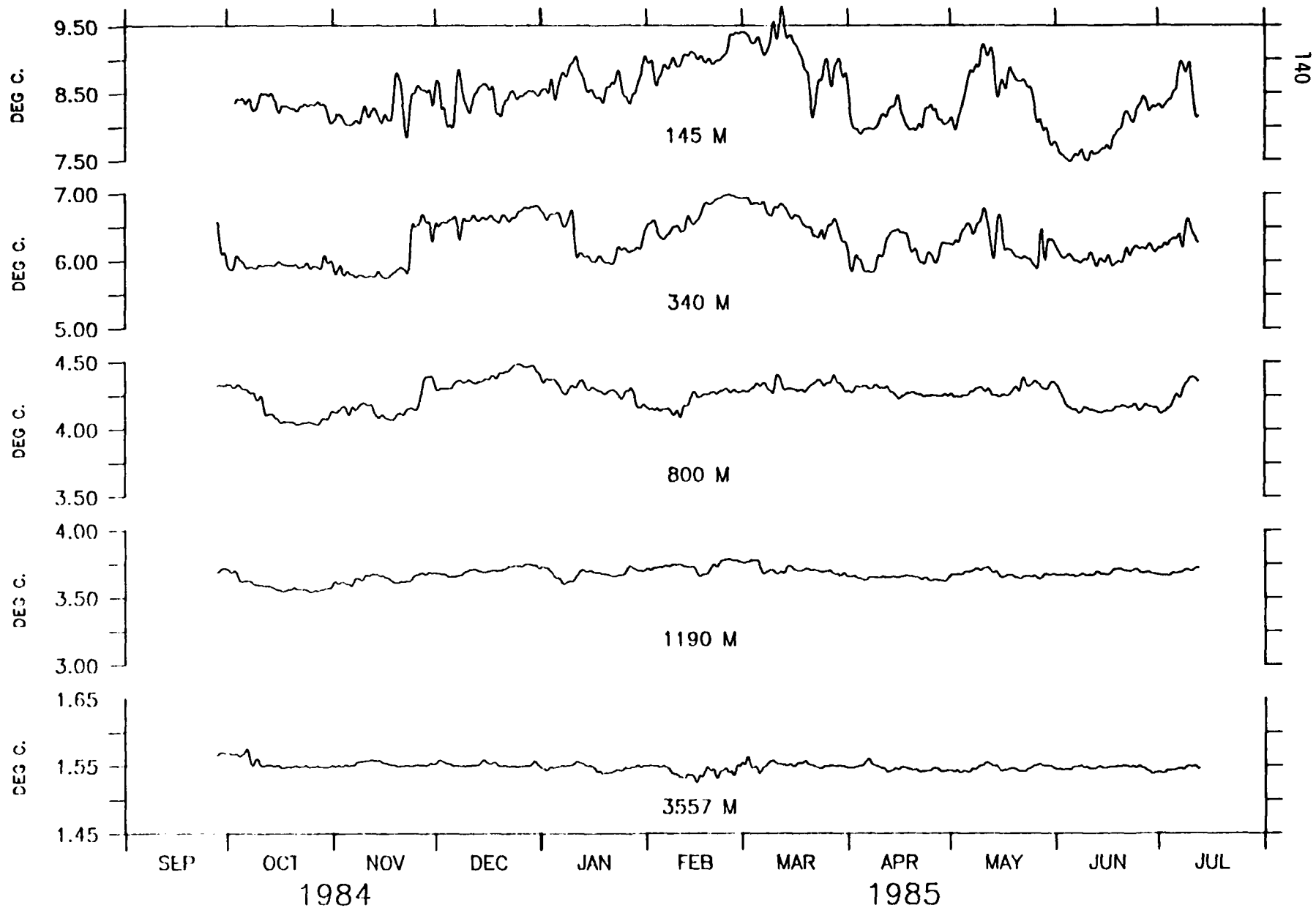
VELOCITY VECTORS, M−2.



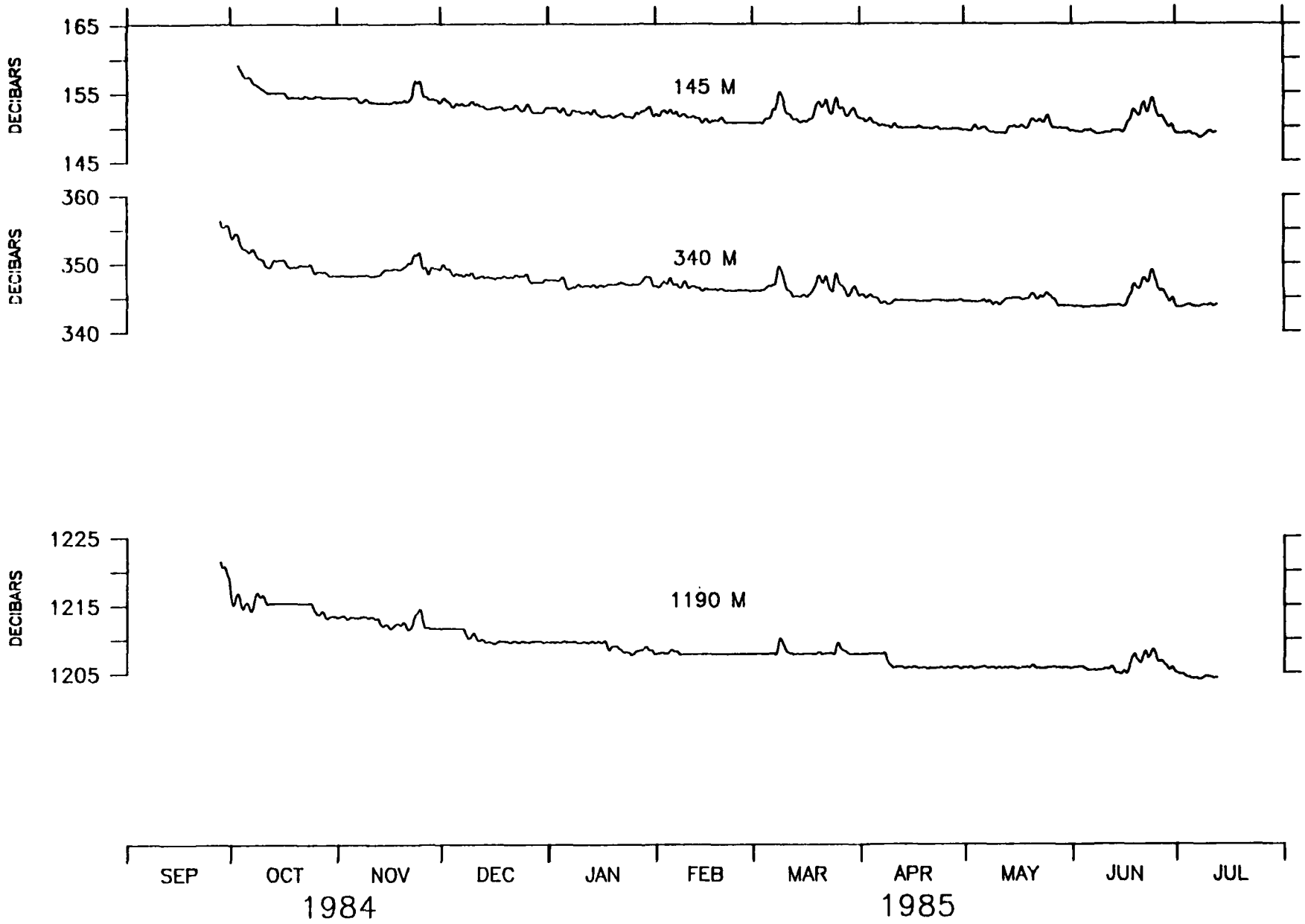
U COMPONENT, M-2.



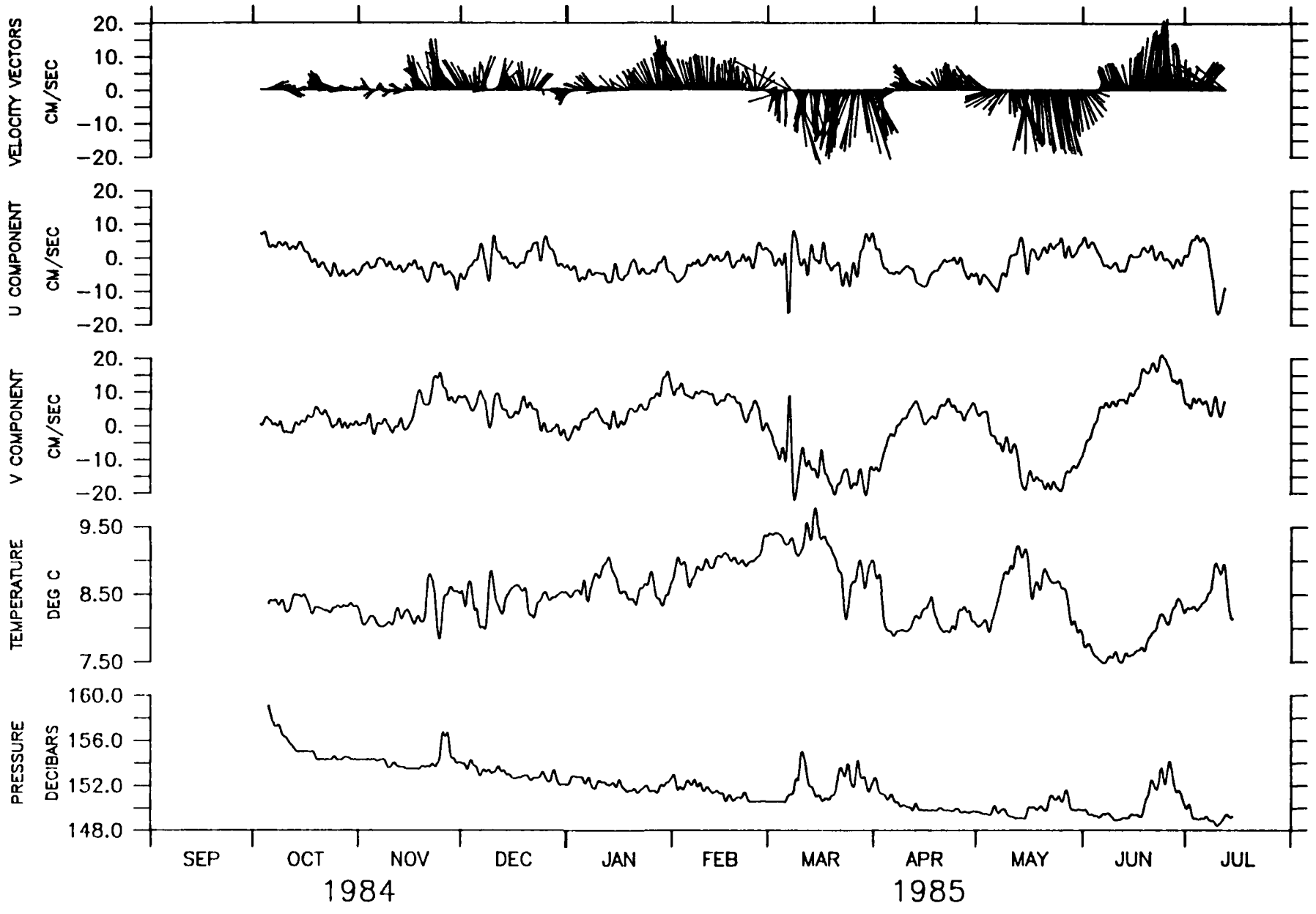
V COMPONENT, M−2.



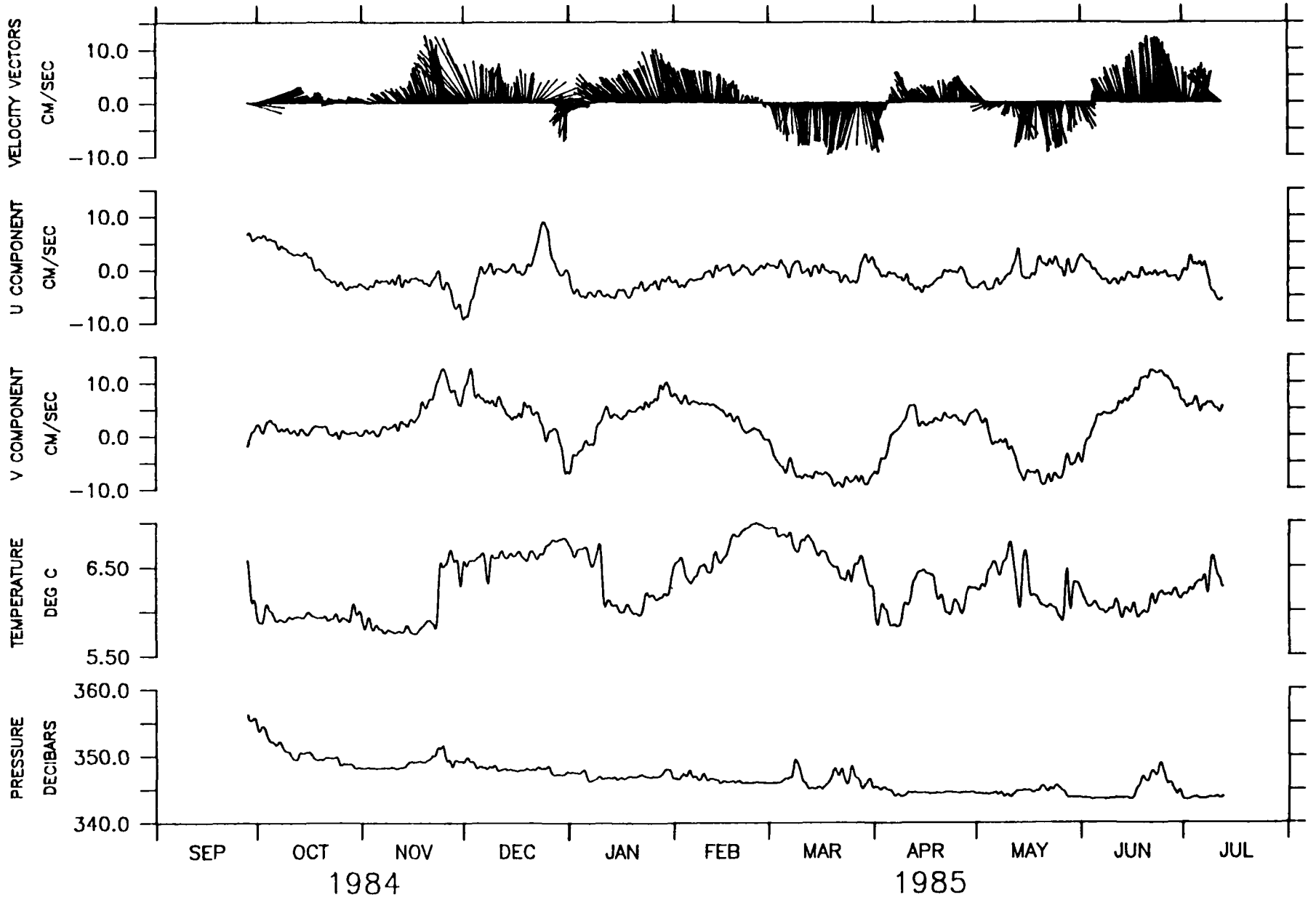
TEMPERATURE M-2.


165
155
145
DECIBARS
145 M
360
350
340
DECIBARS
340 M
1225
1215
1205
DECIBARS
1190 M
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
1984
1985

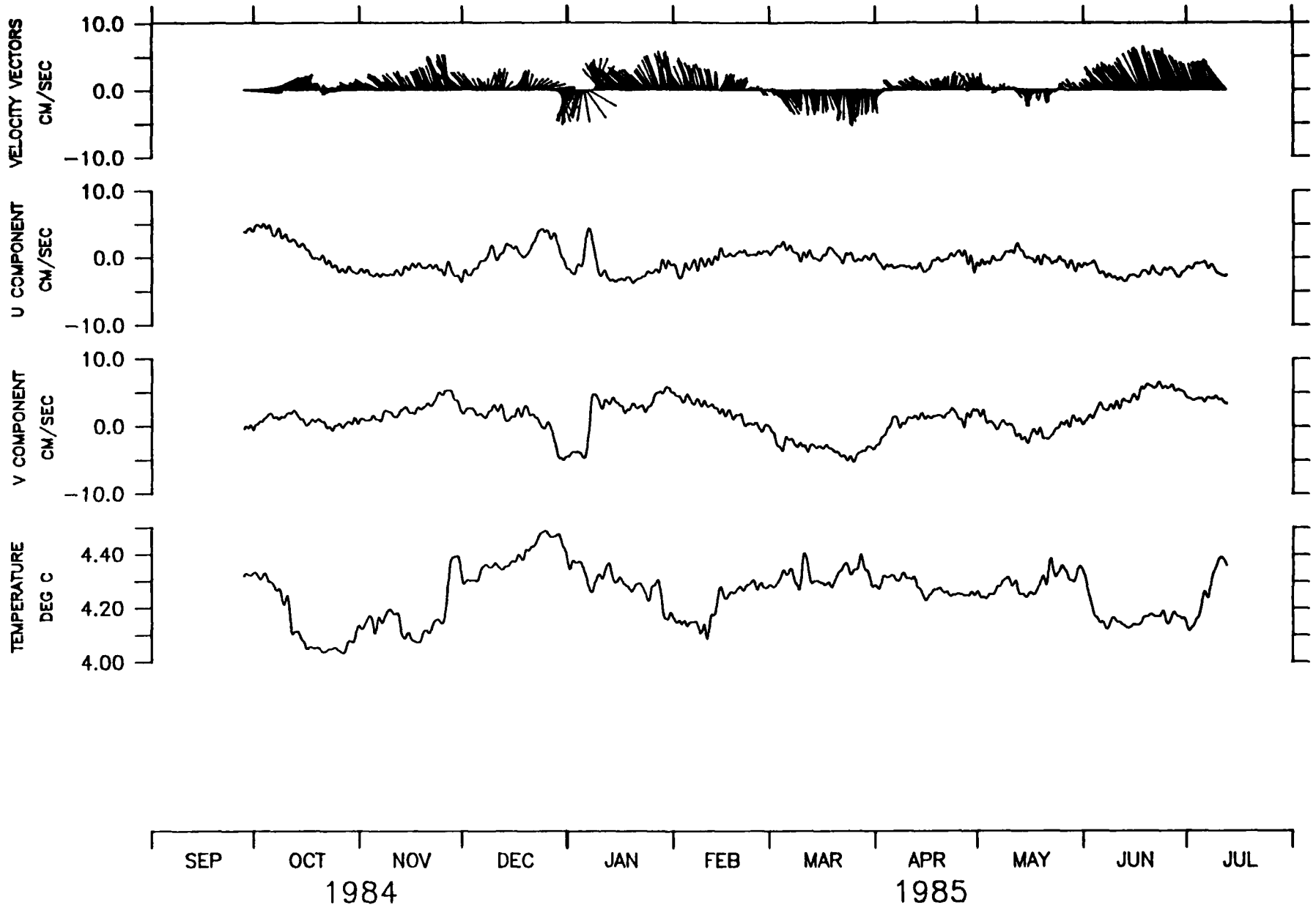
PRESSURE M-2.



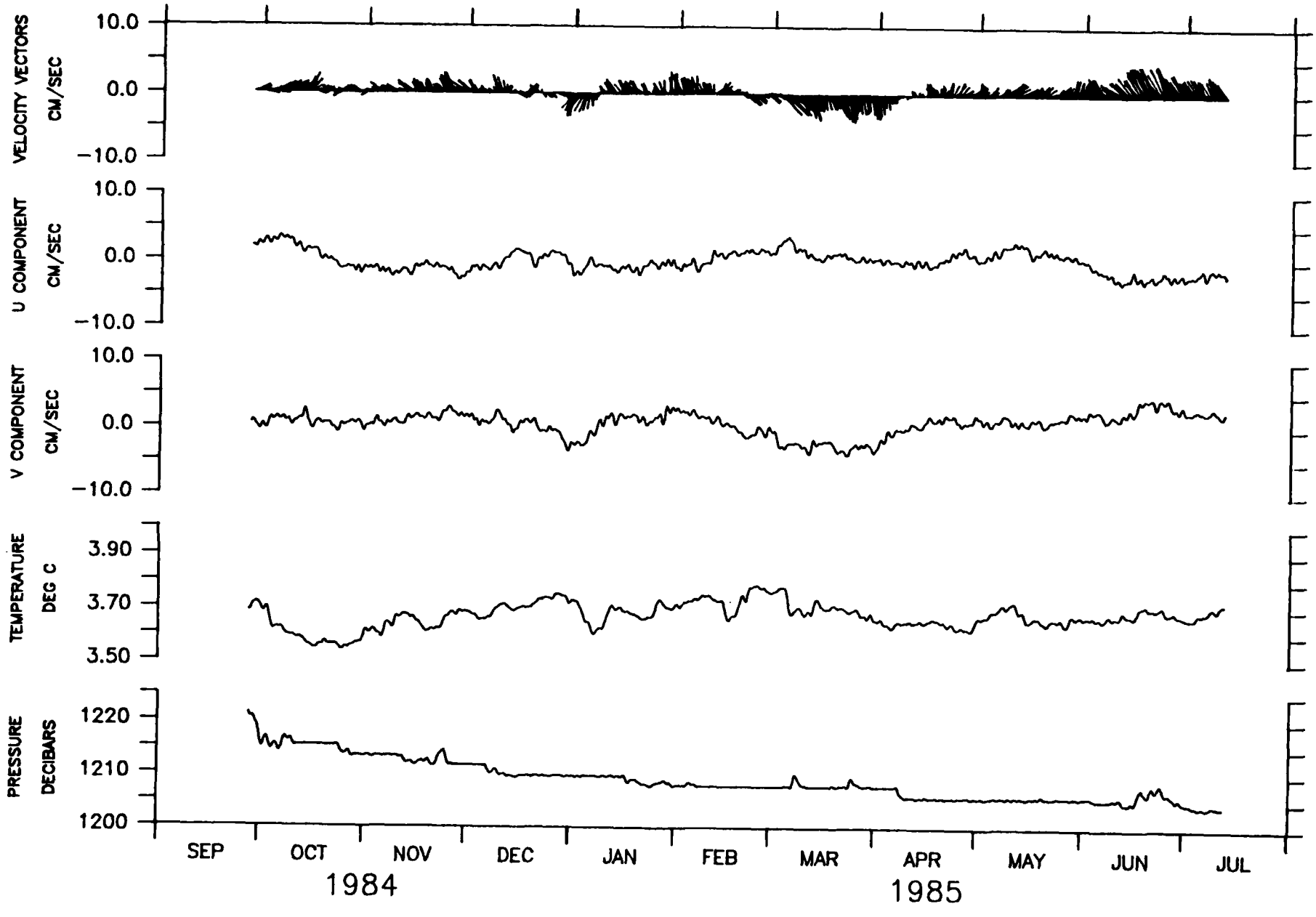
145 M AT OPTOMA MOORING M-2.



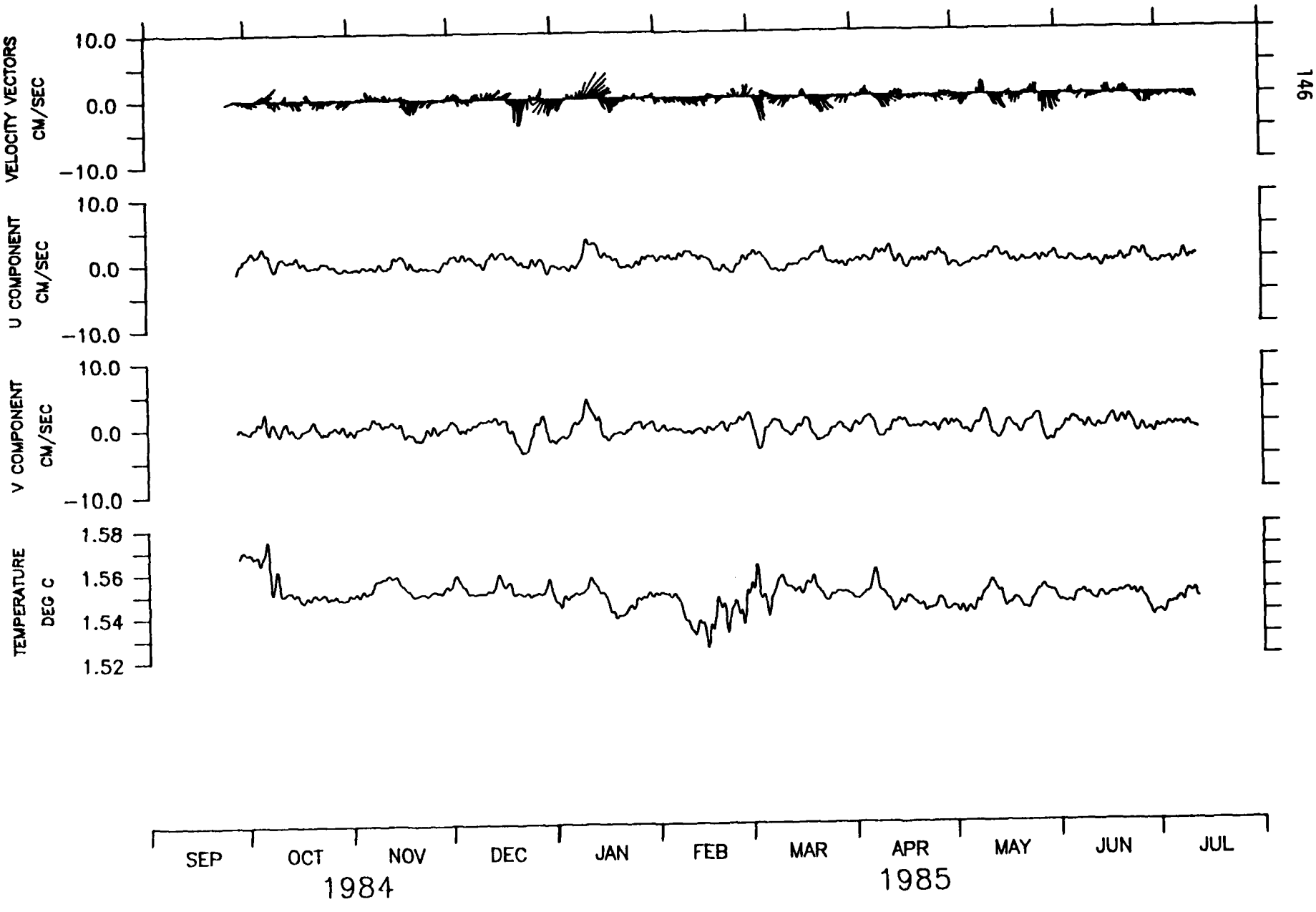
340 M AT OPTOMA MOORING M−2.



800 M AT OPTOMA MOORING M-2.

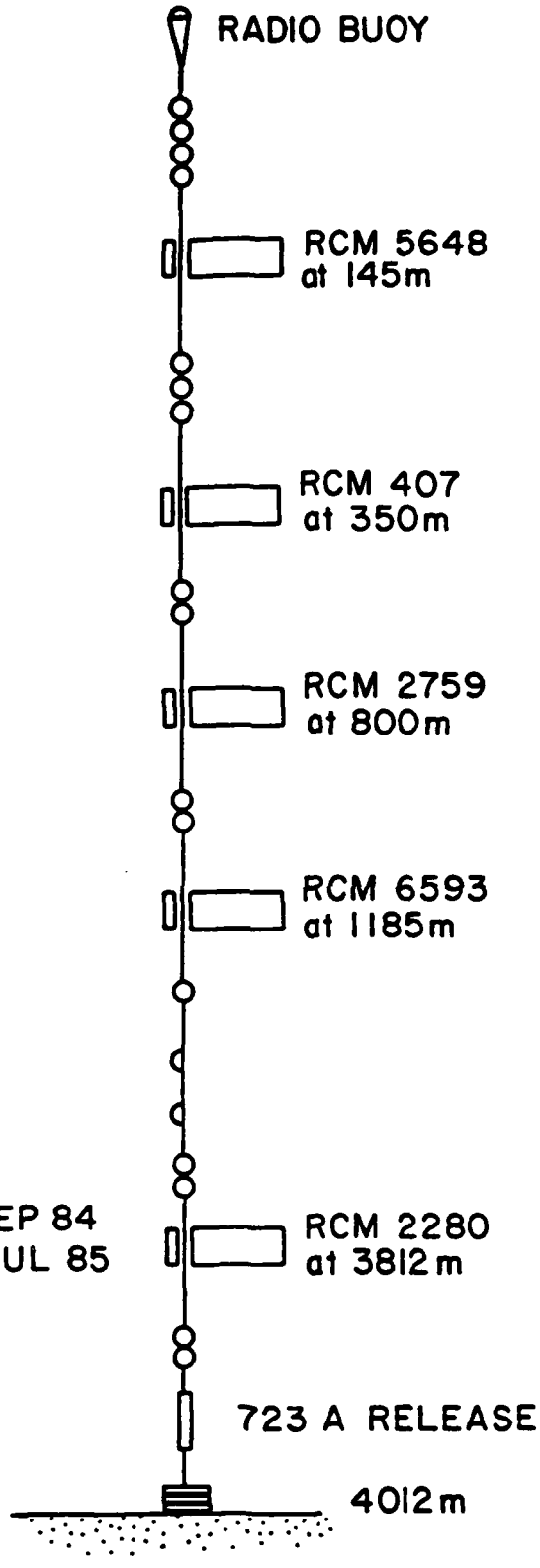


1190 M AT OPTOMA MOORING M-2.



3557 M AT OPTOMA MOORING M-2.

Mooring M-3



MOORING M-3
38° 12.52' N
125°35.05'W

INSTALLED: 26 SEP 84
RECOVERED: 15 JUL 85

M-3

Position: 38° 12.52'N, 125° 35.05'W
Depth of Water: 4012 m
Set at: 2301 UCT 26 SEP 84 by R/V WECOMA
Retrieved at: 1901 UCT 15 JUL 85 by R/V WECOMA
Data Interval: 0348 UCT 27 SEP 84 to 1848 UCT 15 JUL 85

Instrumentation

Depth	RCM 5 Serial No./Tape No.
145 m	5648/20
350 m	407/13
800 m	2759/19
1185 m	6593/7
3812 m	2280/33

Instrument 5648 recorded speed, direction, temperature, pressure and conductivity. Direction, temperature, pressure, and conductivity were recorded until the instrument was recovered. The speed sensor failed and no speed data were recorded.

Instrument 407 recorded speed, direction, temperature, and pressure. Speed, direction, and temperature were recorded until the instrument was recovered. There is a suspicious section of the temperature record (lines 2544 - 4198, 10 Jan 85 - 20 Mar 85) where some spikes due to instrument errors may still be present. The pressure sensor failed.

Instrument 2759 recorded speed, direction, and temperature until the instrument was recovered. Two sections of the speed record have been bridged: lines 2845 - 2857 (1650 23 Jan 85 - 0450 24 Jan 85, and lines 6711 - 6748 (1850 3 Jul 85 - 0240 5 Jul 85).

Instrument 6593 recorded speed, direction, temperature, and pressure until the instrument was recovered. Three sections of the speed record have been bridged:
Lines 2180 - 2244 (2244 26 Dec 84 - 1244 01 Jan 85);
Lines 3504 - 3509 (0244 20 Feb 85 - 0744 20 Feb 85);
Lines 4216 - 4226 (1844 21 Mar 85 - 0444 22 Mar 85)
In each case the speed channel abruptly went to zero..

Instrument 2280 recorded speed, direction, and temperature until 2340 UCT 9 MAR 85 when sticking encoder pins created data that was unusable.

145 M AT M-3. 27 Sep 84 - 15 Jul 85. Tape 5648/20.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
T(°C)	8.63	0.56	0.46	2.31	7.38	10.07	6999
P(db)	149.65	3.84	1.78	7.18	144.80	179.00	6999
C(mmho/cm)	35.07	0.36	-0.38	3.16	33.91	36.03	6999

LLP FILTERED STATISTICS. 145 M AT M-3. TAPE 5648/20

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
T(°C)	8.64	0.54	0.48	2.27	7.49	9.73	1158
P(db)	149.63	3.13	0.94	3.06	145.46	161.05	1158
C(mmho/cm)	35.07	0.34	-0.46	3.38	34.03	35.78	1158

350 M AT M-3. 27 SEP 84 - 15 JUL 85. TAPE 407/13.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	8.13	4.21	0.65	3.14	0.80	27.70	7000
U(cm/sec)	-3.56	5.81	0.01	2.92	-23.00	19.00	7000
V(cm/sec)	-0.66	6.08	0.21	3.23	-19.00	27.00	7000
T(°C)	6.33	0.39	0.49	2.33	5.52	7.47	7000

EDDY KE =	35.36	(cm^2/sec^2)
HEAT FLUX U =	-0.11	(°C/cm/sec)
HEAT FLUX V =	0.03	(°C cm/sec)
MOMENTUM FLUX =	-1.72	(cm^2/sec^2)

LLP FILTERED STATISTICS. 350 M AT M-3. TAPE 407/13.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-3.58	4.62	0.05	2.35	-13.70	6.94	1158
V(cm/sec)	-0.67	4.28	-0.01	2.40	-11.47	10.19	1158
T(°C)	6.33	0.37	0.47	2.26	5.74	7.17	1158

BEGINNING TIME 0600 28 9 84 ENDING TIME 1200 14 7 85

MEAN U = -0.3578D+01	MEAN U*V = -0.1315D+01
MEAN V = -0.6721D+00	MEAN U*U = 0.2135D+02
PRIN. AXIS (DEG.)=0.1595D+03	MEAN V*V = 0.1832D+02

800 M AT M-3. 27 SEP 84 - 15 JUL 85. TAPE 2759/19.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	6.34	3.15	1.06	4.83	0.80	22.30	6999
U(cm/sec)	-2.39	4.63	-0.11	3.44	-20.90	14.60	6999
V(cm/sec)	-0.15	4.78	-0.05	2.91	-20.10	17.40	6999
T(°C)	4.26	0.13	0.70	3.28	3.96	4.66	6999

EDDY KE =	22.16	(cm^2/sec^2)
HEAT FLUX U =	-0.05	(°C cm/sec)
HEAT FLUX V =	0.01	(°C cm/sec)
MOMENTUM FLUX =	-3.40	(cm^2/sec^2)

LLP FILTERED STATISTICS. 800 M AT M-3. TAPE 2759/19.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-2.40	3.44	-0.56	3.93	-13.50	4.64	1158
V(cm/sec)	-0.16	2.31	0.14	2.51	-6.15	5.74	1158
T(°C)	4.26	0.12	0.78	3.30	4.02	4.58	1158

BEGINNING TIME 0600 28 9 84 ENDING TIME 1200 14 7 85

MEAN U = -0.2399D+01	MEAN U*V = -0.1884D+01
MEAN V = -0.1556D+00	MEAN U*U = 0.1187D+02
PRIN. AXIS (DEG.)=0.1650D+03	MEAN V*V = 0.5324D+01

1185 M AT M-3. 27 SEP 84 - 15 JUL 85. TAPE 6593/7.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	5.76	2.88	1.28	5.94	0.80	23.20	7000
U(cm/sec)	-1.66	3.95	-0.34	3.99	-21.10	11.70	7000
V(cm/sec)	-0.82	4.73	0.05	3.01	-16.80	17.80	7000
T(°C)	3.25	0.08	0.10	2.37	3.05	3.49	7000
P(db)	1202.18	3.90	1.06	4.56	1196.40	1228.70	7000

EDDY KE =	18.99	(cm^2/sec^2)
HEAT FLUX U =	0.02	(°C cm/sec)
HEAT FLUX V =	0.06	(°C cm/sec)
MOMENTUM FLUX =	-3.67	(cm^2/sec^2)

LLP STATISTICS. 1185 M AT M-3. TAPE 6593/7.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-1.68	2.66	-0.42	3.46	-9.65	4.20	1158
V(cm/sec)	-0.83	2.48	-0.44	3.24	-7.46	5.95	1158
T(°C)	3.25	0.08	0.10	2.25	3.10	3.41	1158
P(db)	1202.16	3.57	0.57	2.17	1196.39	1212.57	1158

BEGINNING TIME 0600 28 9 84
MEAN U = -0.1677D+01
MEAN V = -0.8264D+00
PRIN. AXIS (DEG.)=0.1467D+03

ENDING TIME 1200 14 7 85
MEAN U*V = -0.1059D+01
MEAN U*U = 0.7089D+01
MEAN V*V = 0.6168D+01

3812 M AT M-3. 27 SEP 84 - 9 MAR 85. TAPE 2280/33.

	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
S(cm/sec)	4.52	2.58	0.62	3.38	0.80	16.10	3933
U(cm/sec)	-0.18	3.07	-0.14	2.97	-13.80	10.20	3933
V(cm/sec)	0.23	4.19	-0.03	2.74	-12.90	12.90	3933
T(°C)	1.51	0.01	1.09	3.78	1.48	1.54	3933

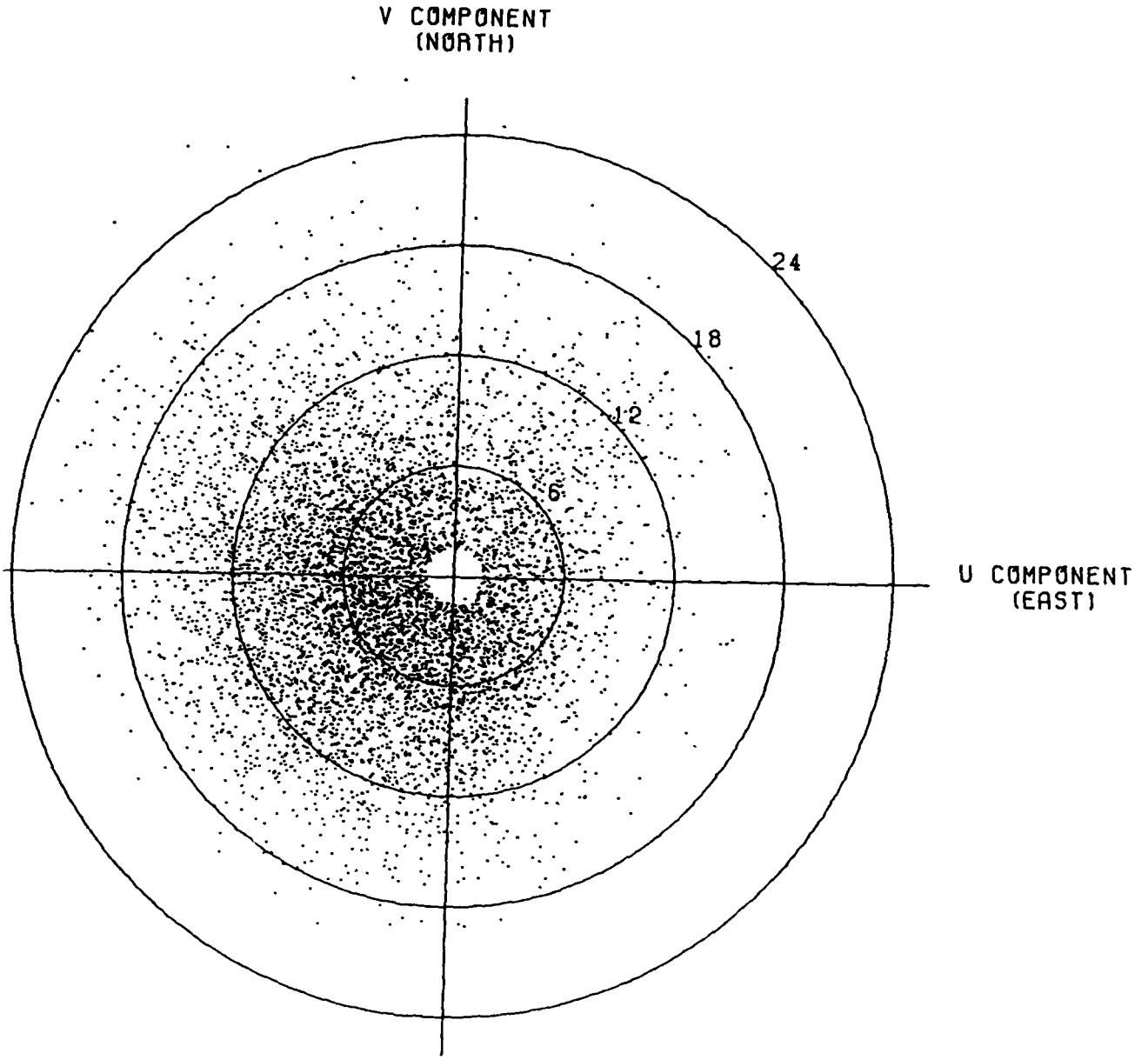
EDDY KE =	13.49	(cm^2/sec^2)
HEAT FLUX U =	0.01	(°C cm/sec)
HEAT FLUX V =	-0.01	(°C cm/sec)
MOMENTUM FLUX =	-6.15	(cm^2/sec^2)

LLP FILTERED STATISTICS. 3812 M AT M-3. TAPE 2280/33.

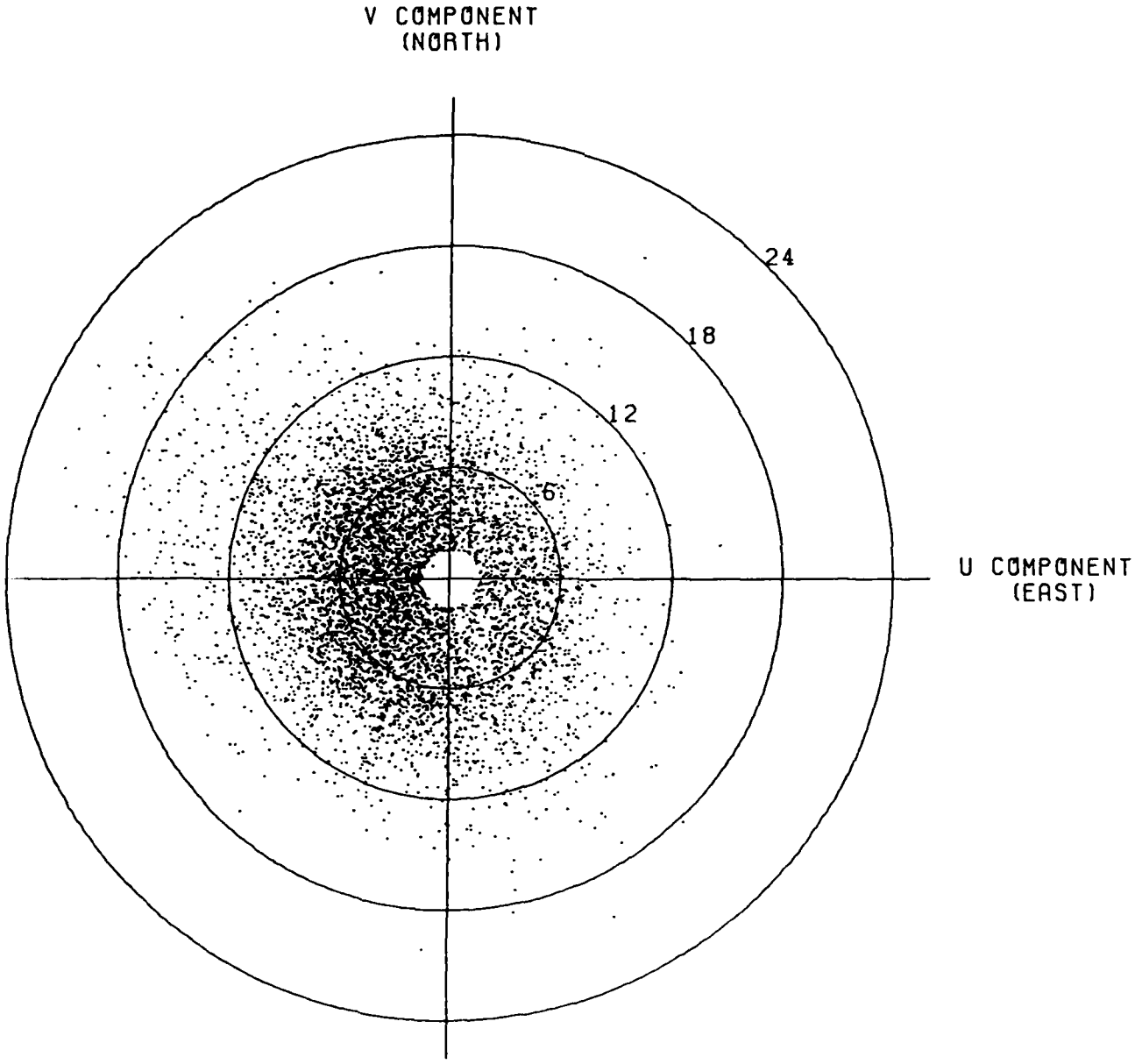
	MEAN	SD	SKEW	KURT	MIN	MAX	LENGTH
U(cm/sec)	-0.18	2.21	0.28	2.60	-5.45	5.73	647
V(cm/sec)	0.26	3.23	-0.48	2.71	-7.99	6.43	647
T(°C)	1.51	0.01	1.27	3.99	1.49	1.54	647

BEGINNING TIME 0600 28 9 84
MEAN U = -0.1786D+00
MEAN V = 0.2590D+00
PRIN. AXIS (DEG.)=0.1184D+03

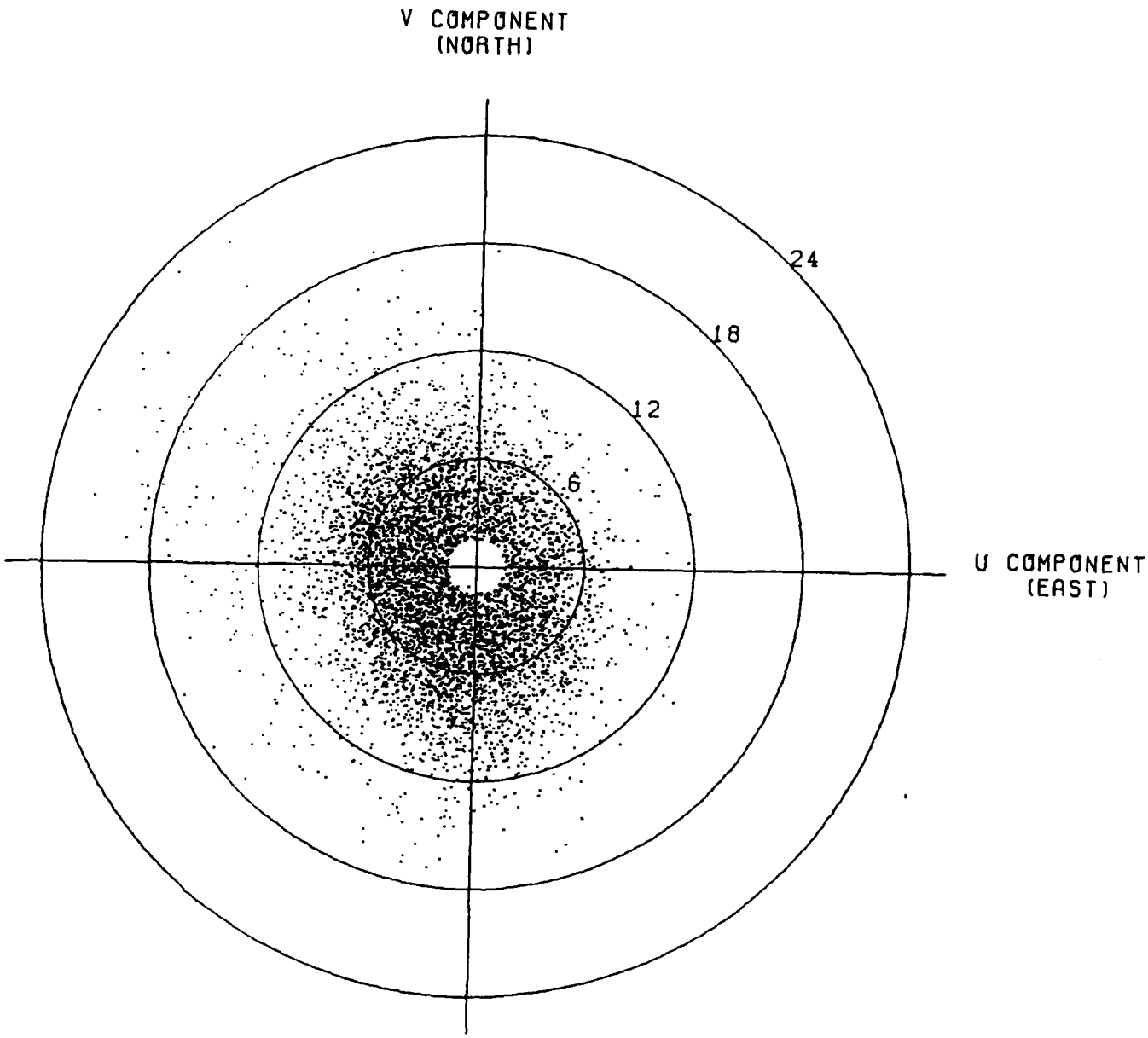
ENDING TIME 1800 8 3 85
MEAN U*V = -0.4274D+01
MEAN U*U = 0.4865D+01
MEAN V*V = 0.1044D+02



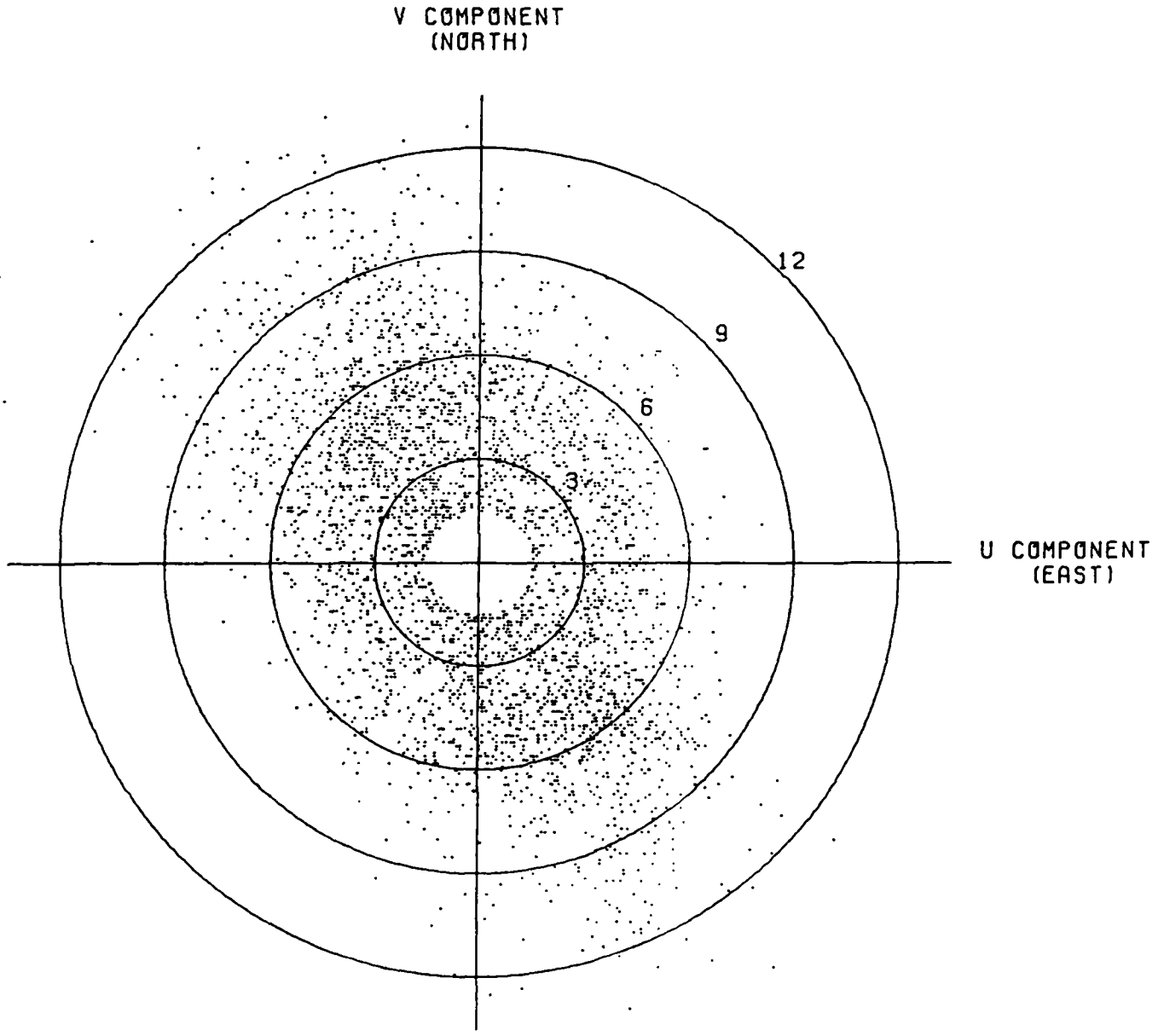
UNFILTERED CURRENT. 350 M AT M-3. TAPE 407/13.



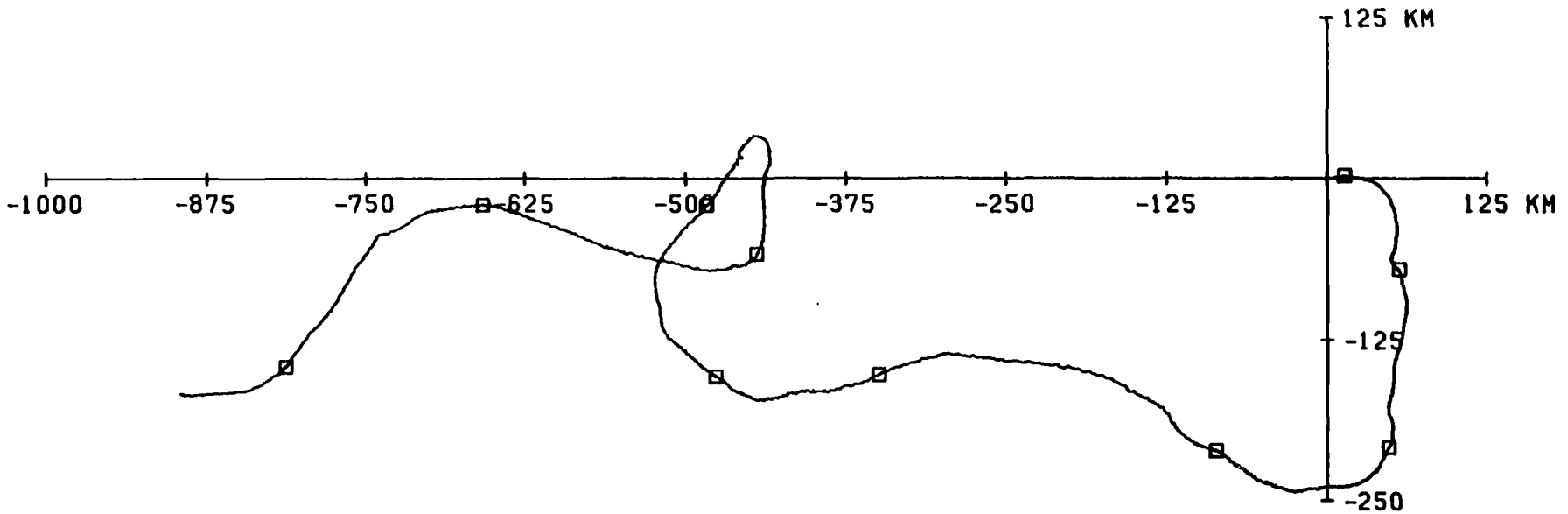
UNFILTERED CURRENT. 800 M AT M-3. TAPE 2759/19.



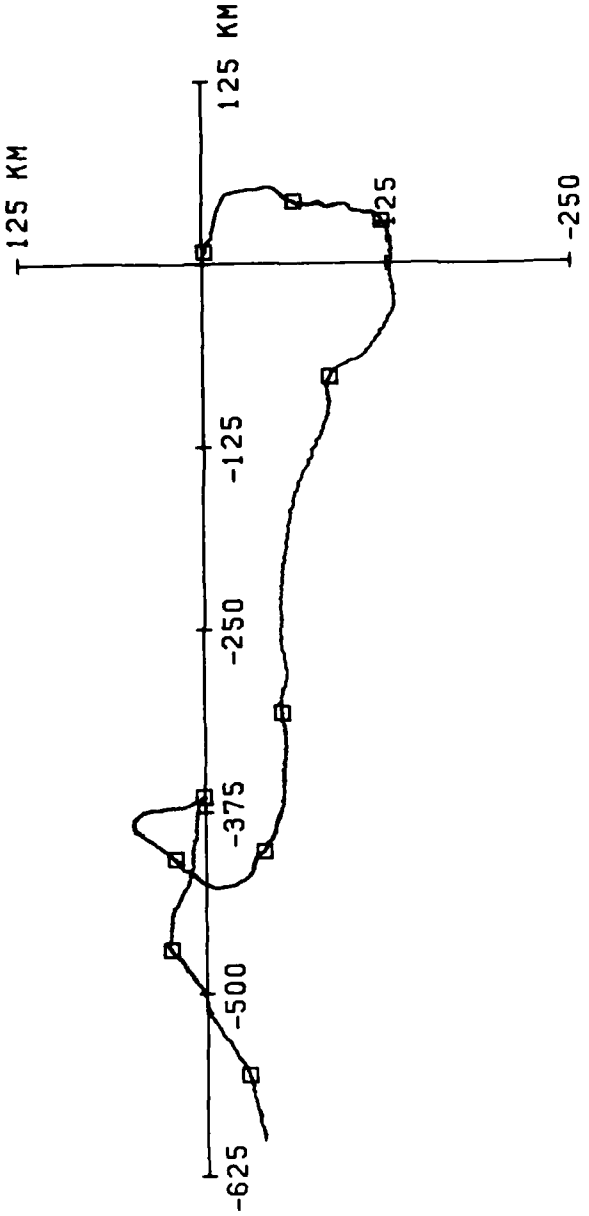
UNFILTERED CURRENT. 1185 M AT M-3. TAPE 6593/7.



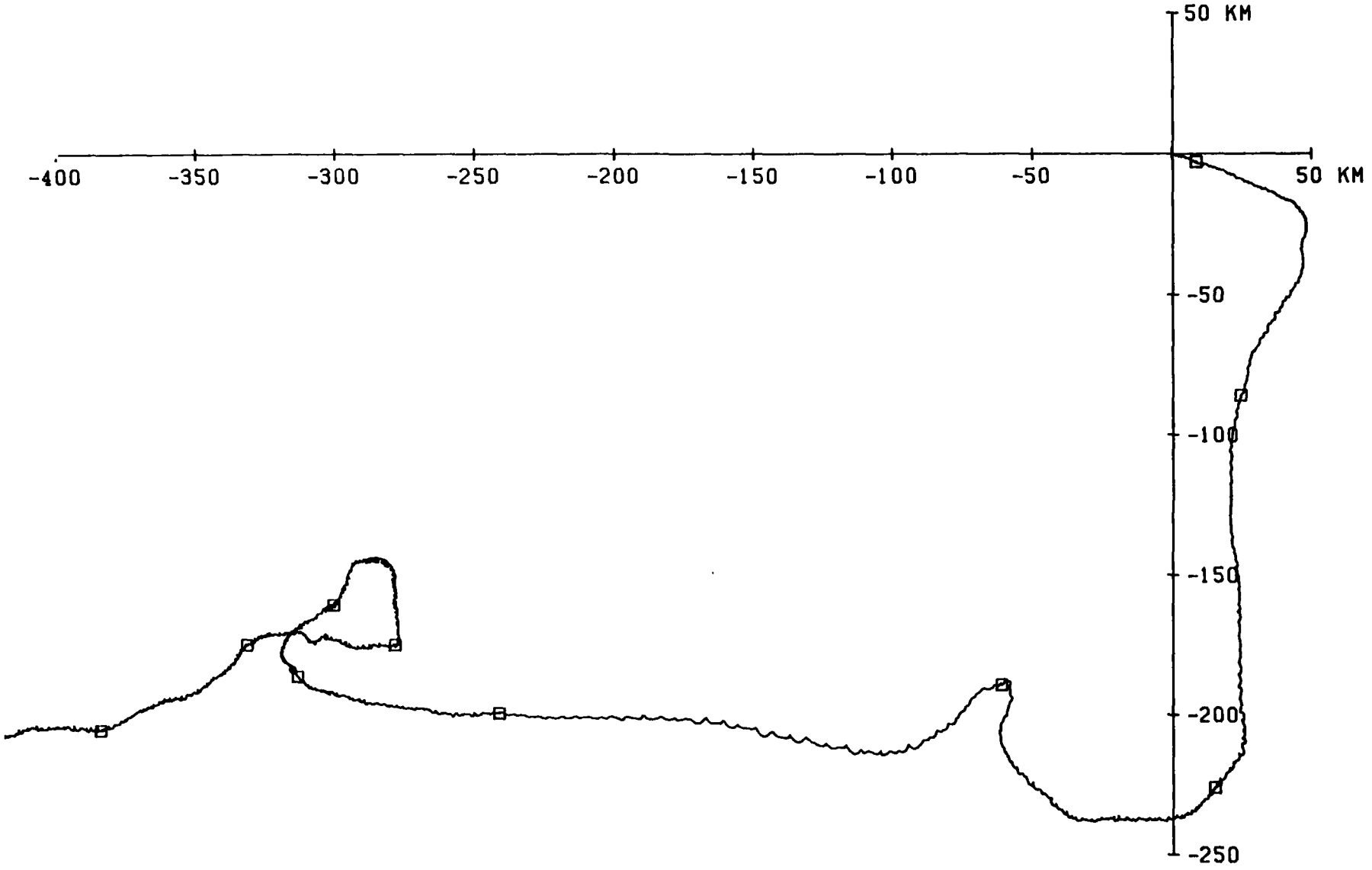
UNFILTERED CURRENT. 3812 M AT M-3. TAPE 2280/33.



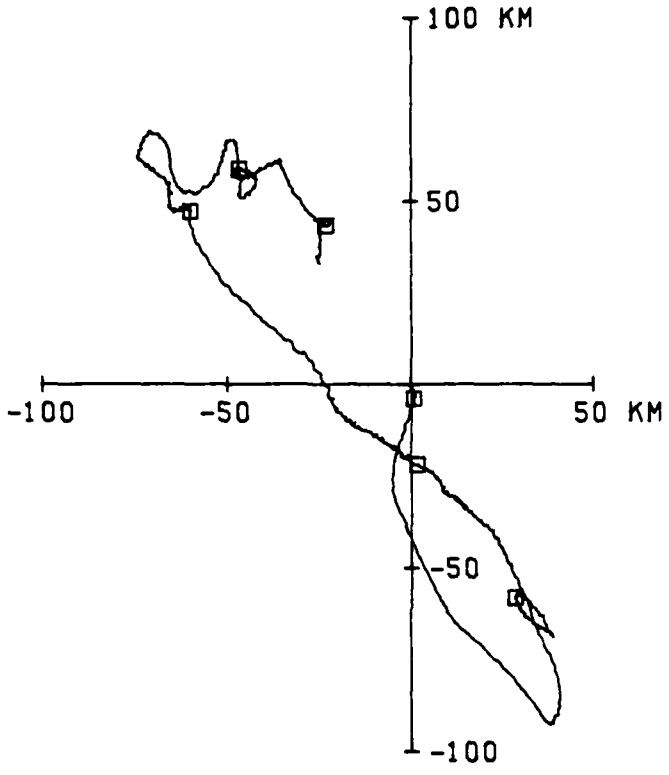
350 M AT M3. 291.6 DAYS STARTING 0348 27 SEP 84.



800 M AT M3. 291.6 DAYS STARTING 0450 27 SEP 84.

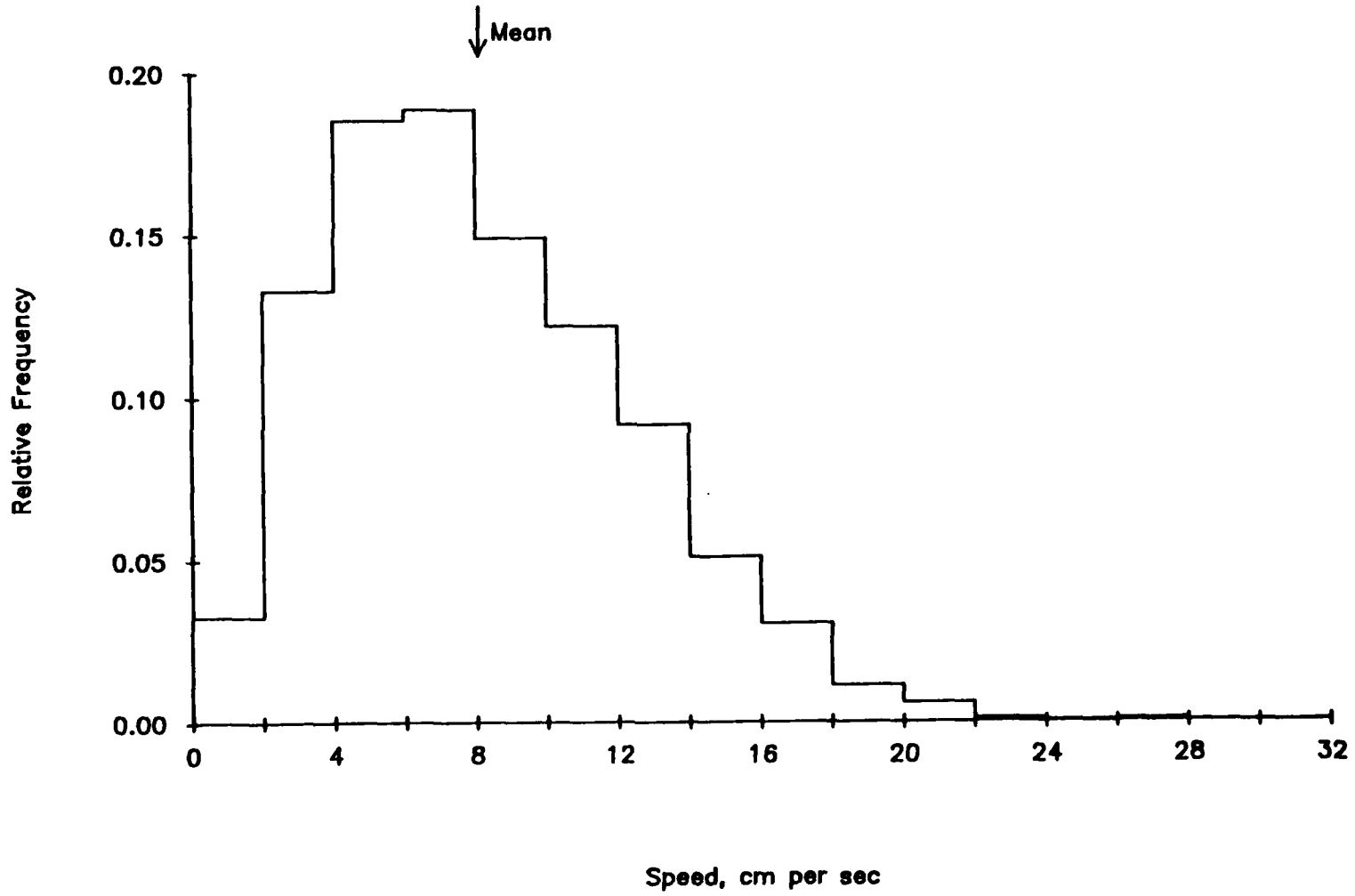


1185 M AT M3. 291.6 DAYS STARTING 0344 27 SEP 84.

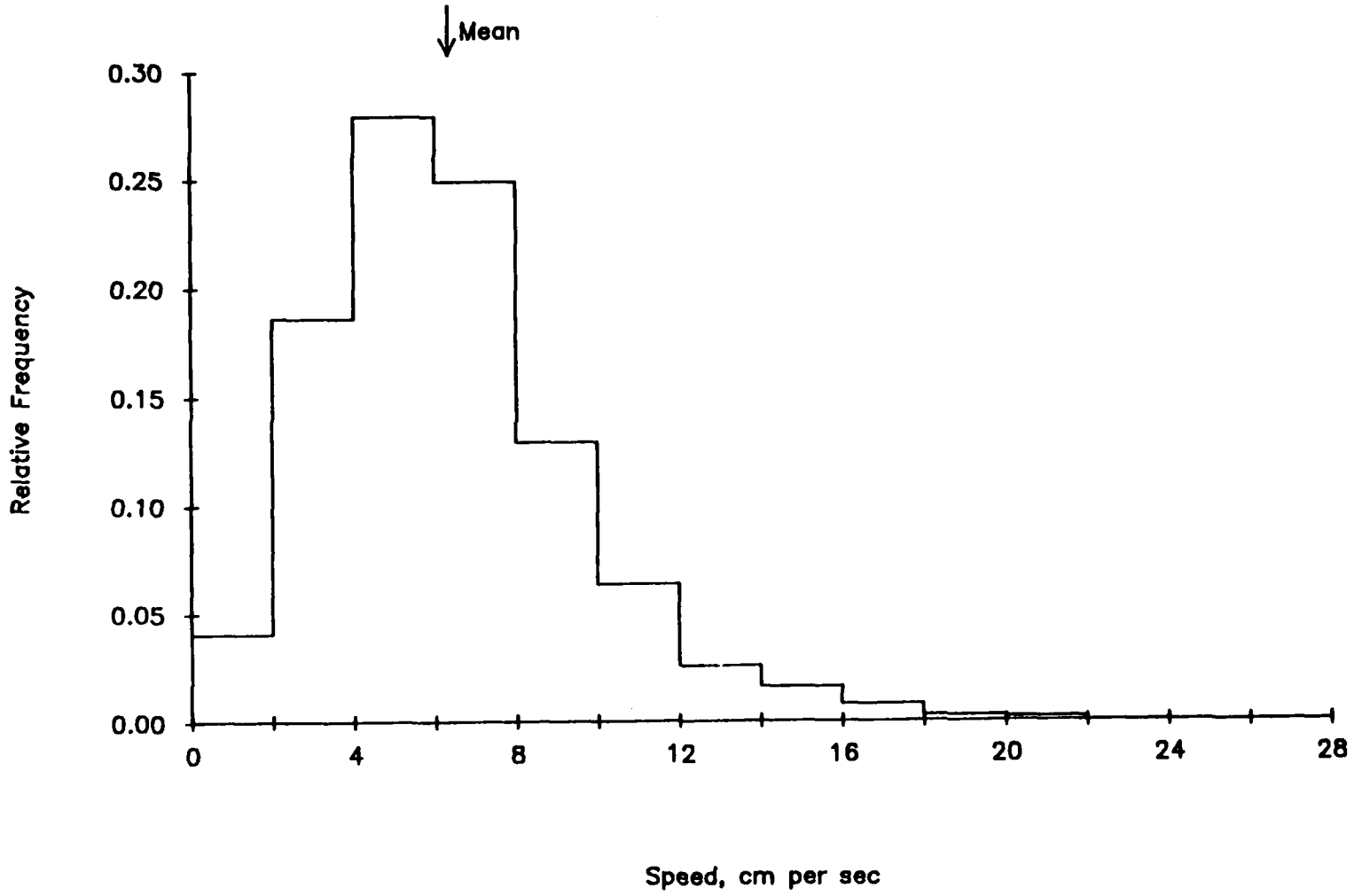


3812 M AT M3. 163.8 DAYS STARTING 0340 27 SEP 84.

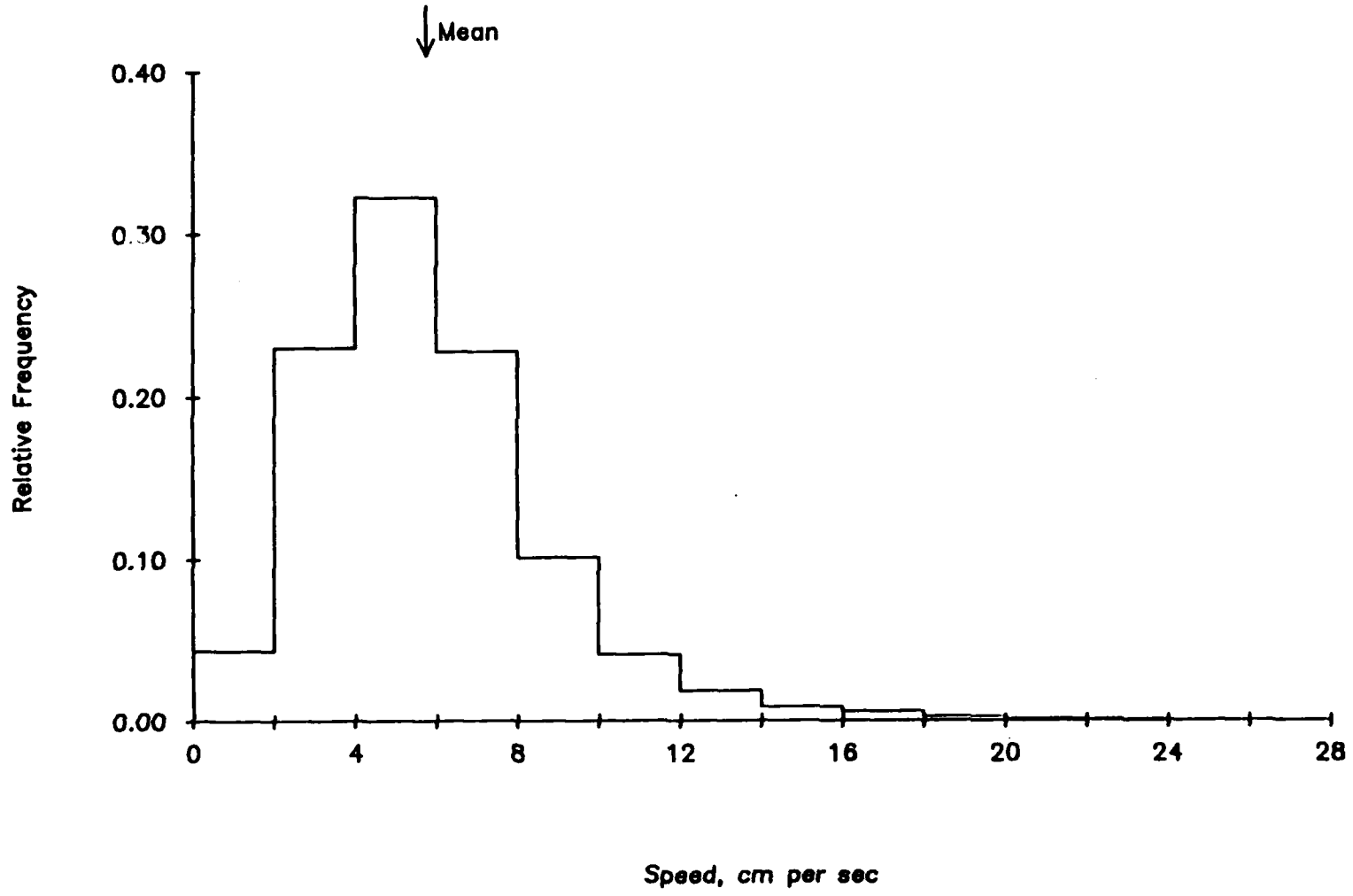
350 M at M–3. 27 Sep 84 – 15 Jul 85. Tape 407/13.



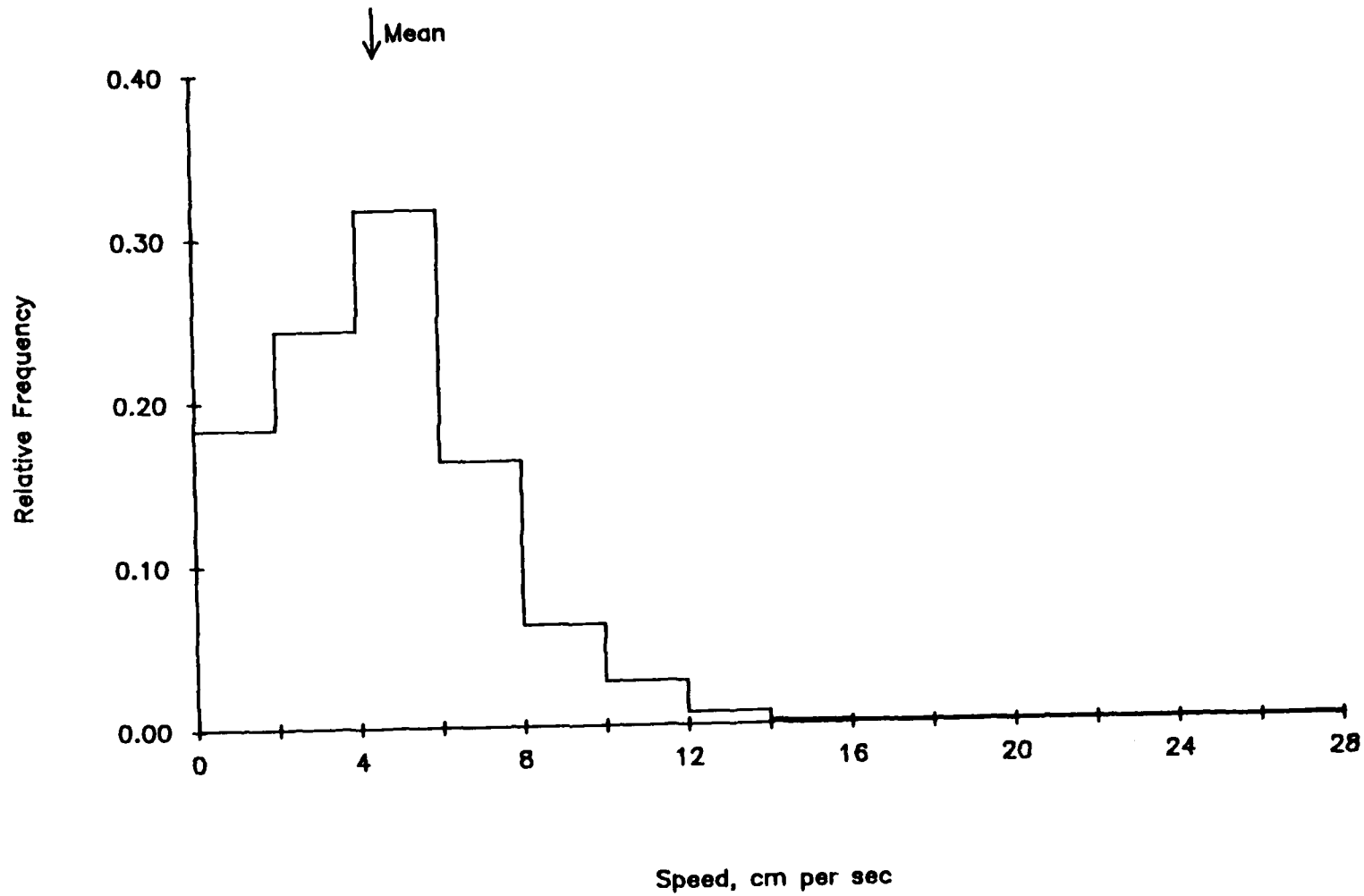
800 M at M-3. 27 Sep 84 - 15 Jul 85. Tape 2759/19.



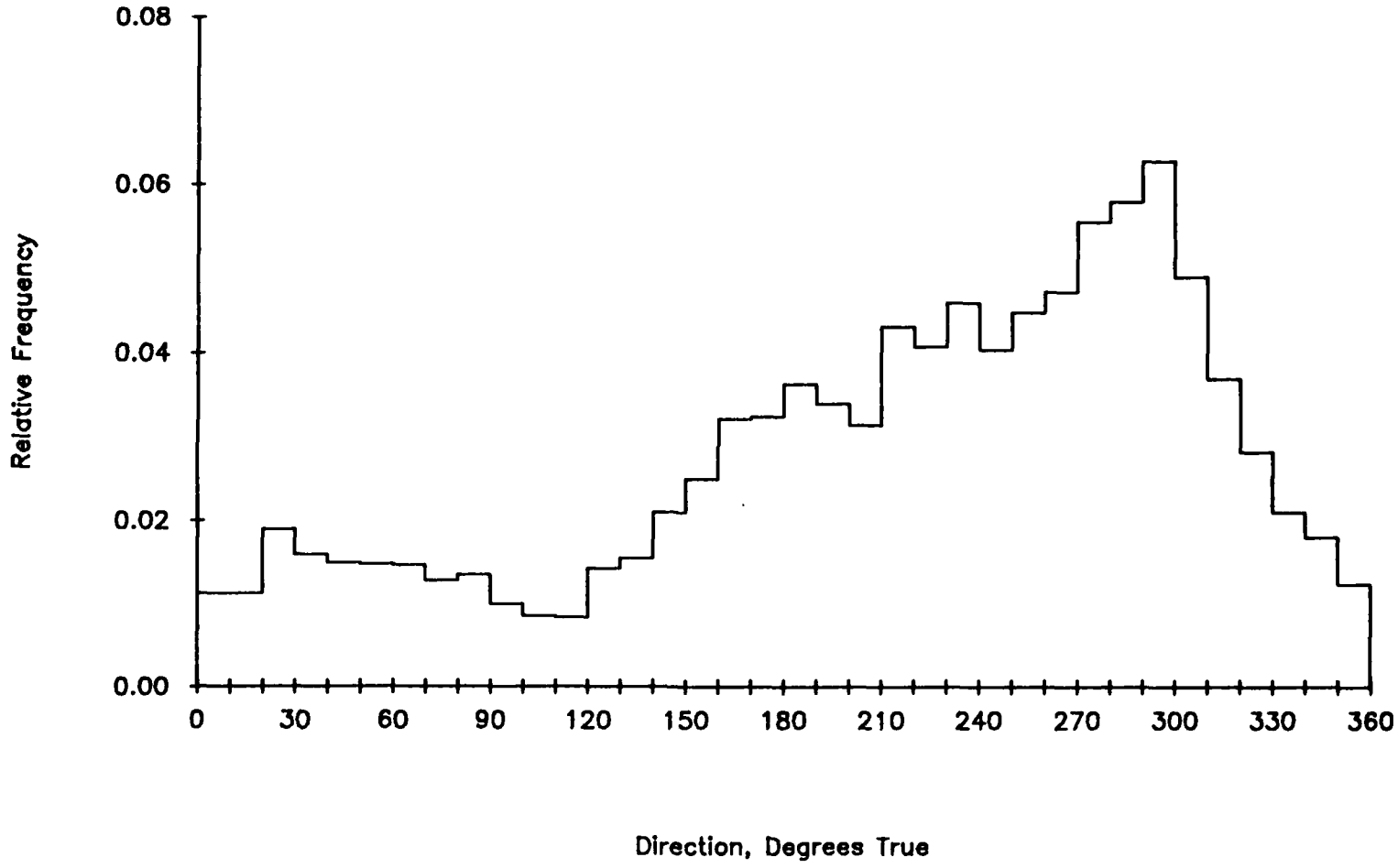
1185 M at M3. 27 Sep 84 – 15 Jul 85. Tape 6593/7.



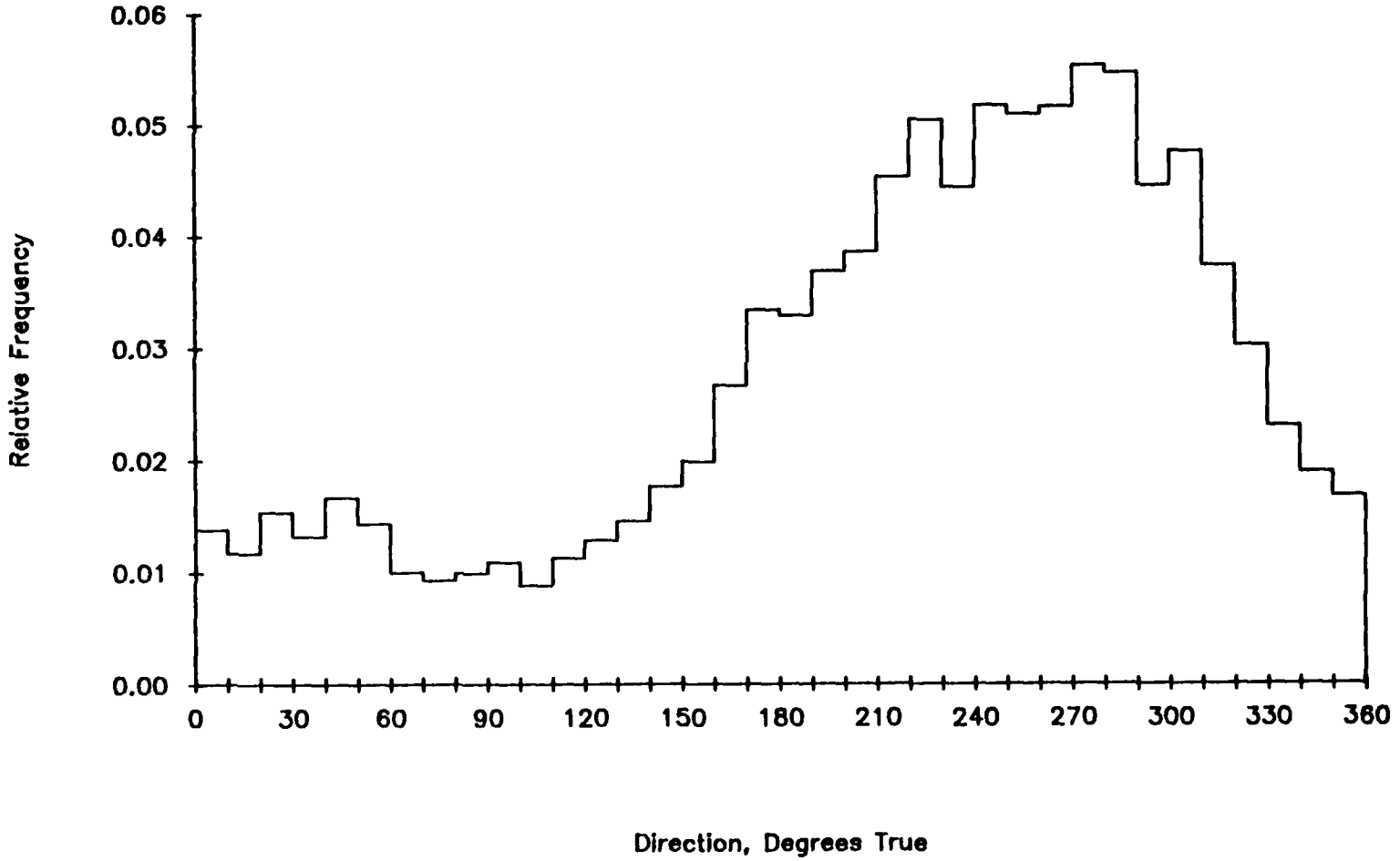
3812 M at M3. 27 Sep 84 – 9 Mar 85. Tape 2280/33.



145 M at M3. 27 Sep 84 – 15 Jul 85. Tape 5648/20.



350 M at M-3. 27 Sep 84 - 15 Jul 85. Tape 407/13.



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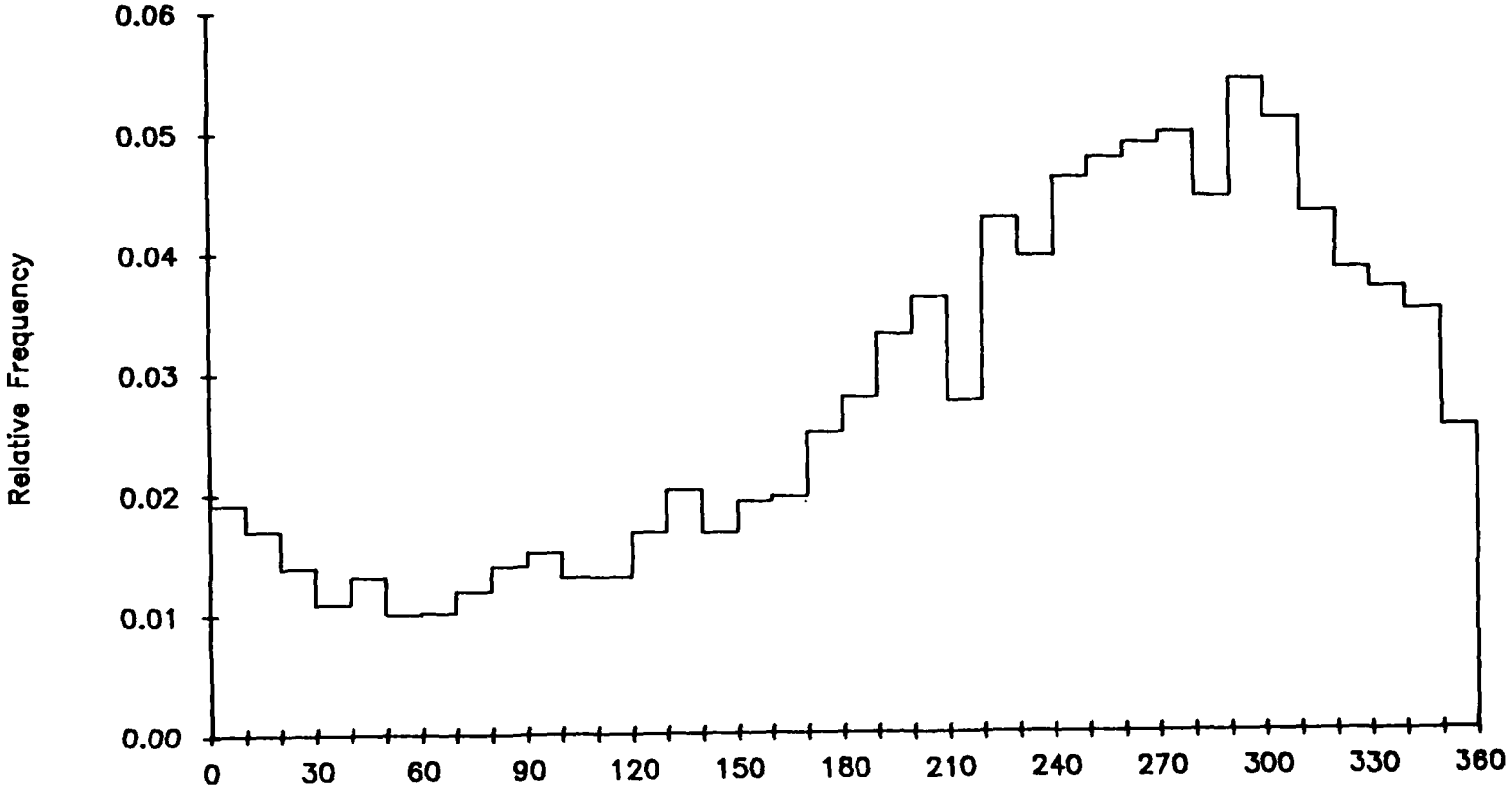

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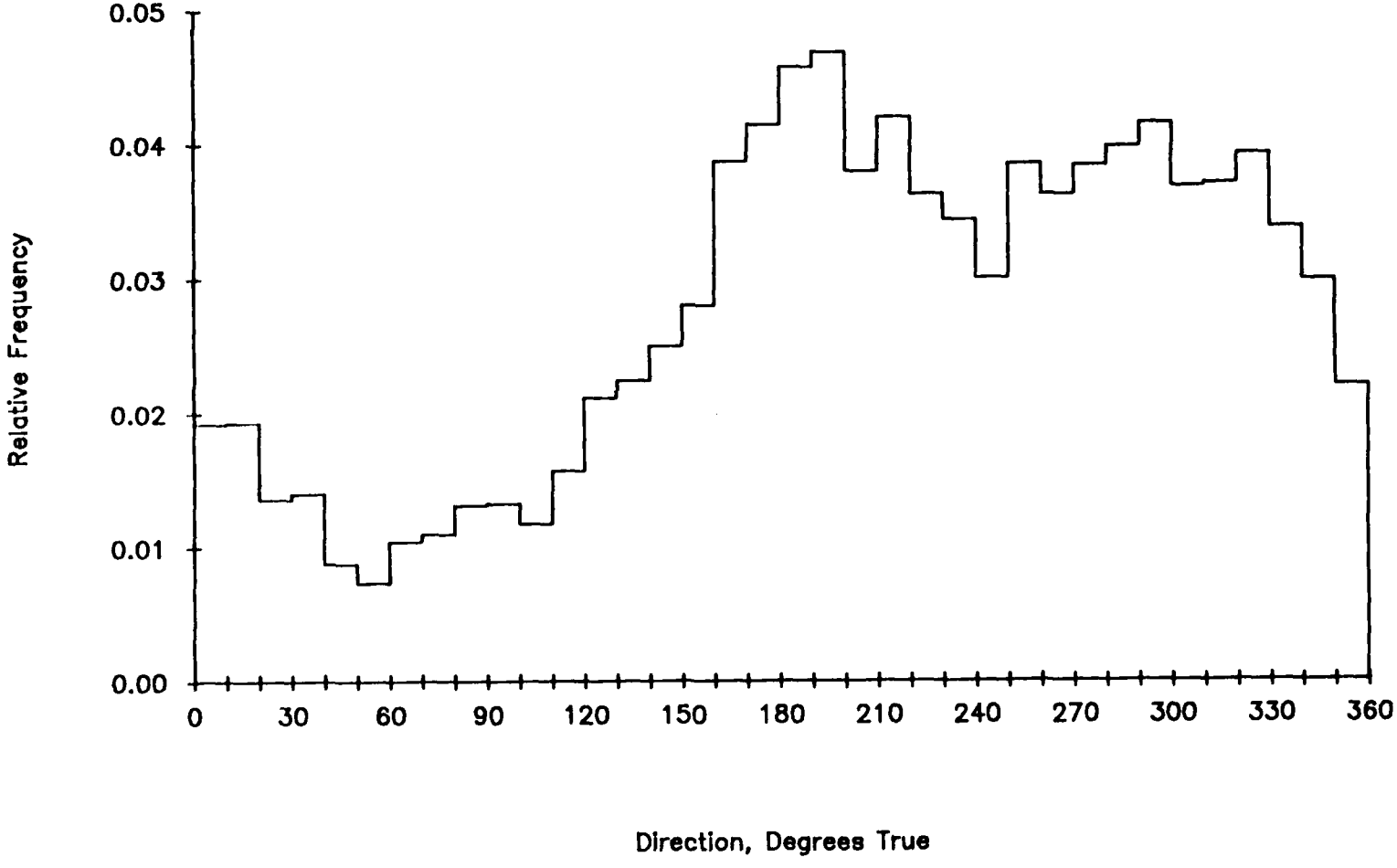

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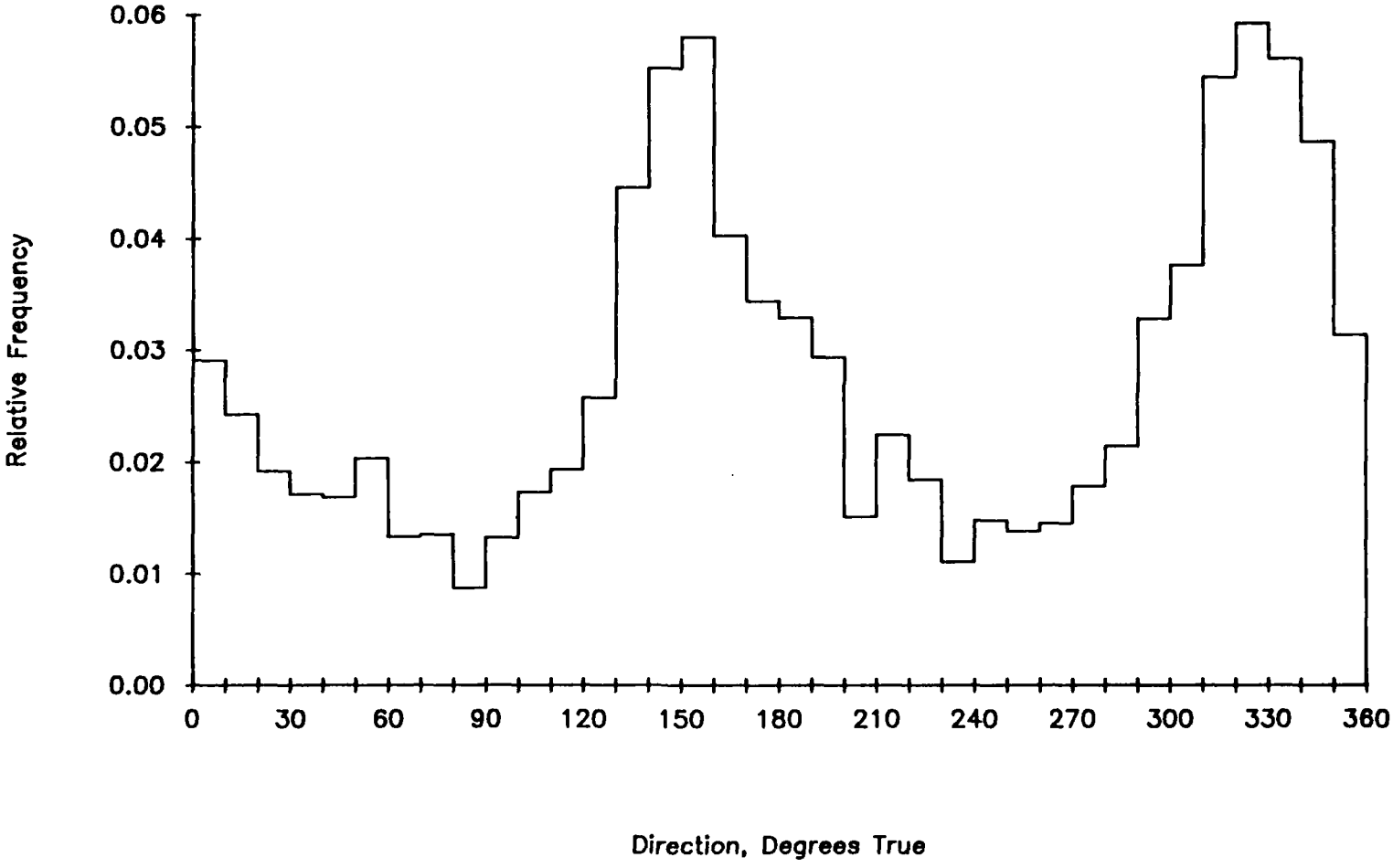

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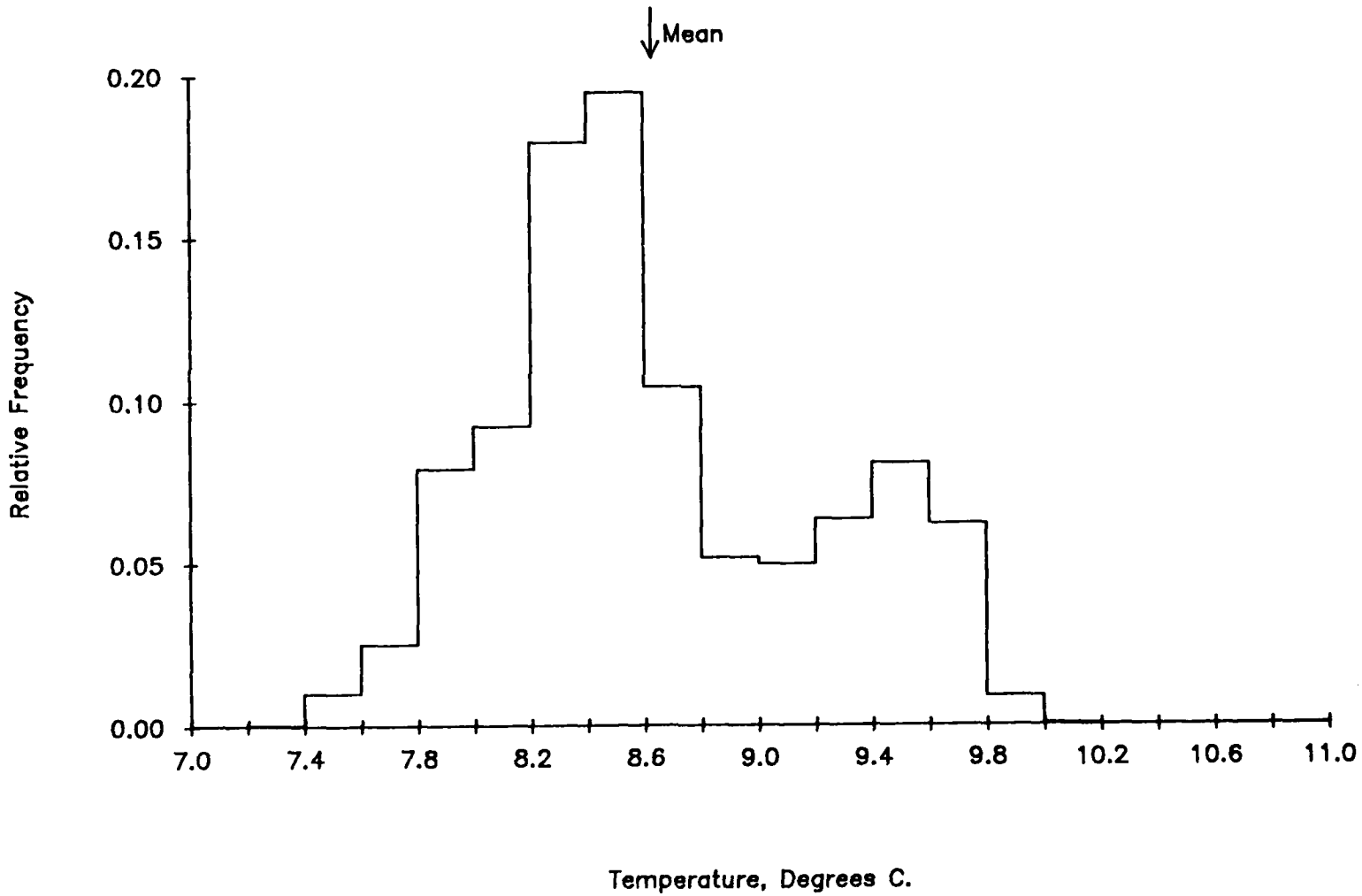

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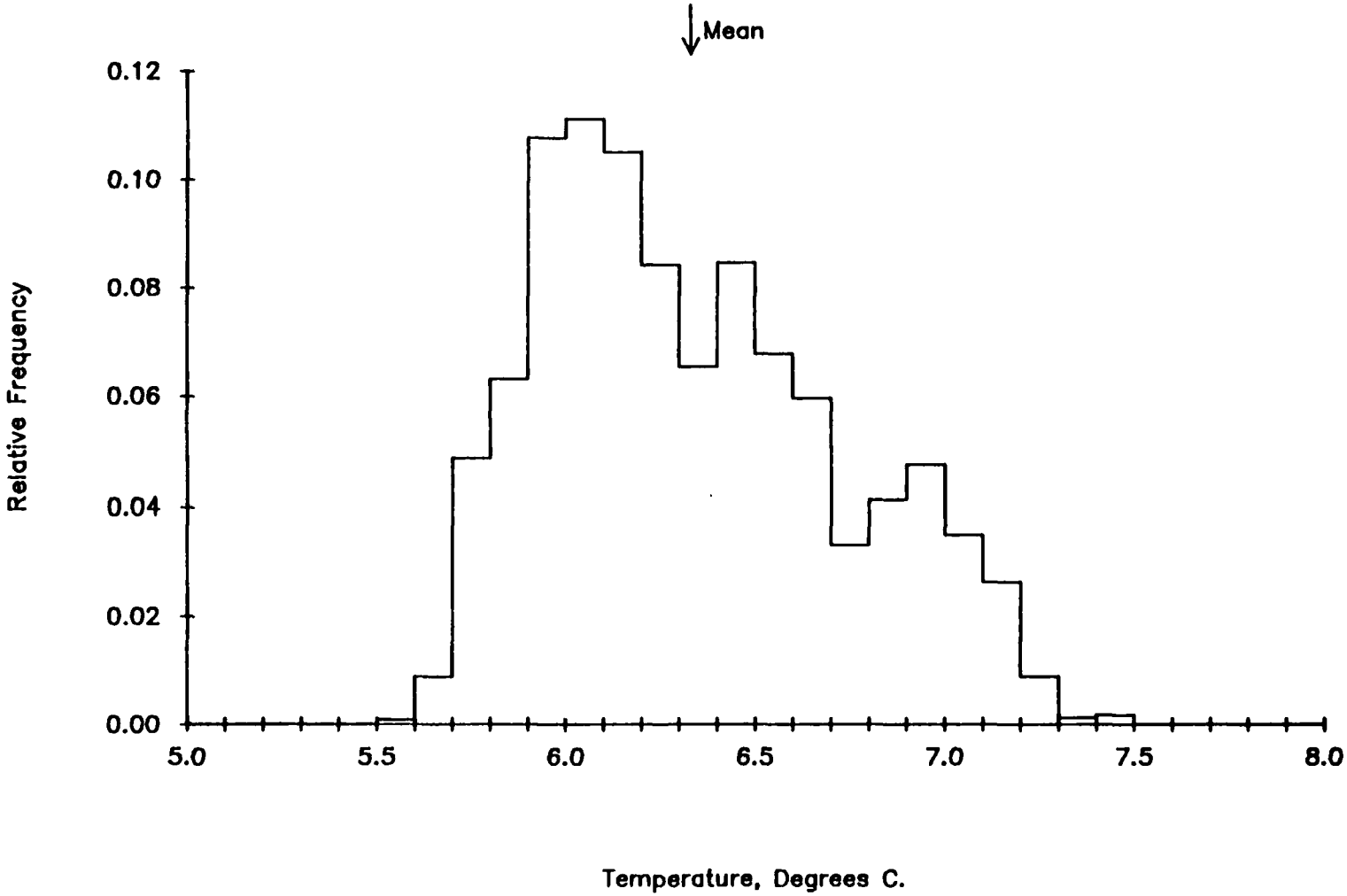

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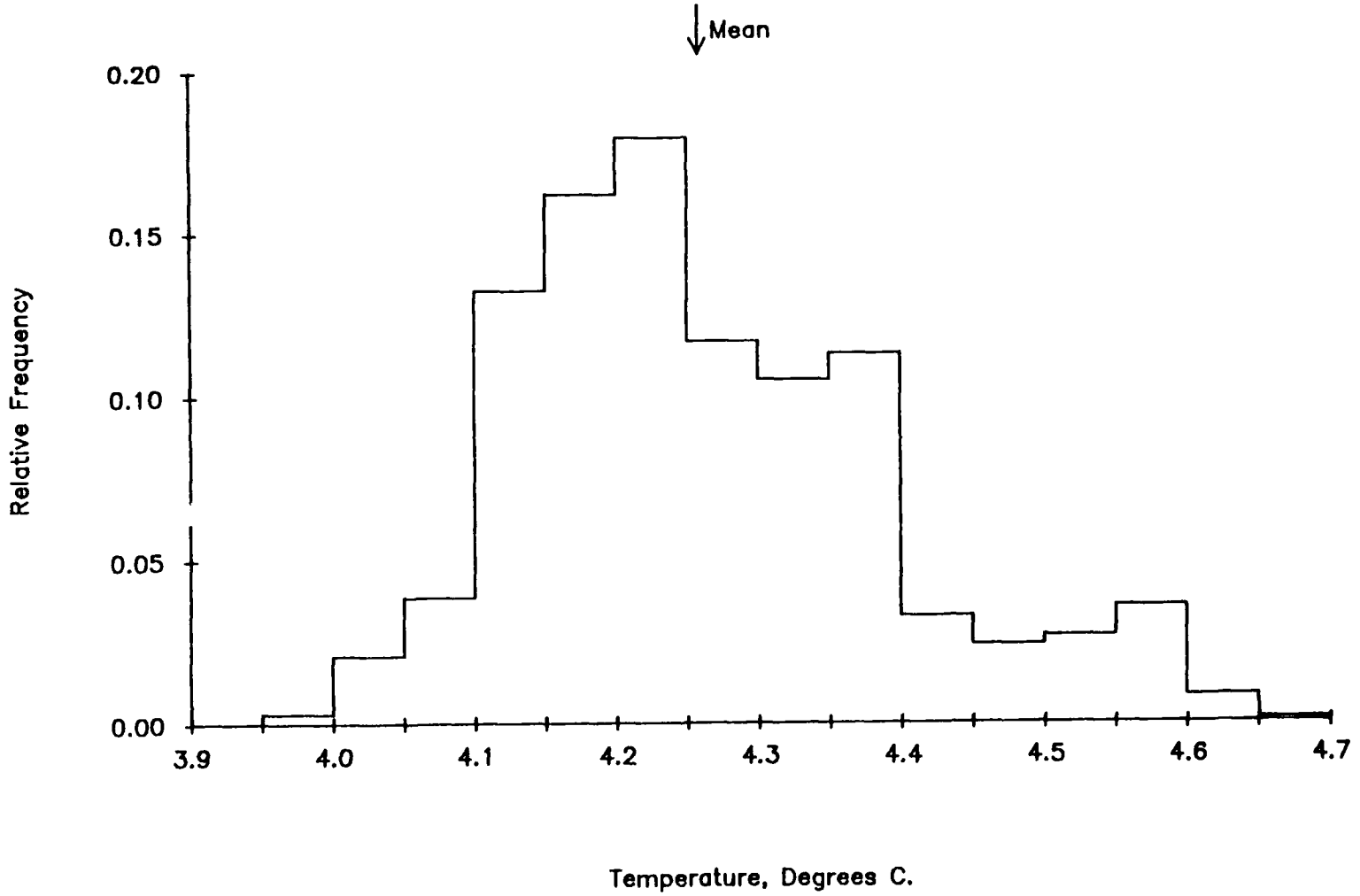

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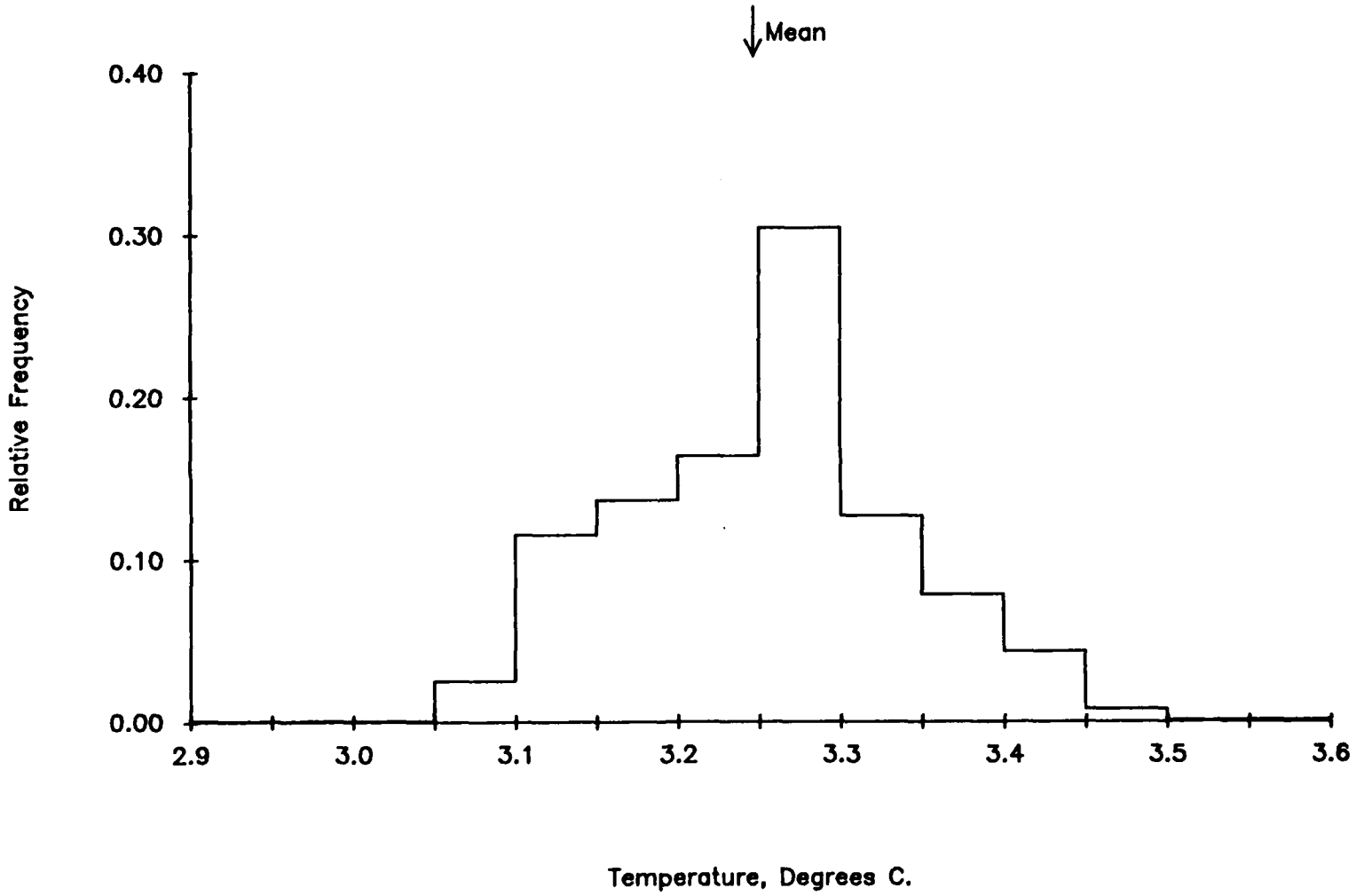

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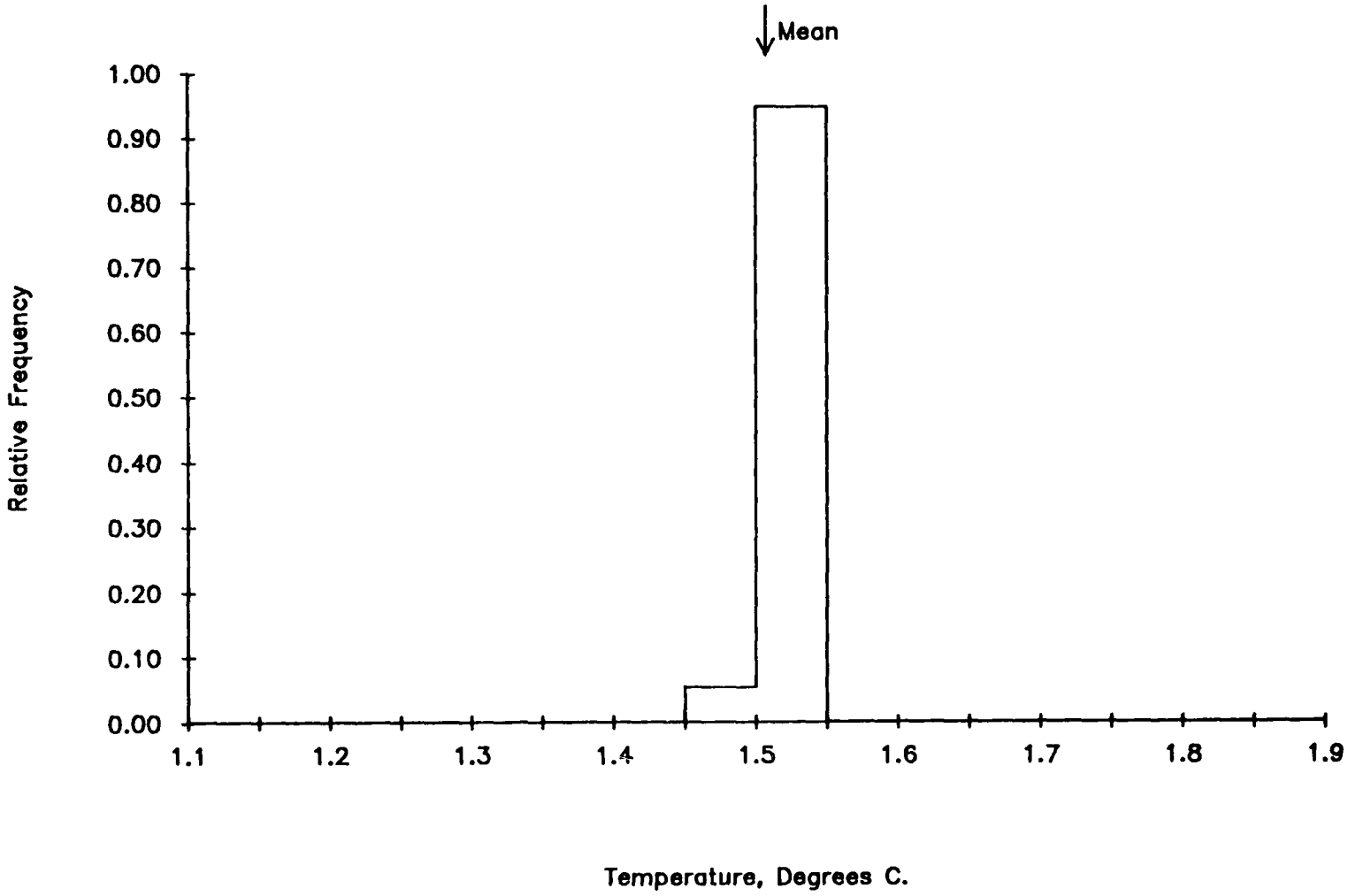

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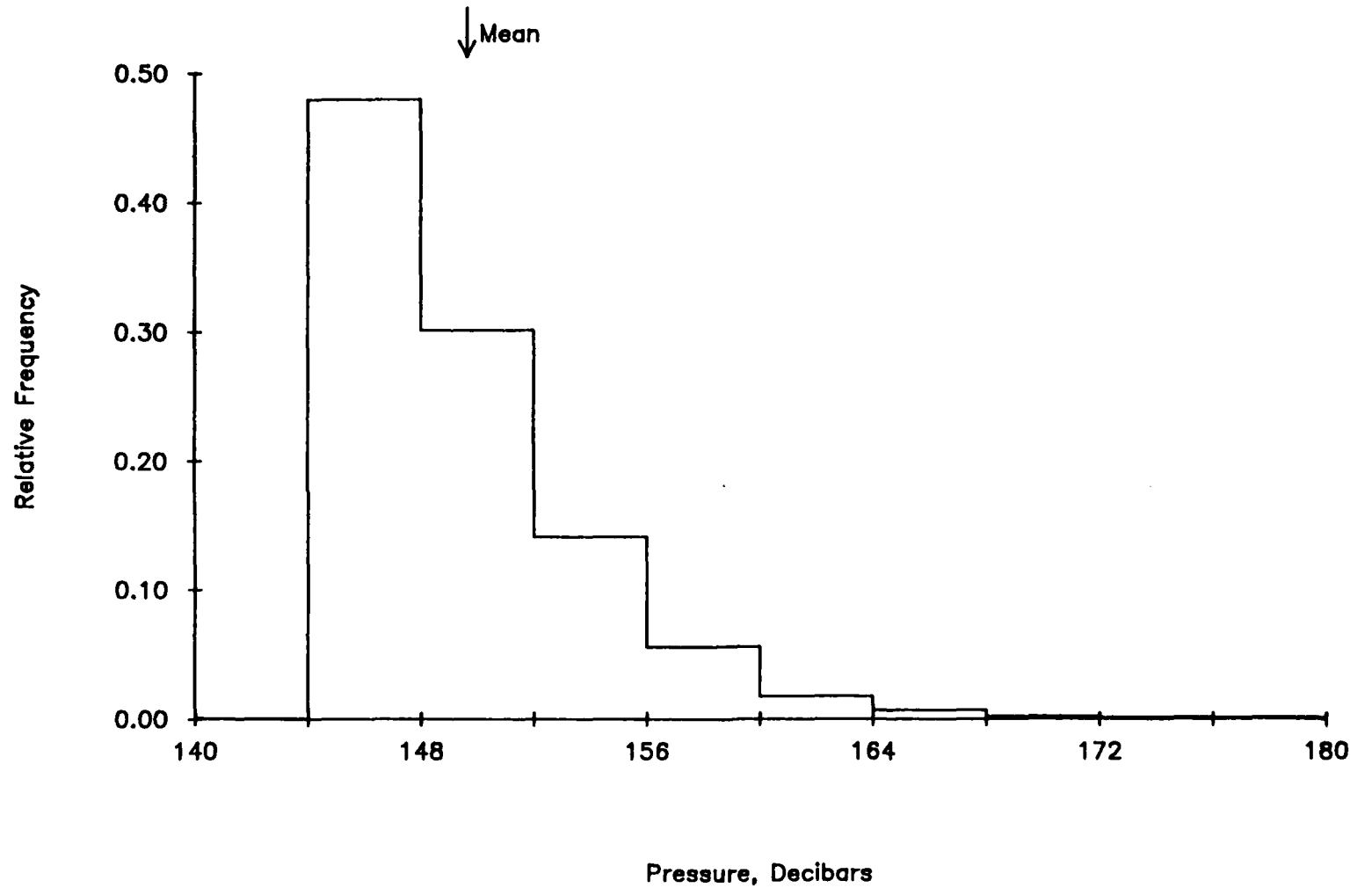

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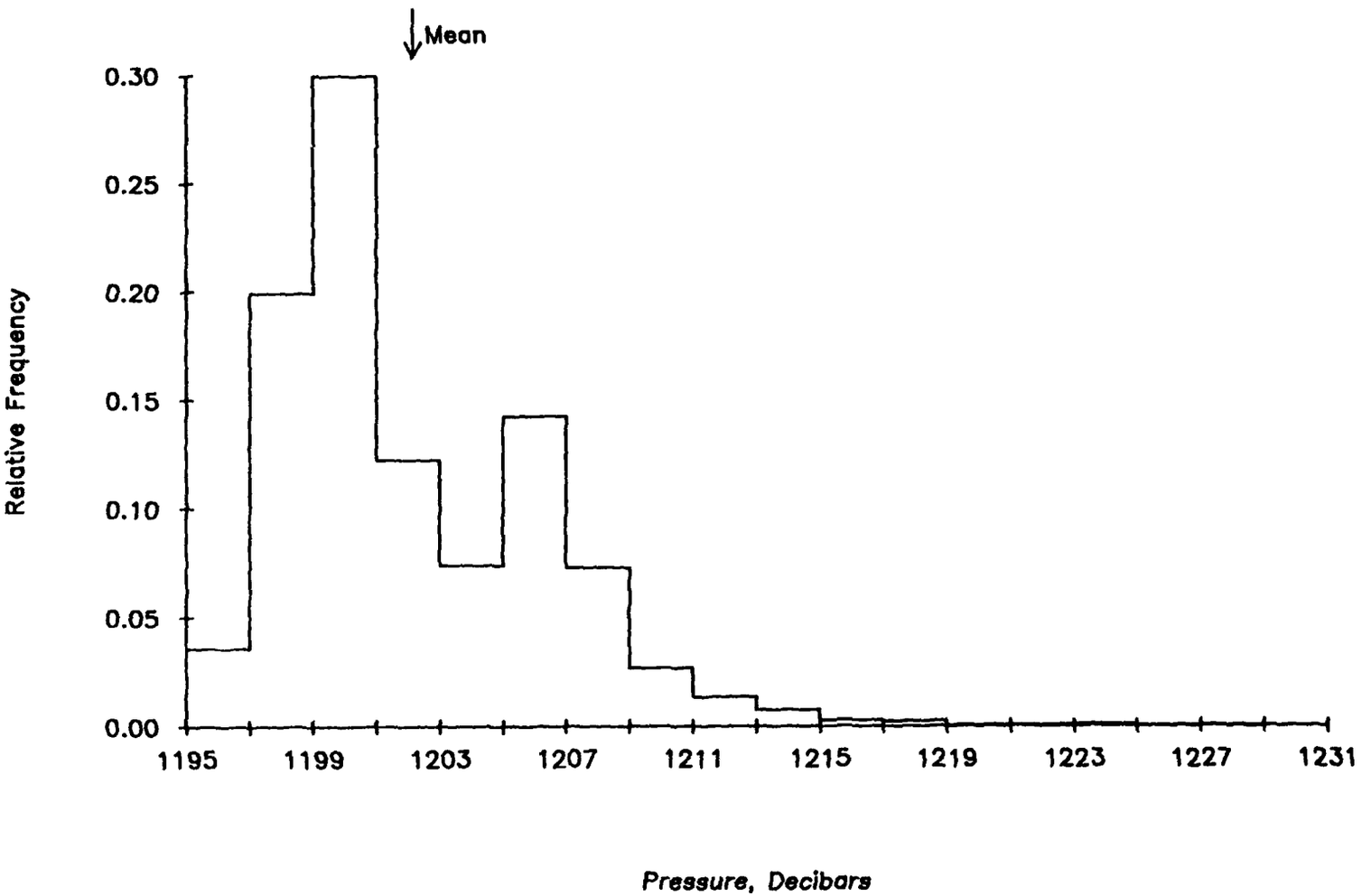
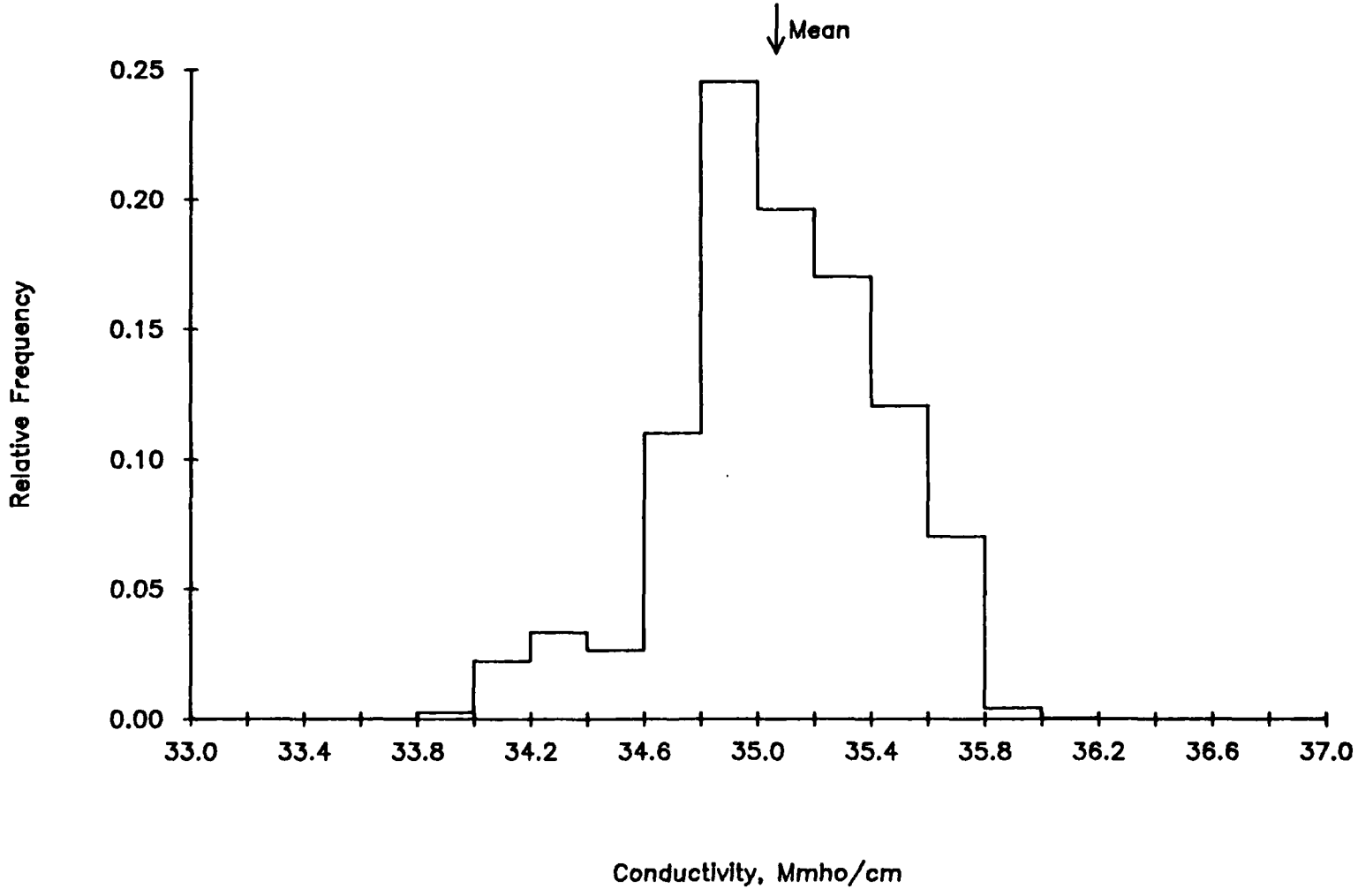
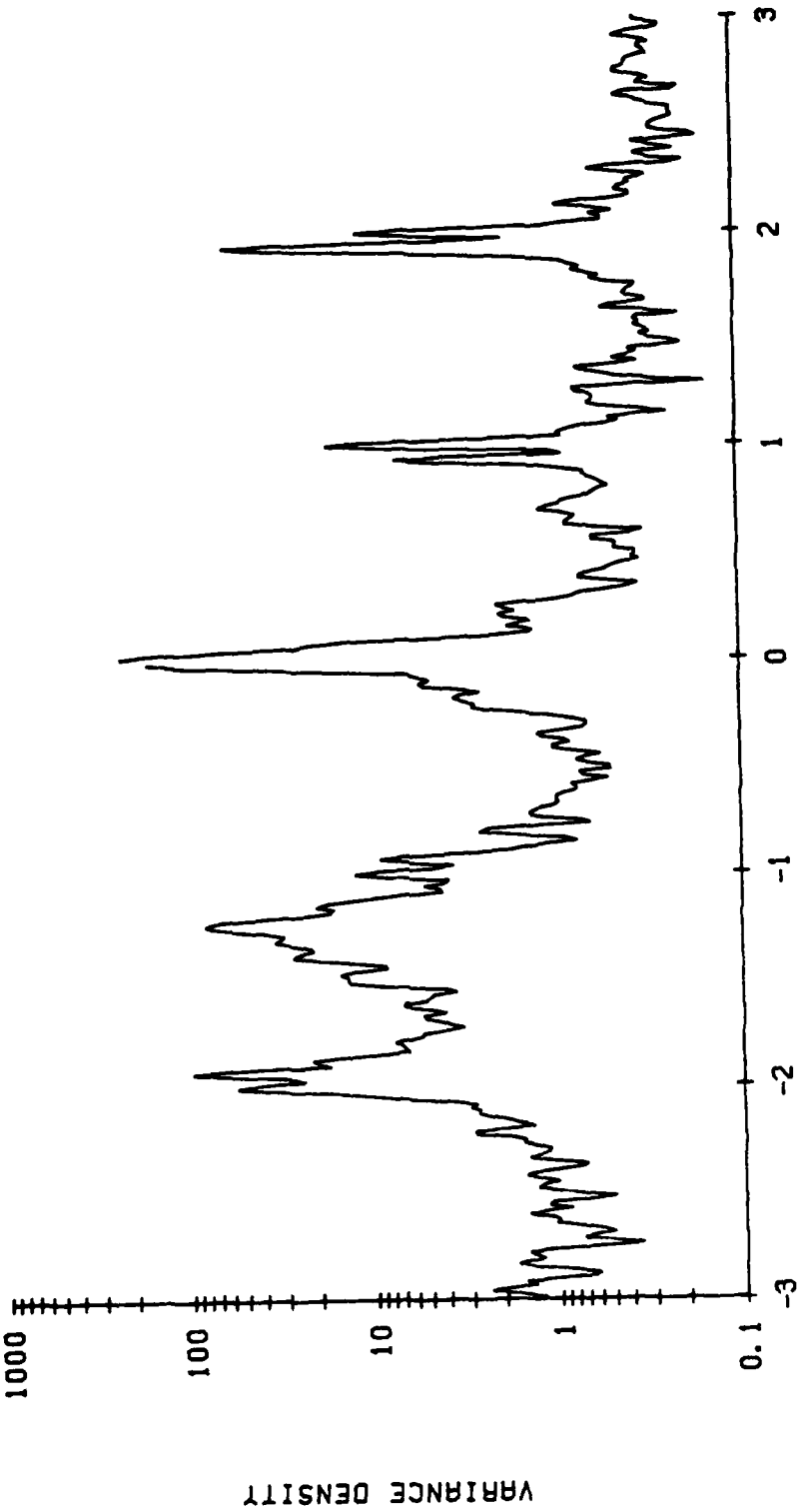
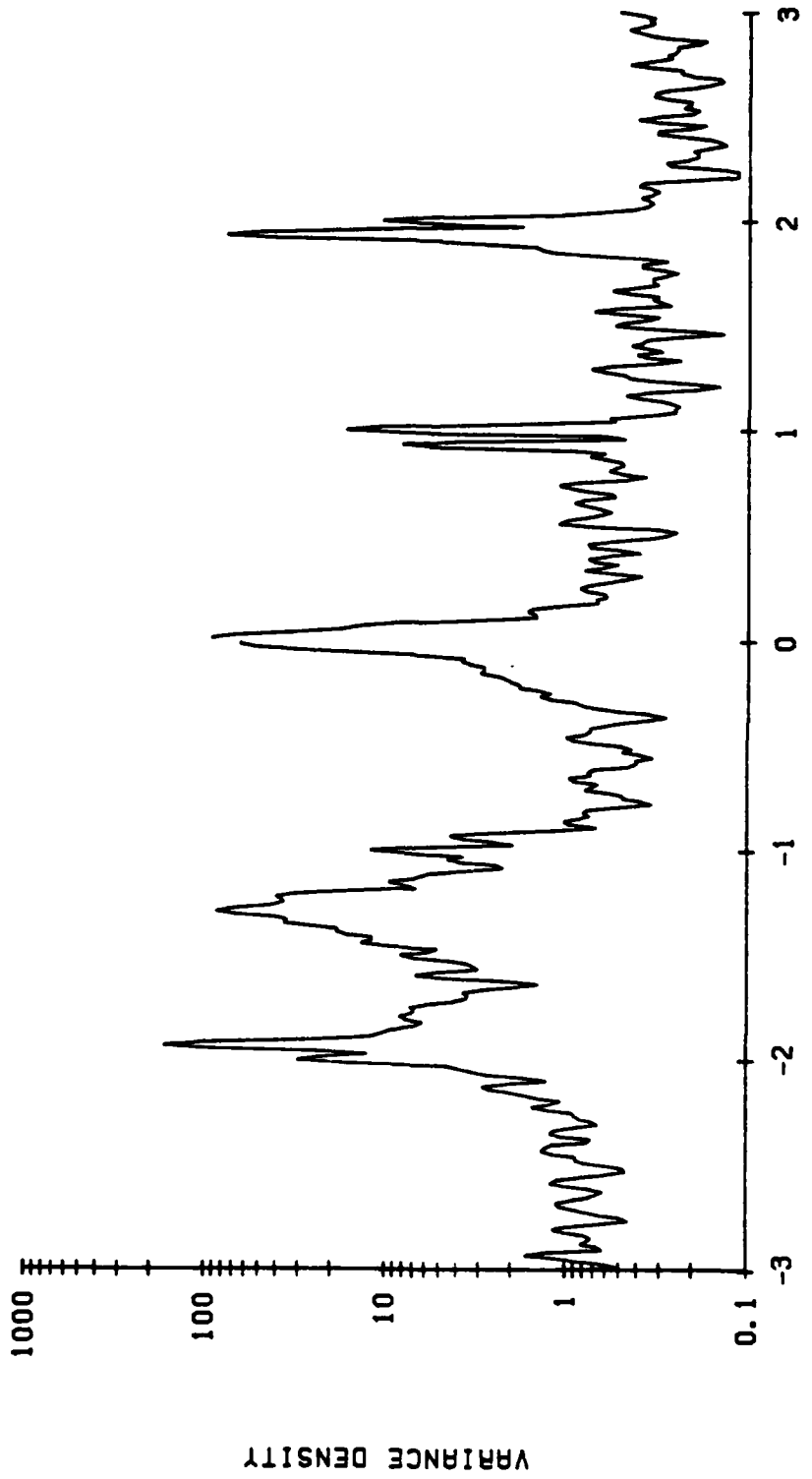


145 M at M3. 27 Sep 84 – 15 Jul 85. Tape 5648/20.




UNFILTERED CURRENT. 350 M AT M-3.
VARIANCE DENSITY
1000
100
10
1
0.1
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY


UNFILTERED CURRENT. 800 M AT M-3.
VARIANCE DENSITY
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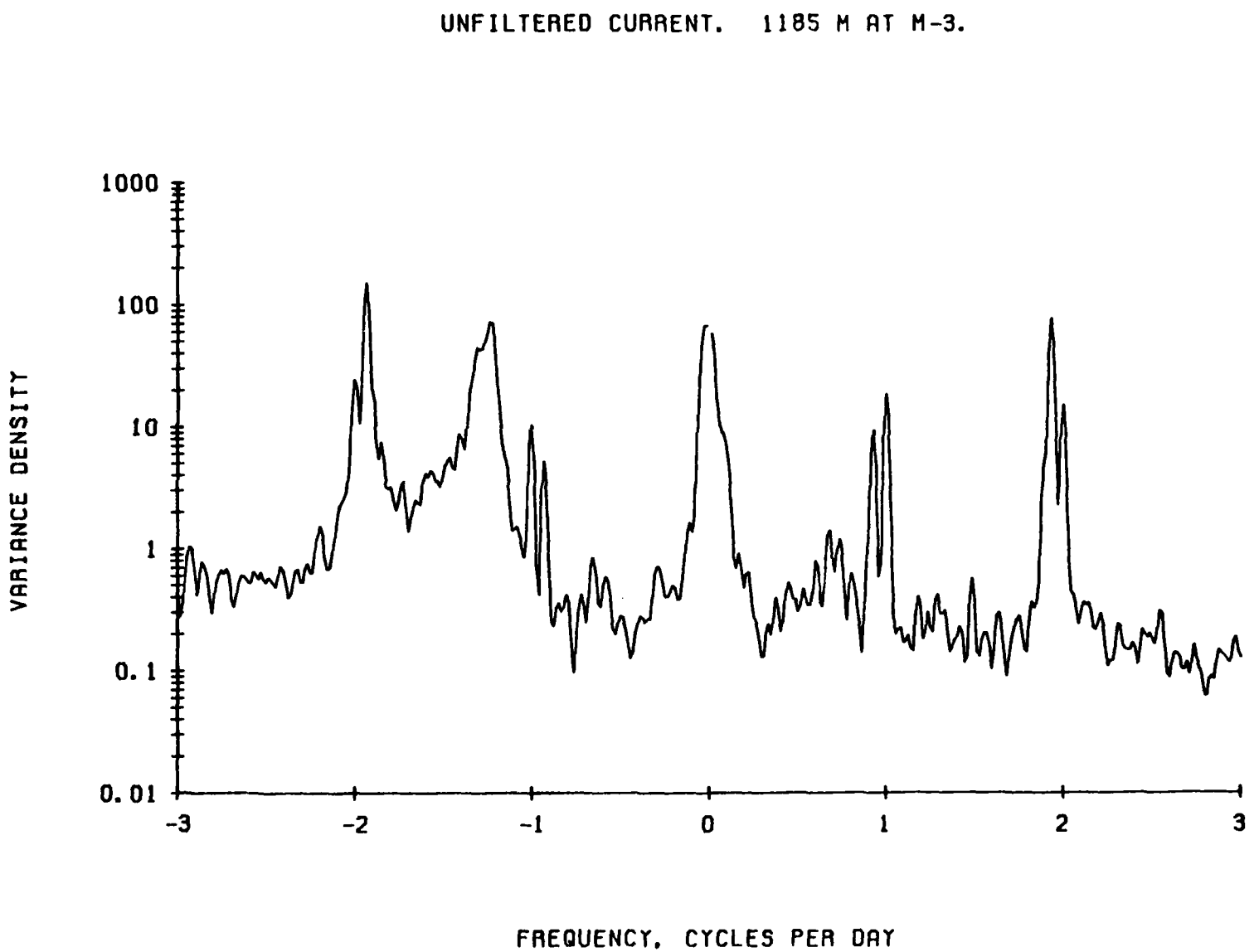
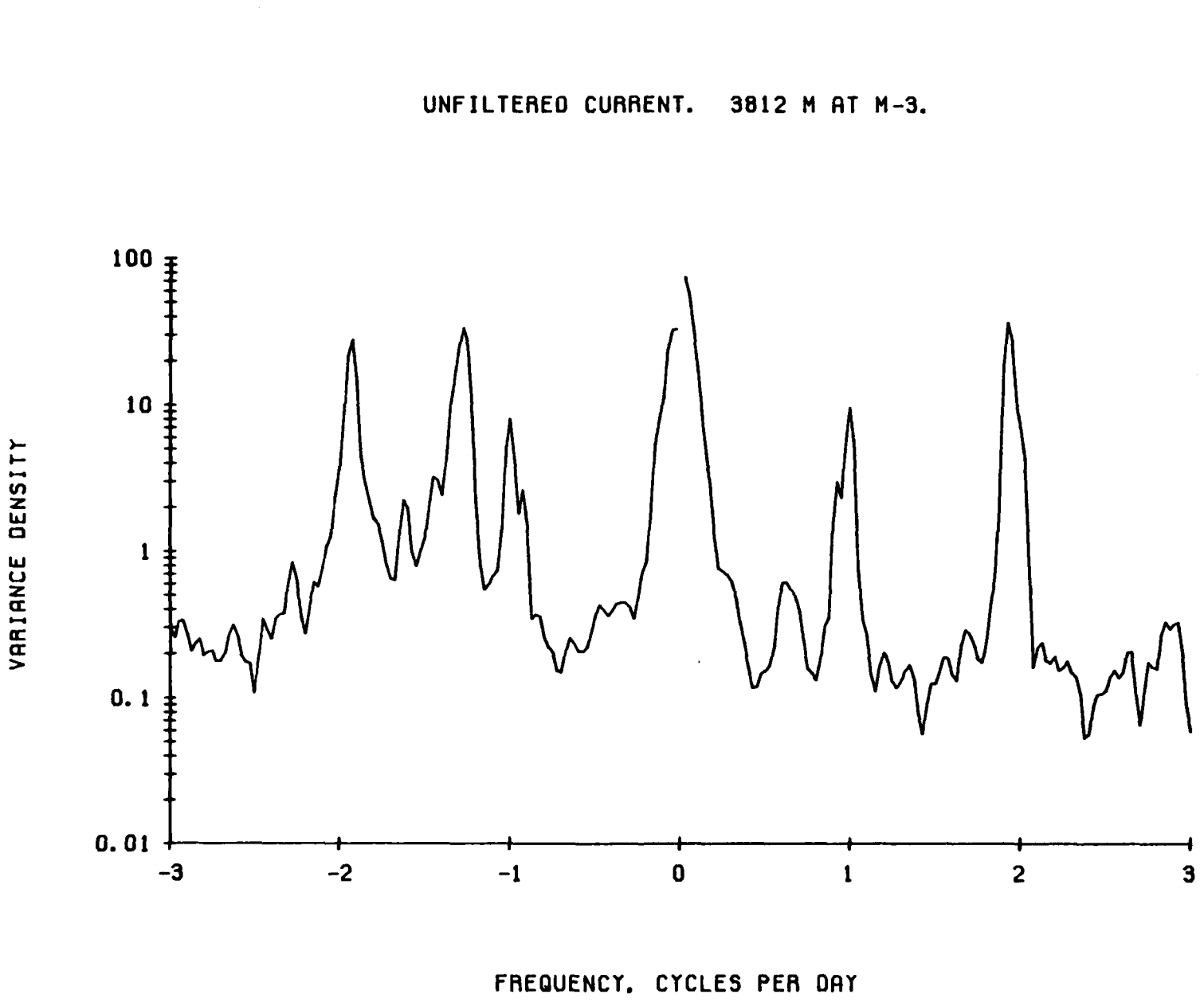
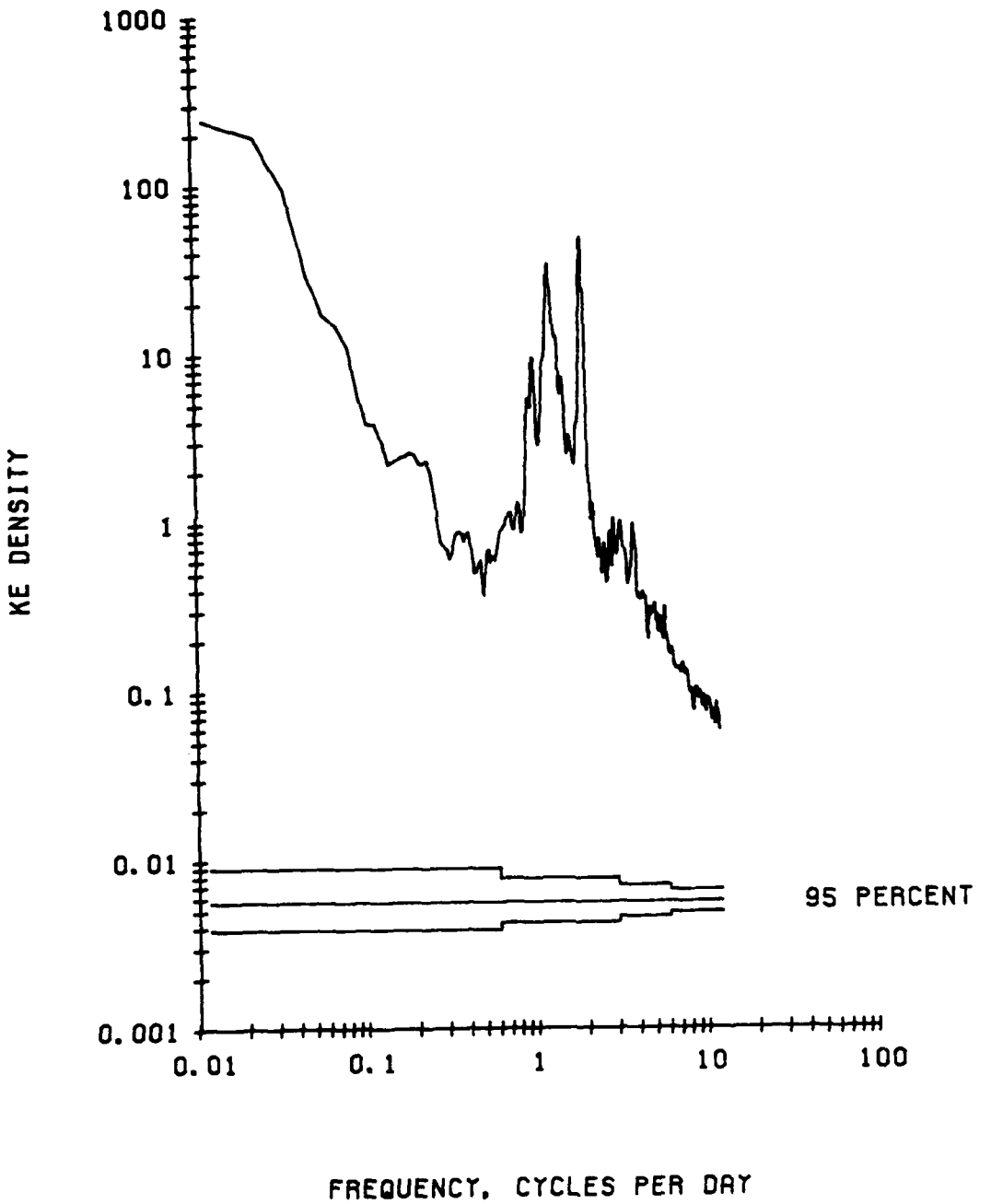
100
10
1
0.1
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

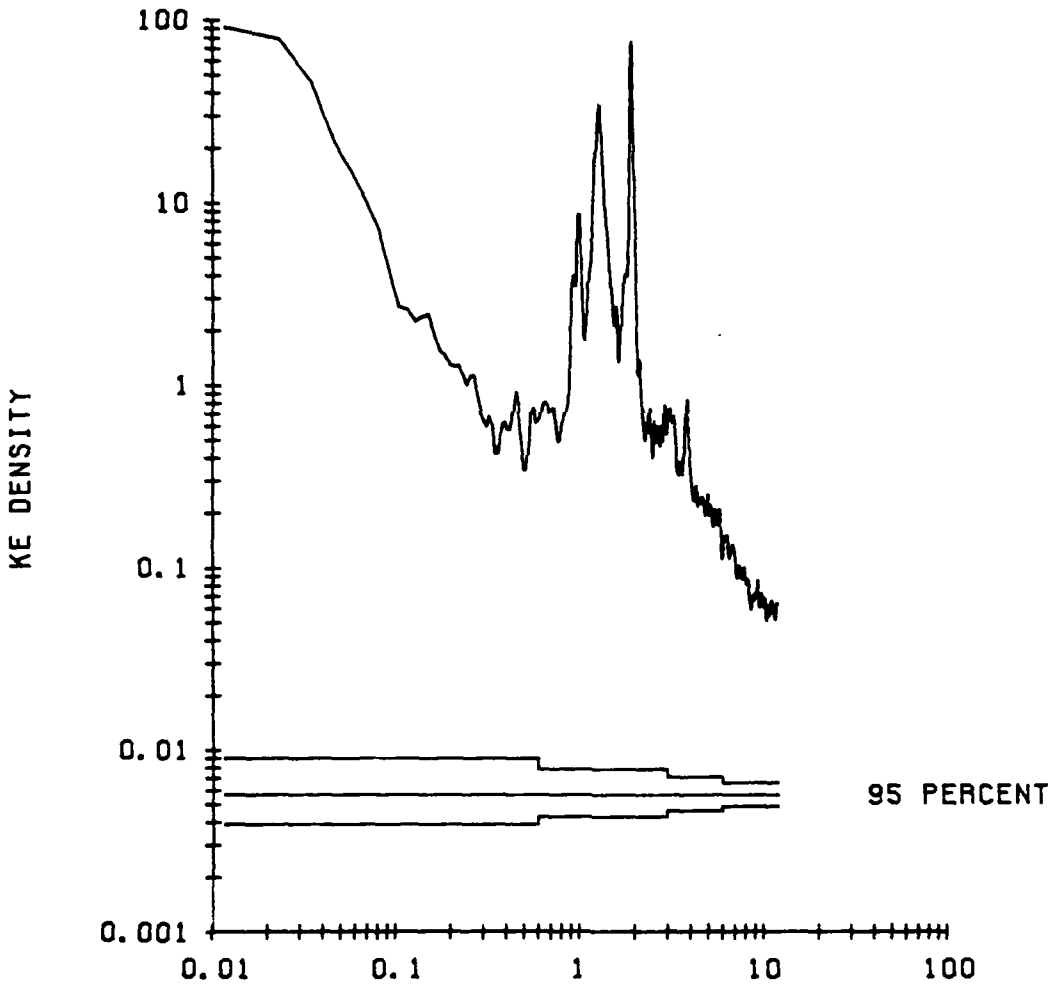

UNFILTERED CURRENT. 1185 M AT M-3.
VARIANCE DENSITY
1000
100
10
1
0.1
0.01
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY


UNFILTERED CURRENT. 3812 M AT M-3.
VARIANCE DENSITY
100
10
1
0.1
0.01
-3
-2
-1
0
1
2
3
FREQUENCY, CYCLES PER DAY

UNFILTERED CURRENT. 350 M AT M-3.

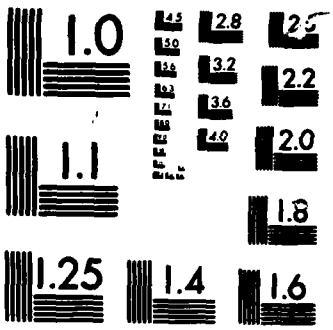


UNFILTERED CURRENT. 800 M AT M-3.



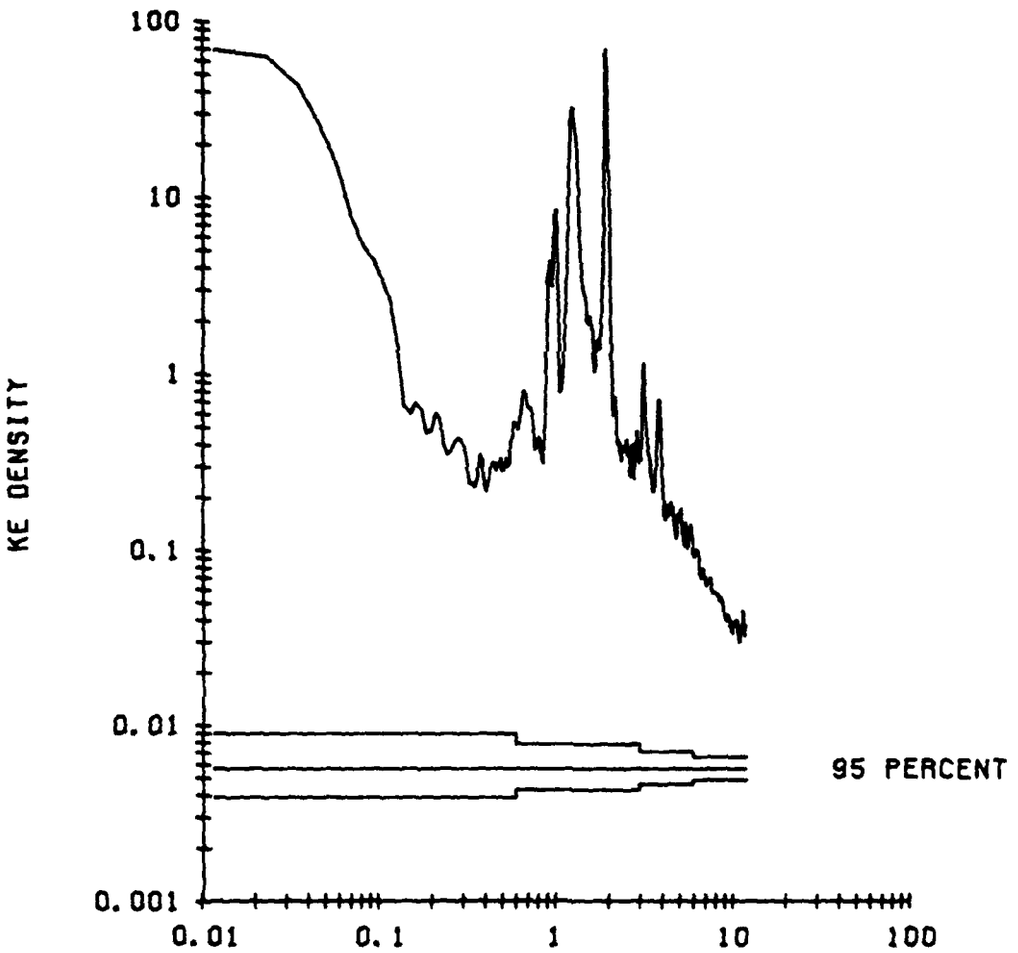
AD-A167 776 CURRENT MEASUREMENTS FROM MOORINGS OFF NORTHERN CALIFORNIA: SEPTEMBER 198..(U) OREGON STATE UNIV CORVALLIS COLL OF OCEANOGRAPHY R L SMITH ET AL. APR 86 3/3

UNCLASSIFIED DATA-121 N00014-84-C-0218 F/G 8/3 NL

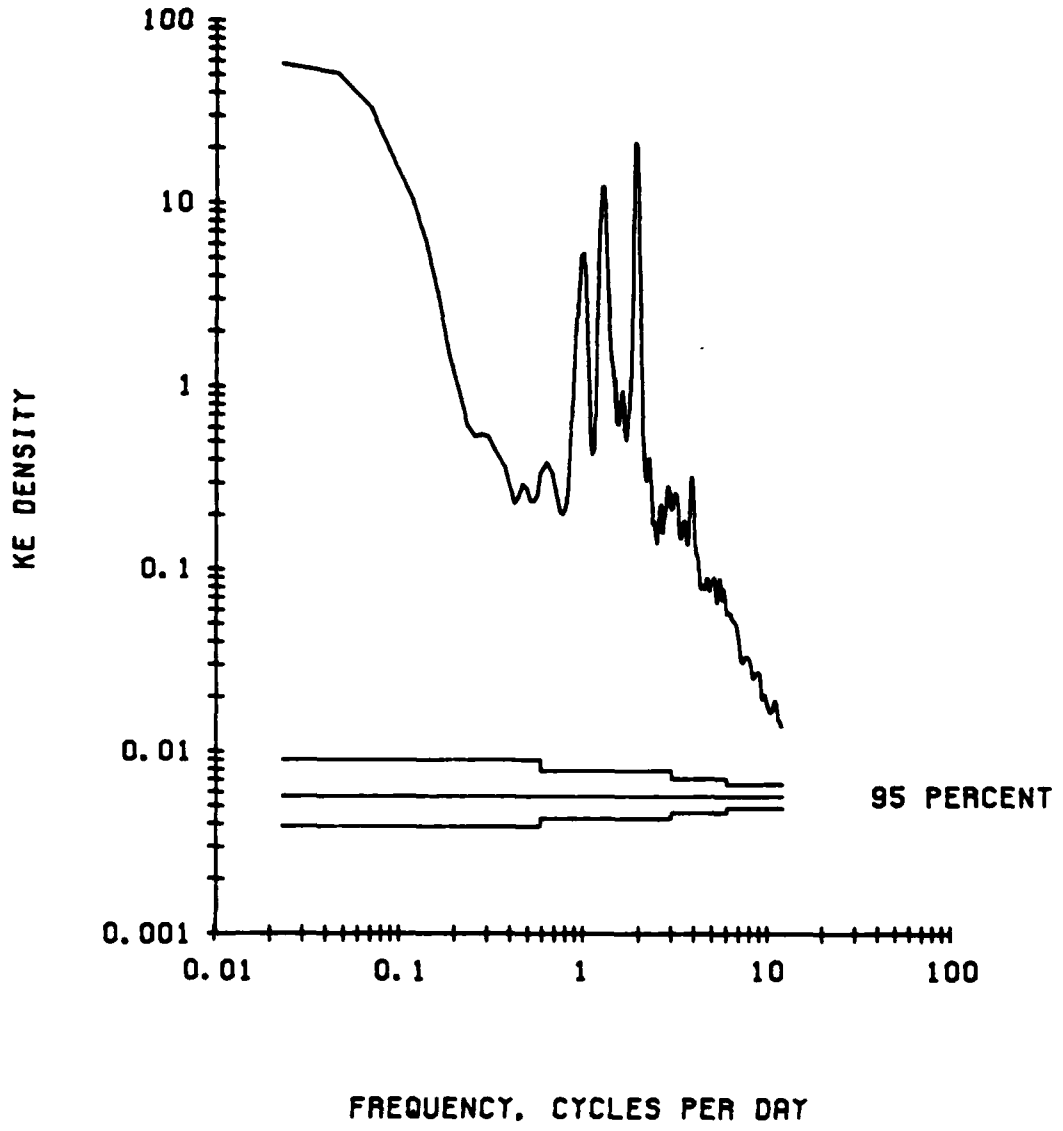


MICROCOPY CHART

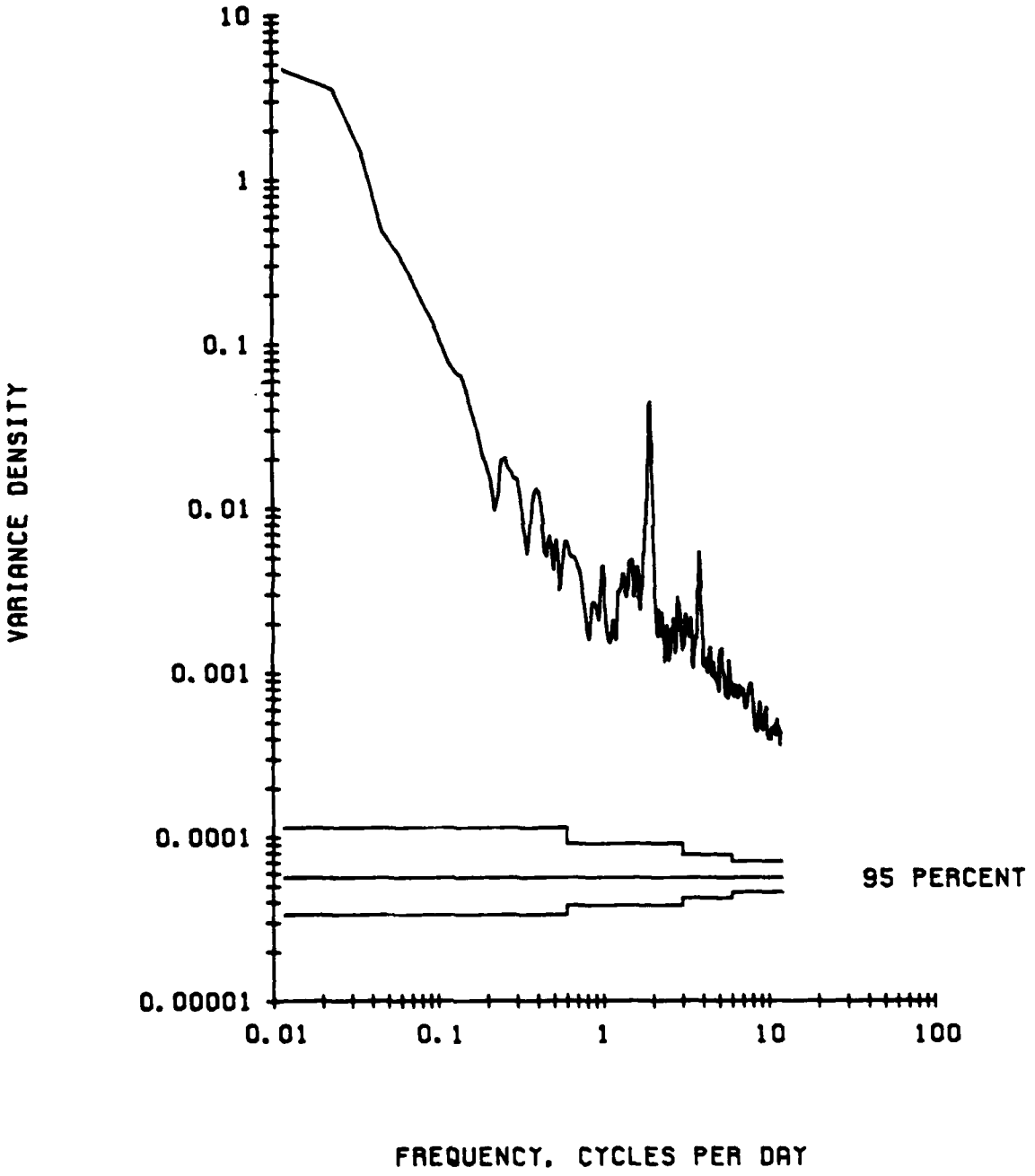
UNFILTERED CURRENT. 1185 M AT M-3.



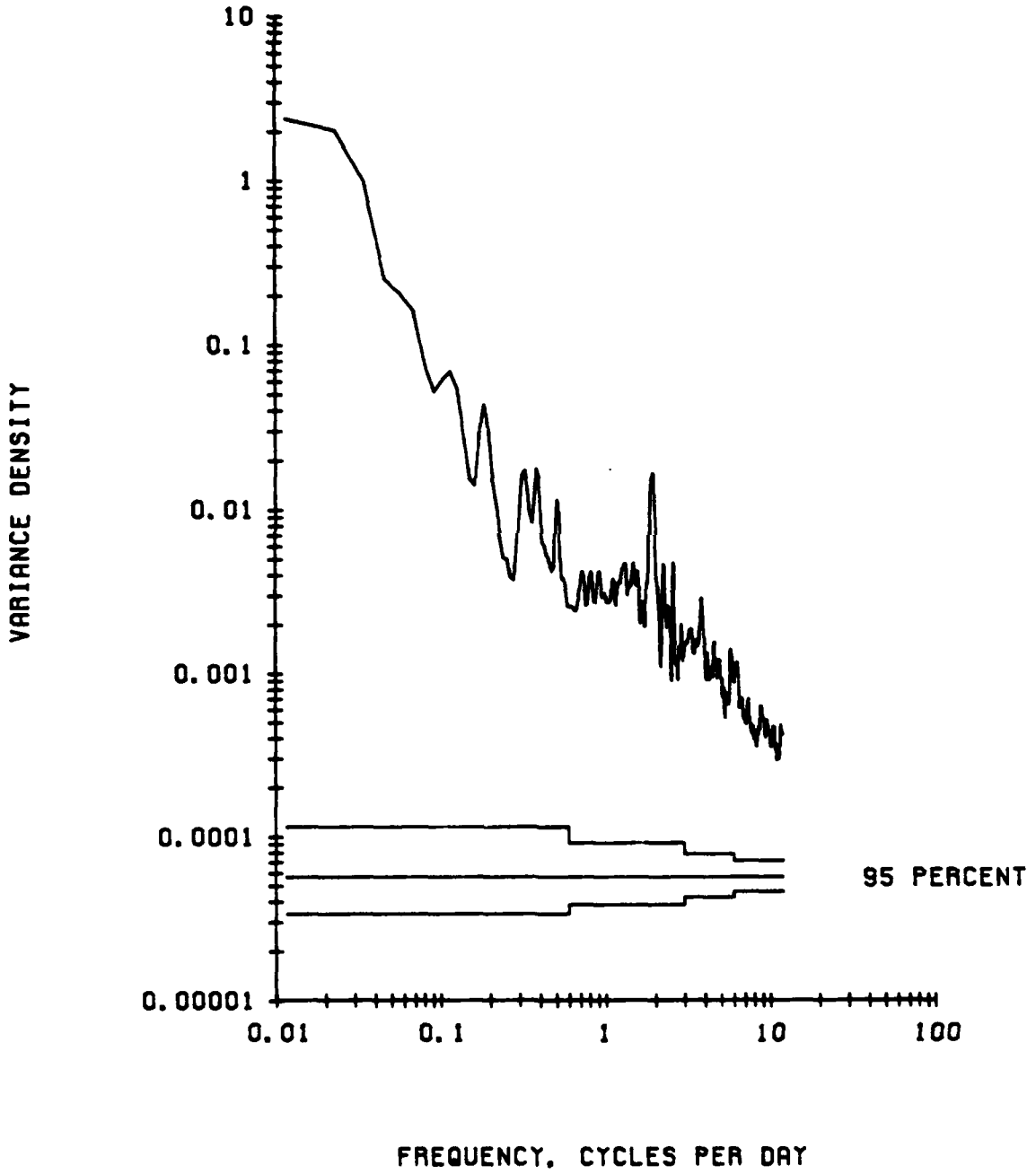
UNFILTERED CURRENT. 3812 M AT M-3.



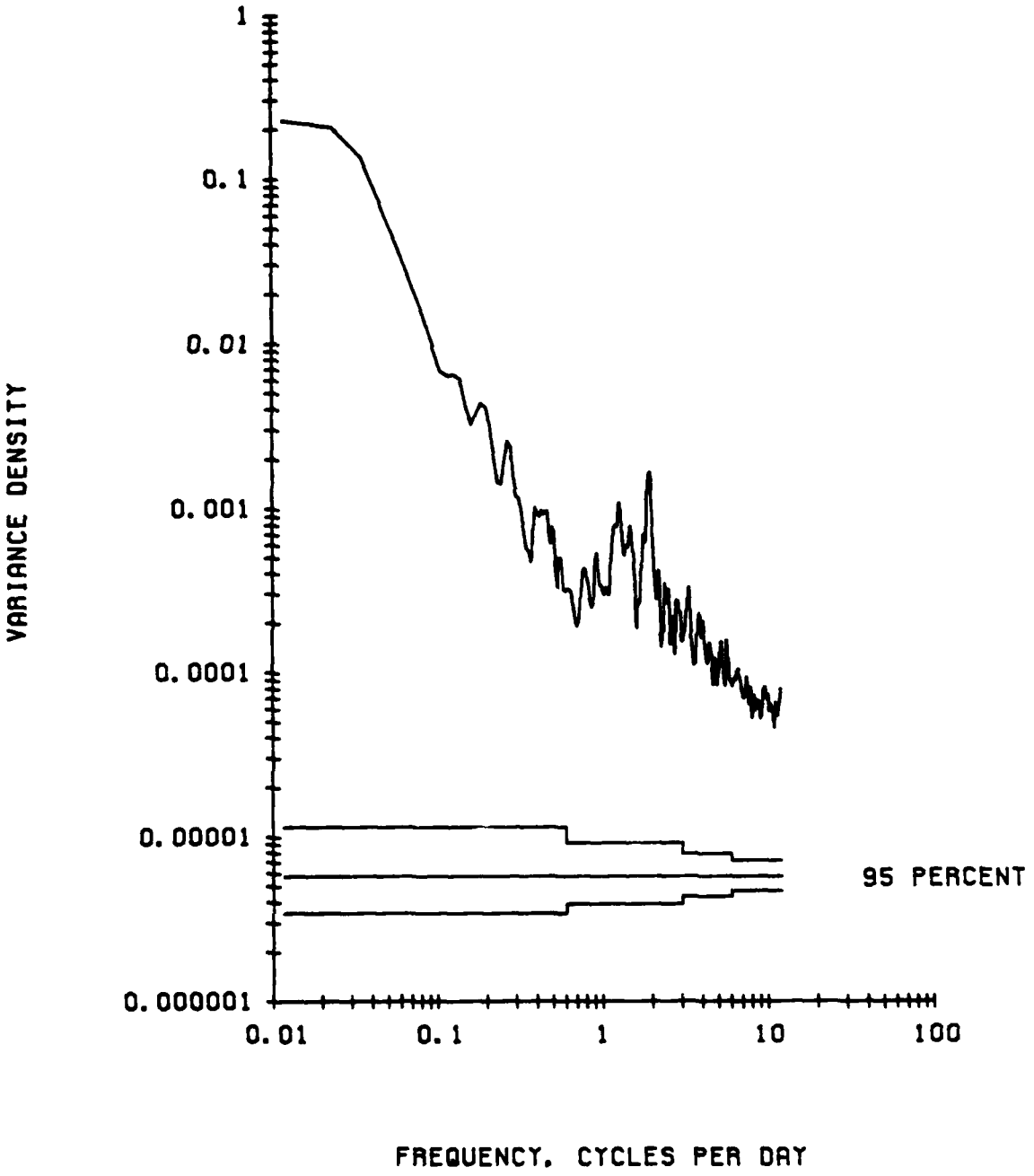
UNFILTERED TEMPERATURE. 145 M AT M-3.



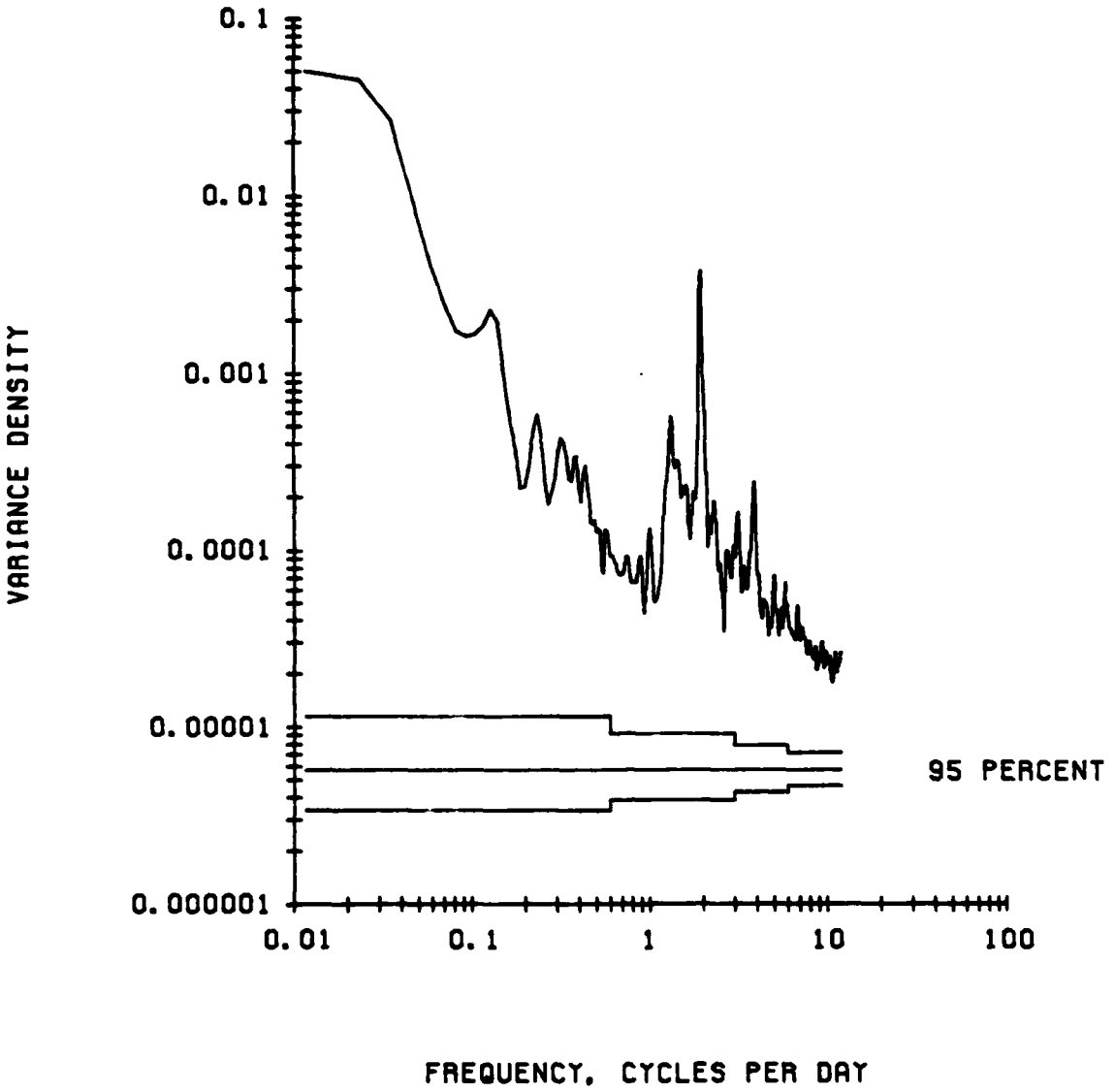
UNFILTERED TEMPERATURE. 350 M AT M-3.



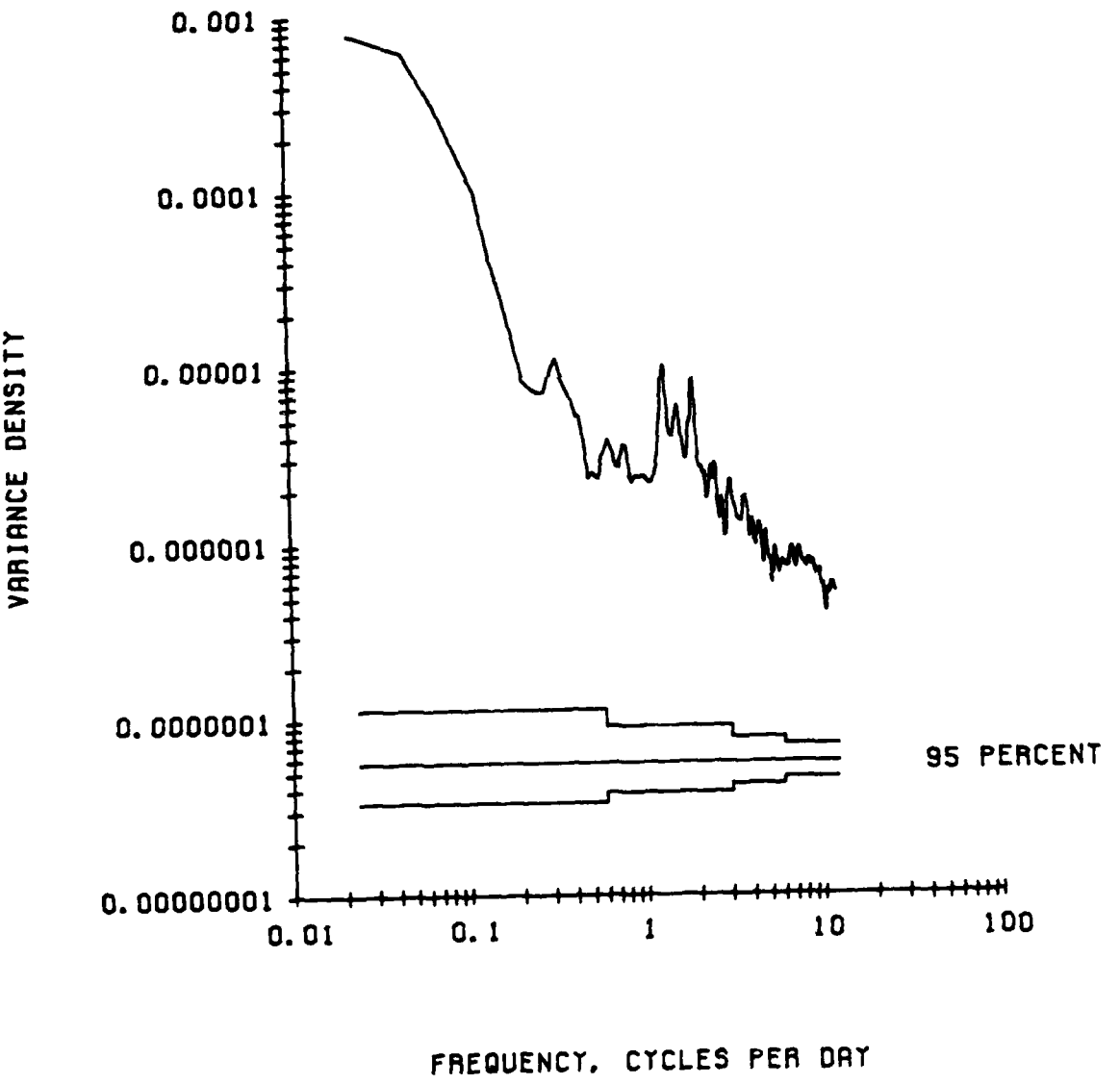
UNFILTERED TEMPERATURE. 800 M AT M-3.



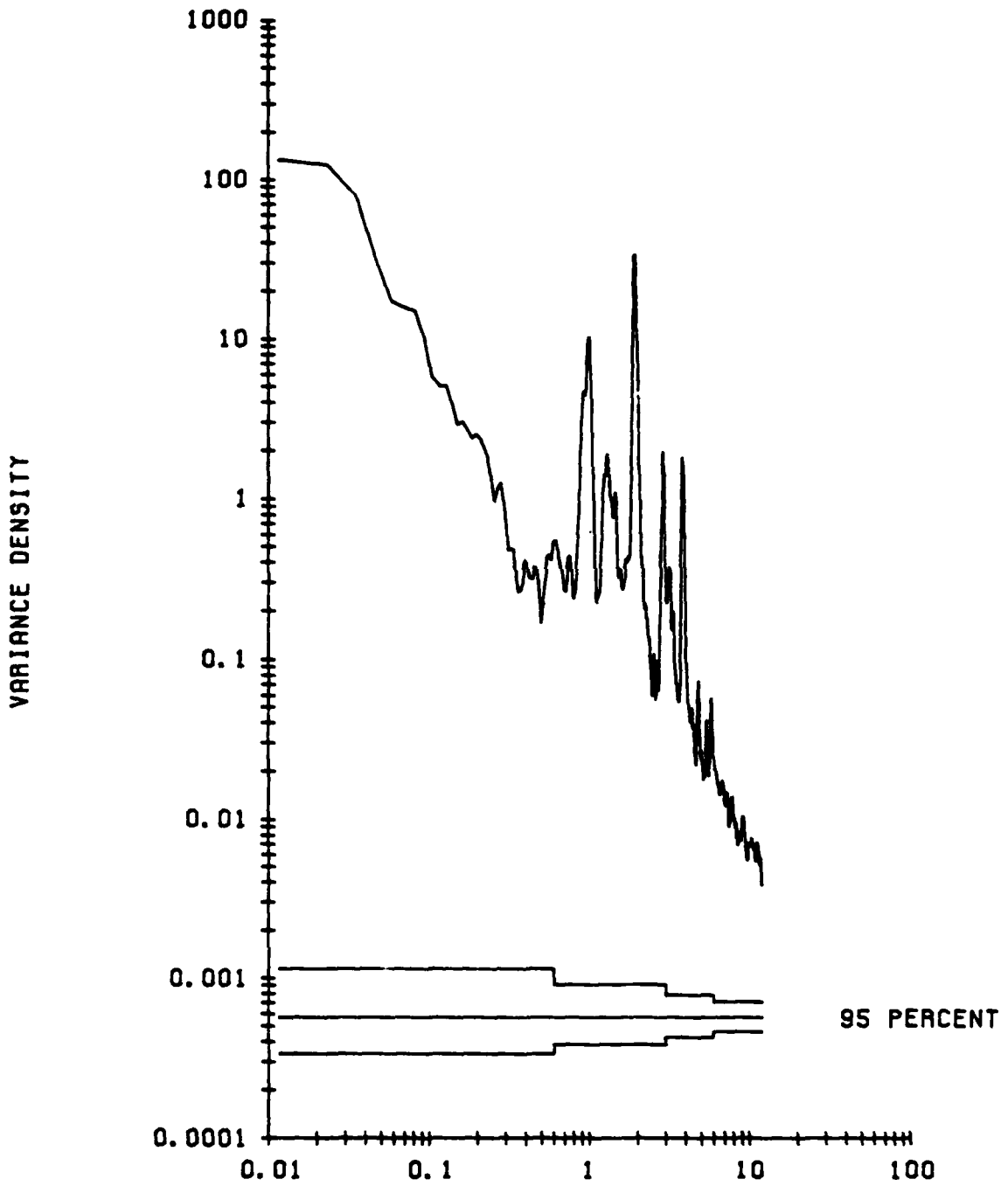
UNFILTERED TEMPERATURE. 1185 M AT M-3.



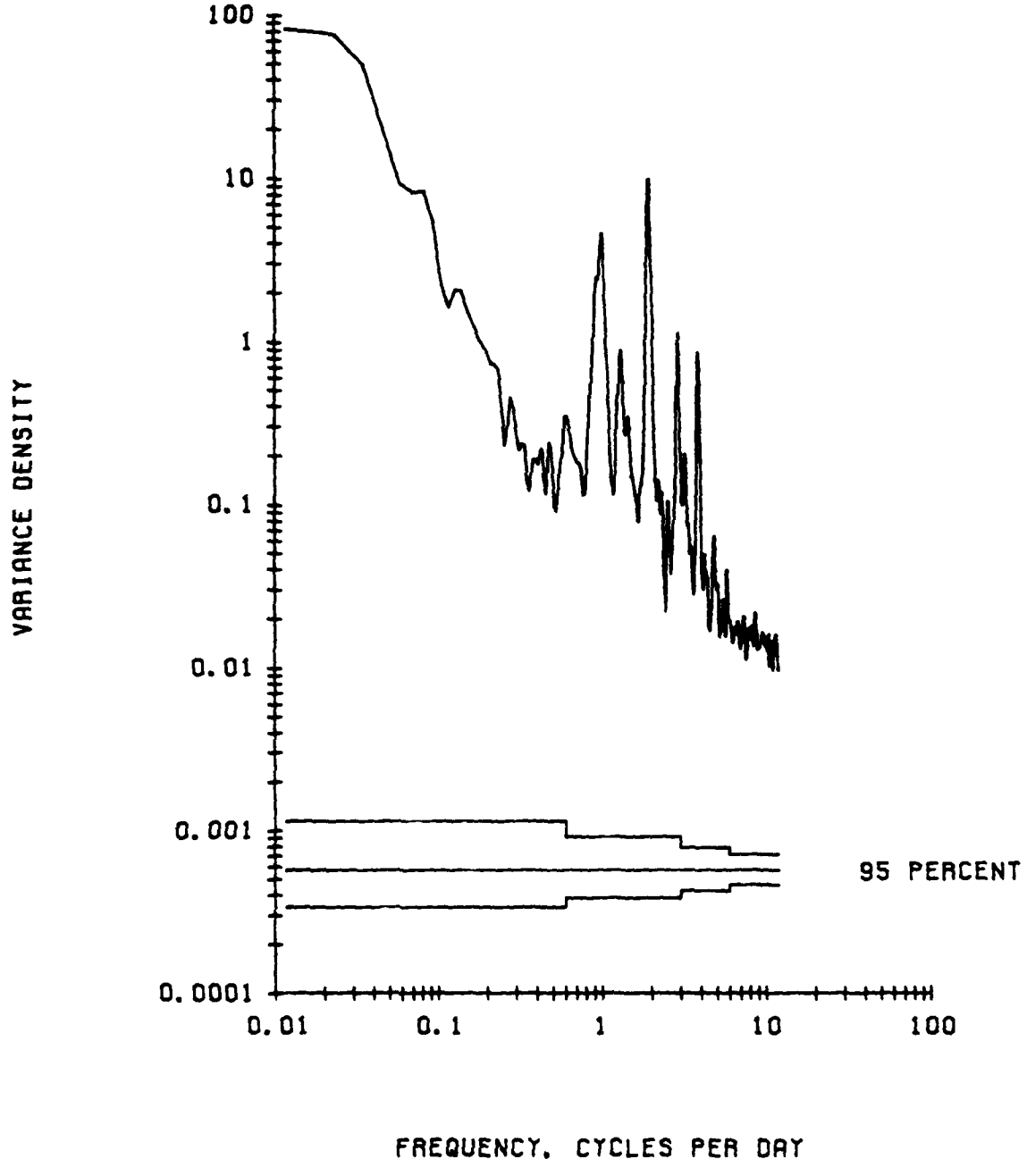
UNFILTERED TEMPERATURE. 3812 M AT M-3.



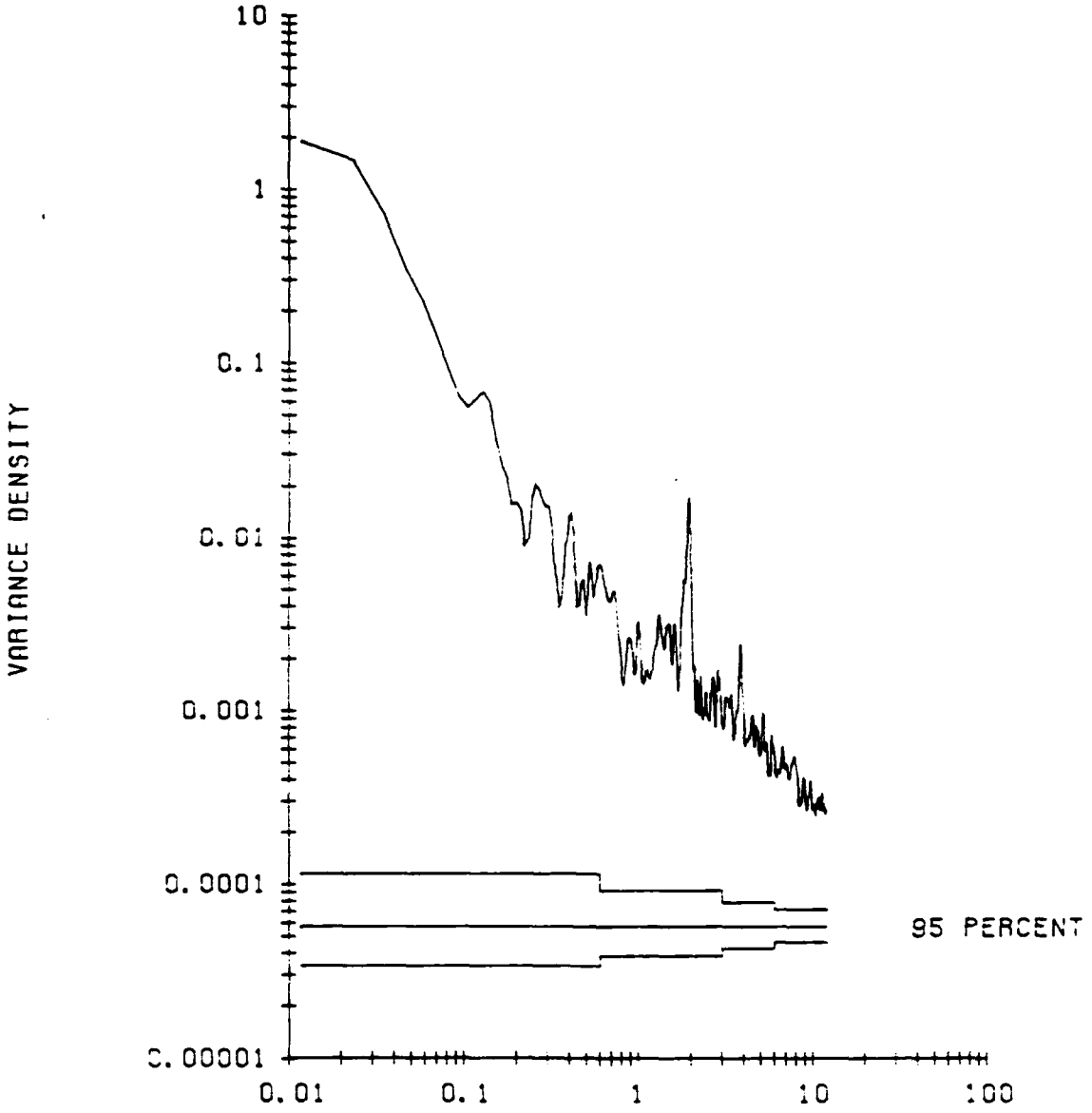
UNFILTERED PRESSURE. 145 M AT M-3.

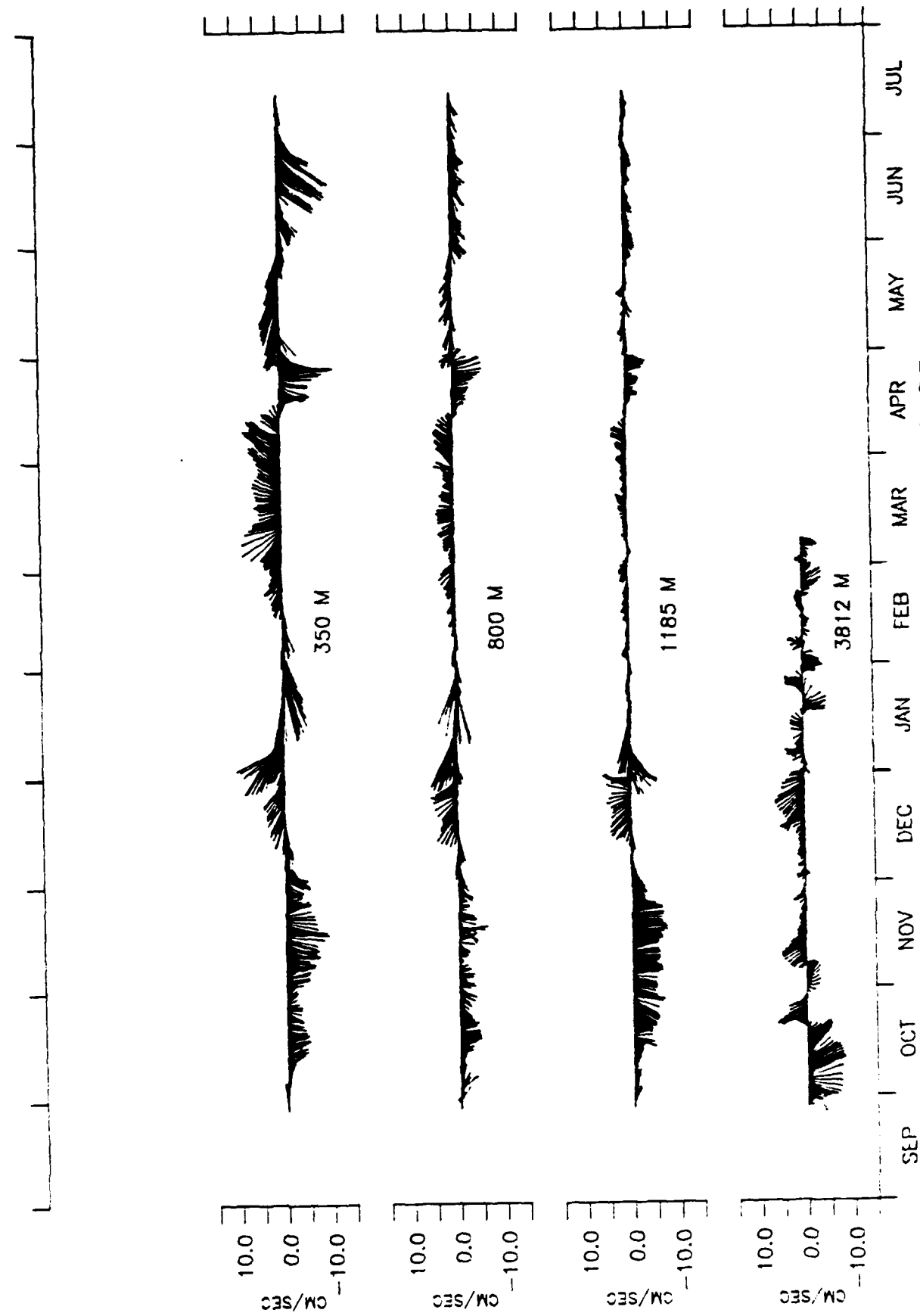


UNFILTERED PRESSURE. 1185 M AT M-3.

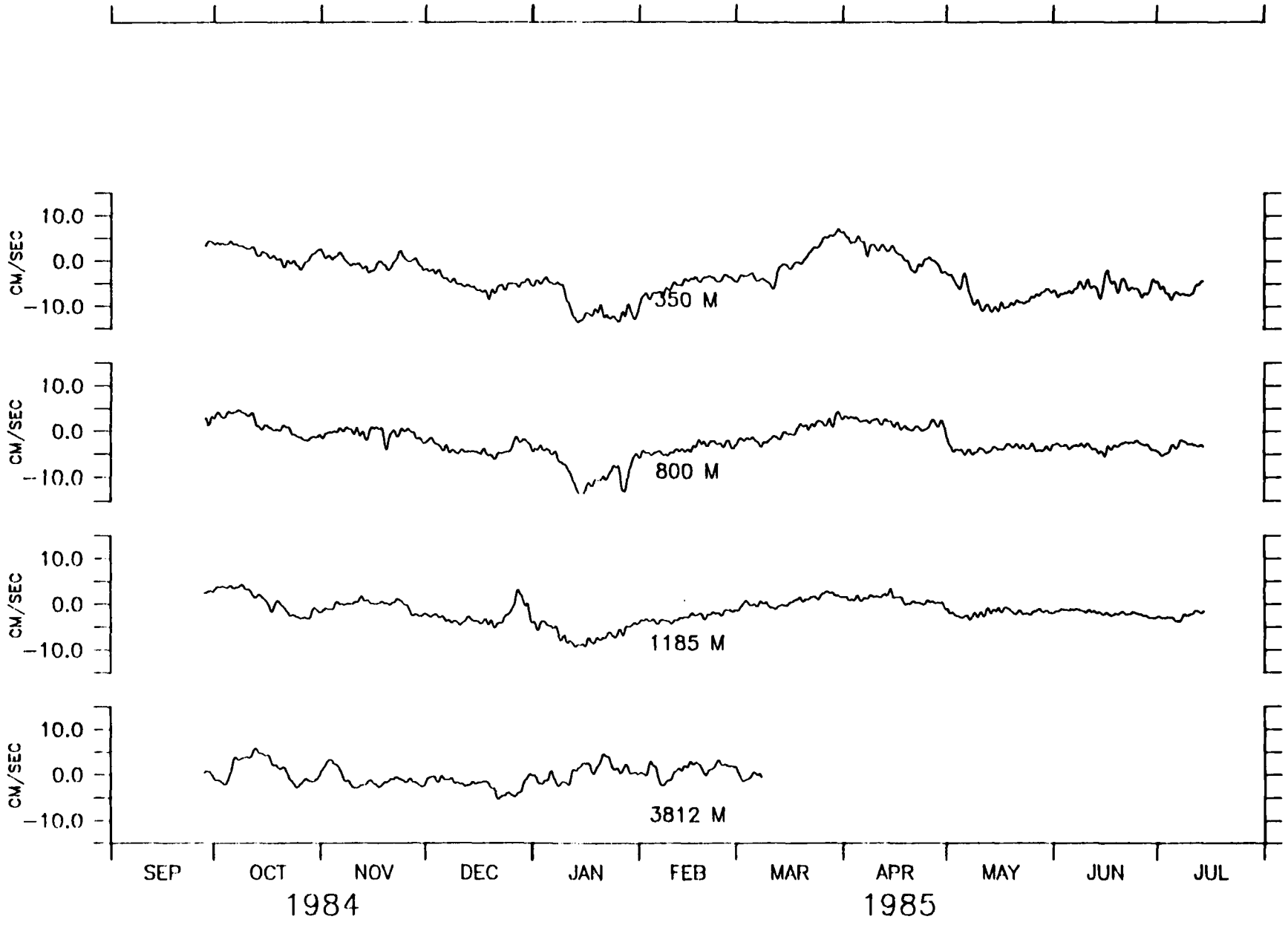


UNFILTERED CONDUCTIVITY. 145 M AT M-3.





VELOCITY VECTORS, M−3.



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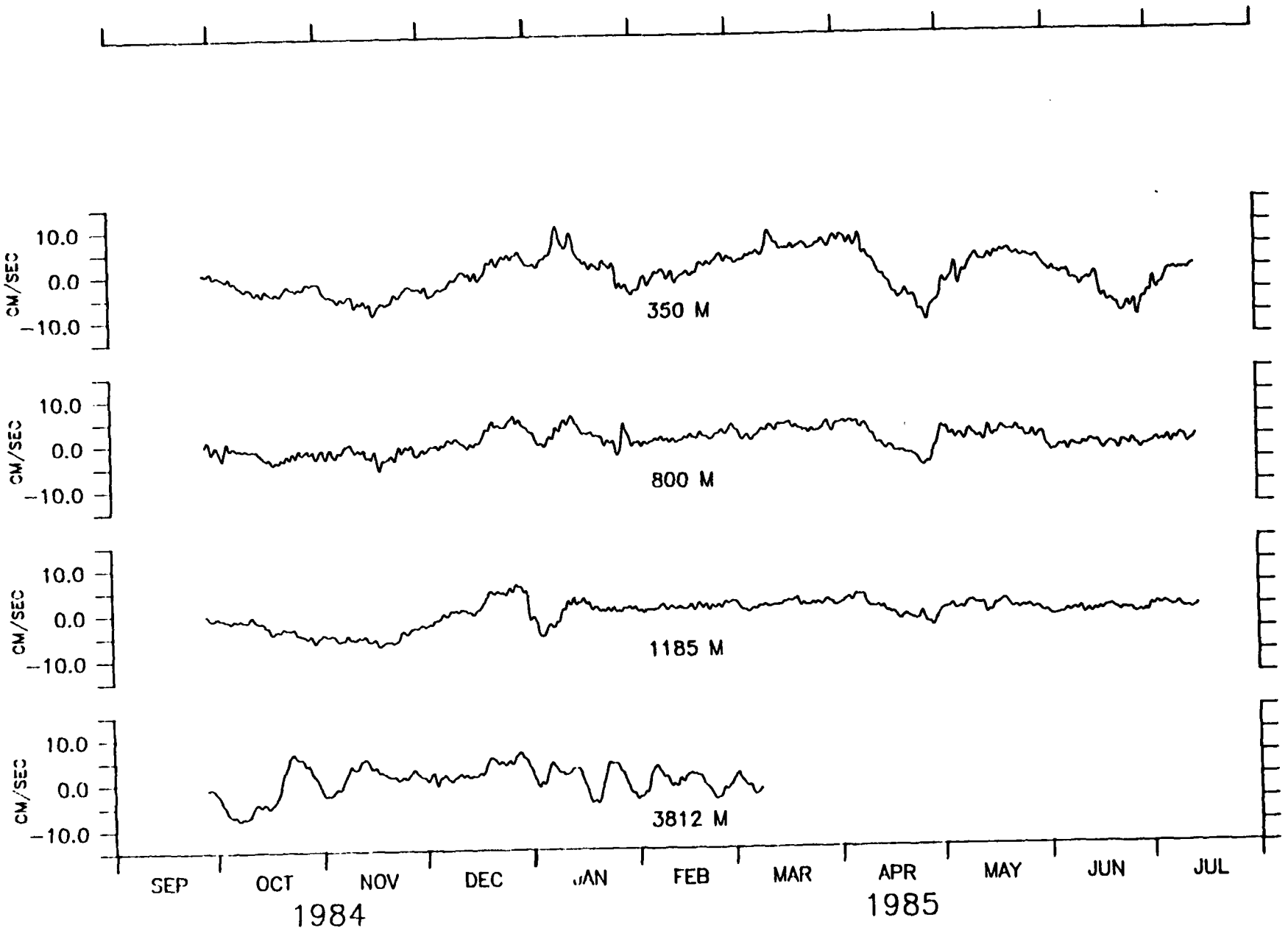
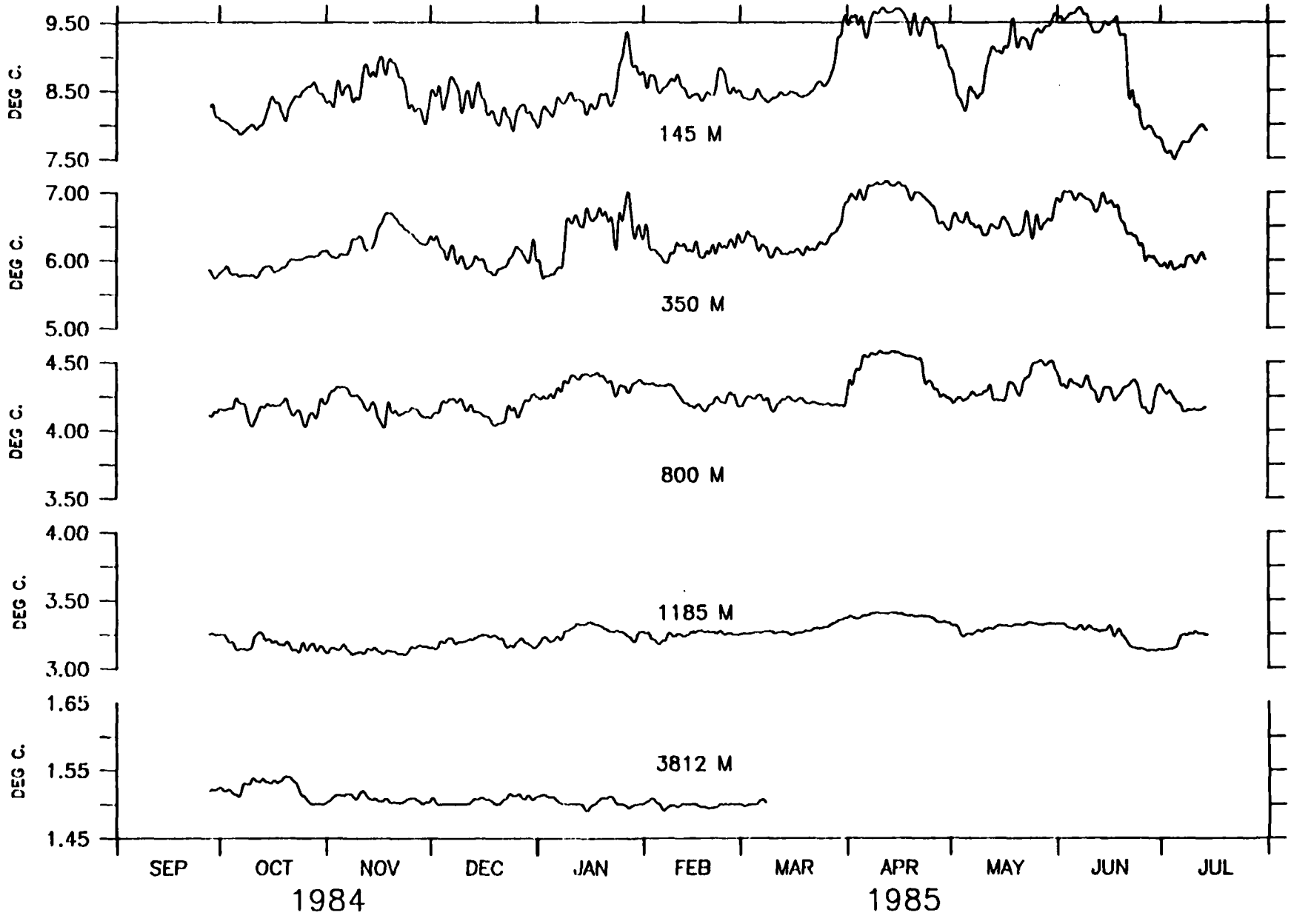
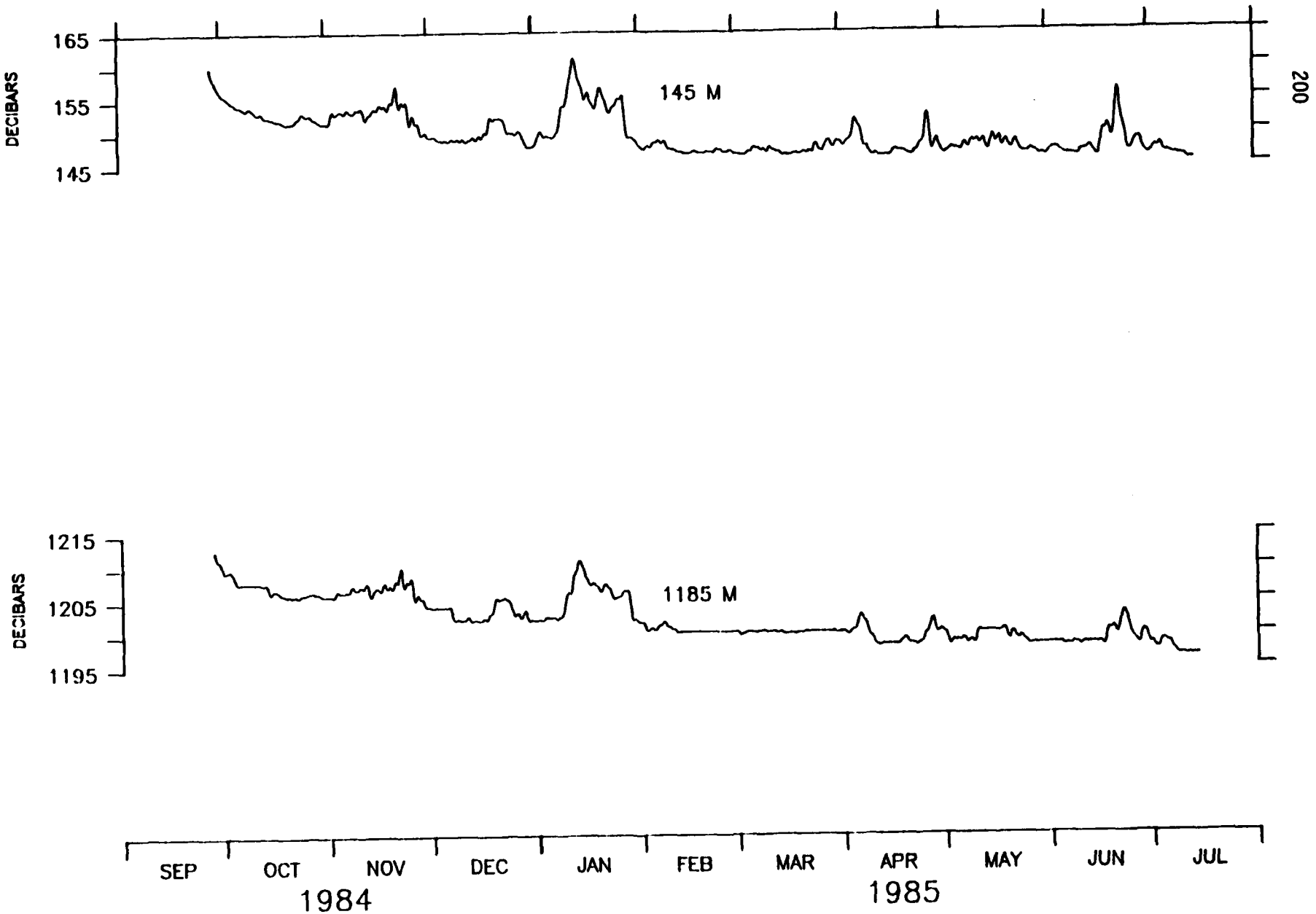


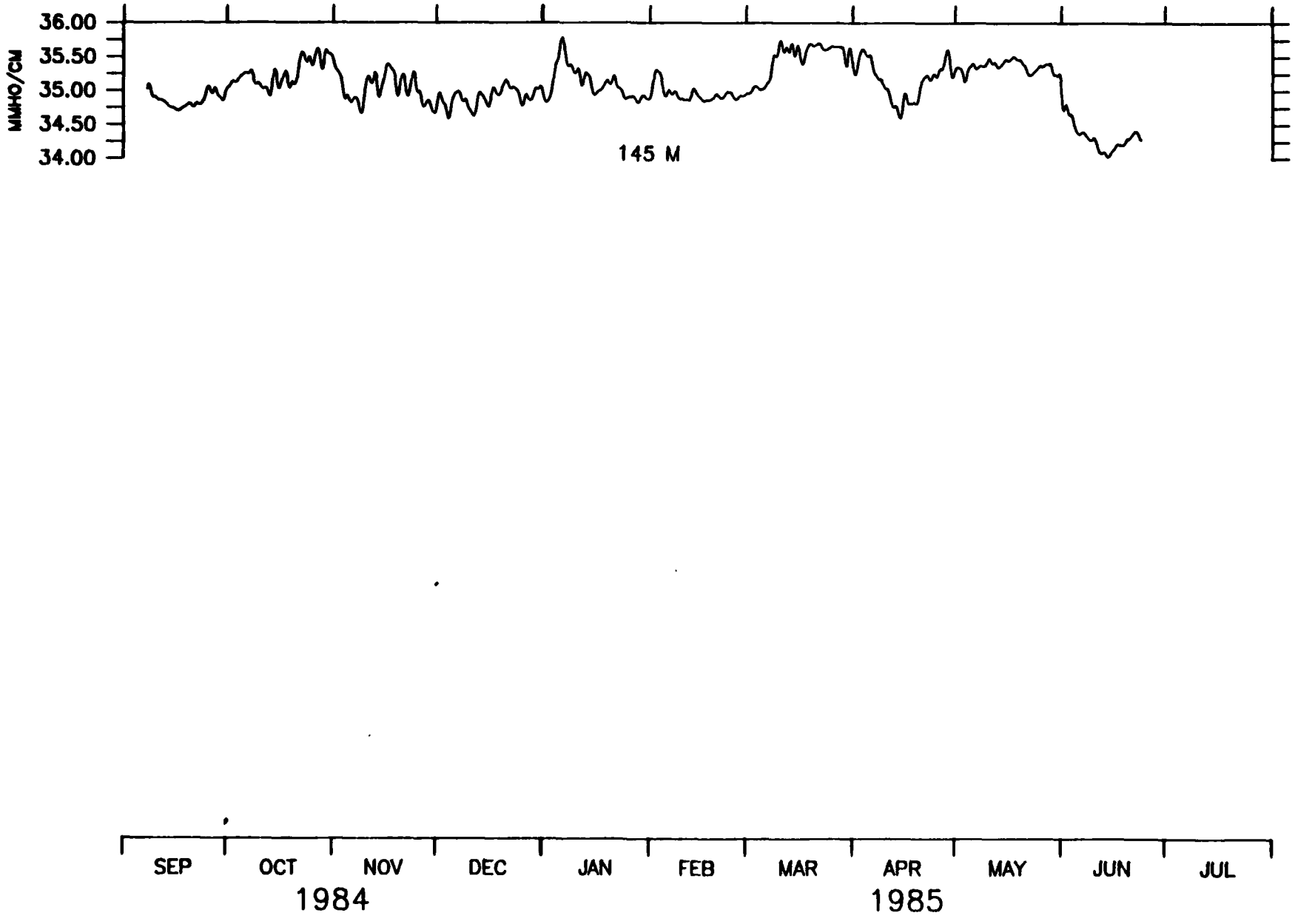
V COMPONENT, M-3.



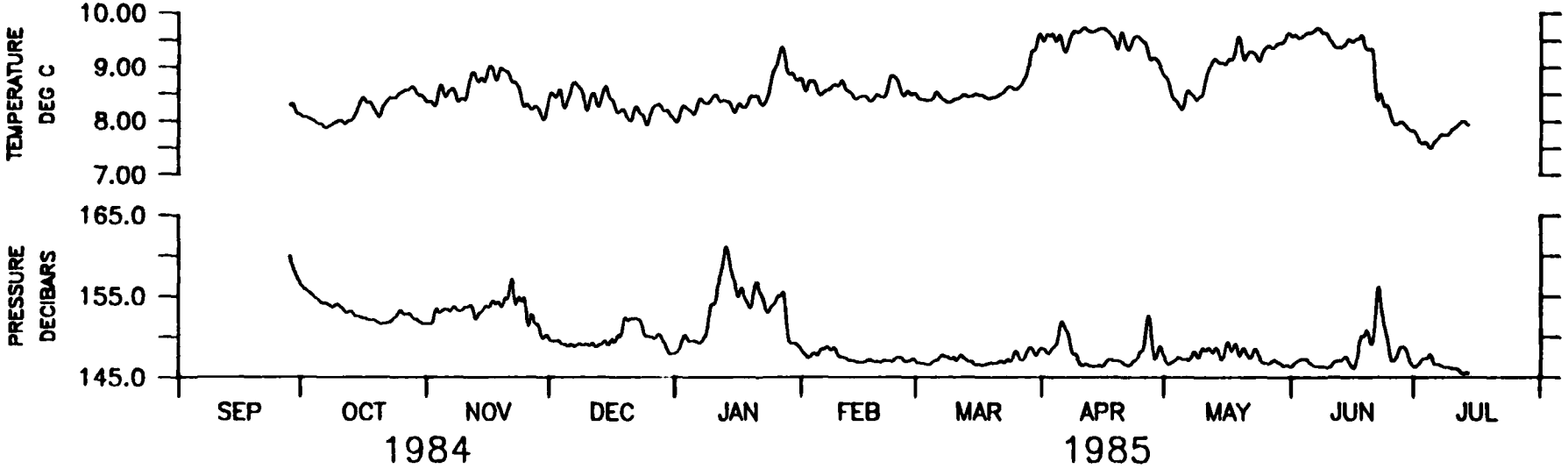
TEMPERATURE M-3.


DECIBARS
165
155
145
145 M
200
DECIBARS
1215
1205
1195
1185 M
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
1984
1985

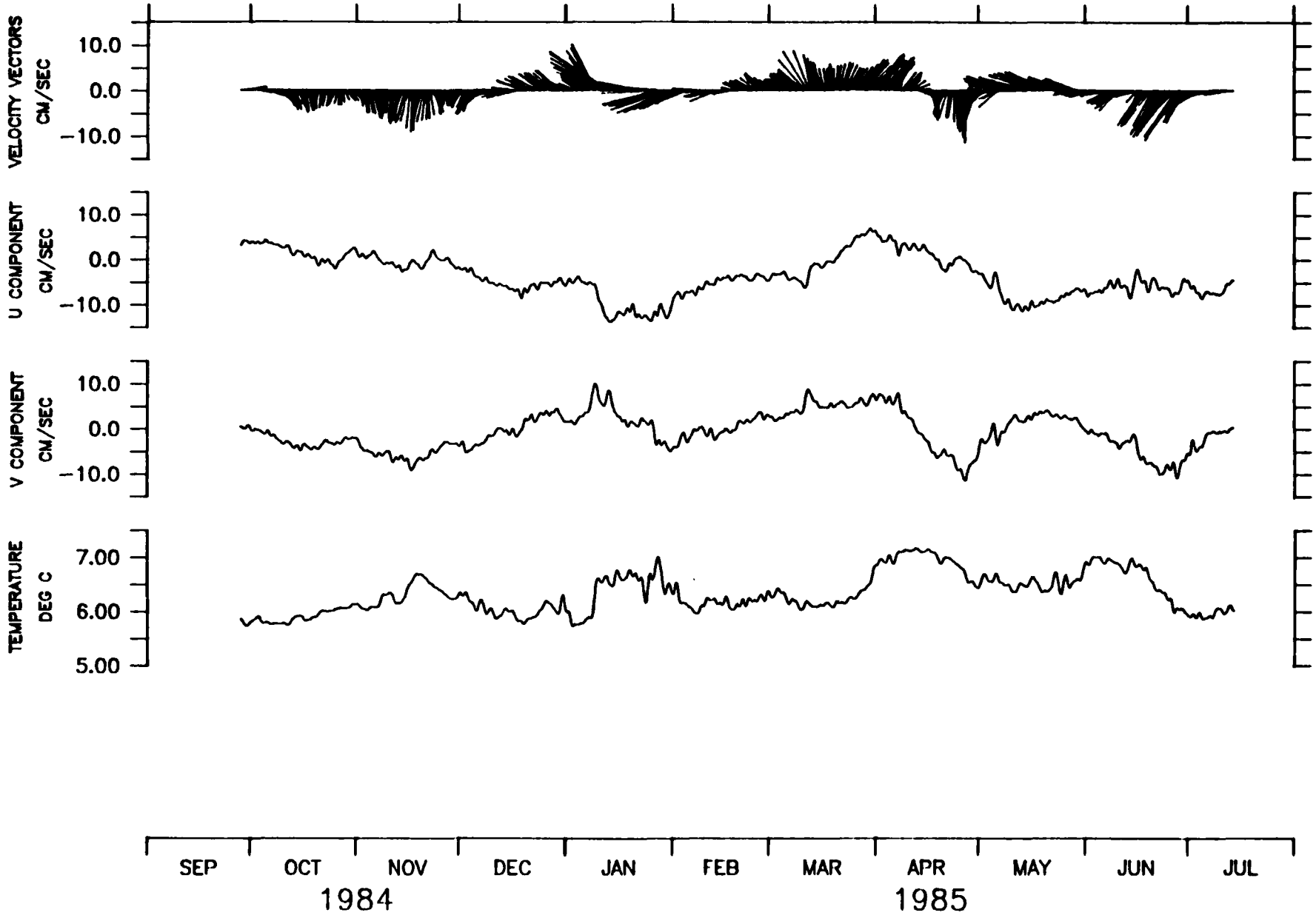
PRESSURE M-3.



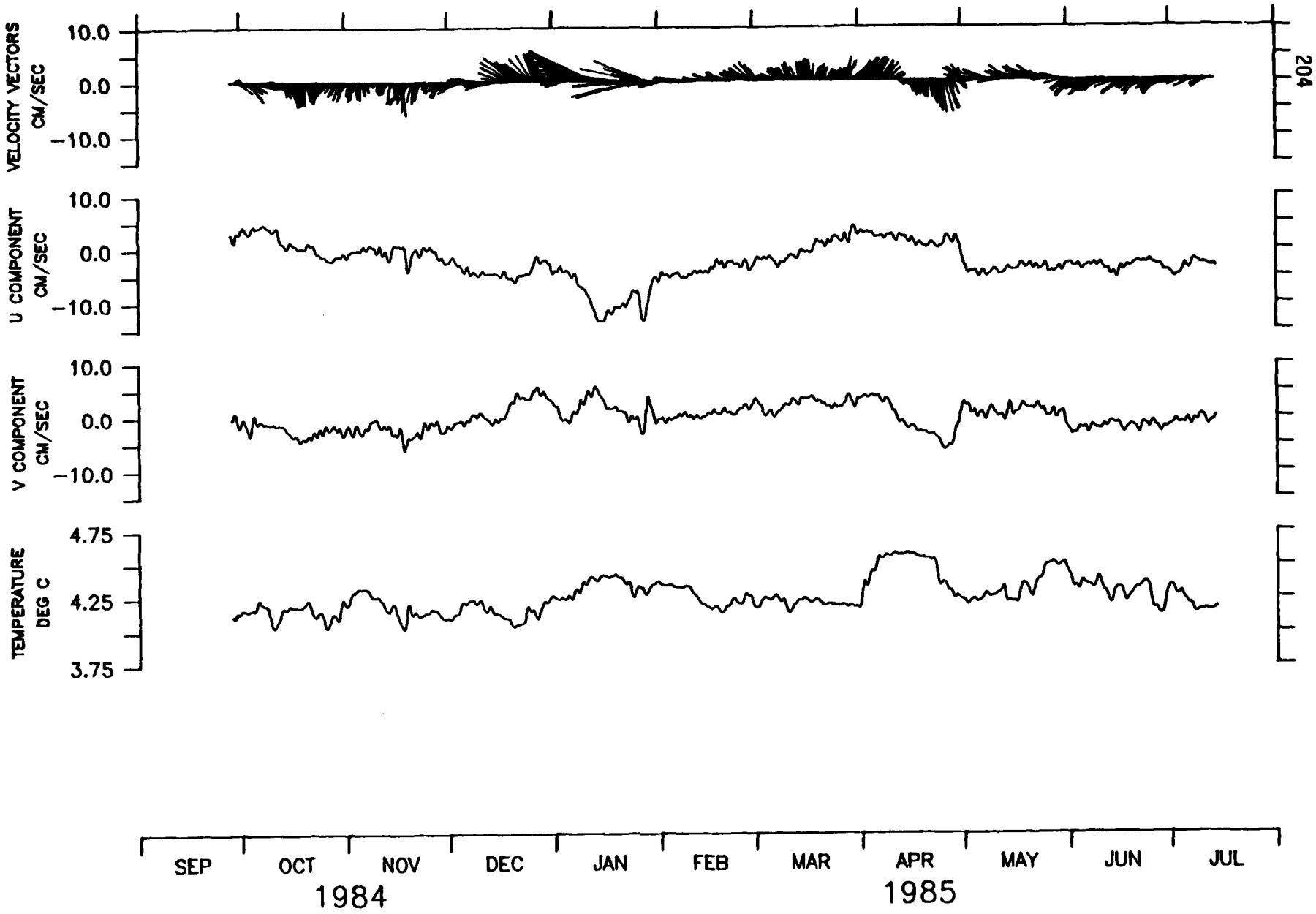
CONDUCTIVITY, M-3.



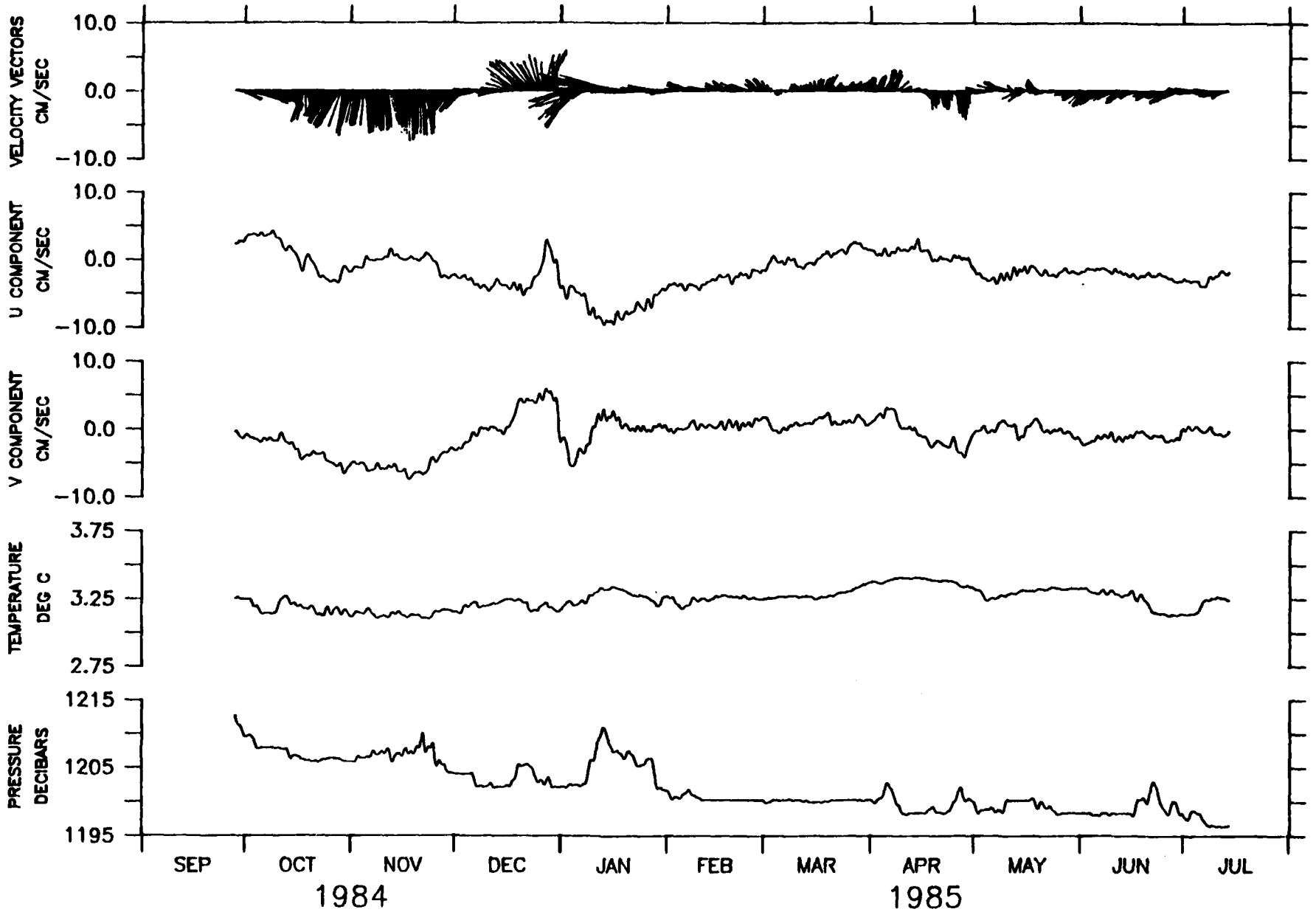
145 M AT OPTOMA MOORING M–3.



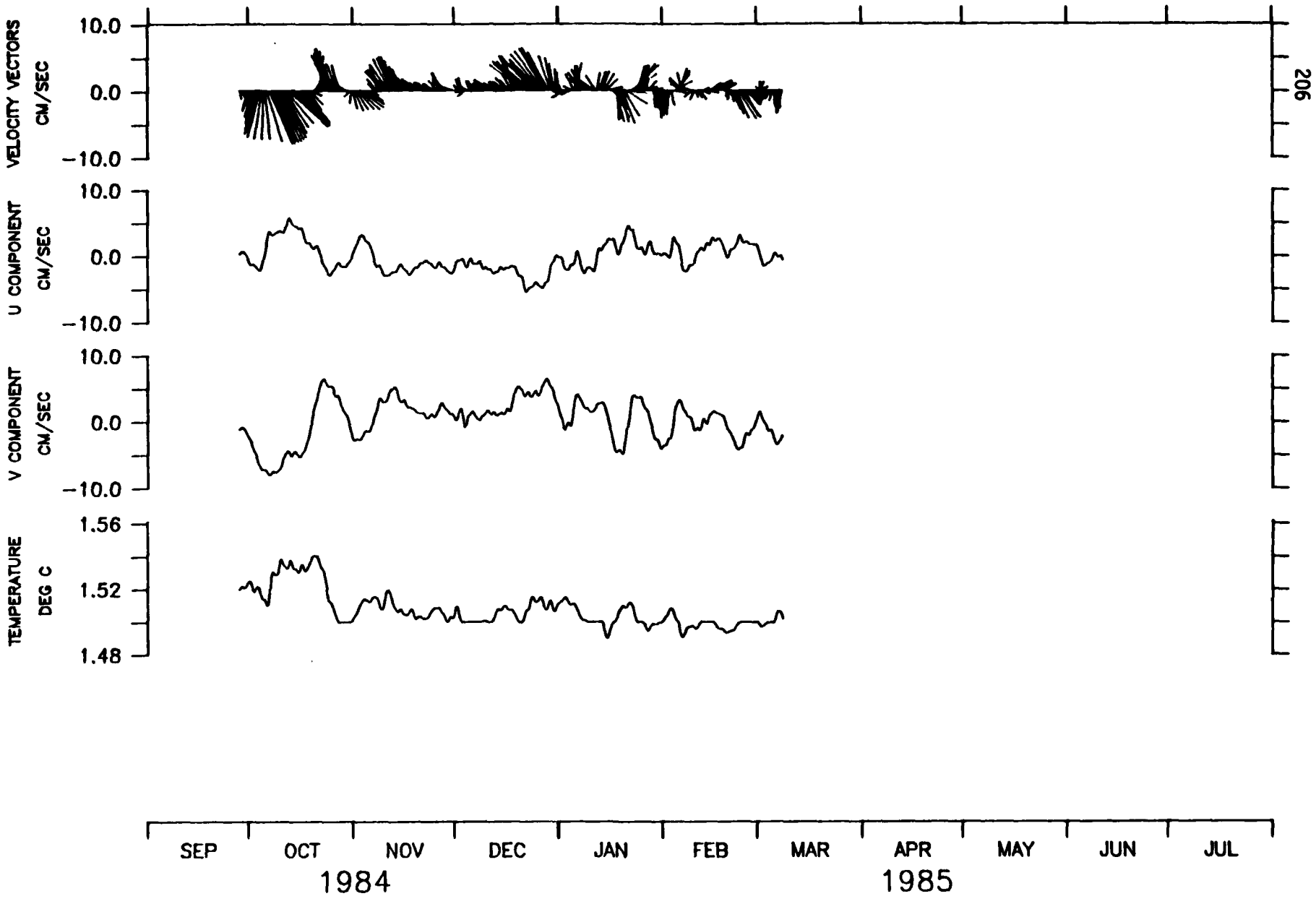
350 M AT OPTOMA MOORING M-3.



800 M AT OPTOMA MOORING M-3.

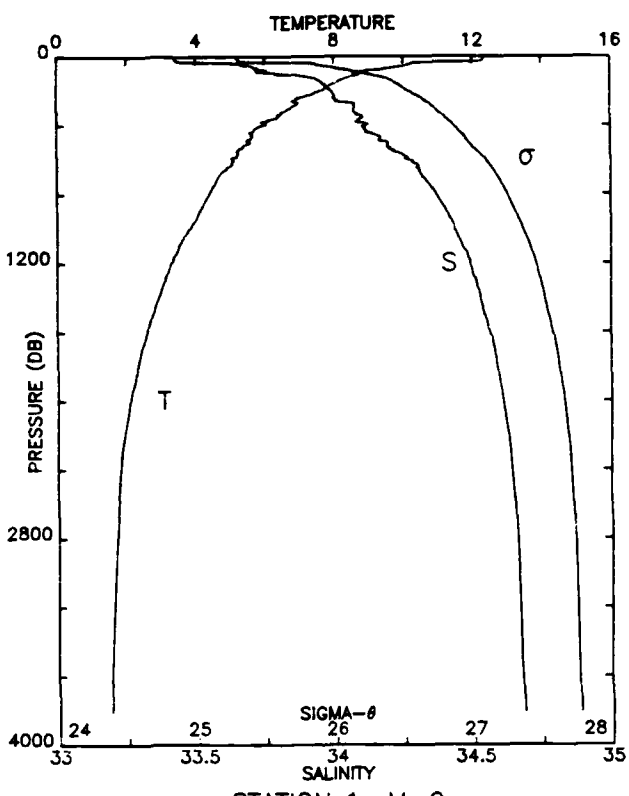


1185 M AT OPTOMA MOORING M-3.

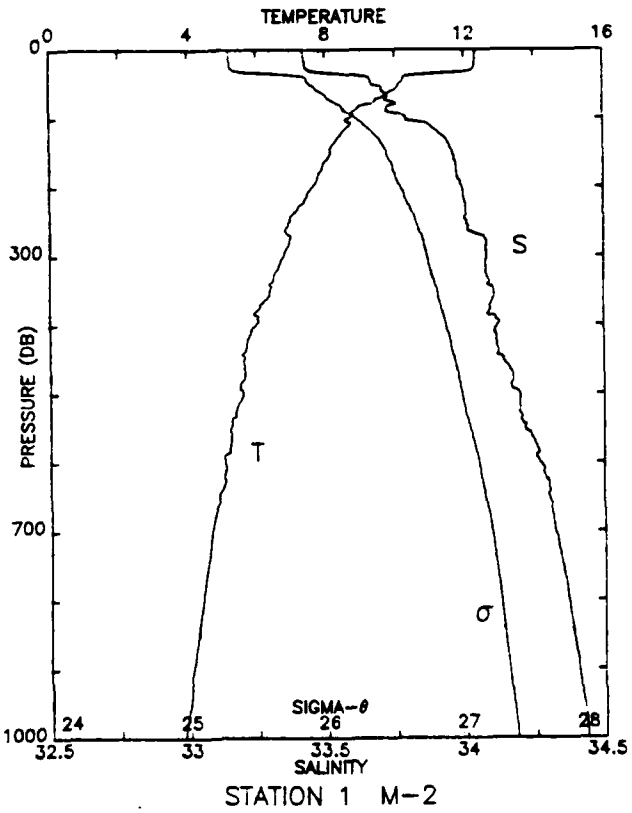


3812 M AT OPTOMA MOORING M-3.

CTD DATA



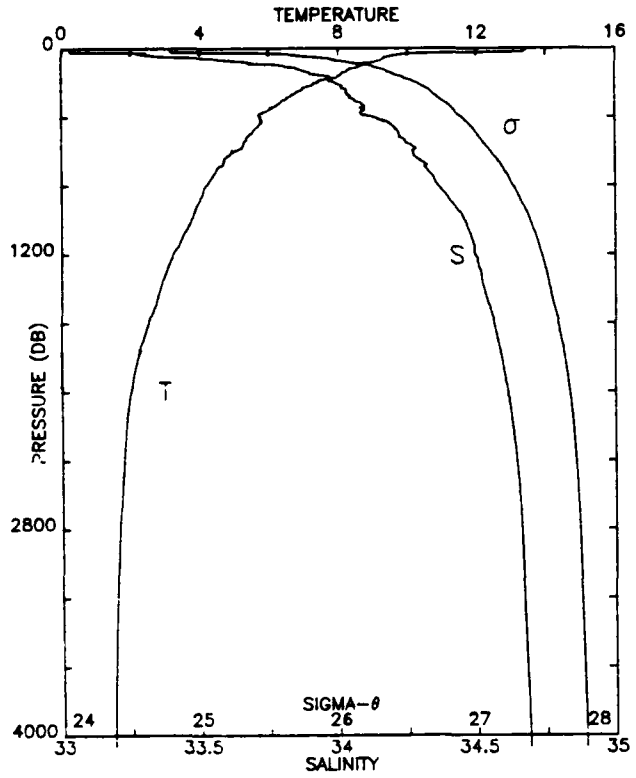
STATION 1 M–2



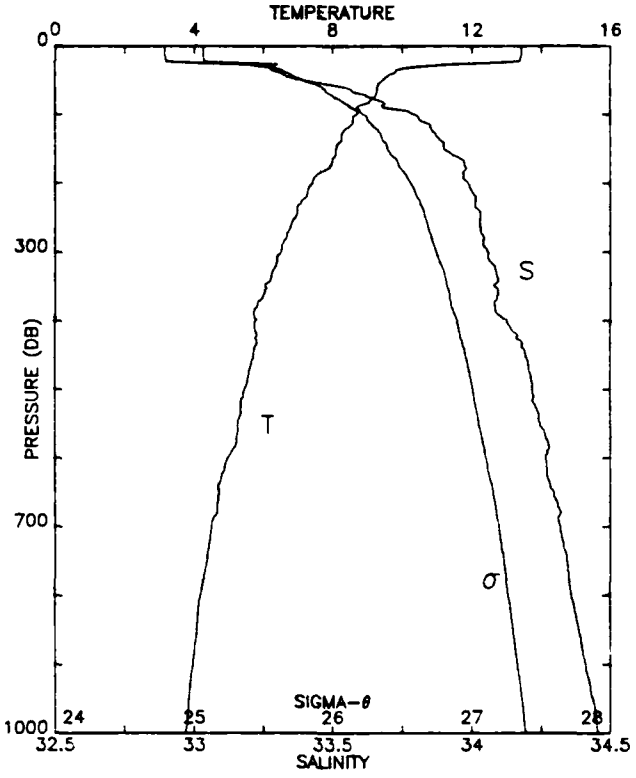
STATION 1 M–2

STA NO 1 M-2 LAT: 38 11.5 N LONG:124 24.7 W
14 JUL 1985 0222 GMT PROBE 2561 DEPTH 3767M

PRESS	TEMP	SAL	POTEN TEMP	SIGMA THETA	SVA	DELD
3	12.328	33.420	12.328	25.301	266.2	0.008
10	12.327	33.424	12.325	25.304	266.1	0.027
20	12.310	33.429	12.307	25.312	265.6	0.053
30	12.233	33.442	12.229	25.336	263.5	0.080
40	10.285	33.655	10.280	25.855	214.4	0.104
50	10.139	33.670	10.133	25.891	212.1	0.125
60	9.935	33.708	9.928	25.955	205.2	0.146
70	9.616	33.721	9.608	26.019	199.3	0.166
80	9.226	33.750	9.217	26.105	191.4	0.185
90	8.829	33.727	8.819	26.150	187.2	0.204
100	8.658	33.791	8.648	26.227	180.0	0.223
110	8.702	33.875	8.691	26.286	174.6	0.240
120	8.498	33.906	8.486	26.342	169.5	0.258
130	8.341	33.937	8.327	26.390	165.1	0.274
140	8.193	33.948	8.179	26.421	162.3	0.291
150	8.127	33.956	8.112	26.438	160.8	0.307
175	7.882	33.970	7.864	26.485	156.8	0.347
200	7.631	33.992	7.611	26.539	152.0	0.385
225	7.314	34.005	7.293	26.594	147.0	0.422
250	6.940	34.006	6.917	26.647	142.2	0.459
300	6.774	34.077	6.746	26.726	135.4	0.528
400	5.960	34.116	5.926	26.864	123.2	0.657
500	5.579	34.196	5.537	26.975	113.7	0.775
600	5.046	34.268	4.997	27.095	102.9	0.883
800	4.374	34.368	4.313	27.251	89.3	1.074
1000	3.808	34.433	3.733	27.362	79.5	1.243
1500	2.741	34.542	2.636	27.552	62.3	1.591
2000	2.079	34.608	1.941	27.662	52.1	1.873
2500	1.764	34.646	1.588	27.720	47.2	2.119
3000	1.636	34.663	1.416	27.746	45.9	2.351
3500	1.548	34.674	1.281	27.764	45.4	2.579
3805	1.499	34.683	1.201	27.777	44.8	2.717



STATION 2 M–3

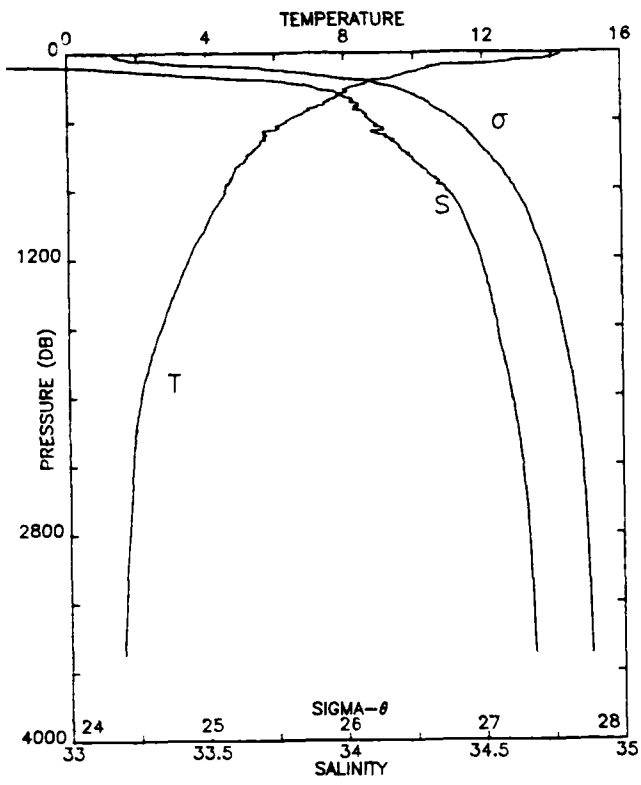


STATION 2 M–3

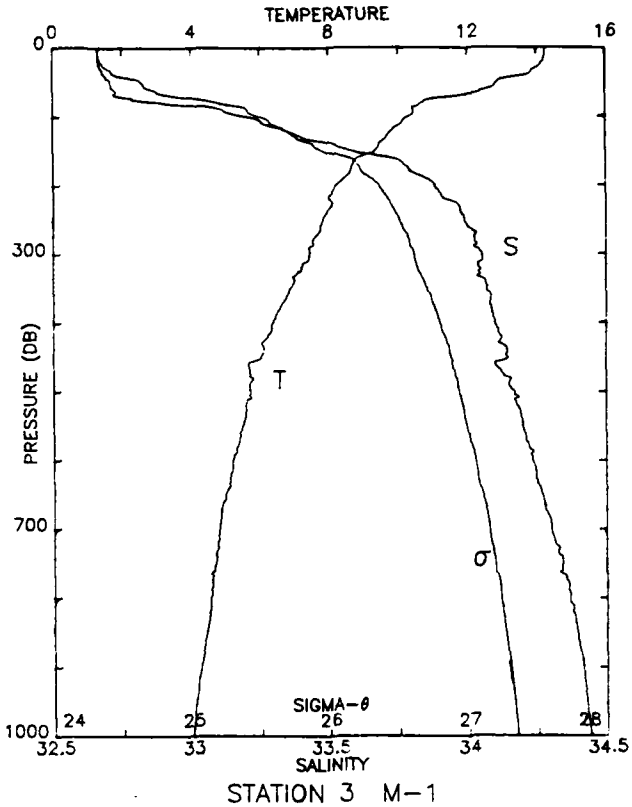
STA NO 2 M-3 LAT: 38 12.5 N LONG:125 35.1 W
15 JUL 1985 2152 GMT PROBE 2561 DEPTH 4020M

PRESS	TEMP	SAL	POTEN TEMP	SIGMA THETA	SVA	DELD
1	13.420	33.032	13.420	24.785	315.2	0.003
10	13.424	33.032	13.422	24.785	315.5	0.032
20	13.384	33.033	13.381	24.794	314.9	0.063
30	10.642	33.282	10.638	25.501	247.8	0.092
40	9.748	33.322	9.743	25.685	230.4	0.115
50	9.444	33.398	9.438	25.794	220.3	0.138
60	9.297	33.537	9.291	25.926	207.9	0.159
70	9.256	33.604	9.248	25.986	202.4	0.180
80	9.089	33.670	9.081	26.065	195.1	0.200
90	8.709	33.691	8.699	26.140	188.1	0.219
100	8.690	33.796	8.680	26.226	180.1	0.237
110	8.586	33.824	8.575	26.264	176.7	0.255
120	8.420	33.854	8.408	26.313	172.2	0.272
130	8.275	33.873	8.262	26.350	168.8	0.289
140	8.221	33.898	8.207	26.378	166.4	0.306
150	8.108	33.901	8.092	26.398	164.7	0.323
175	7.954	33.976	7.937	26.479	157.3	0.363
200	7.430	33.988	7.411	26.565	149.5	0.401
225	7.131	34.016	7.110	26.629	143.7	0.438
250	6.925	34.031	6.902	26.669	140.1	0.473
300	6.514	34.059	6.487	26.747	133.3	0.542
400	5.781	34.127	5.748	26.894	120.1	0.668
500	5.452	34.219	5.411	27.008	110.4	0.783
600	4.974	34.267	4.926	27.103	102.0	0.889
800	4.180	34.360	4.119	27.265	87.6	1.078
1000	3.743	34.455	3.669	27.387	77.1	1.242
1500	2.702	34.548	2.598	27.560	61.5	1.584
2000	1.994	34.612	1.857	27.672	50.7	1.861
2500	1.749	34.648	1.573	27.723	46.9	2.103
3000	1.608	34.664	1.389	27.749	45.4	2.333
3500	1.527	34.676	1.260	27.767	44.9	2.559
4000	1.481	34.687	1.162	27.783	44.7	2.782
4065	1.484	34.688	1.159	27.784	44.9	2.811

LIN INT SAL 1843-1853 DB



STATION 3 M-1



STATION 3 M-1

STA NO 3 M-1 LAT: 38 56.6 N LONG:124 59.8 W
16 JUL 1985 2106 GMT PROBE 2561 DEPTH 3453M

PRESS	TEMP	SAL	POTEN TEMP	SIGMA THETA	SVA	DELD
1	14.258	32.663	14.258	24.329	358.7	0.004
10	14.250	32.664	14.248	24.332	358.7	0.036
20	14.197	32.666	14.195	24.344	357.8	0.072
30	13.997	32.673	13.992	24.392	353.5	0.107
40	13.729	32.688	13.723	24.459	347.4	0.142
50	13.871	32.709	12.864	24.646	329.8	0.176
60	12.618	32.720	12.610	24.704	324.5	0.209
70	12.761	32.735	12.752	24.877	308.2	0.241
80	10.696	32.898	10.687	25.195	278.0	0.270
90	10.431	33.114	10.420	25.409	257.8	0.296
100	10.312	33.200	10.301	25.496	249.7	0.322
110	10.099	33.262	10.087	25.581	241.9	0.346
120	9.832	33.343	9.818	25.689	231.7	0.370
130	9.660	33.406	9.646	25.767	224.5	0.393
140	9.459	33.521	9.444	25.890	213.0	0.415
150	9.345	33.583	9.328	25.956	206.9	0.436
175	8.653	33.788	8.635	26.226	181.5	0.483
200	8.232	33.883	8.212	26.365	168.7	0.527
225	8.112	33.961	8.089	26.445	161.5	0.568
250	7.825	33.988	7.800	26.509	155.8	0.608
300	7.444	34.053	7.416	26.615	146.4	0.683
400	6.352	34.096	6.316	26.798	129.7	0.821
500	5.709	34.167	5.667	26.936	117.4	0.944
600	5.172	34.232	5.123	27.052	107.1	1.057
800	4.514	34.366	4.452	27.234	91.1	1.254
1000	3.971	34.441	3.895	27.352	80.9	1.425
1500	2.809	34.535	2.703	27.540	63.7	1.782
2000	2.054	34.597	1.916	27.655	52.6	2.071
2500	1.781	34.642	1.605	27.715	47.7	2.318
3000	1.627	34.664	1.407	27.747	45.7	2.552
3497	1.527	34.680	1.260	27.771	44.6	2.776

END

DTIC

6-86