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**A Compilation of
Observations from
Moored Current Meters**

Volume XIII
Currents, Temperature and Pressure
Southeast of New Zealand
April 1978-May 1980

by
J. S. Bottero
H. L. Bryden
D. C. Root
J. Simpkins III

Data Report 88
Reference 81-8
June 1981

National Science Foundation
Grant No. OCE-772887

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School of Oceanography
Oregon State University
Corvallis, OR 97331

A COMPILATION
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FROM MOORED CURRENT METERS

VOLUME XIII

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ABSTRACT

Observations were made southeast of New Zealand from April 1978 to May 1980 with the objectives of investigating the dynamics of low-frequency motions and their effects on the Antarctic Circumpolar Current; and the formation of subantarctic mode water on Campbell Plateau. Self-recording instruments were deployed during a 7-month period from April to November 1978, and during an 18-month period from November 1978 to May 1980. The 7-month array consisted of 15 Aanderaa current meters and 5 Aanderaa thermistor chains. The 18-month array consisted of 3 Aanderaa current meters. Measurements from these instruments are summarized in this report through statistical tables, progressive vector diagrams, real time plots, rotary and standard spectra, and stick figures.

INTRODUCTION

As part of the International Southern Ocean Studies program, a set of observations were made in the region southeast of New Zealand during the period April 1978 to May 1980. The major components of this work were a large-scale hydrographic survey under the direction of Dr. Michael McCartney, an array of moored current and temperature observations under the direction of Dr. Harry Bryden, and a study of the polar front zone under the direction of Dr. Terrence Joyce (Morrison, Baker, Gordon, McCartney, Nowlin, Pillsbury and Warren, 1980). The purposes of the moored current and temperature measurements, with which this report is primarily concerned, were to investigate the dynamics of low-frequency motions or eddies and their effects on the mean circulation, and the formation of sub-antarctic mode water on Campbell Plateau.

The first array of self-recording moored instruments were deployed from R/V TANGAROA during April 1978 (Figure 1). The array consisted of a coherent cluster of 5 moorings near $49^{\circ}30'S$, $170^{\circ}W$ (Figure 2) and a single mooring at $51^{\circ}10'S$, $175^{\circ}E$. The cluster was designed to study the combined spatial and temporal variability of eddies in the region downstream from where the Antarctic Circumpolar Current interacts with Macquarie Ridge. The single mooring on

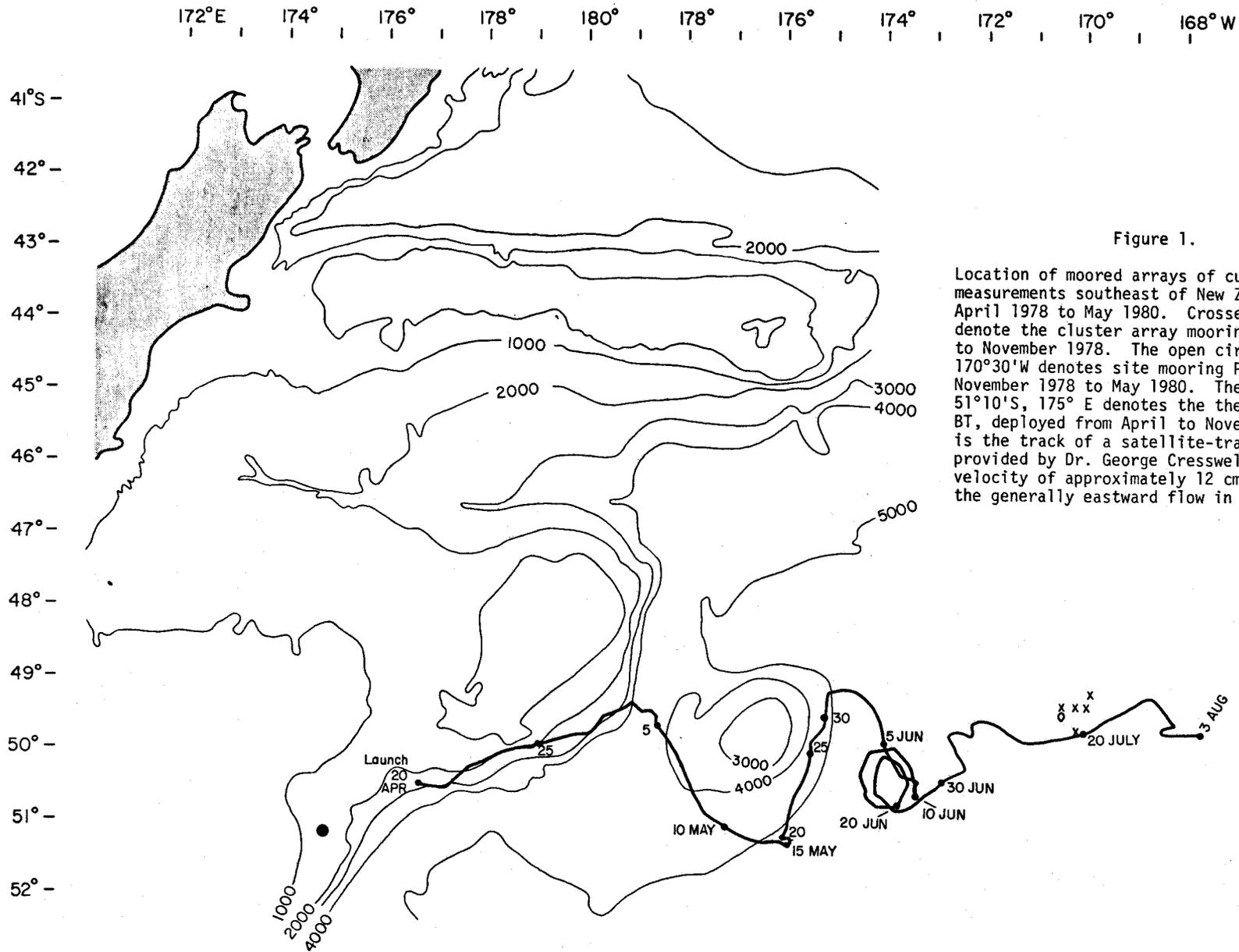


Figure 1.

Location of moored arrays of current and temperature measurements southeast of New Zealand during the period April 1978 to May 1980. Crosses near 49°30'S, 170° W denote the cluster array moorings deployed from April to November 1978. The open circle near 49°24'S, 170°30'W denotes site mooring Pikopiko deployed from November 1978 to May 1980. The darkened circle near 51°10'S, 175° E denotes the thermistor chain mooring BT, deployed from April to November 1978. Also shown is the track of a satellite-tracked drifting buoy provided by Dr. George Cresswell. The buoy's eastward velocity of approximately 12 cm/s is meant to indicate the generally eastward flow in this region.

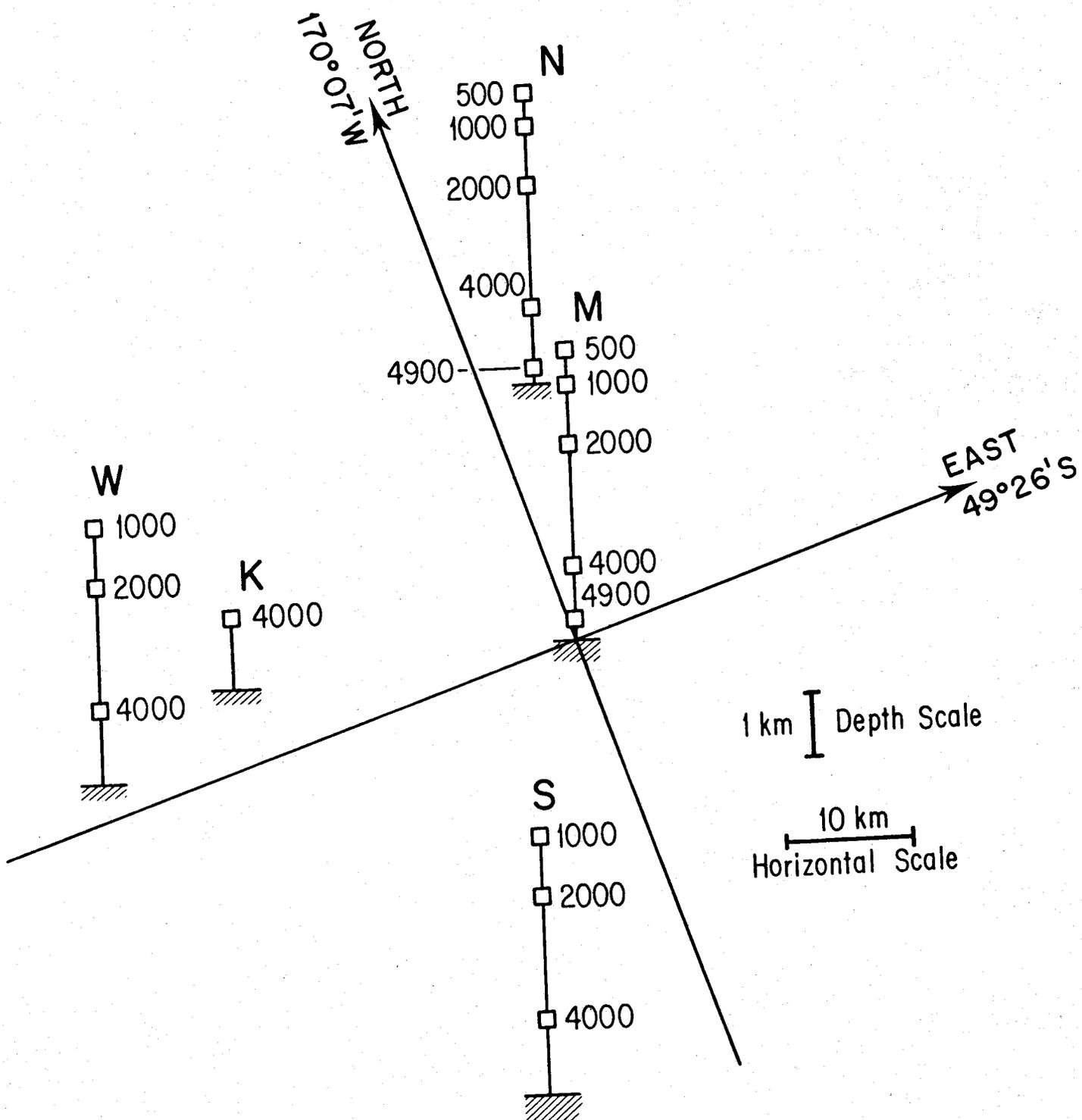
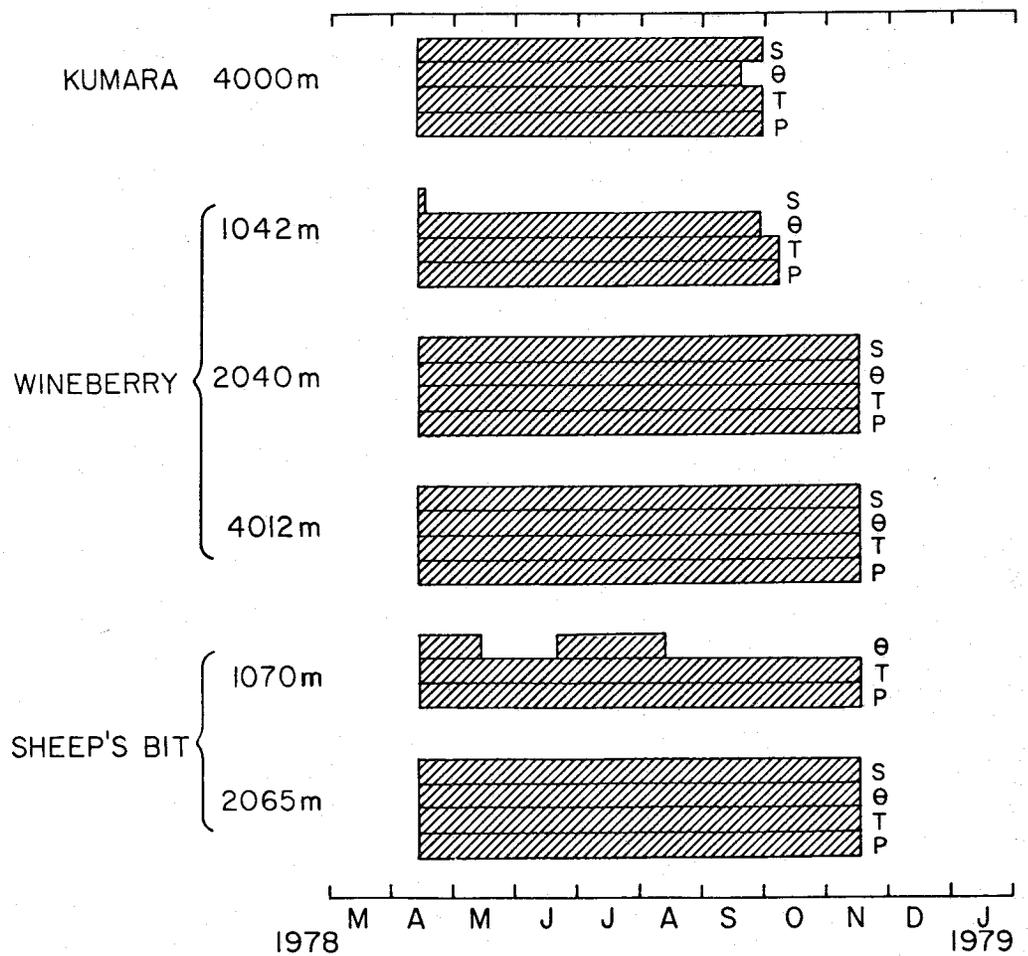
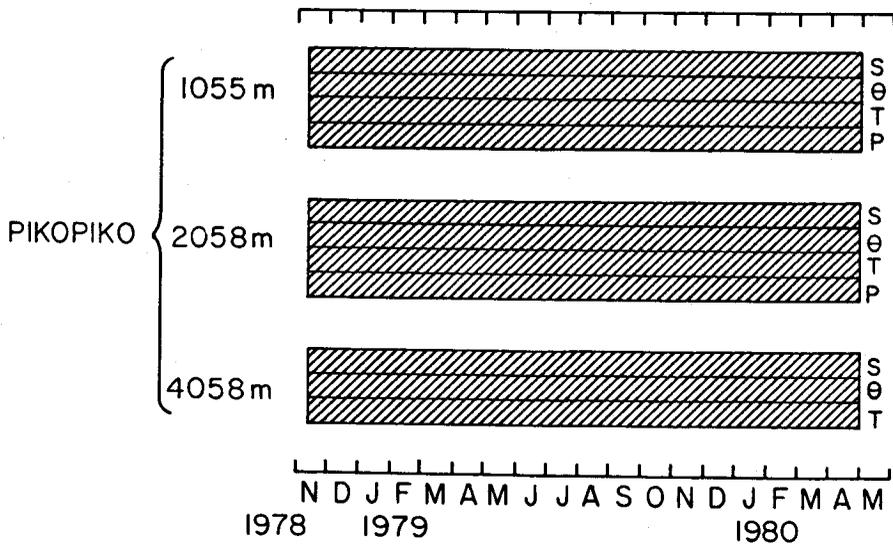
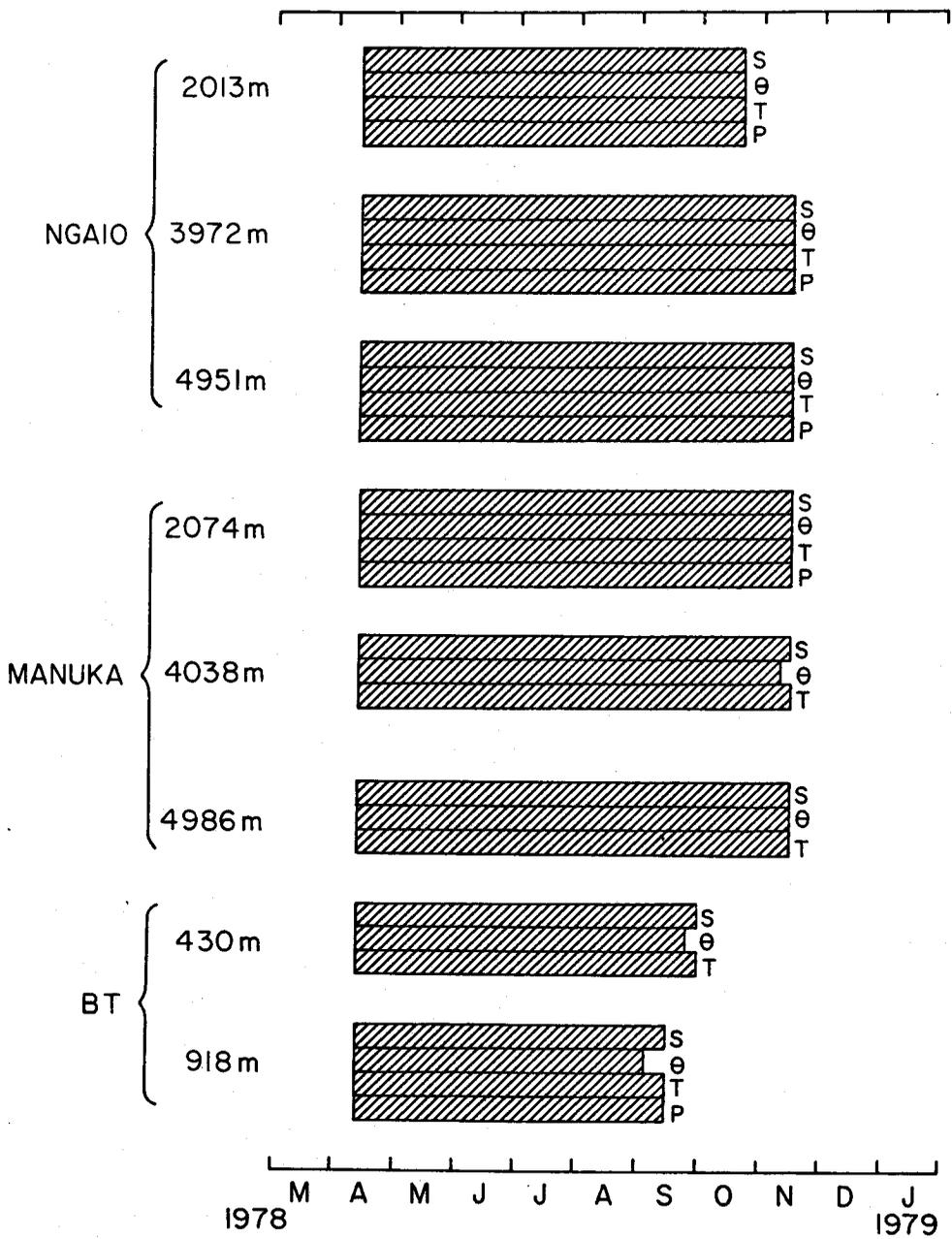


Figure 2. Positions of current meters deployed in the cluster array near 49°30'S, 170°W from April to November 1978.

Figure 3. Operation time of current meters deployed southeast of New Zealand during the period April 1978 to May 1980.





Campbell Plateau, with 5 100m-long thermistor chains deployed between 100m and 650m depths and 2 current meters at 310 and 950m depths, was designed to study the formation of sub-antarctic mode water. During the cruise aboard R/V TANGAROA, a hydrographic survey was made around the cluster array through the efforts of Dr. Ron Heath and Dr. Stanley Hayes. A drifting buoy provided by Dr. George Cresswell was deployed upstream of the cluster array (Heath, Bryden and Hayes, 1978).

This first array was recovered from R/V KNORR during November 1978. On each of the moorings Manuka and Ngaio, the mooring line had been cut between 1500 and 2000m in depth, resulting in a loss of the 4 current meters deployed at 500 and 1000m depths. Investigation of the data from the recovered instruments suggested that each line had parted during late October. The cause of the cuts could not be determined. During this cruise aboard R/V KNORR, another hydrographic survey was made around the array under the direction of Dr. Michael McCartney.

The second array consisting of the site mooring Pikopiko with 3 Aanderaa current meters at 1000, 2000, and 4000m depths (Figure 1) was deployed at 49°24'S, 170°30'W (Bryden and Joyce, 1979). The site mooring was recovered aboard R/V TANGAROA during May 1980.

CURRENT METER PROGRAM

The recovered array of instruments consists of 18 Aanderaa current meters and 5 thermistor chains on 7 moorings. All of the current meter moorings were subsurface, taut-wire moorings. Their design followed, in large part, the Woods Hole Oceanographic Institution intermediate mooring scheme (Heinmiller and Walden, 1973). The current meters used were Aanderaa RCM 5's and are described by Pillsbury et al. (1974). The thermistor chains used were made by Aanderaa and were 100m in length. The duration of the record from each instrument is presented in Figure 3.

Each current meter was equipped to measure current speed, direction, and temperature. Current meters shallower than 2500m were also equipped to measure pressure. Each 100m-thermistor chain was equipped to measure temperature at 10m intervals. The shallowest thermistor chain was equipped to measure pressure. Because of the narrow range of temperatures expected in this region, we restricted the range of the temperature sensors to -2°C to $+6^{\circ}\text{C}$ on those meters which could be so equipped. The resolution for this range is $\pm 0.008^{\circ}\text{C}$. All calibrations for temperature were done with an NBS traceable quartz thermometer and the pre- and post-calibrations agreed within $\pm 0.02^{\circ}\text{C}$, on average.

The upper current meters were fitted with Vernitron

Corp. Model 3000 potentiometer type gauge pressure transducers. The range of the transducers was set at 0-5000 psig. They have an accuracy of 1% of range and a resolution of 0.1% of range.

The Aanderaa current meters were calibrated before and after the experiment and all units exhibited satisfactory, reproducible data. The method of calibration and subsequent procedures used in the data processing are generally described by Pillsbury et al. (1974).

DESCRIPTION OF PROCESSED DATA

Data from each mooring are presented separately in the following order: Kumara, Wineberry, Sheep's Bit, Ngaio, Manuka, BT, and Pikopiko. The header page gives information about the mooring location, instrumentation, data interval, and a statement describing the kind of data collected at that point 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 the arithmetic mean, standard deviation, skewness, kurtosis, maximum value, minimum value, and the number of hourly values of the record length for each variable measured: U

is the true east-west velocity component and V is the true north-south velocity component in cm/s, T is temperature in C, and P is pressure in pascals.

Real time plots of the data follow the table of statistics. Data were taken each hour and plots which show each point are too long to be easily included in this report. To reduce the plots the data were filtered with a 60+1+60 point Cosine-Lanczos filter with a half-amplitude at 34.3 hours and half power at 40 hours. The data points output by the filter program are at 6 hour intervals. This filter was designed to remove both tidal and inertial oscillations from the data.

After the statistics are presented for each mooring a progressive vector diagram is presented for each current record on the mooring. Then plots of east and north velocity components, temperature and pressure versus time are presented for each instrument. Because some of the temperature variation is due to tilting of the mooring in strong currents, corrected temperature rather than measured temperature is plotted versus time. The corrected temperature, T_c , is calculated from the measured temperature, T_m , and pressure, P_m , as follows:

$$T_c = T_m - (P_m - \bar{P}_m)(\partial T / \partial p)$$

where \bar{P}_m is the mean pressure and $\partial T / \partial p$ has the following

values:

<u>Depth (m)</u>	<u>$\partial T/\partial p$ ($^{\circ}\text{C}/100$ dbars)</u>
1000	-.397
2000	-.066
4000	-.052

If a mooring has at least one pressure record, then a time series of predicted pressure is generated for the instruments with no pressure records at 2000 and 4000m depths by assuming a uniform tilt of the mooring. Then a corrected temperature time series is generated and plotted. Because the temperature time series at 4900m depths do not vary more than 1 bit from their mean values, these temperatures are not plotted against time and their spectra are not shown. For mooring BT temperature plots for the thermistor chains are included following the current meter temperature plots.

Following these real time plots, a rotary spectrum and a kinetic energy spectrum are presented for each current record. A spectrum of temperature variance and a spectrum of pressure variance follow for each measured temperature or pressure record.

After the spectra, time series plots of velocity component and temperature are presented for those moorings with the best vertical information so that vertical coherence and phase can be judged visually. Thus, east and north velocity components at 2000, 4000, and 4900m depths are presented for moorings Ngaio and Manuka; temperatures at 1000, 2000, and 4000m depths are presented for mooring Wineberry; and stick figures of currents at 1000, 2000, and 4000m depths are presented for BT and Pikopiko.

In Section II, plots are presented so that horizontal coherence and phase can be judged visually. Stick figures for 2000m currents on Wineberry, Ngaio, Manuka and Sheep's Bit are presented, followed by stick figures for 4000m currents on Wineberry, Ngaio and Manuka. Careful examination of these figures should reveal an eastward propagation of events at a speed of about 10 cm/s.

ANALYSIS OF MEASUREMENTS

These moored current and temperature measurements have been used in a review of the role of eddies in the circulation of the Southern Ocean (Bryden, 1979, 1980, 1981) and in a study of internal waves (Hayes, 1979). In addition, Dr. Bryden is analyzing the measurements to study the dynamics of eddies and their effects on the mean circulation in the region southeast of New Zealand; Dr. Heath and Dr. Paul May are studying tidal motions observed

in these records; Dr. McCartney is investigating the formation of subantarctic mode water with the data on mooring BT; and Dr. Dale Pillsbury is comparing these measurements with those made in the Drake Passage.

ACKNOWLEDGMENTS

Support for these measurements was provided by the Office for the International Decade of Ocean Exploration of the National Science Foundation under grant OCE 77-22887. Ron Heath with the support of the New Zealand Oceanographic Institute of the Department of Scientific and Industrial Research arranged shiptime aboard R/V TANGAROA for deployment of the initial array in April 1978 and for recovery of the final site mooring in May 1980. These measurements would not have been possible without the logistical support generously provided by Ron Heath, Bruce Shakespeare and their colleagues at New Zealand Oceanographic Institute. The mooring deployments and recoveries were carefully carried out under difficult conditions by Ben Moore, Ed Seifert and Bob Still. The willingness of Dale Pillsbury to provide the necessary liaison between scientists at Woods Hole Oceanographic Institution and technical support in the Buoy Group at Oregon State University made this cooperative experiment feasible.

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- Pillsbury, R.D., J.S. Bottero, R.E. Still and W.E. Gilbert 1974. A compilation of observations from moored current meters, Vol. VI, Oregon Continental Shelf, April-October 1972. Oregon State University, School of Oceanography, Corvallis. Data Report 57, Reference 74-2, 230p.

SECTION I
INSTALLATIONS

KUMARA

KUMARA

Position: 49°20.9'S, 170°19.0'W
Depth of Water: 5125 m
Set at: 0618 UCT 15 APR '78 by R/V TANGAROA
Retrieved at: 0506 UCT 15 NOV '78 by R/V KNORR
Data Interval: 0920 UCT 15 APR '78 to 2020 UCT 29 SEP '78

InstrumentationIntended Depth

4000 m

RCM5 Serial No./Tape No.

2284/9

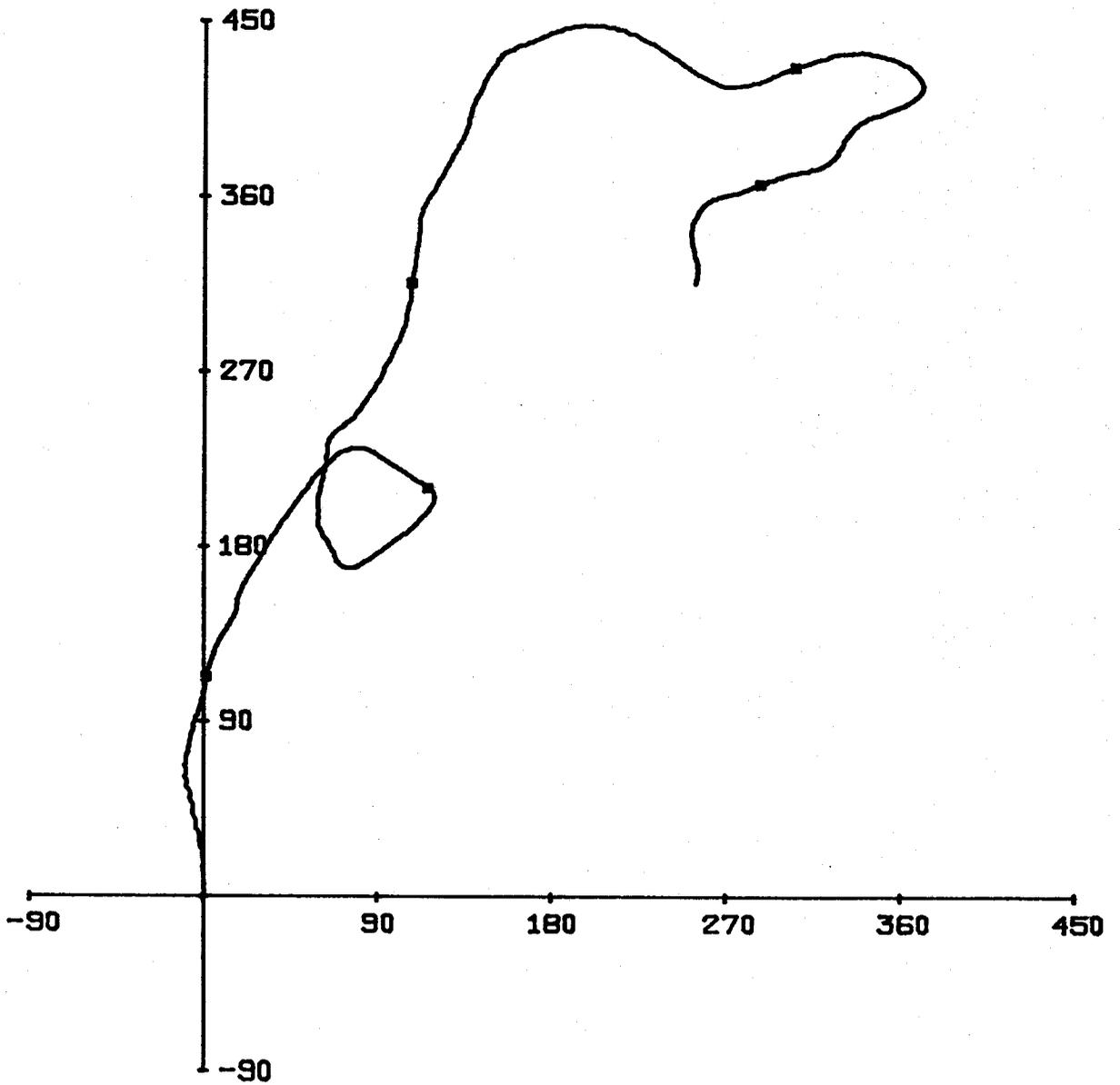
Instrument 2284 recorded speed, and temperature once per hour until 2020 UCT 29 SEP '78. Good directions were recorded until 0120 UCT 17 SEP '78.

KUMARA

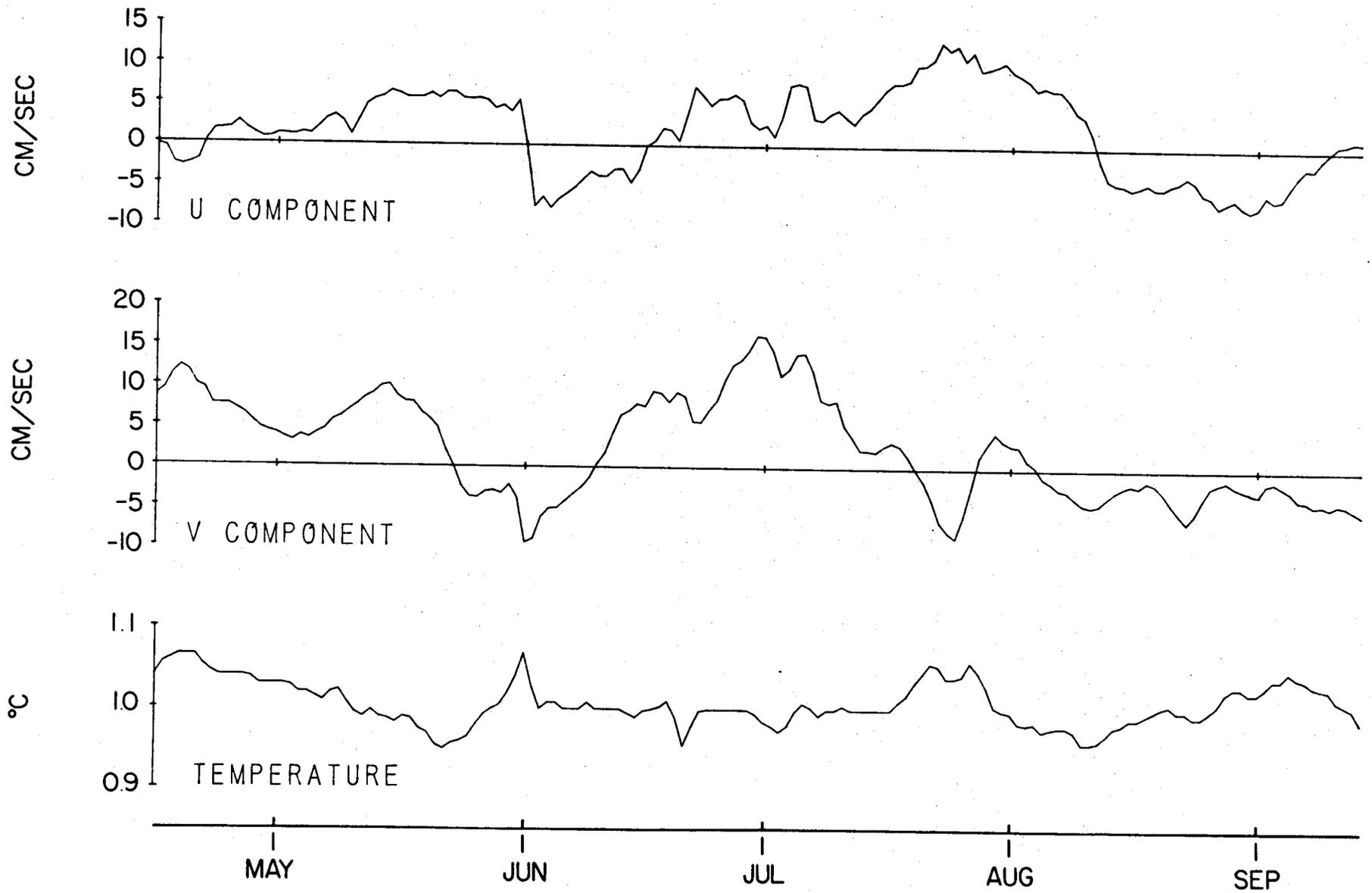
4000 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
S	8.04	3.56	.78	3.50	21.20	.70	4020
U	1.90	5.49	-.05	2.23	18.20	-13.00	3713
V	2.36	6.42	.31	2.28	21.20	-12.90	3719
T	1.01	.03	.25	2.86	1.09	.93	4020

Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.

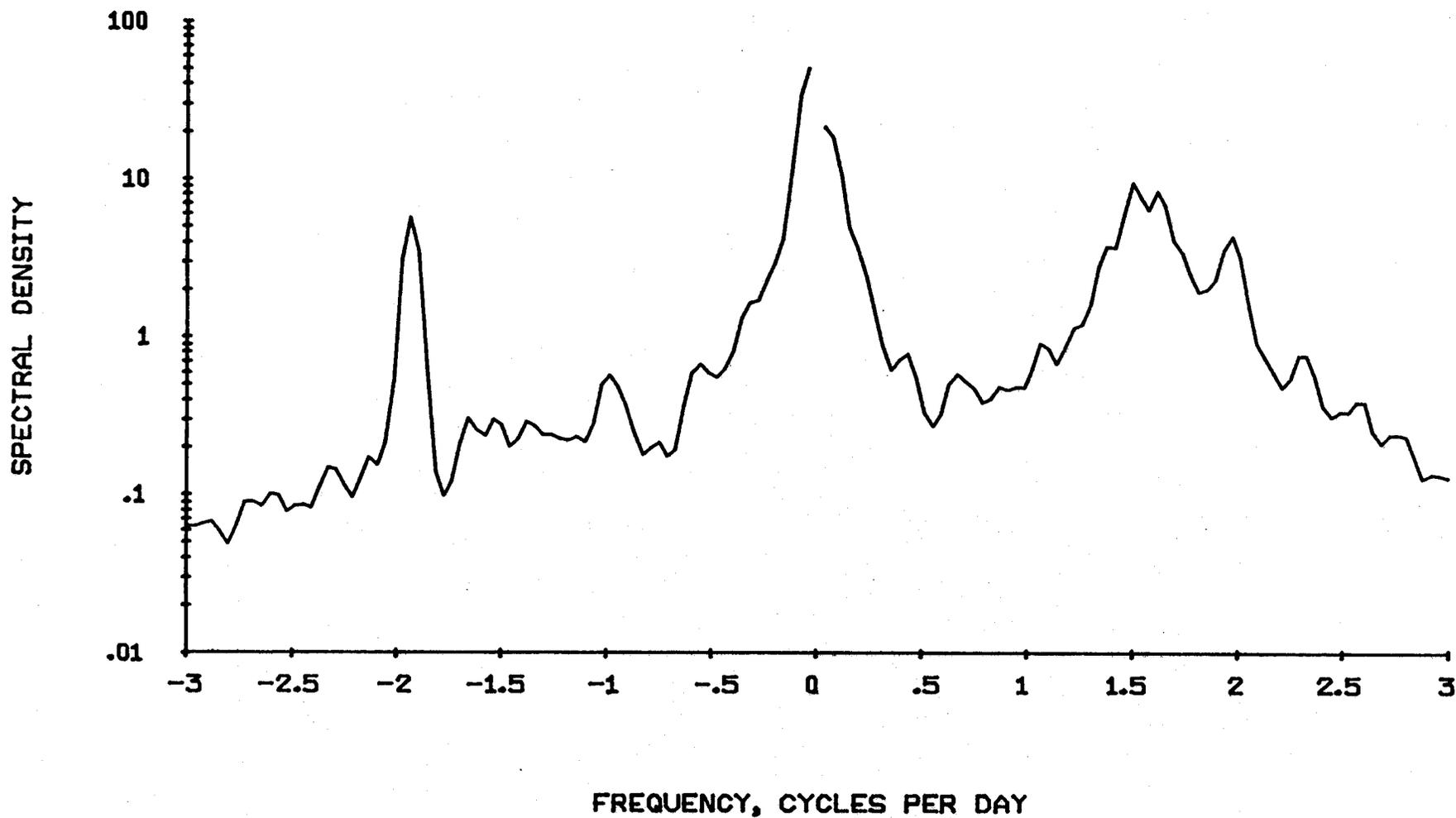


4000 METERS AT KUMARA. 15 APR 78 - 29 SEP 78.

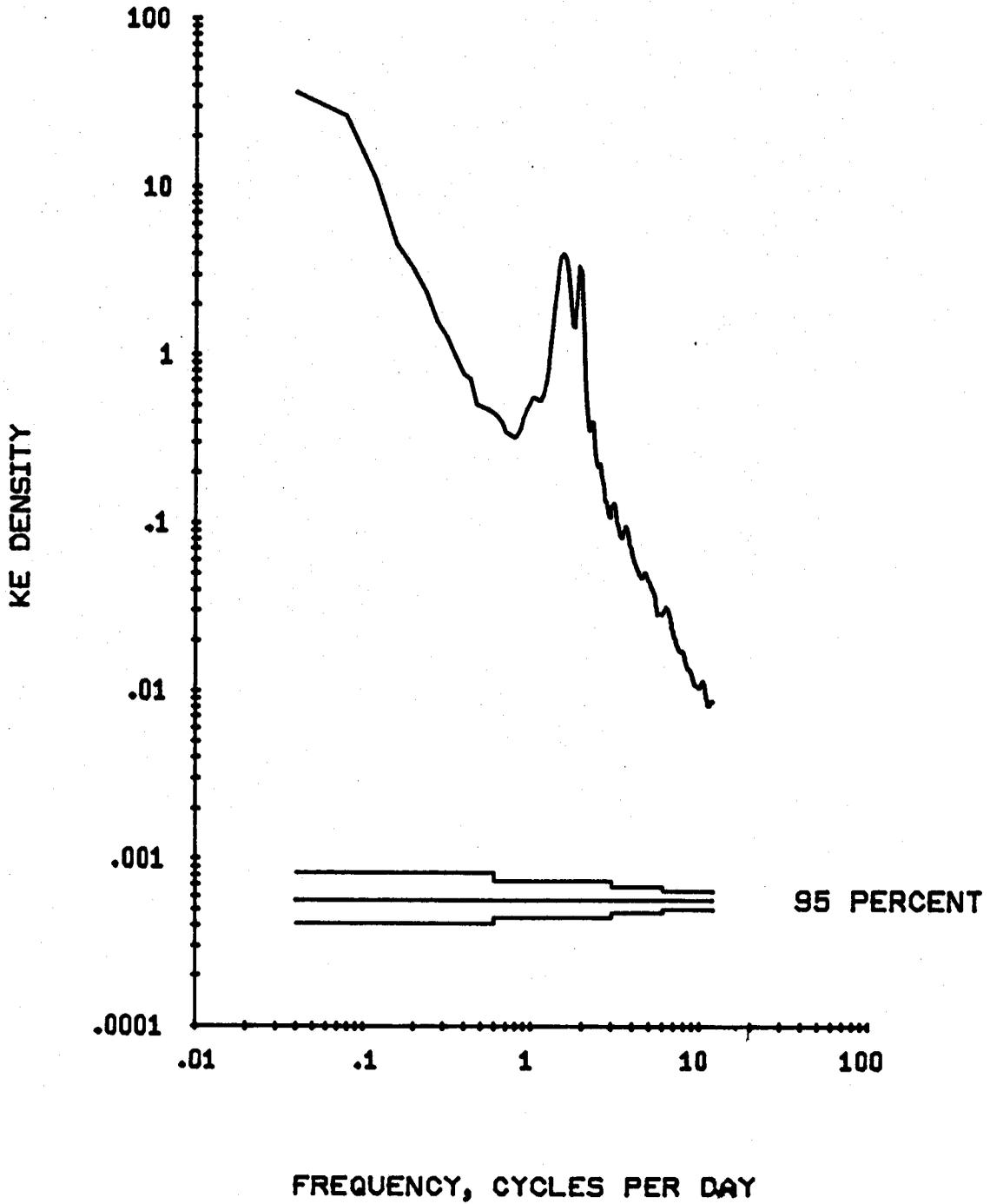


RIDGE STATION K. AT 4000 METERS

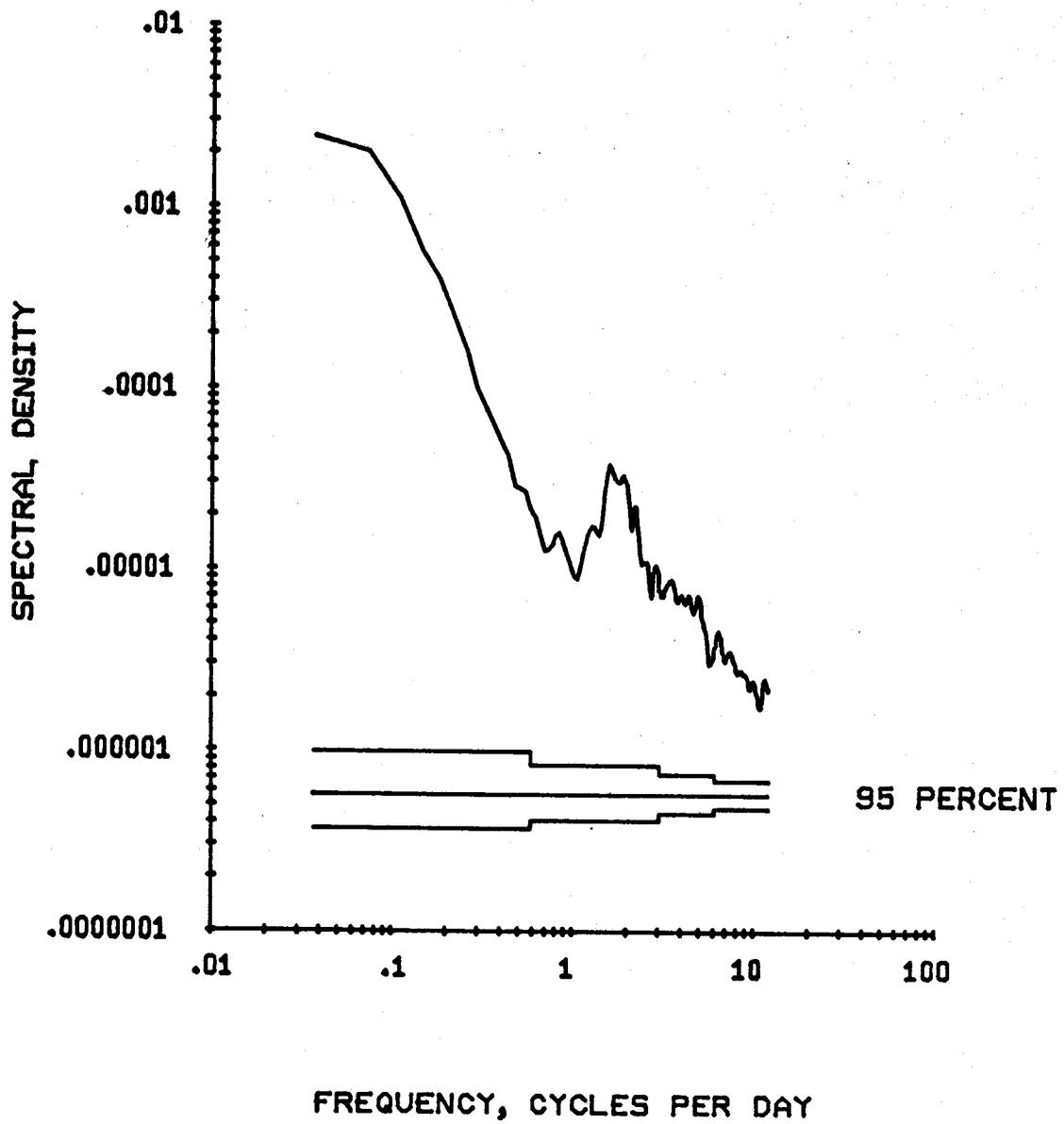
UNFILTERED CURRENT. 4000 METERS AT KUMARA.



UNFILTERED CURRENT. 4000 METERS AT KUMARA.



UNFILTERED TEMPERATURE. 4000 METERS AT KUMARA.



WINEBERRY

WINEBERRY

Position: 49°22.1'S, 170°30.7'W
 Depth of Water: 5070 m
 Set at: 0141 UCT 13 APR '78 by R/V TANGAROA
 Retrieved at: 1740 UCT 17 NOV '78 by R/V KNORR
 Data Interval: 0416 UCT 13 APR '78 to 1516 UCT 17 NOV '78

Instrumentation

<u>Intended Depth</u>	<u>RCM5 Serial No./Tape No.</u>
1000 m	1242/14
2000 m	1244/13
4000 m	2130/12

Instrument 1242 recorded temperature and pressure once per hour until 1218 UCT 4 OCT '78. The speed sensor failed during installation. Good directions were recorded until 0518 UCT 27 SEP '78.

Instrument 1244 recorded speed, direction, temperature, and pressure once per hour until the instrument was recovered.

Instrument 2130 recorded speed, direction, and temperature once per hour until the instrument was recovered.

WINEBERRY

1042 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
T	4.04	.58	.82	3.99	5.69	2.60	4185
P	10477069.	1033366.	4.56	24.88	16997000.	10014000.	4185

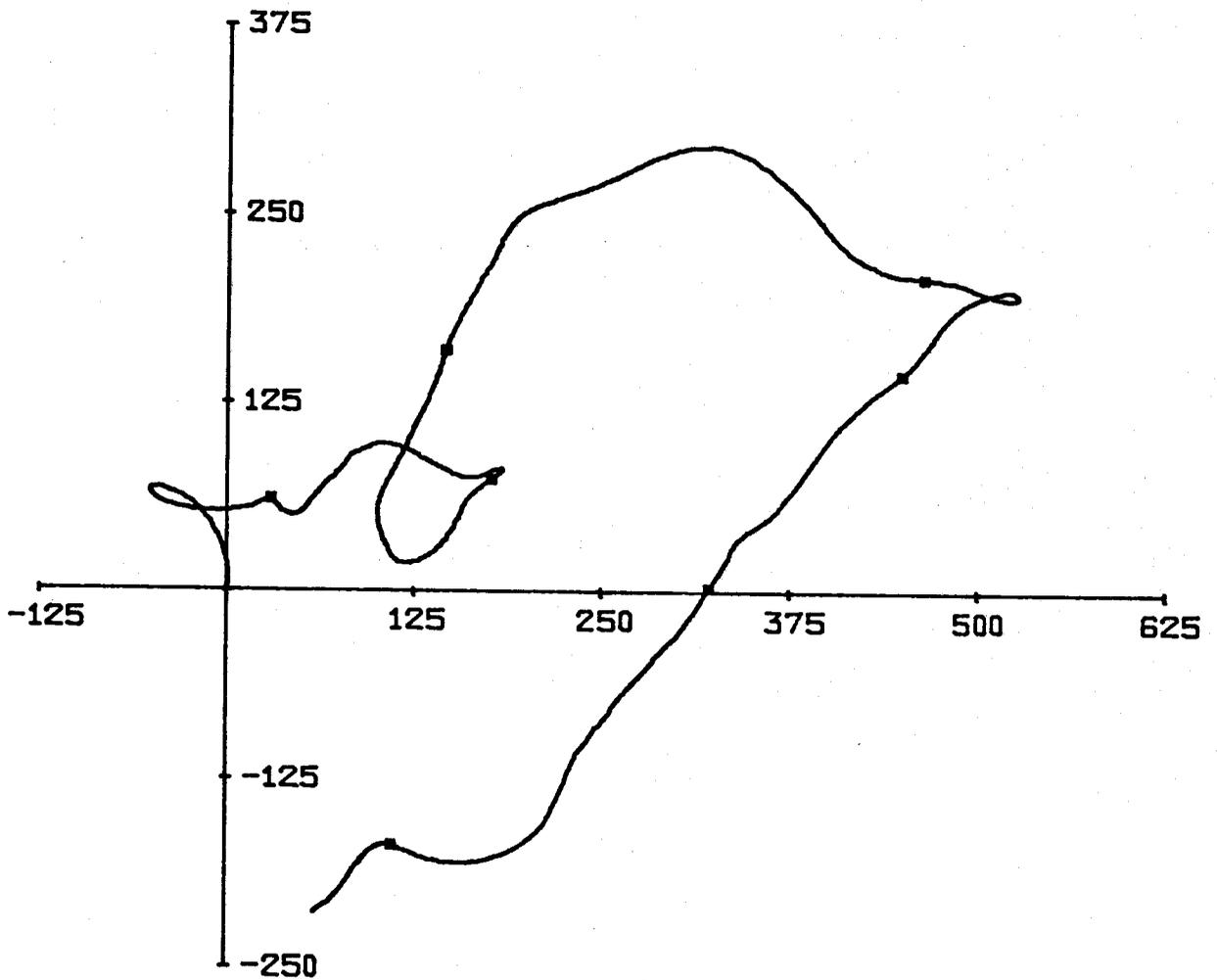
2040 m

S	9.64	6.10	1.56	5.71	37.40	.70	5243
U	.31	8.70	.45	4.51	37.40	-30.10	5243
V	-1.13	7.28	-.02	3.54	18.80	-28.90	5243
T	2.34	.05	-.67	7.50	2.48	2.04	5243
P	20501750.	814970.	3.96	19.04	25152000.	20115000.	5243

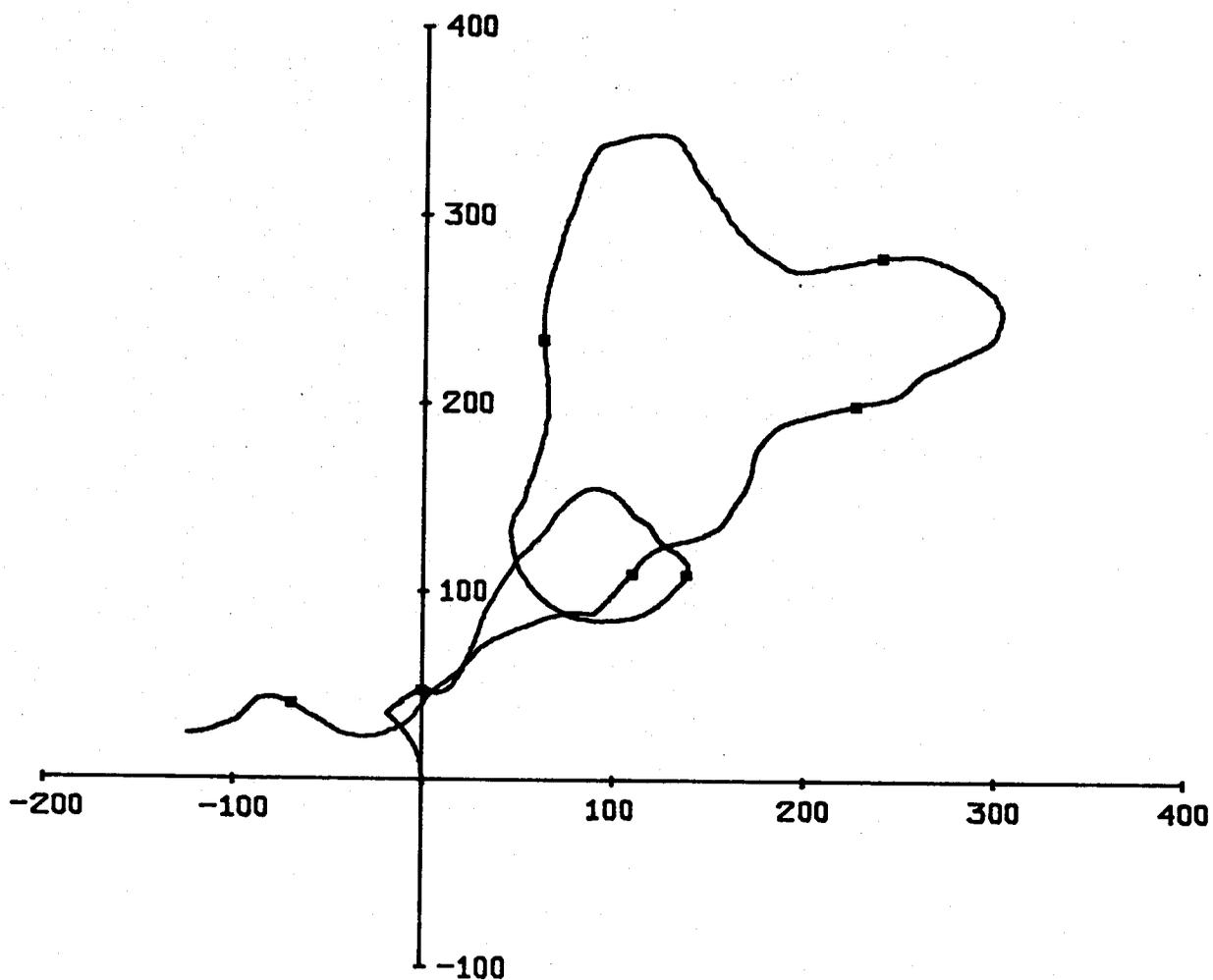
4012 m

S	7.71	3.53	.70	3.47	22.40	.70	5244
U	-.65	5.89	.43	2.26	16.60	-15.40	5244
V	.13	6.07	.56	3.21	18.50	-20.20	5244
T	1.02	.03	.85	3.98	1.13	.96	5244

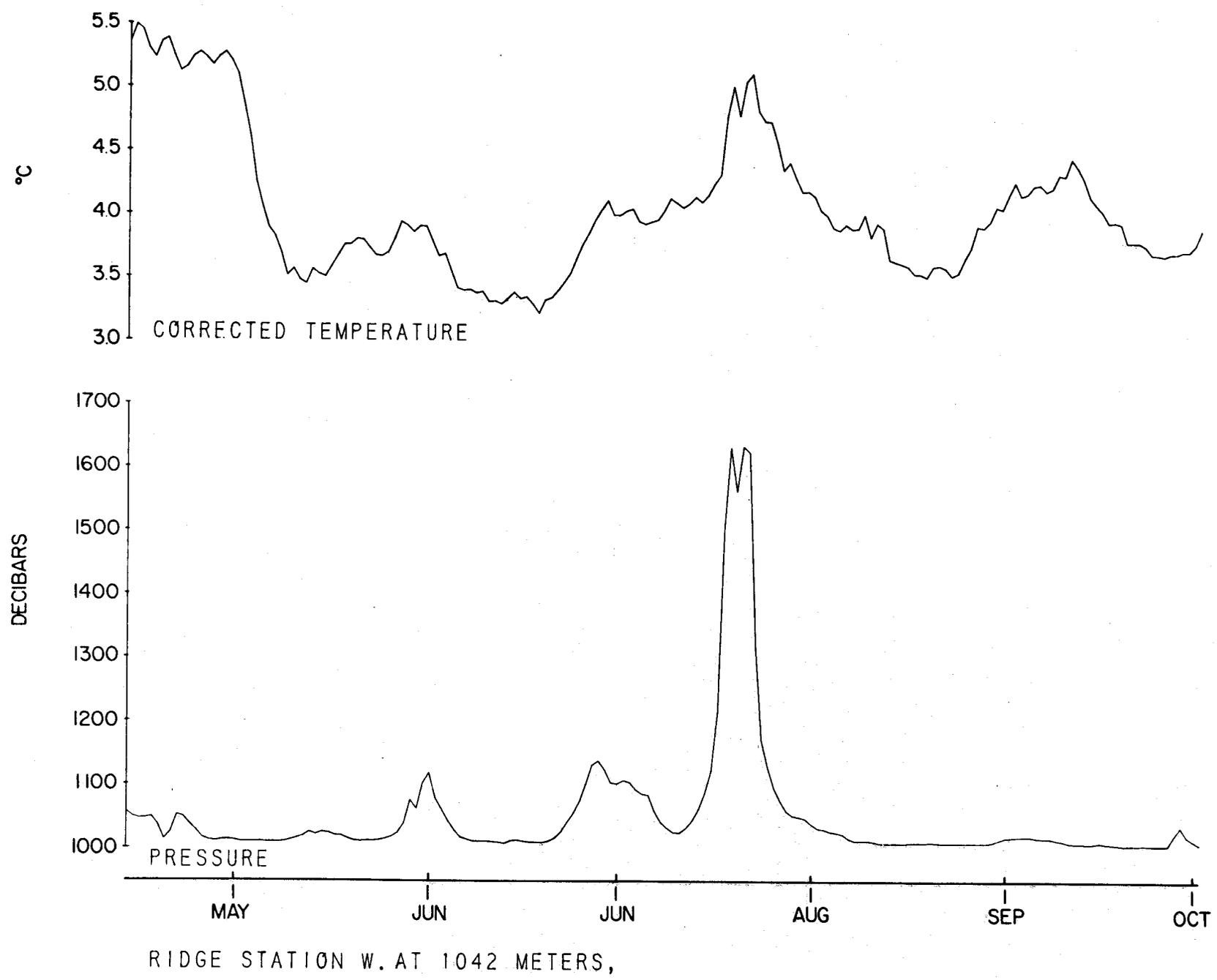
Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.



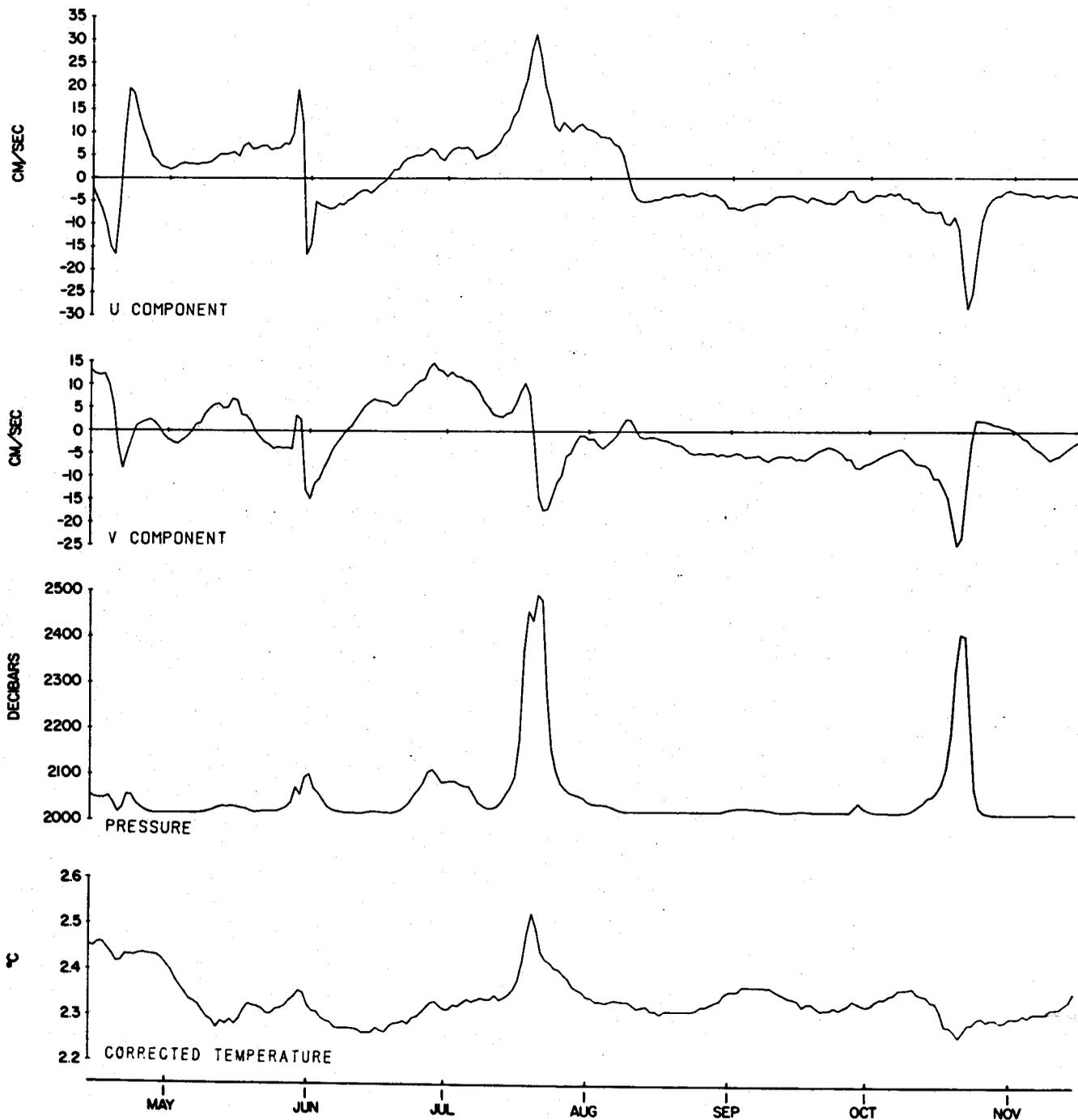
2040 METERS AT WINEBERRY. 13 APR 78 - 17 NOV 78



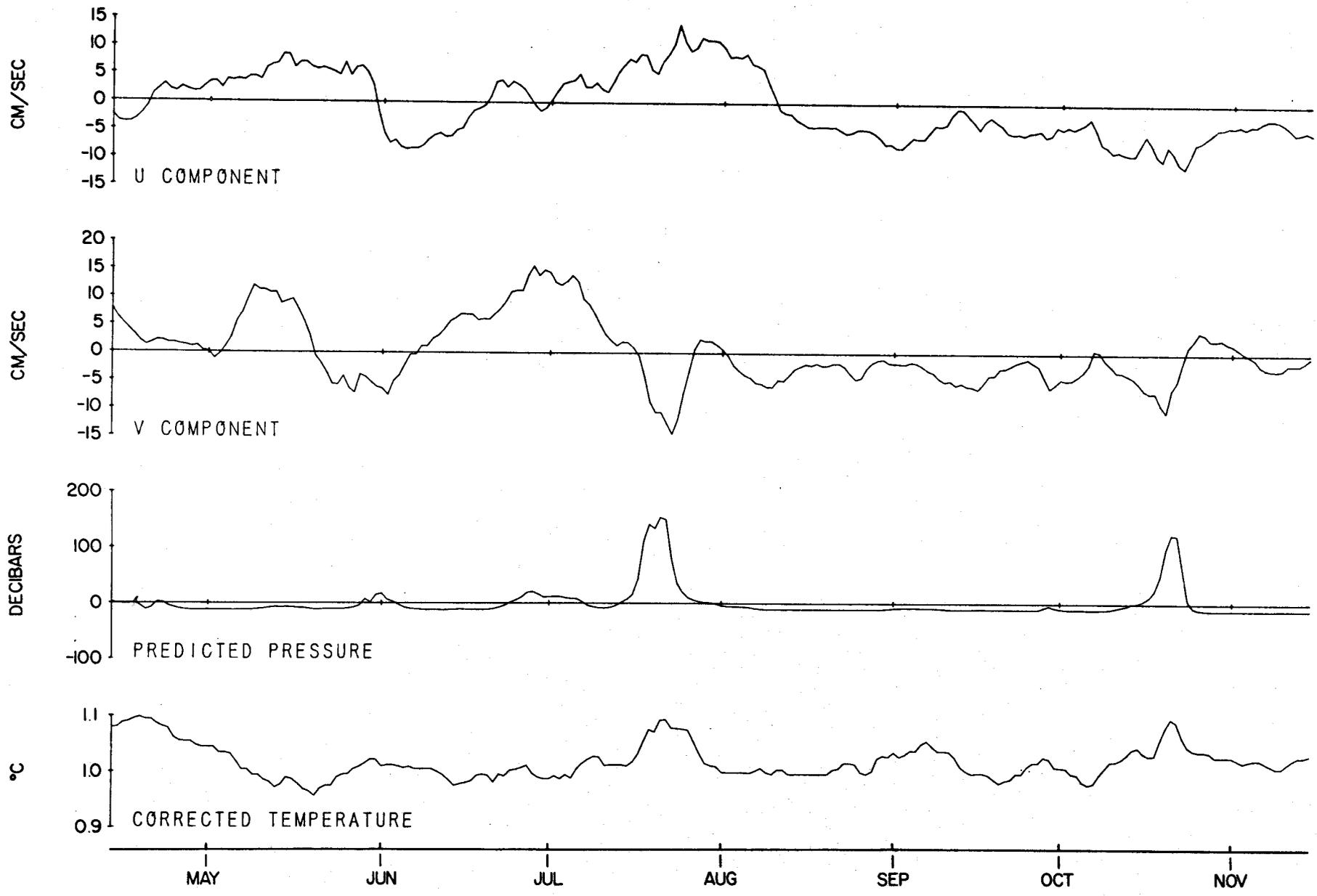
4012 METERS AT WINEBERRY. 13 APR 78 - 17 NOV 78.



RIDGE STATION W. AT 1042 METERS,

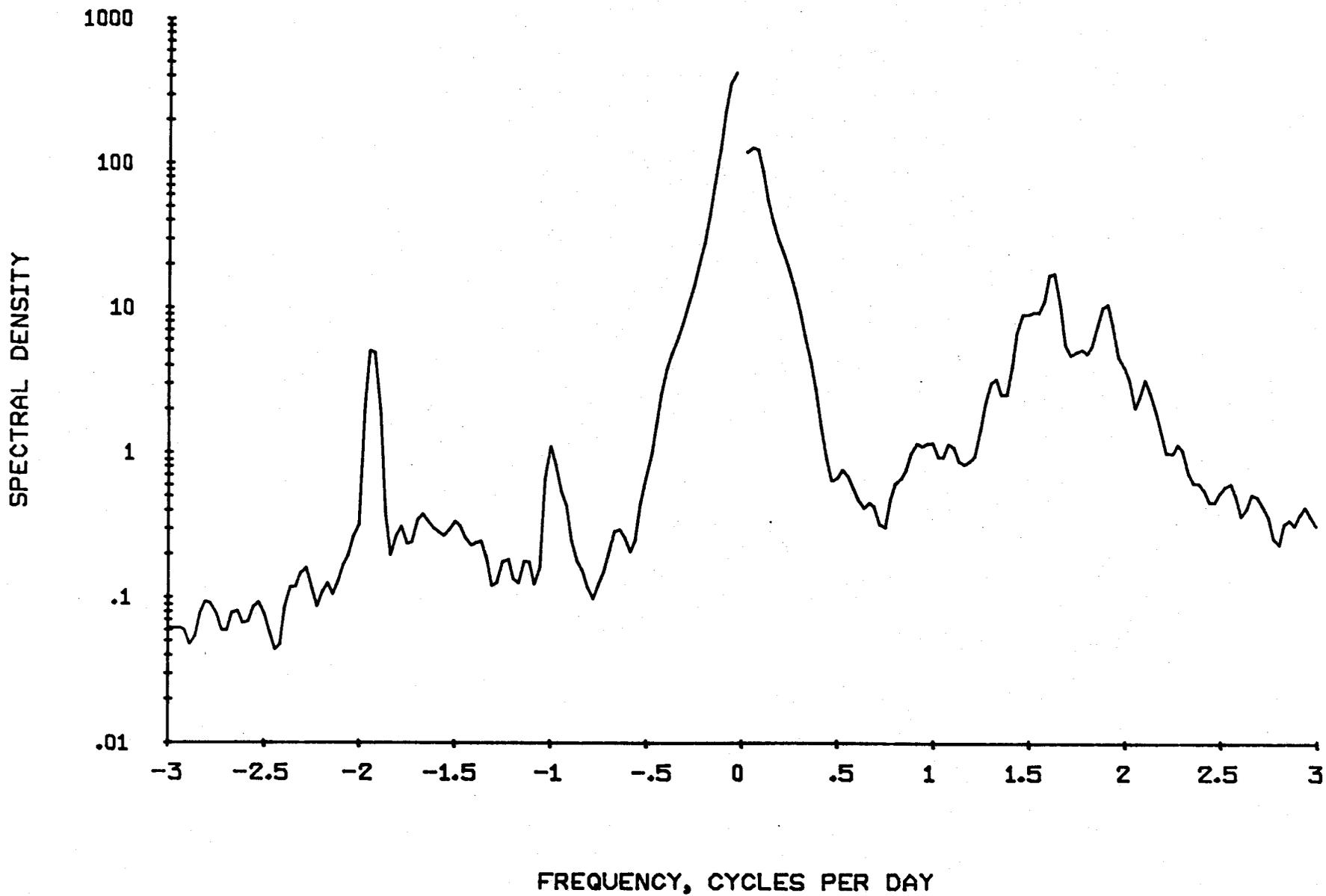


RIDGE STATION W. AT 2040 METERS

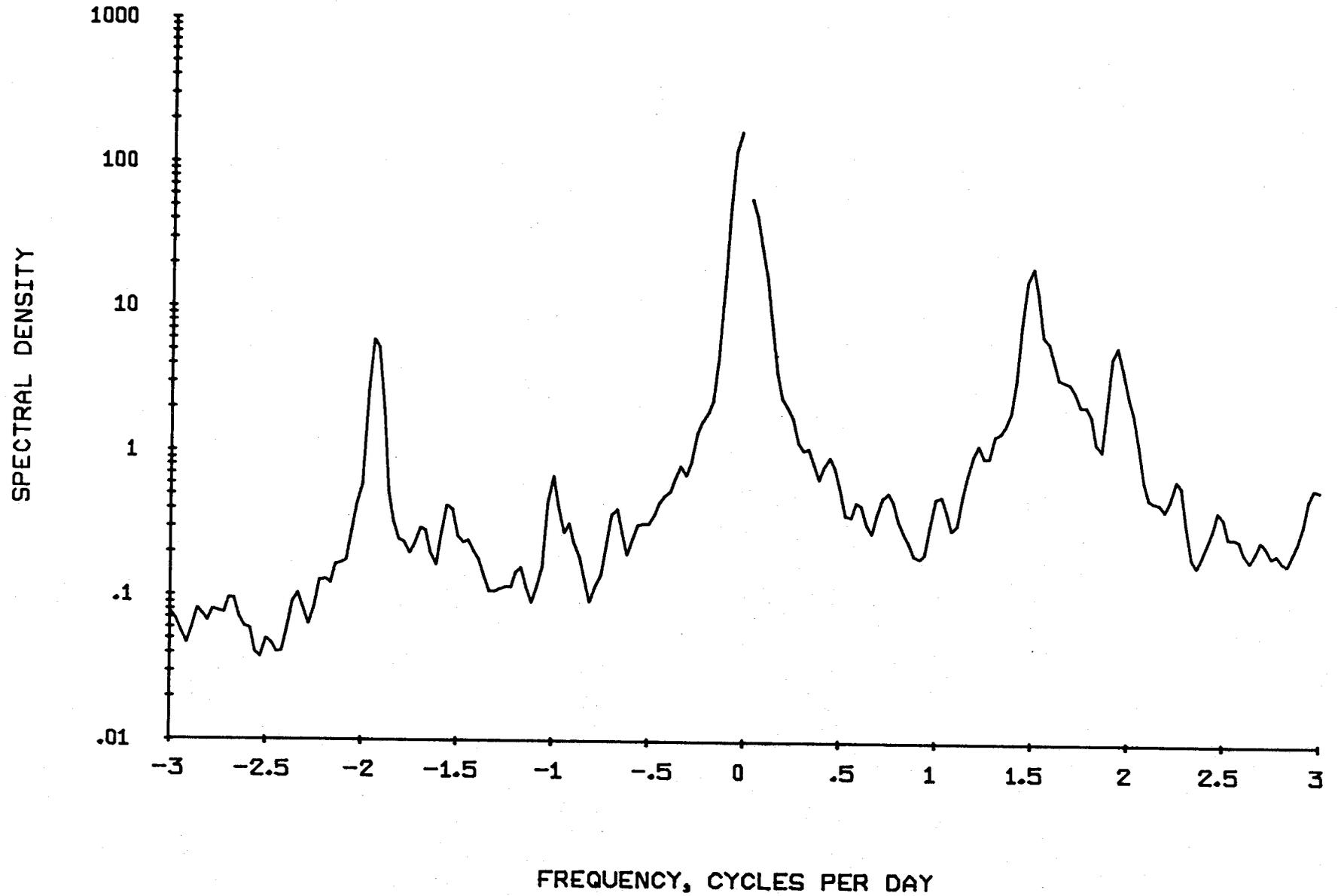


RIDGE STATION W. AT 4012 METERS

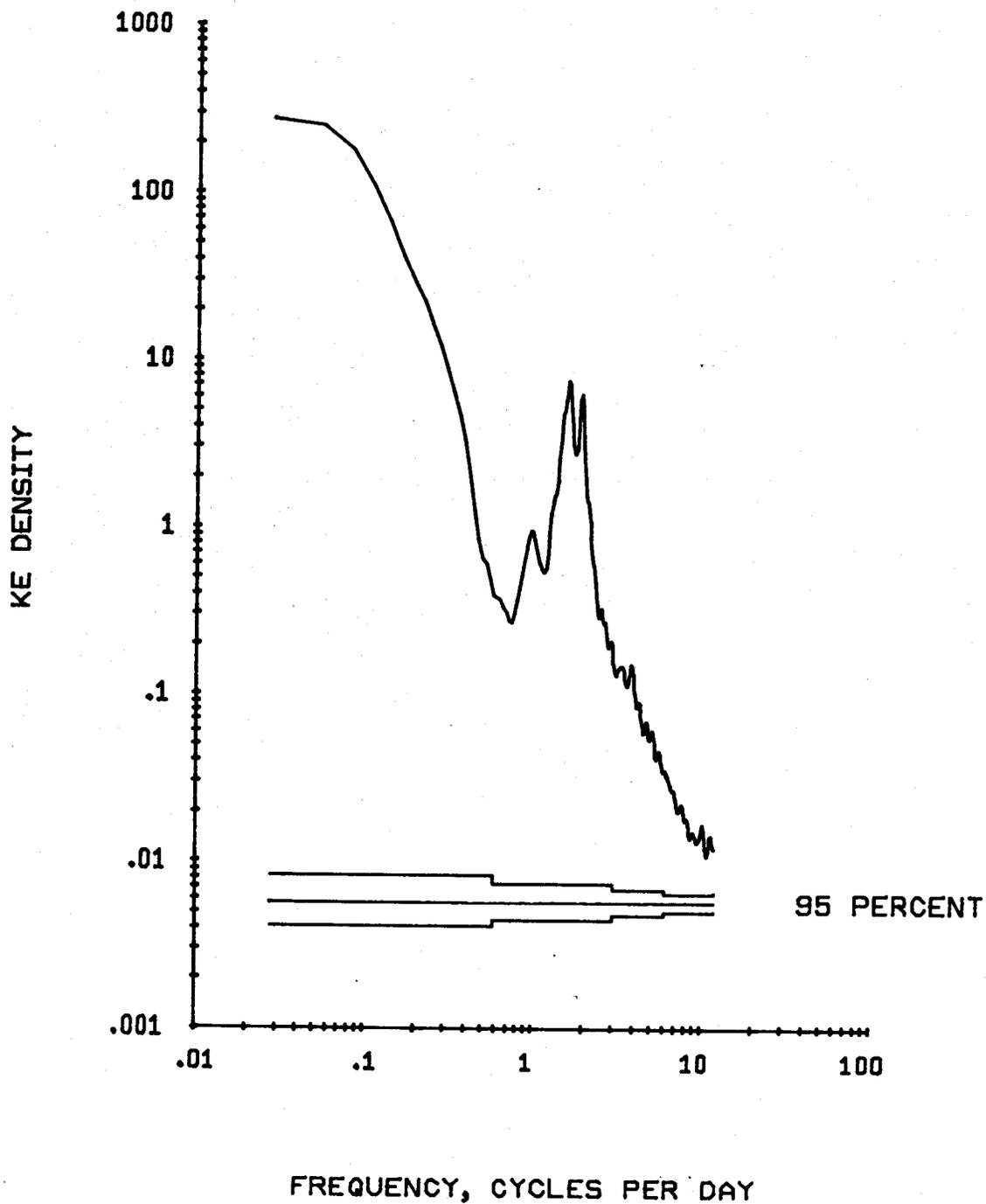
UNFILTERED CURRENT. 2040 METERS AT WINEBERRY.



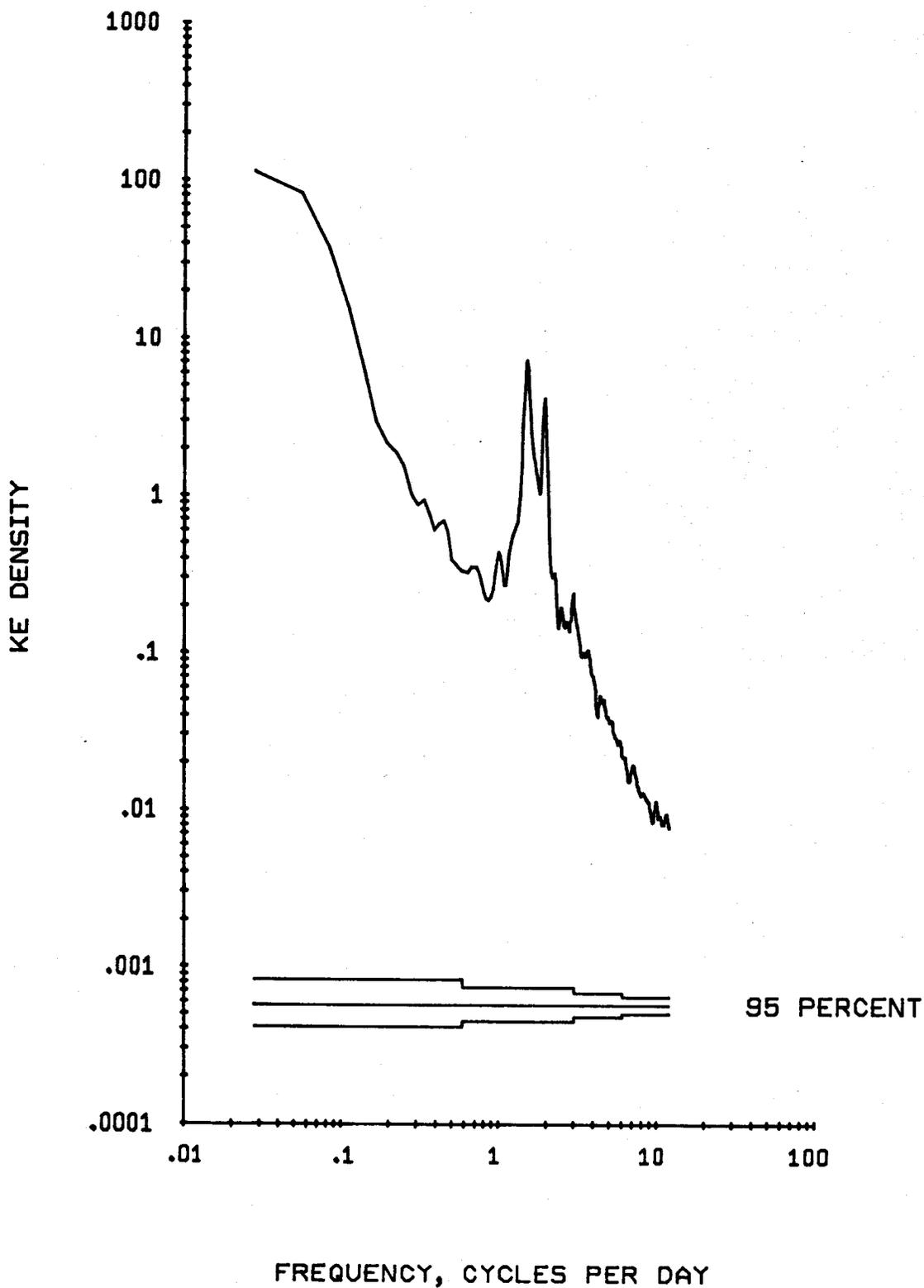
UNFILTERED CURRENT. 4012 METERS AT WINEBERRY.



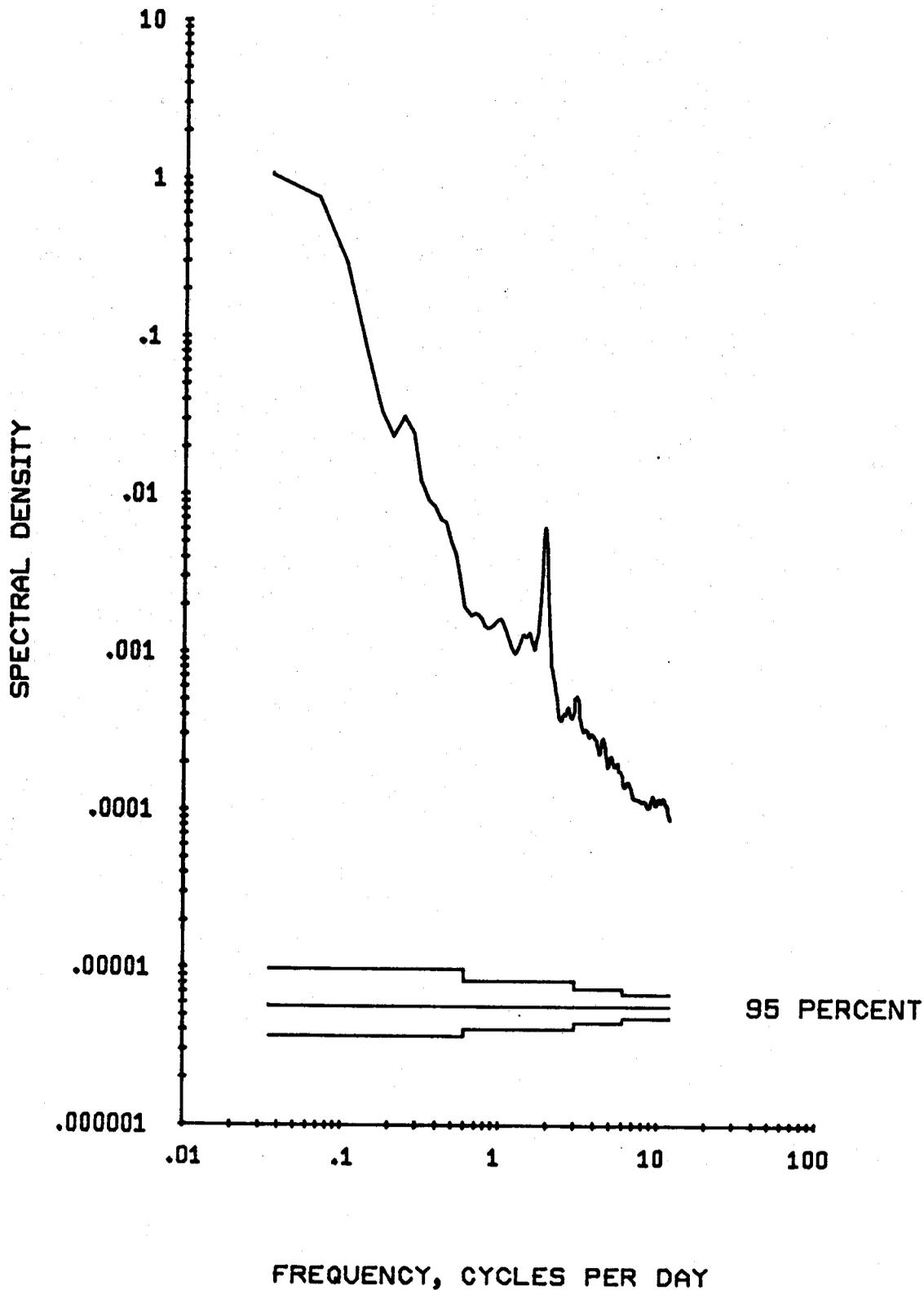
UNFILTERED CURRENT. 2040 METERS AT WINEBERRY.



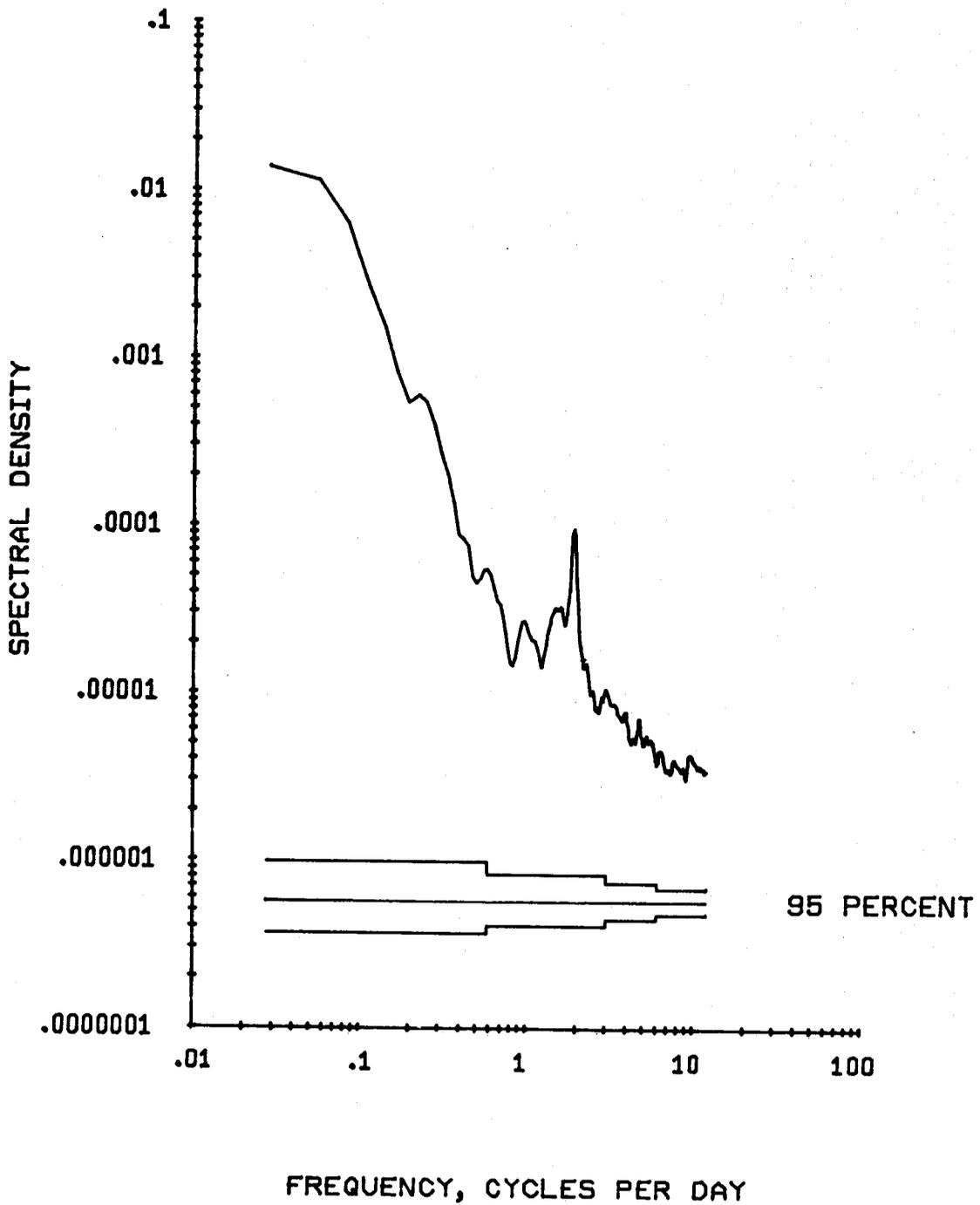
UNFILTERED CURRENT. 4012 METERS AT WINEBERRY.



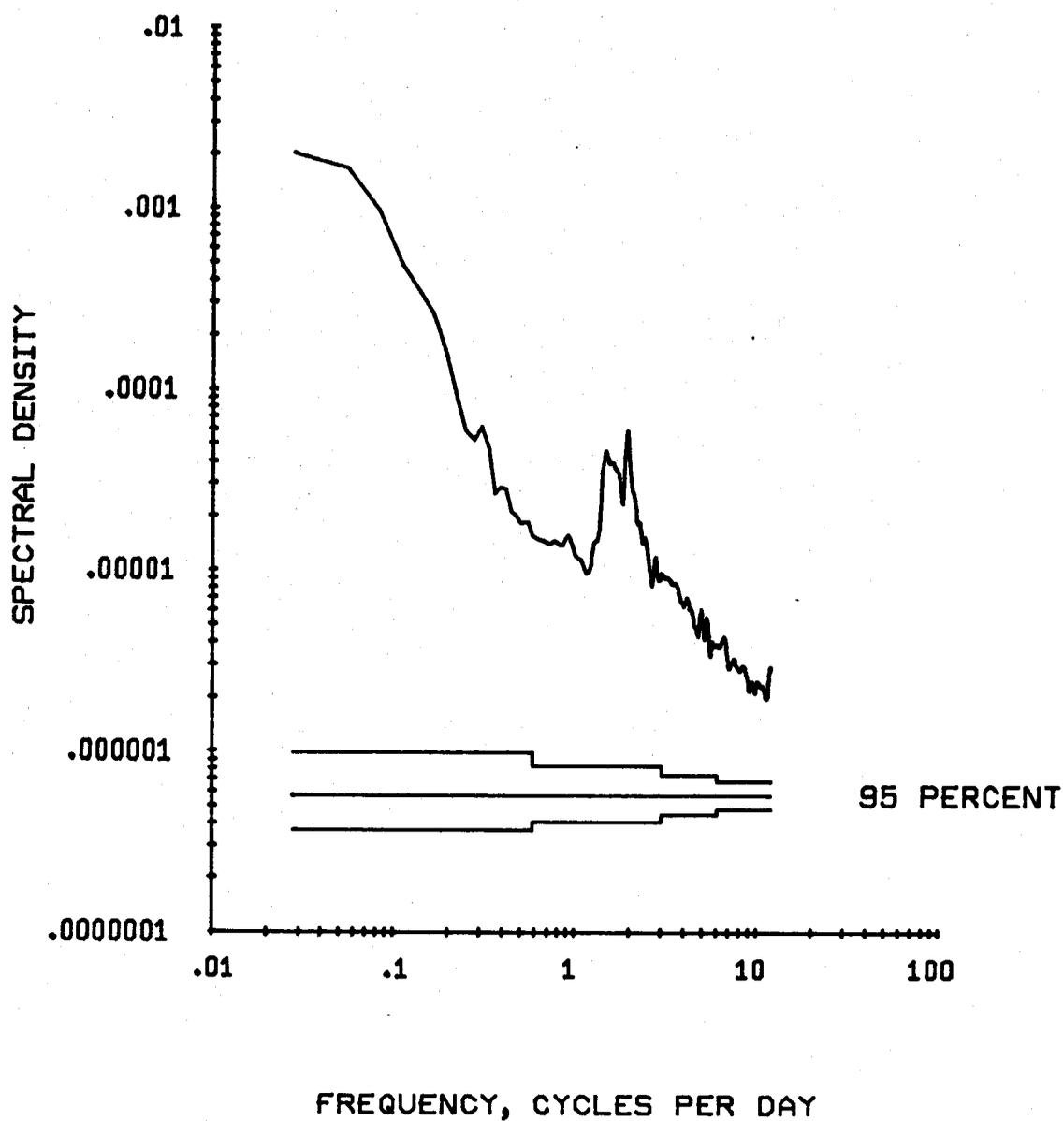
UNFILTERED TEMPERATURE. 1042 METERS AT WINEBERRY.



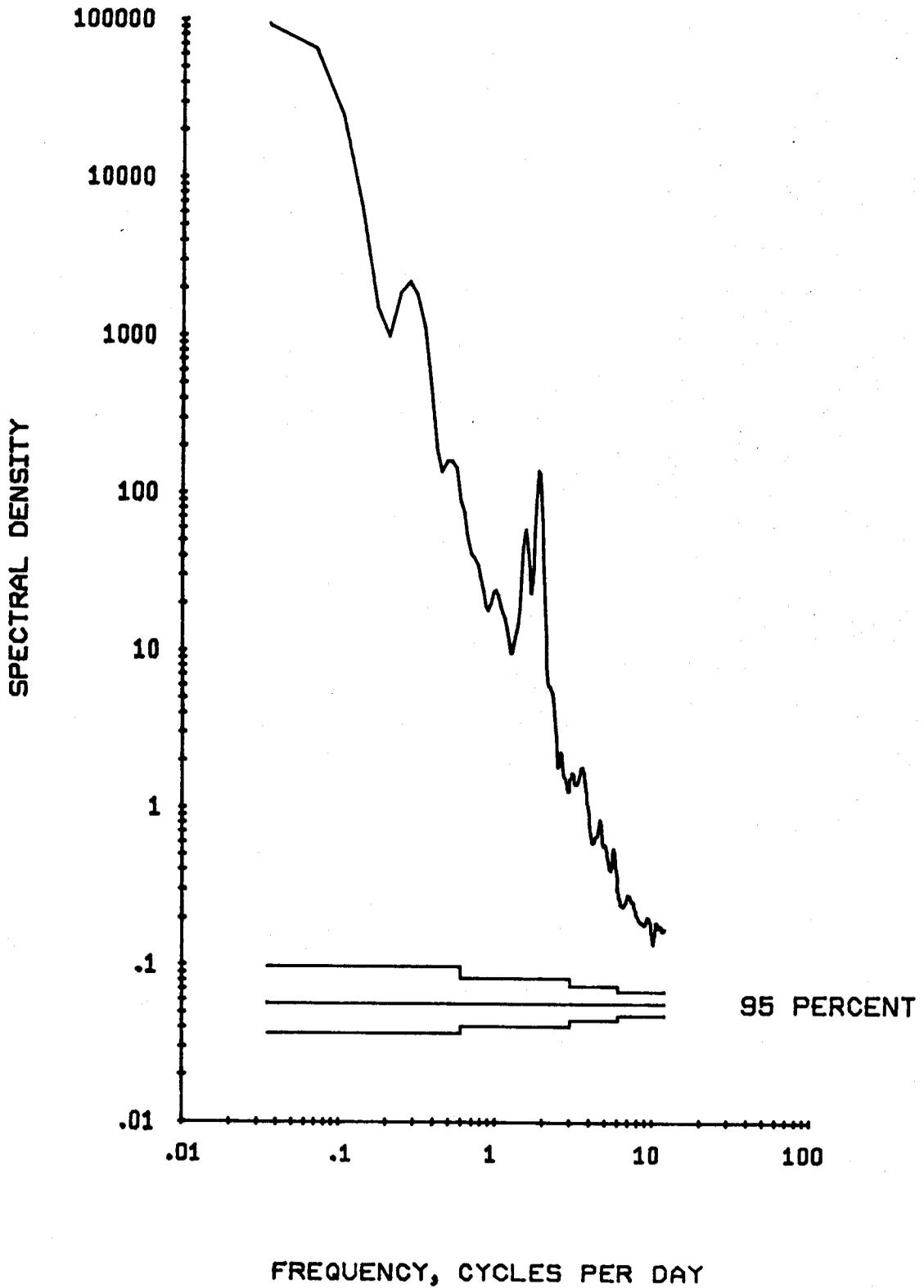
UNFILTERED TEMPERATURE. 2040 METERS AT WINEBERRY.



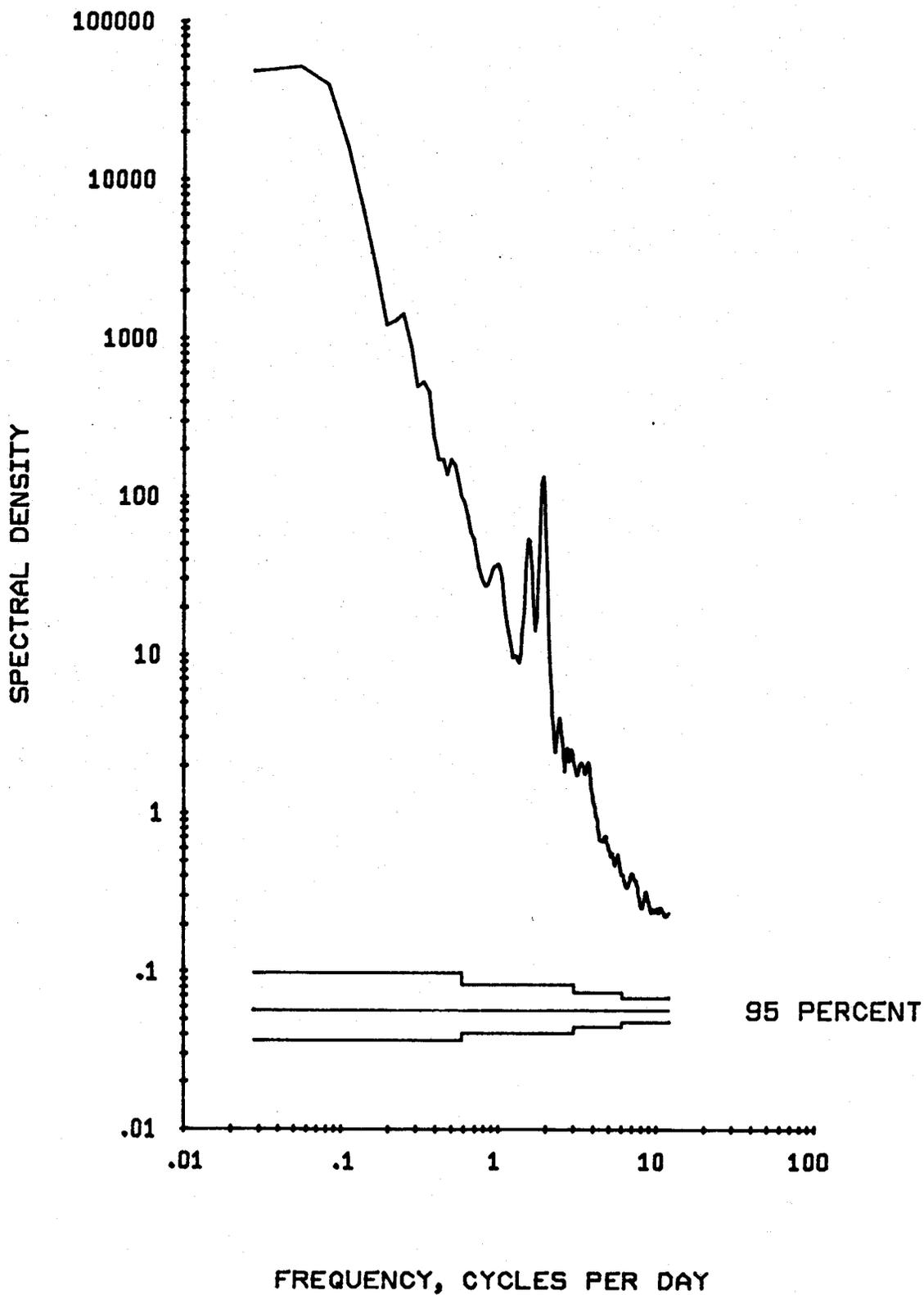
UNFILTERED TEMPERATURE. 4012 M AT WINEBERRY.

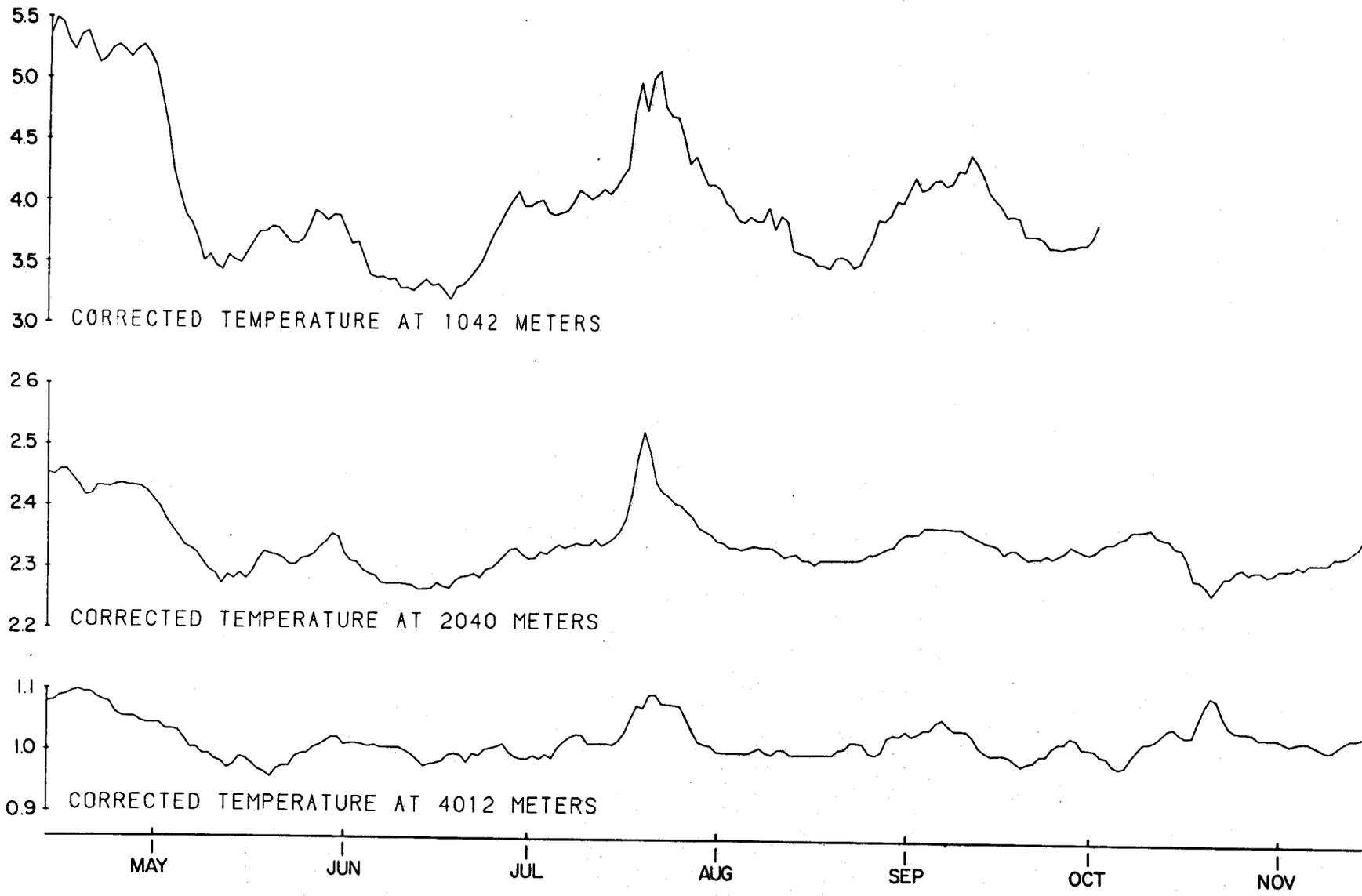


UNFILTERED PRESSURE. 1042 METERS AT WINEBERRY.



UNFILTERED PRESSURE. 2040 METERS AT WINEBERRY.





RIDGE STATION W.

SHEEP'S BIT

SHEEP'S BIT

Position: 49°41.9'S, 170°09.6'S
 Depth of Water: 5310 m
 Set at: 0858 UCT 13 APR '78 by R/V TANGAROA
 Retrieved at: 0100 UCT 18 NOV '78 by R/V KNORR
 Data Interval: 1221 UCT 13 APR '78 to 2223 UCT 17 NOV '78

Instrumentation

<u>Intended Depth</u>	<u>RCM5 Serial No./Tape No.</u>
1000 m	500/19
2000 m	501/45
4000 m	2281/5

Instrument 500 recorded speed, direction, temperature, and pressure once per hour. The speed sensor failed during installation. The compass may also have failed. No directions between about 140 degrees and 315 degrees were recorded. By comparing this record with the next deeper one it was possible to find two segments that almost certainly did not contain directions in the blanked region, and these have been retained in the saved data file. The remainder of the direction record was zeroed. The zeroed portions are: (0023 UCT 9 MAY '78 to 2323 UCT 24 Jun '78); and (0023 UCT 9 AUG '78 through the end of the file).

Instrument 501 recorded speed, direction, temperature, and pressure once per hour until the instrument was recovered.

Instrument 2281 failed to yield any data. The tape was blank.

SHEEP'S BIT

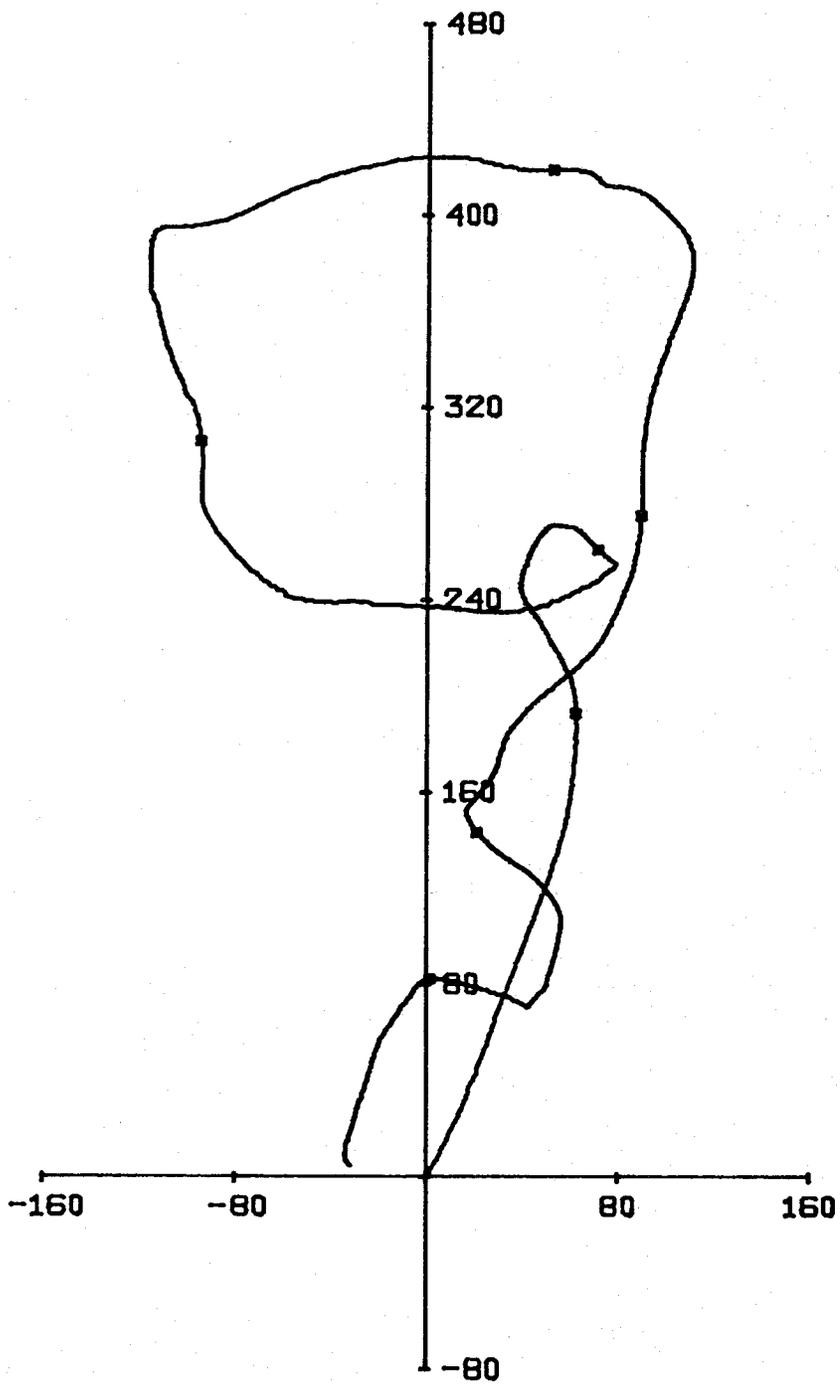
1070 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
T	3.87	.31	-.06	2.92	4.77	2.75	5242
P	10753728.	415107.	2.75	10.55	13531000.	10523000.	5242

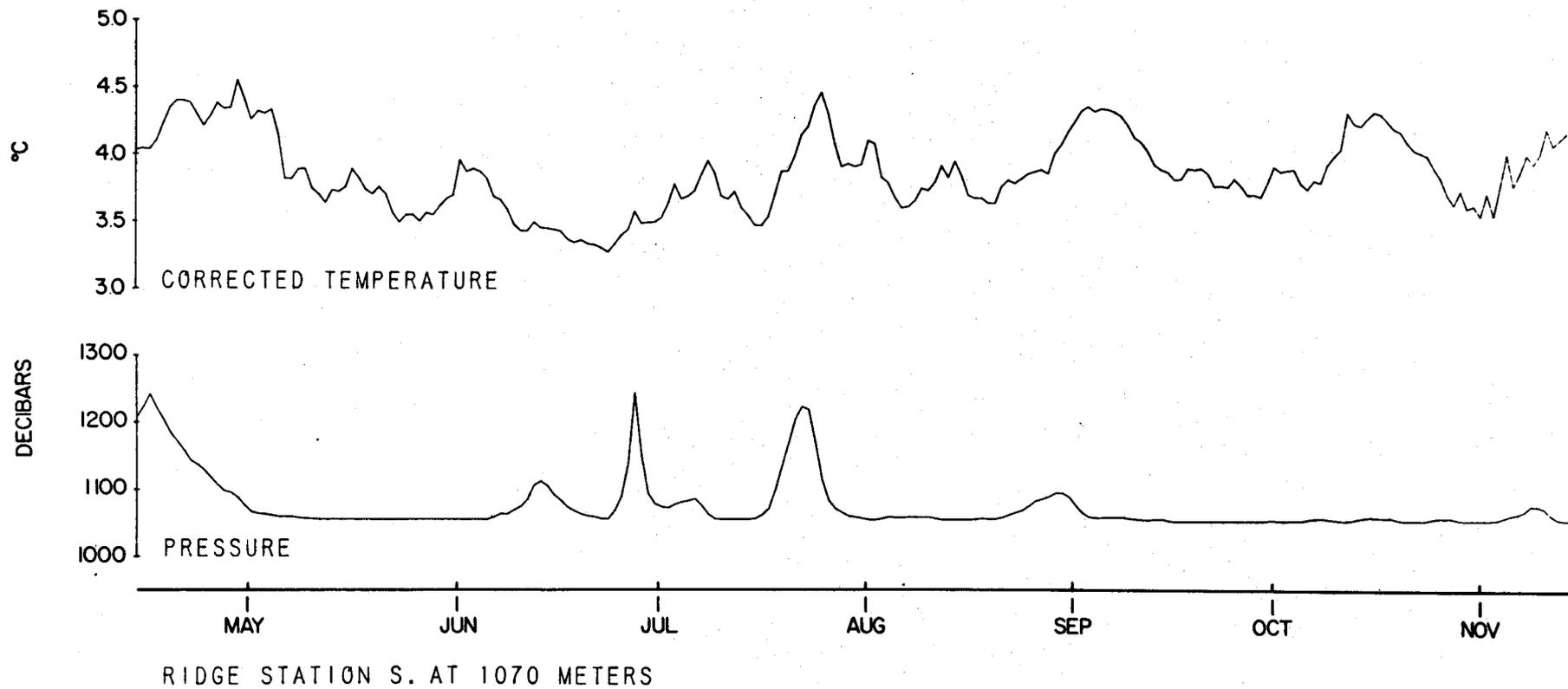
2065 m

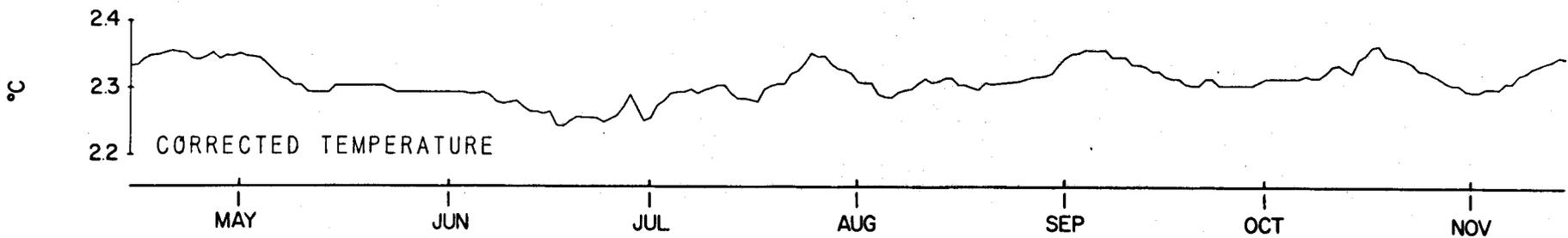
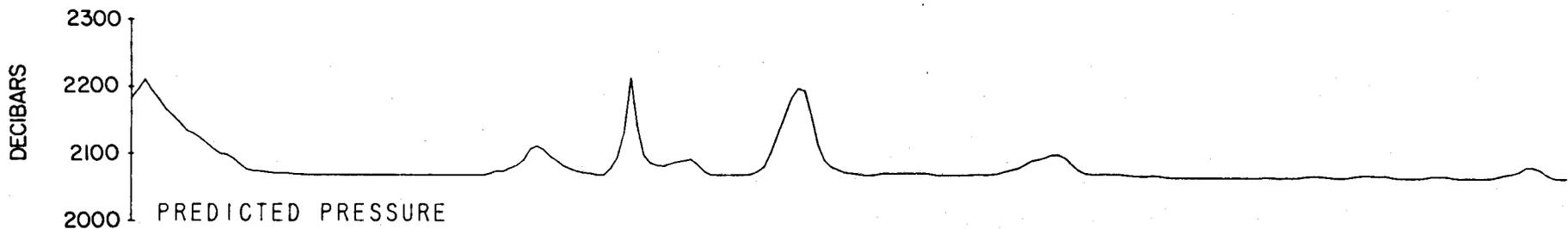
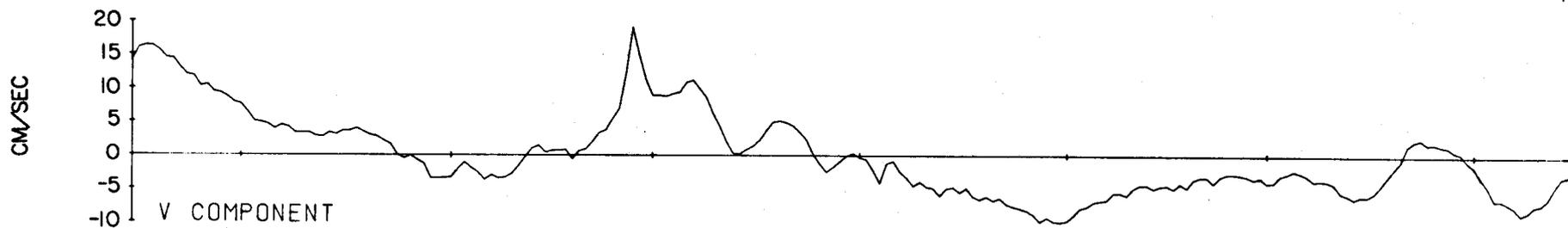
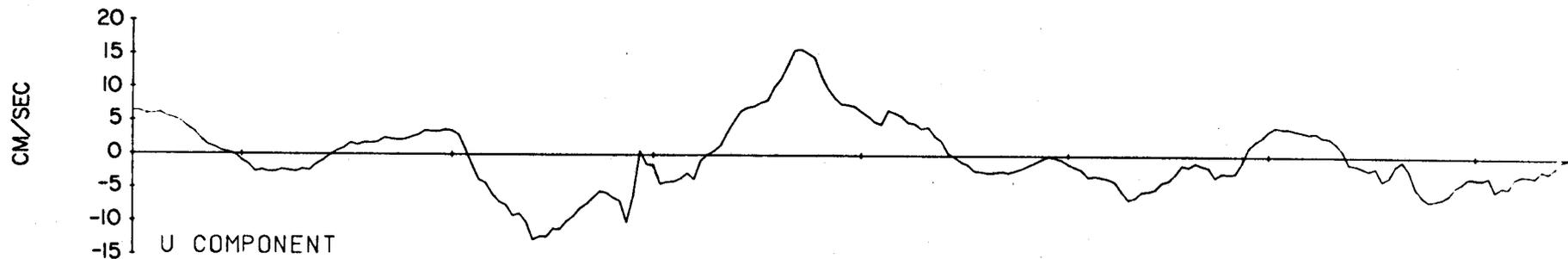
S	7.52	4.13	.74	3.50	25.30	.70	5243
U	-.17	5.53	.31	3.76	20.10	-18.10	5243
V	.02	6.56	.75	3.15	22.30	-15.30	5243
T	2.31	.03	-.49	3.42	2.38	2.19	5243

Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.



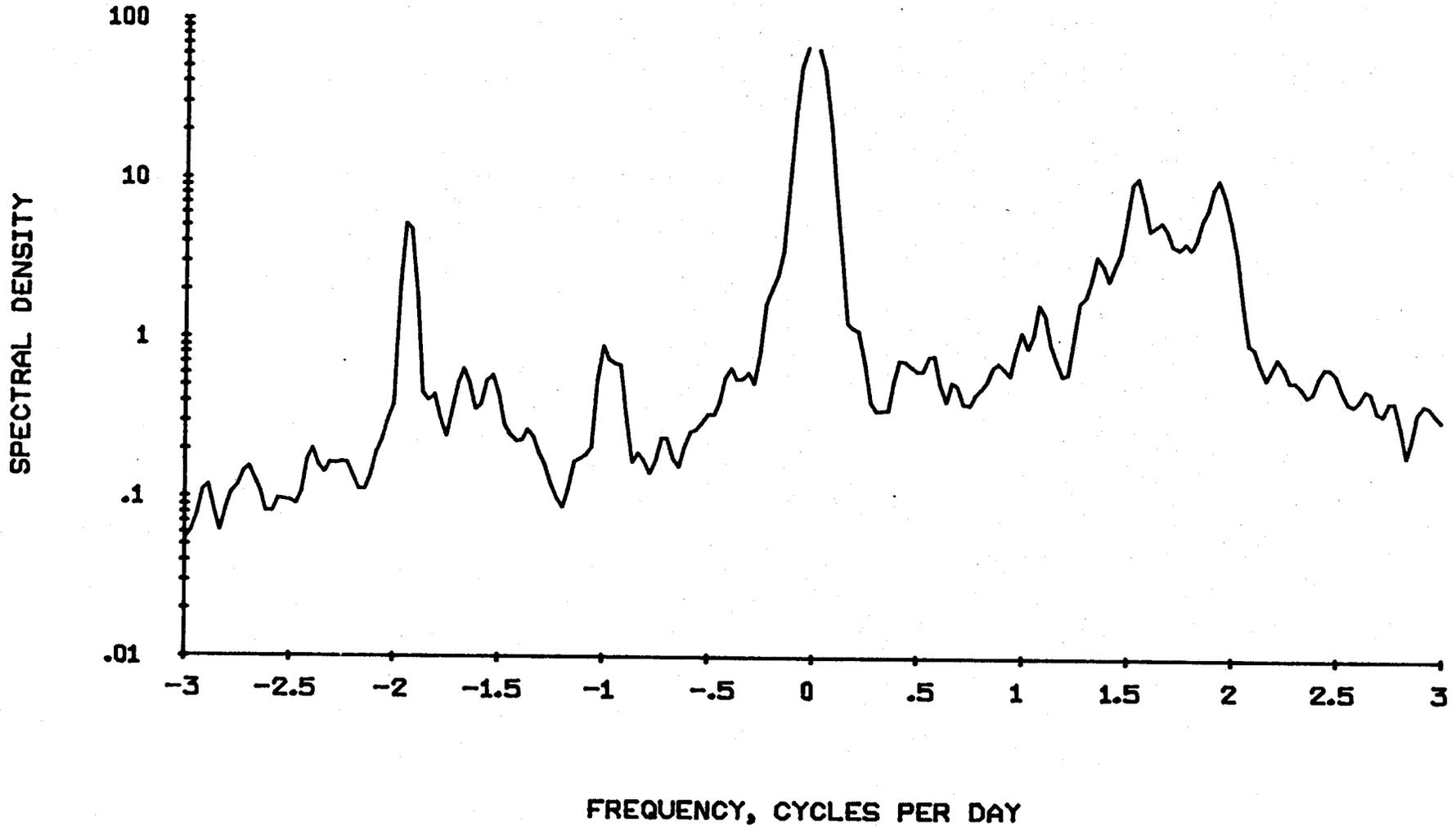
2065 METERS AT SHEEP'S BIT. 13 APR 78 - 17 NOV 78.



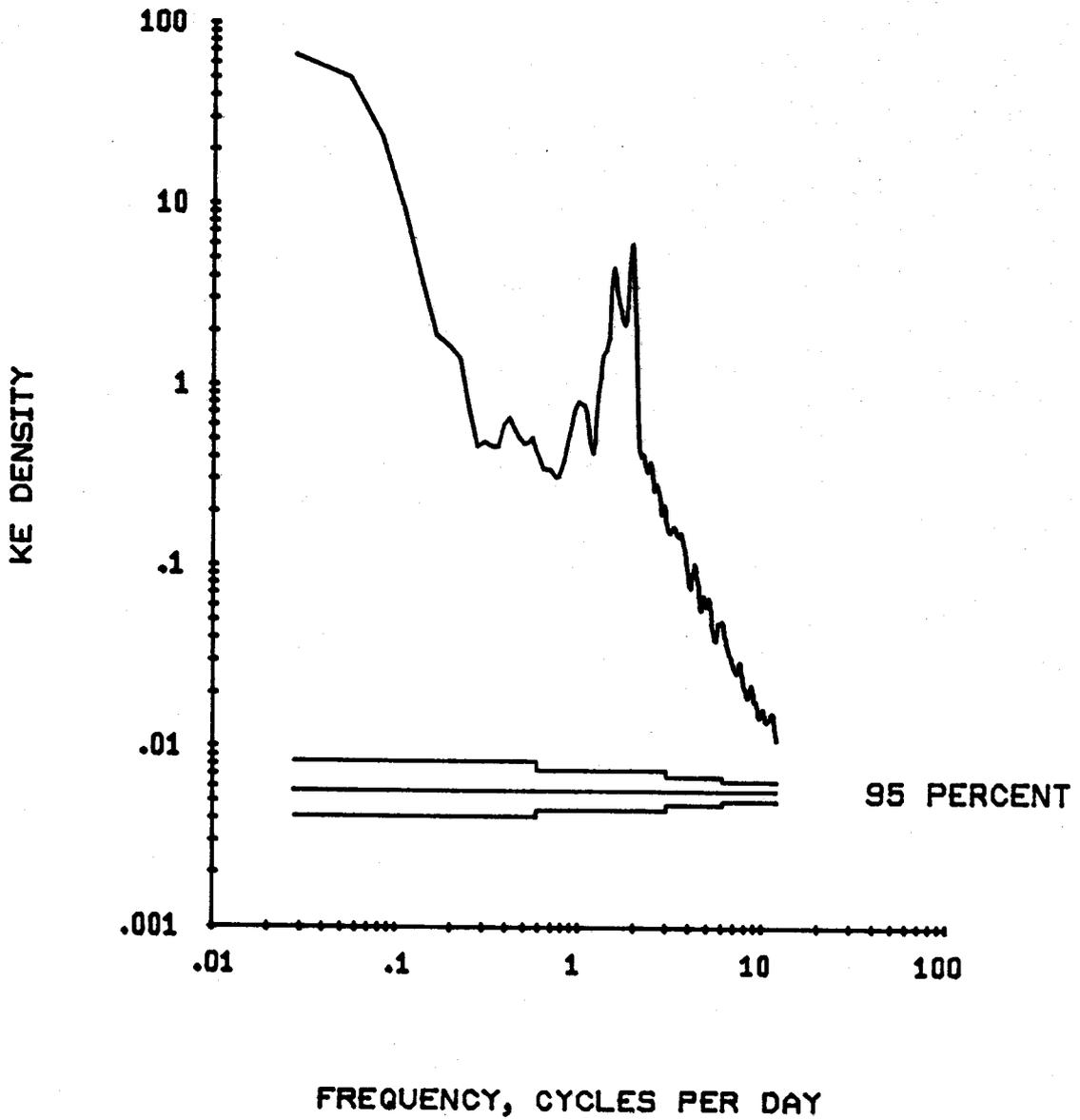


RIDGE STATION S. AT 2065 METERS

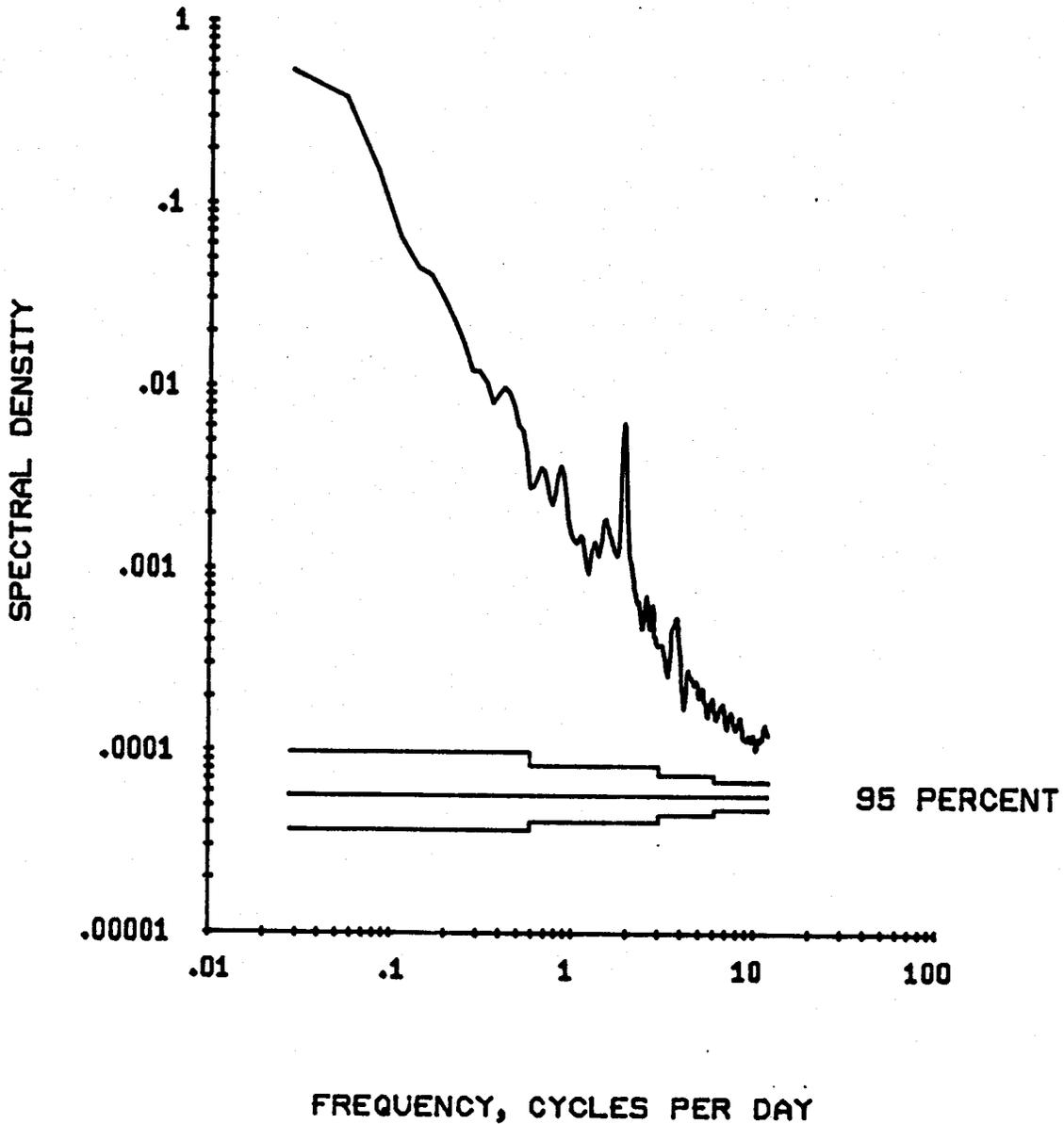
UNFILTERED CURRENT. 2065 METERS AT SHEEP'S BIT.



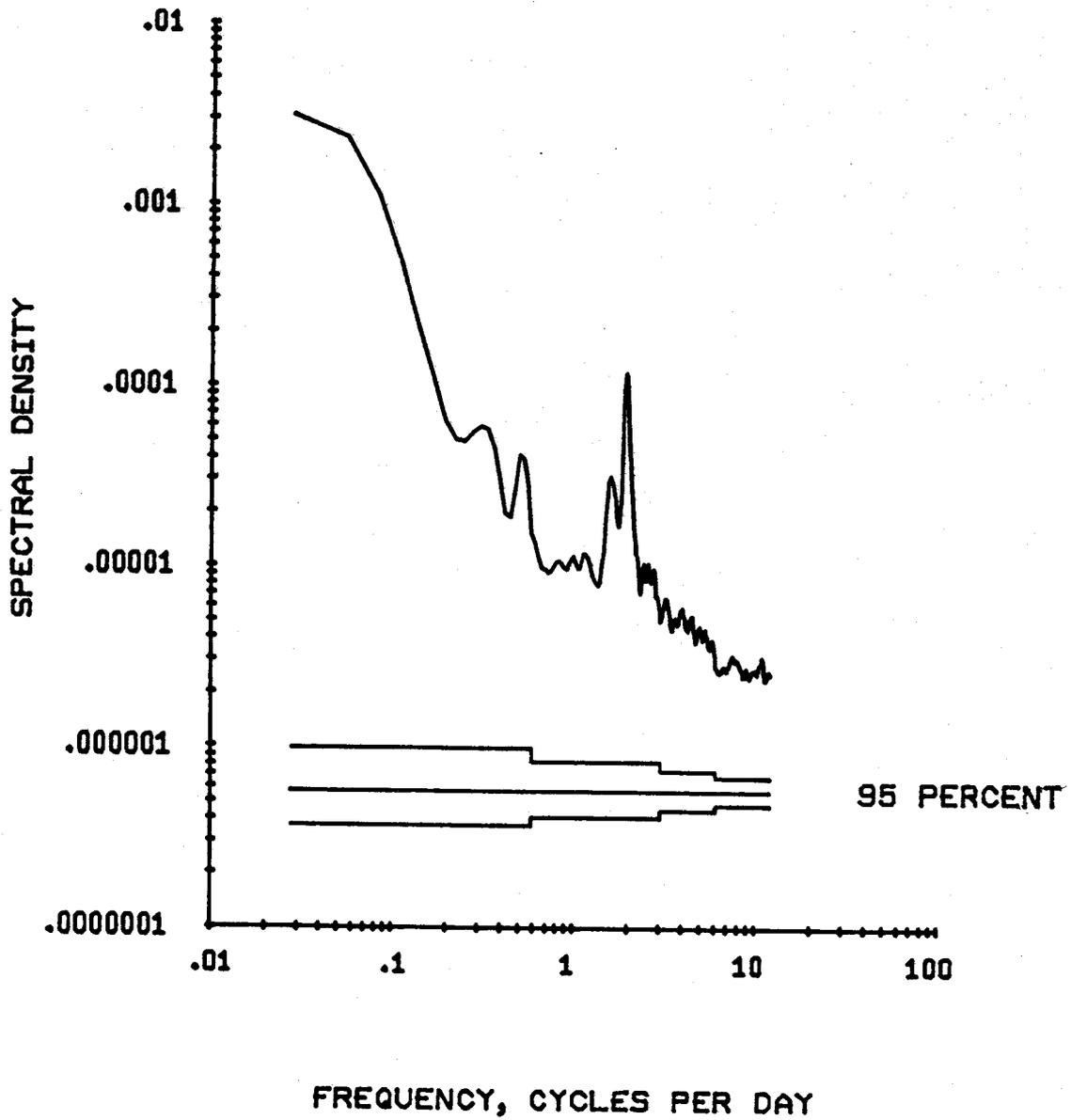
UNFILTERED CURRENT. 2065 METERS AT SHEEP'S BIT.



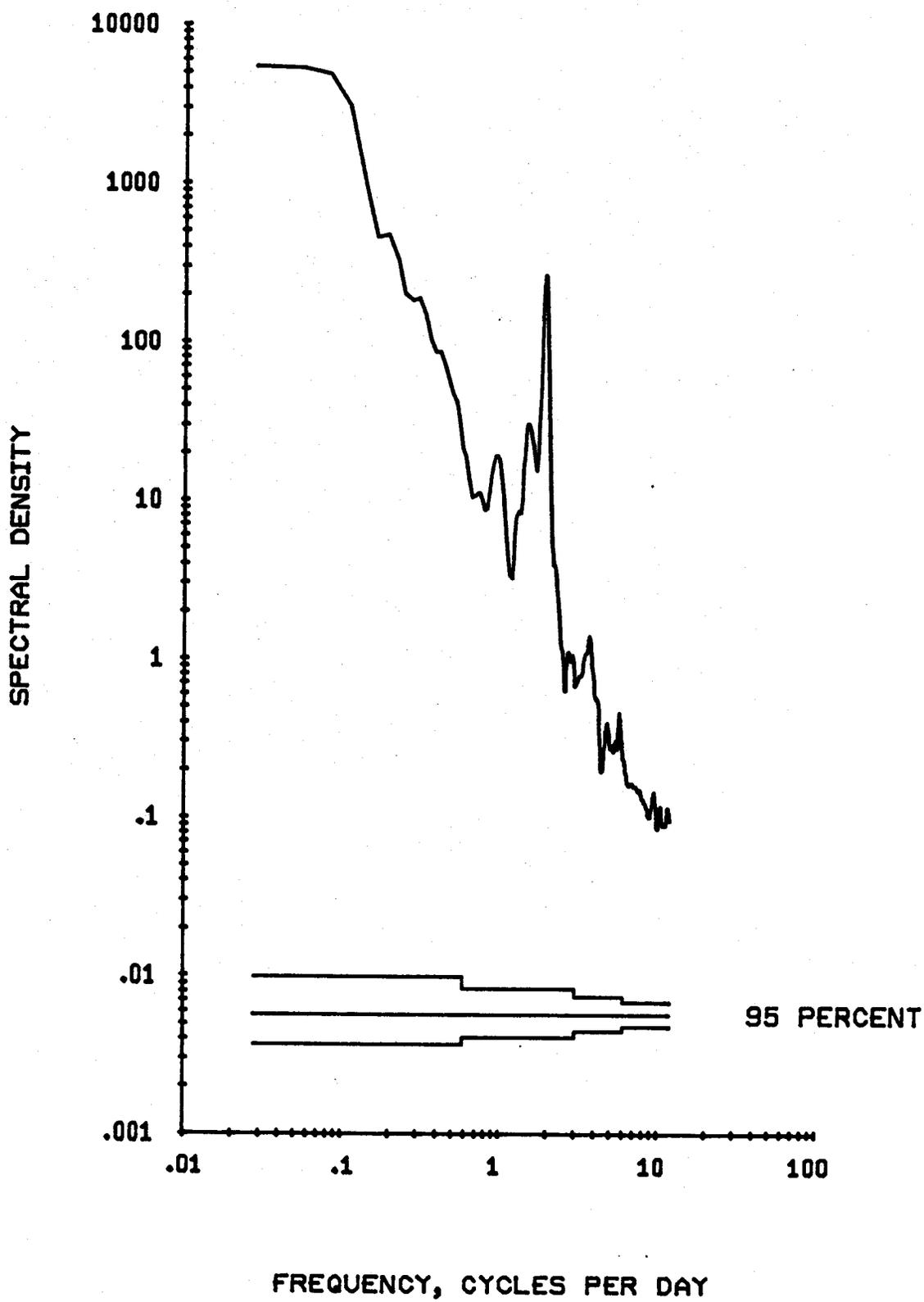
UNFILTERED TEMPERATURE. 1070 METERS AT SHEEP'S BIT.



UNFILTERED TEMPERATURE. 2065 METERS AT SHEEP'S BIT.



UNFILTERED PRESSURE. 1070 METERS AT SHEEP'S BIT.



NGAIO

NGAIO

Position: 49°12.5'S, 169°53.6'W
Depth of Water: 5240 m
Set at: 0735 UCT 12 APR '78 by R/V TANGAROA
Retrieved at: 1926 UCT 16 NOV '78 by R/V KNORR
Data Interval: 1044 UCT 12 APR '78 to 1544 UCT 15 NOV '78

Instrumentation

<u>Intended Depth</u>	<u>RCM5 Serial No./Tape No.</u>
2000 m	495/50
4000 m	2282/7
5000 m	3124/6

Instrument 495 recorded speed, direction, temperature, and pressure once per hour until 2113 UCT 22 OCT '78.

Instrument 2282 recorded speed, direction, and temperature once per hour until the instrument was recovered.

Instrument 3124 recorded speed, direction, and temperature once per hour until the instrument was recovered.

NGAIO

2013 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
S	12.96	6.10	1.68	6.71	40.00	.70	4631
U	1.97	7.92	-.18	2.81	25.60	-23.80	4631
V	-1.68	11.66	.17	3.05	36.40	-39.10	4631
T	2.38	.05	-.03	2.82	2.51	2.23	4631
P	20235242.	777719.	1.63	5.45	23557000.	19472000.	4631

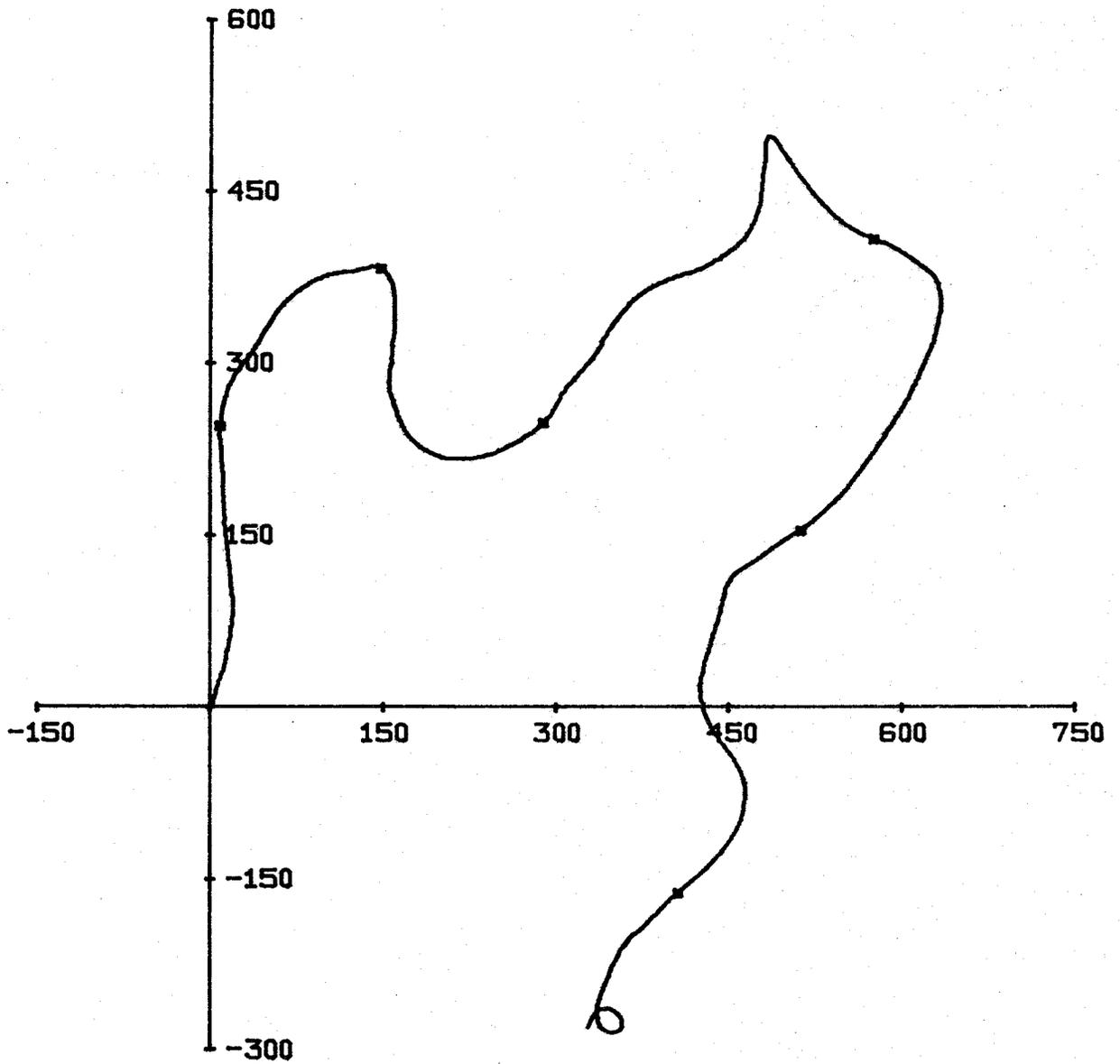
3972 m

S	8.38	3.09	.33	3.09	21.20	.70	5214
U	.84	5.33	-.08	2.94	17.30	-16.30	5214
V	-1.44	6.96	.39	2.27	17.10	-20.20	5214
T	1.06	.03	.78	4.81	1.20	.97	5214

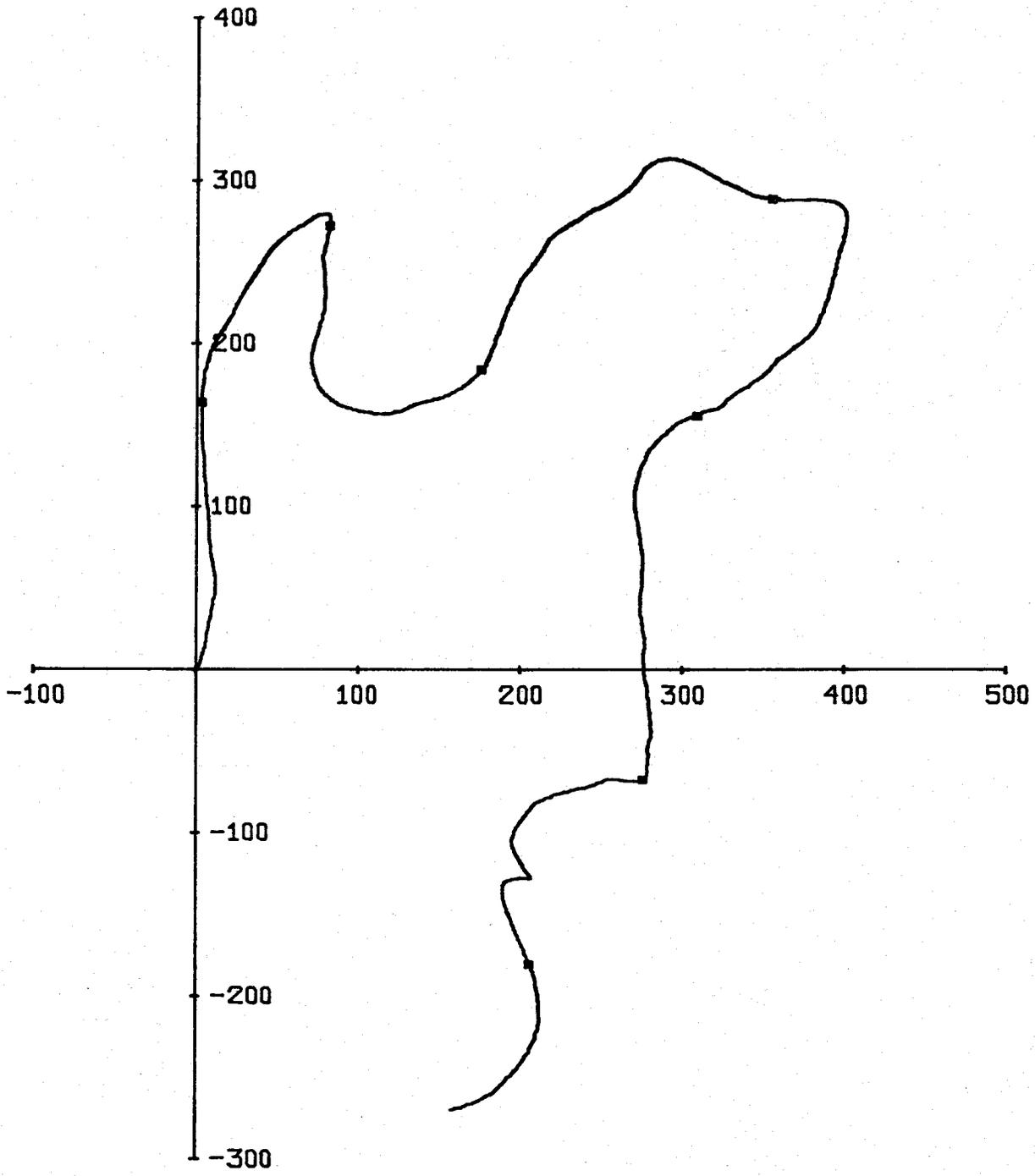
4951 m

S	8.01	3.54	.44	3.74	25.00	.70	5214
U	-1.25	4.97	.47	2.85	19.00	-13.50	5214
V	-2.16	6.76	.36	2.47	17.70	-24.20	5214
T	.93	.01	.35	4.73	.96	.91	5214

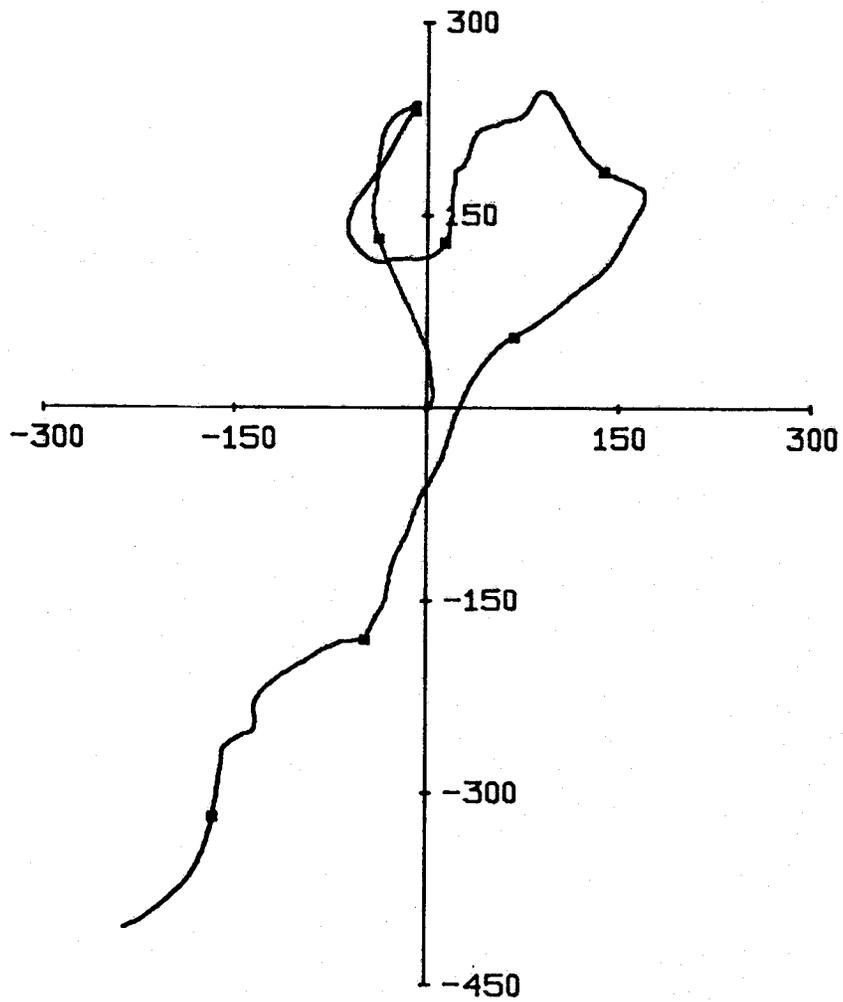
Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.



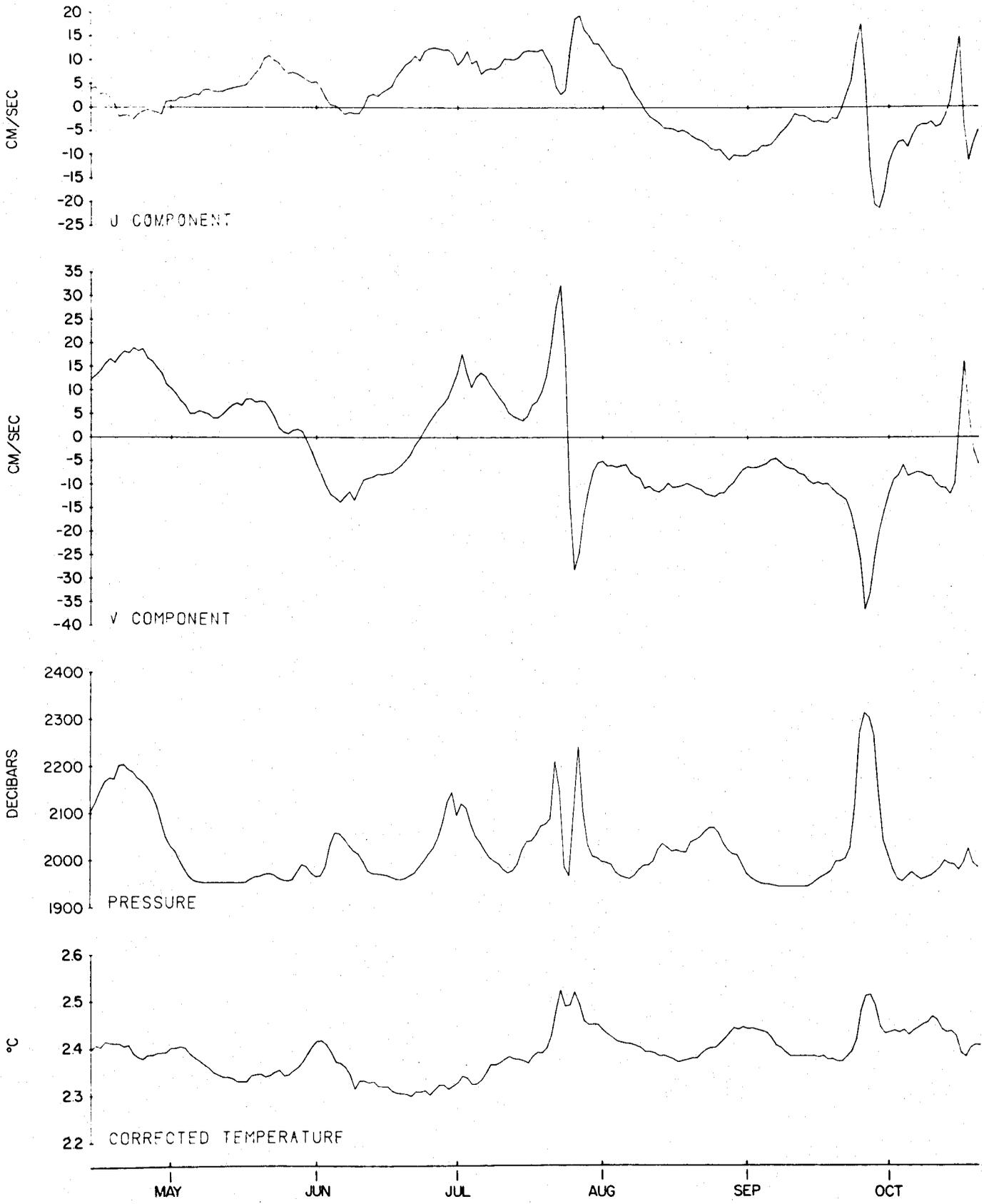
2013 METERS AT NGAIO. 12 APR 78 - 22 OCT 78.



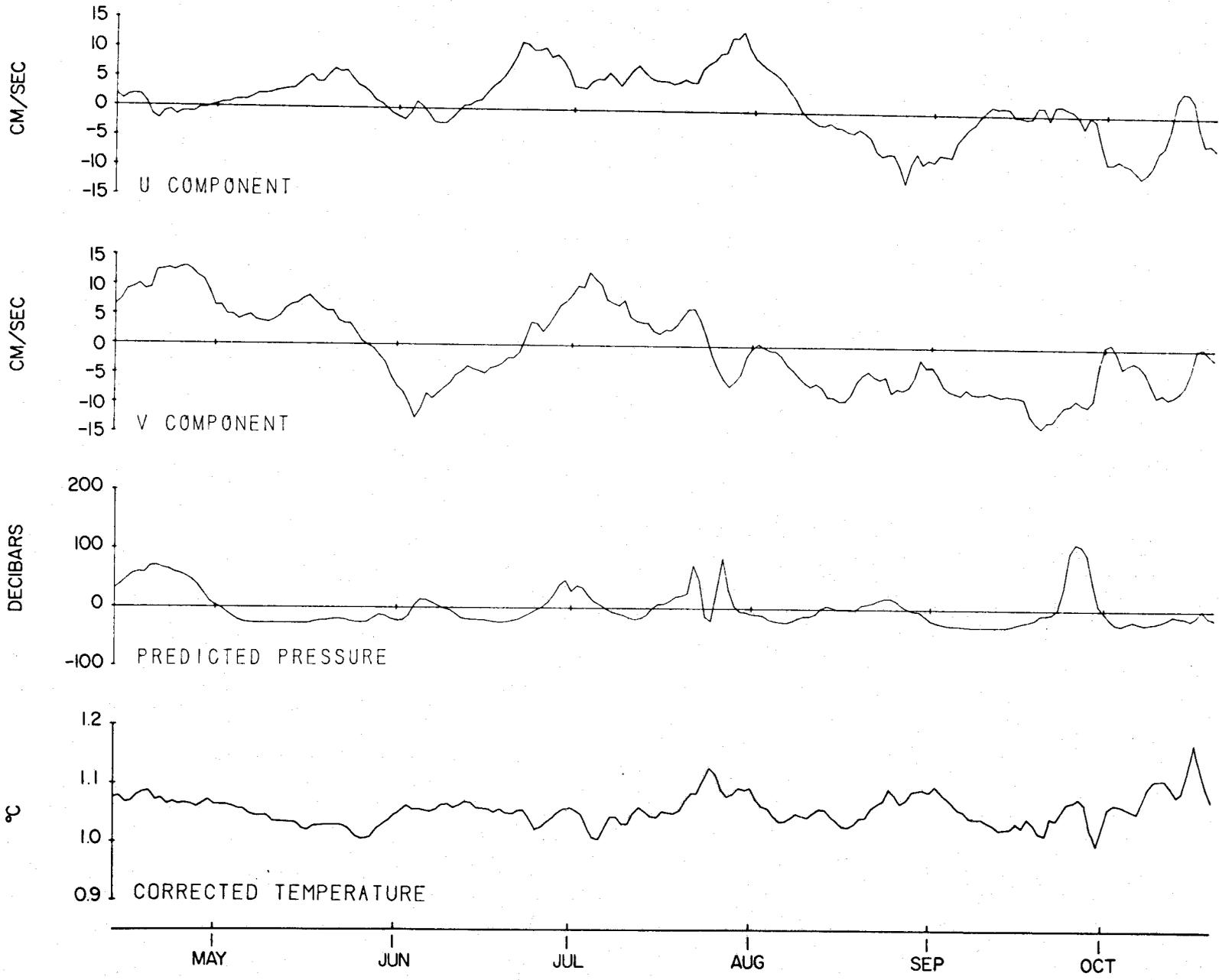
3972 METERS AT NGAIO. 12 APR 78 - 15 NOV 78



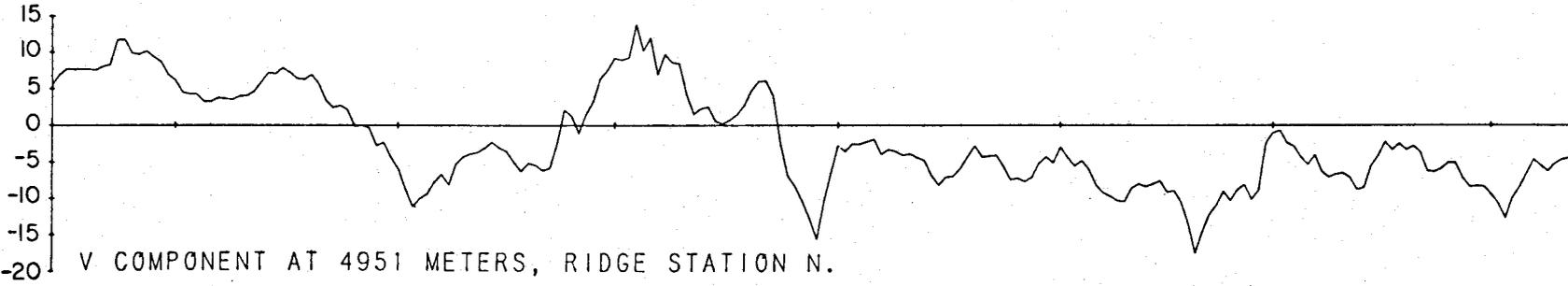
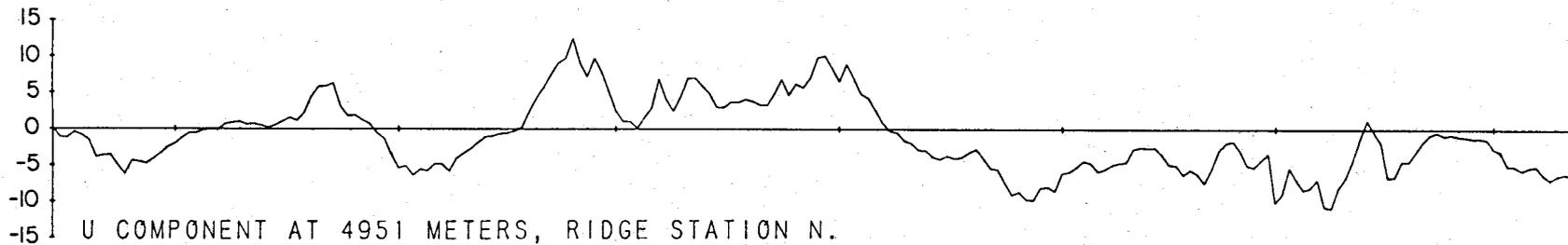
4951 METERS AT NGAIO. 12 APR 78 - 15 NOV 78.



RIDGE STATION N. AT 2013 METERS

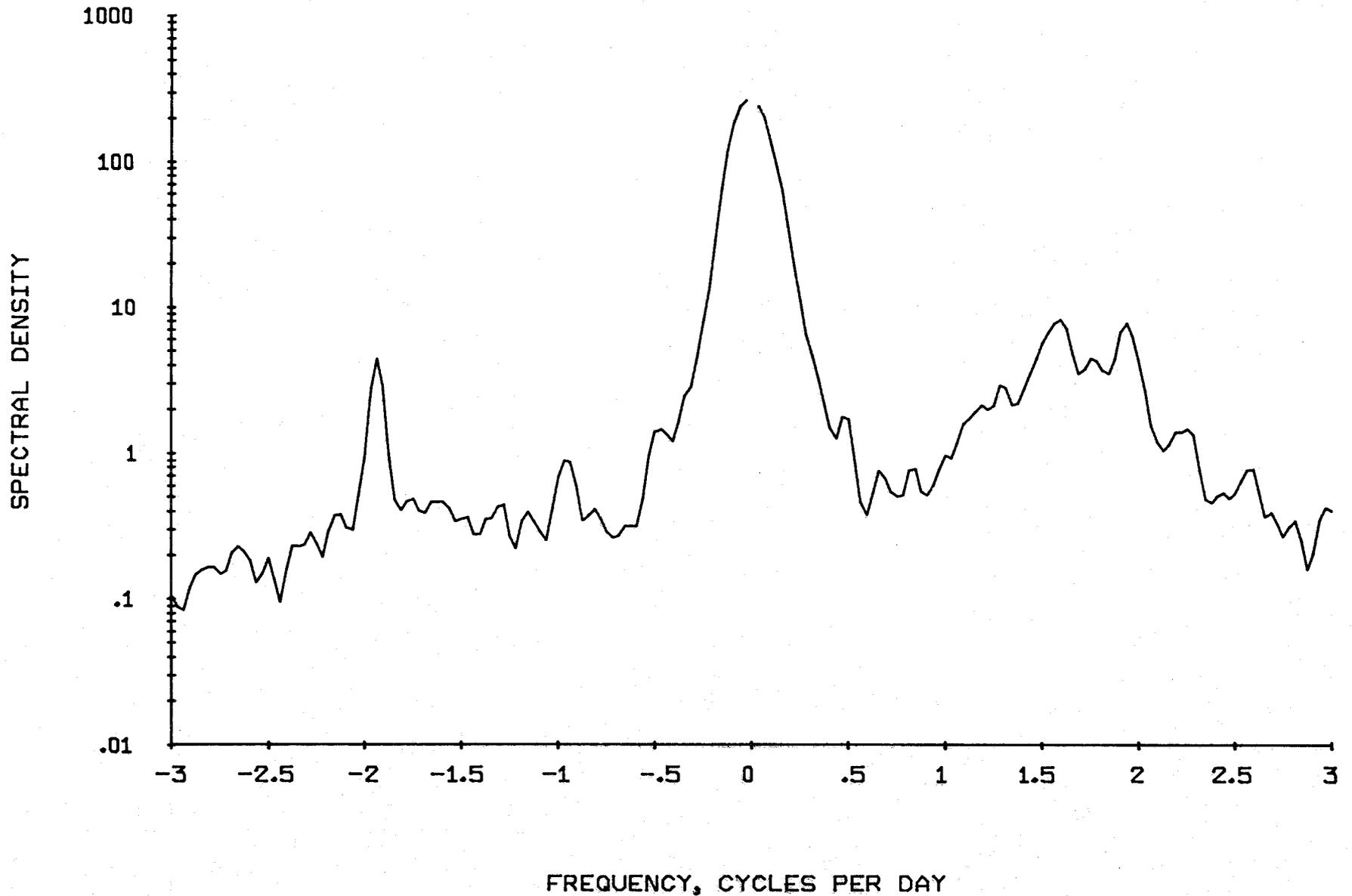


RIDGE STATION N. AT 3972 METERS

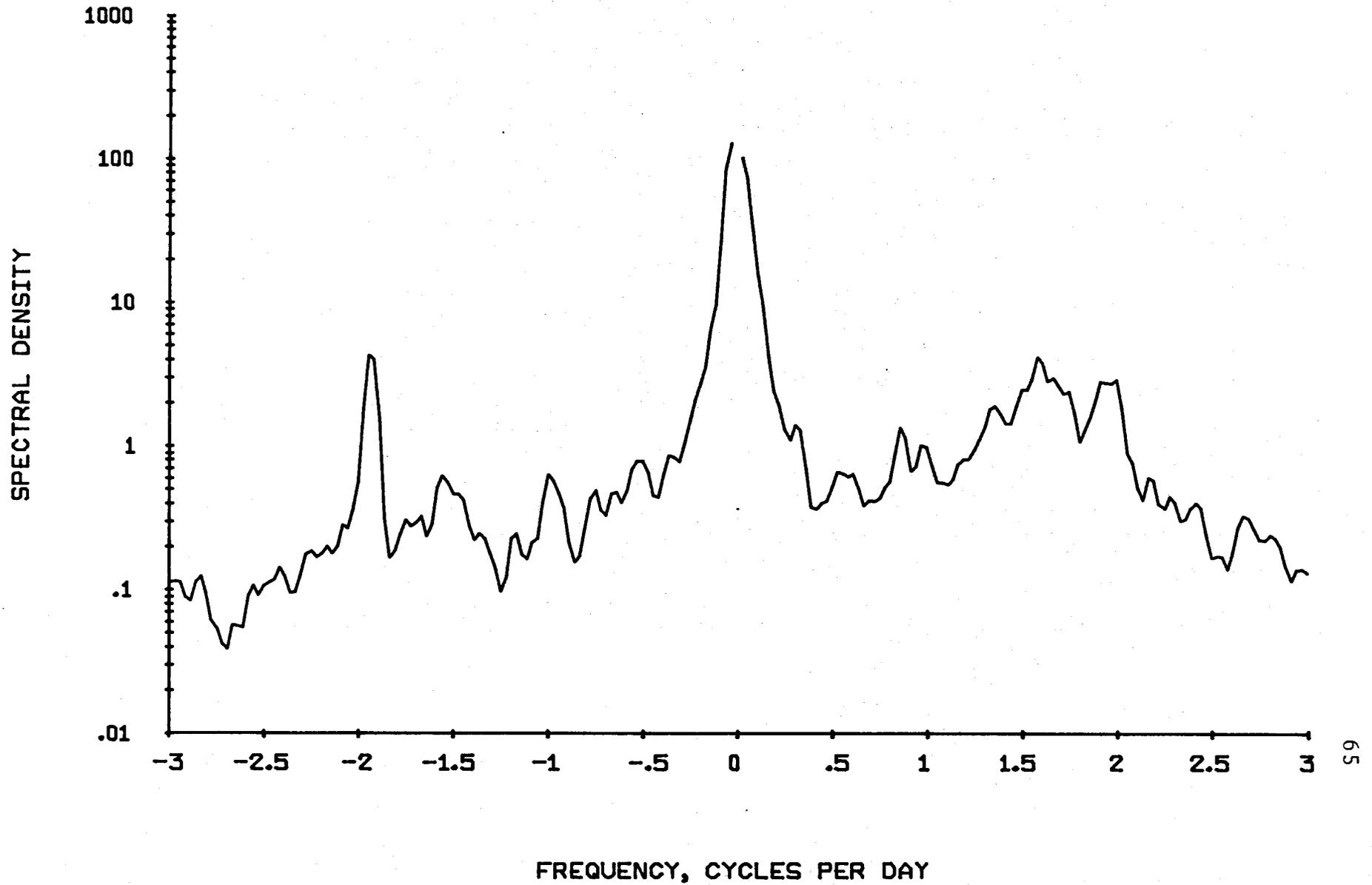


MAY JUN JUL AUG SEP OCT NOV

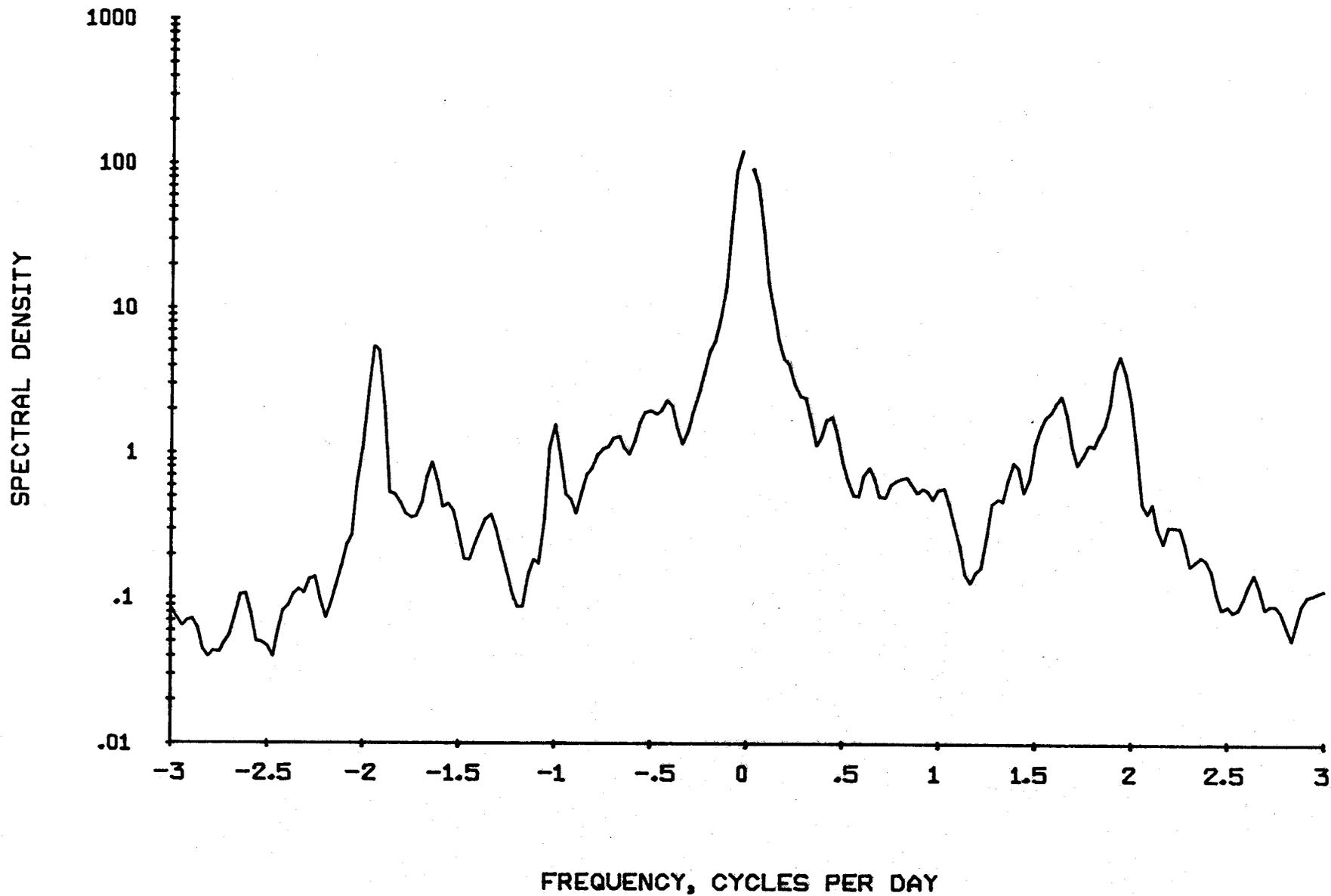
UNFILTERED CURRENT. 2013 METERS AT NGAIO.



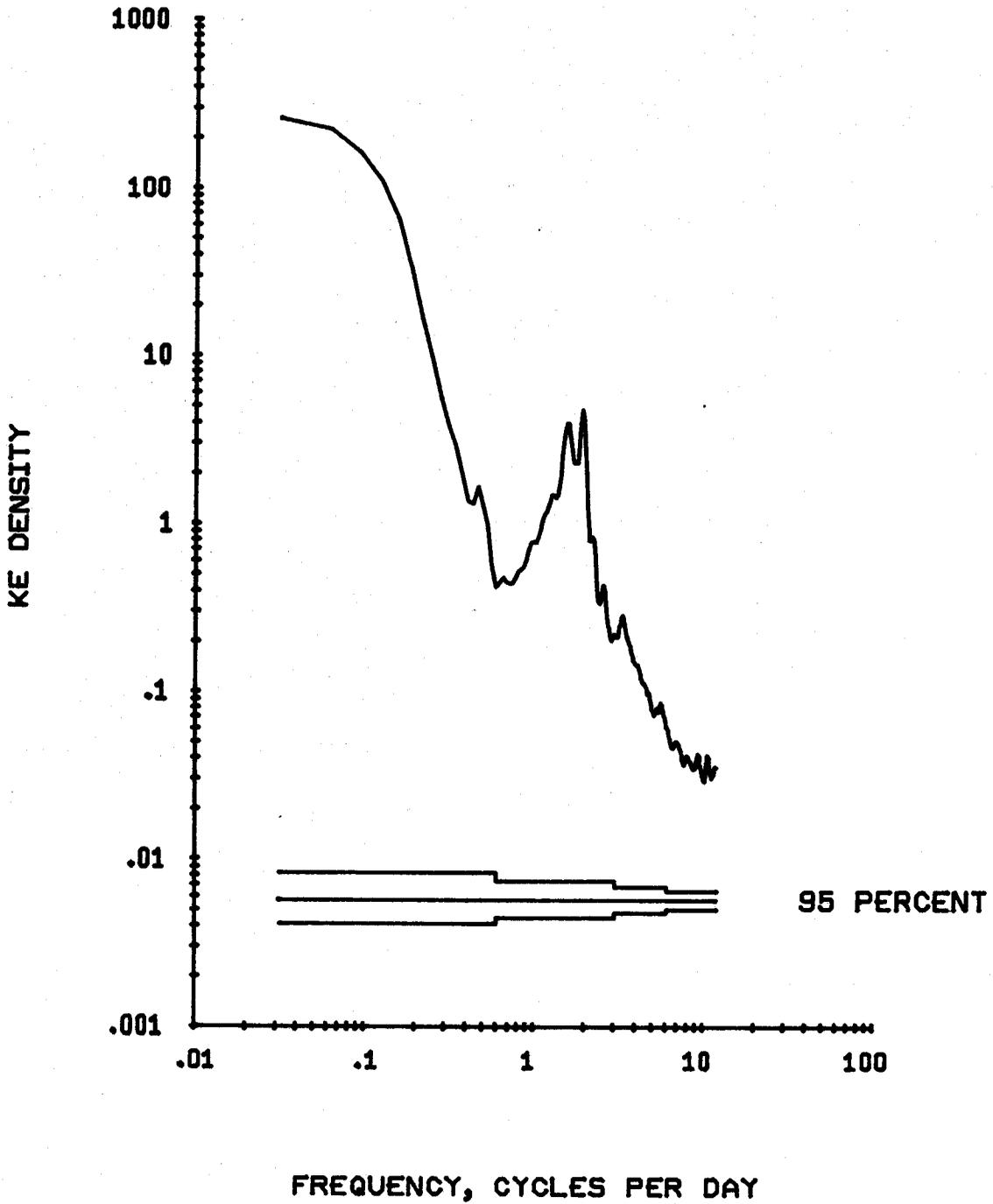
UNFILTERED CURRENT. 3972 METERS AT NGAIO.



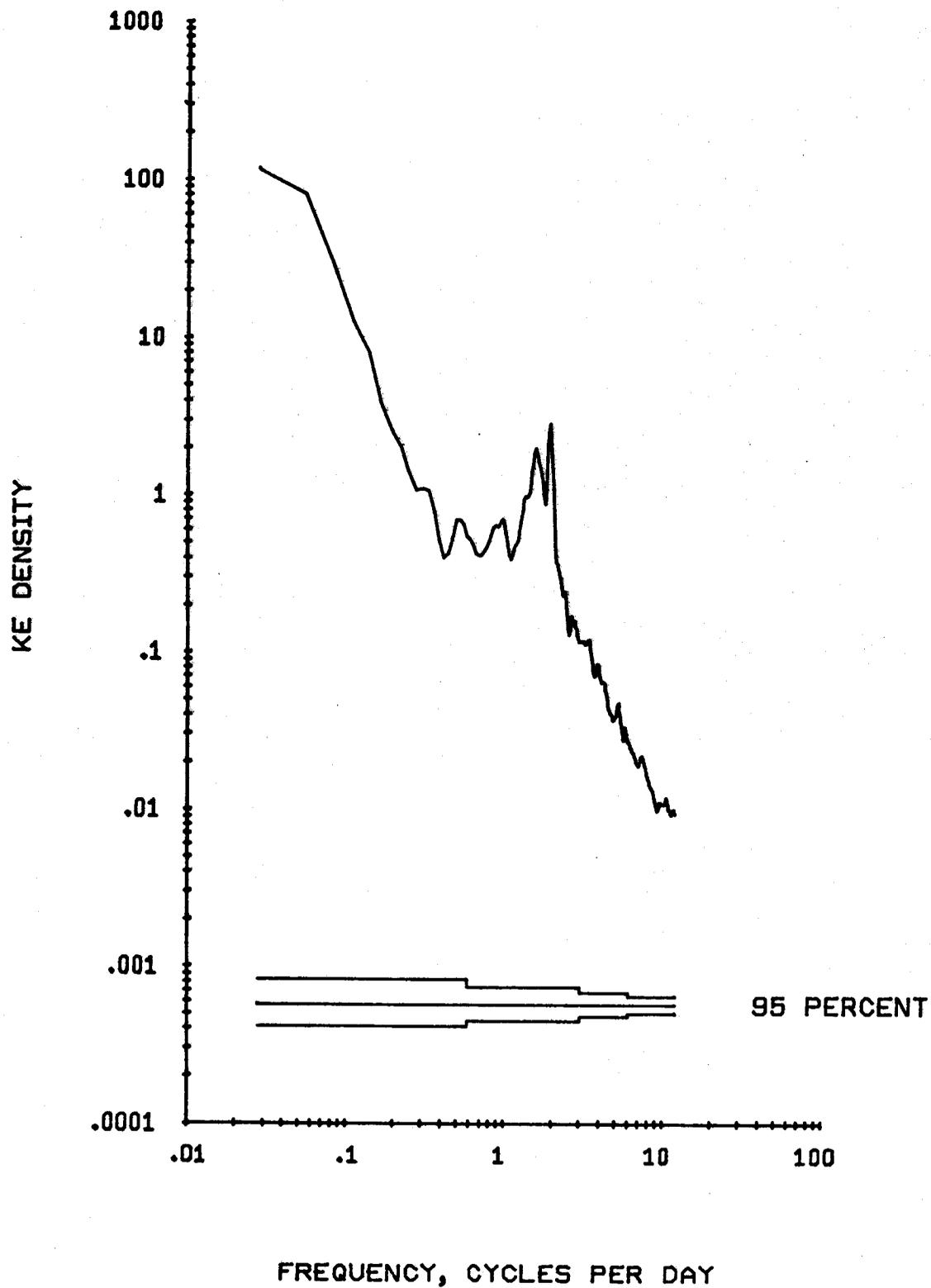
UNFILTERED CURRENT. 4951 METERS AT NGAIO.



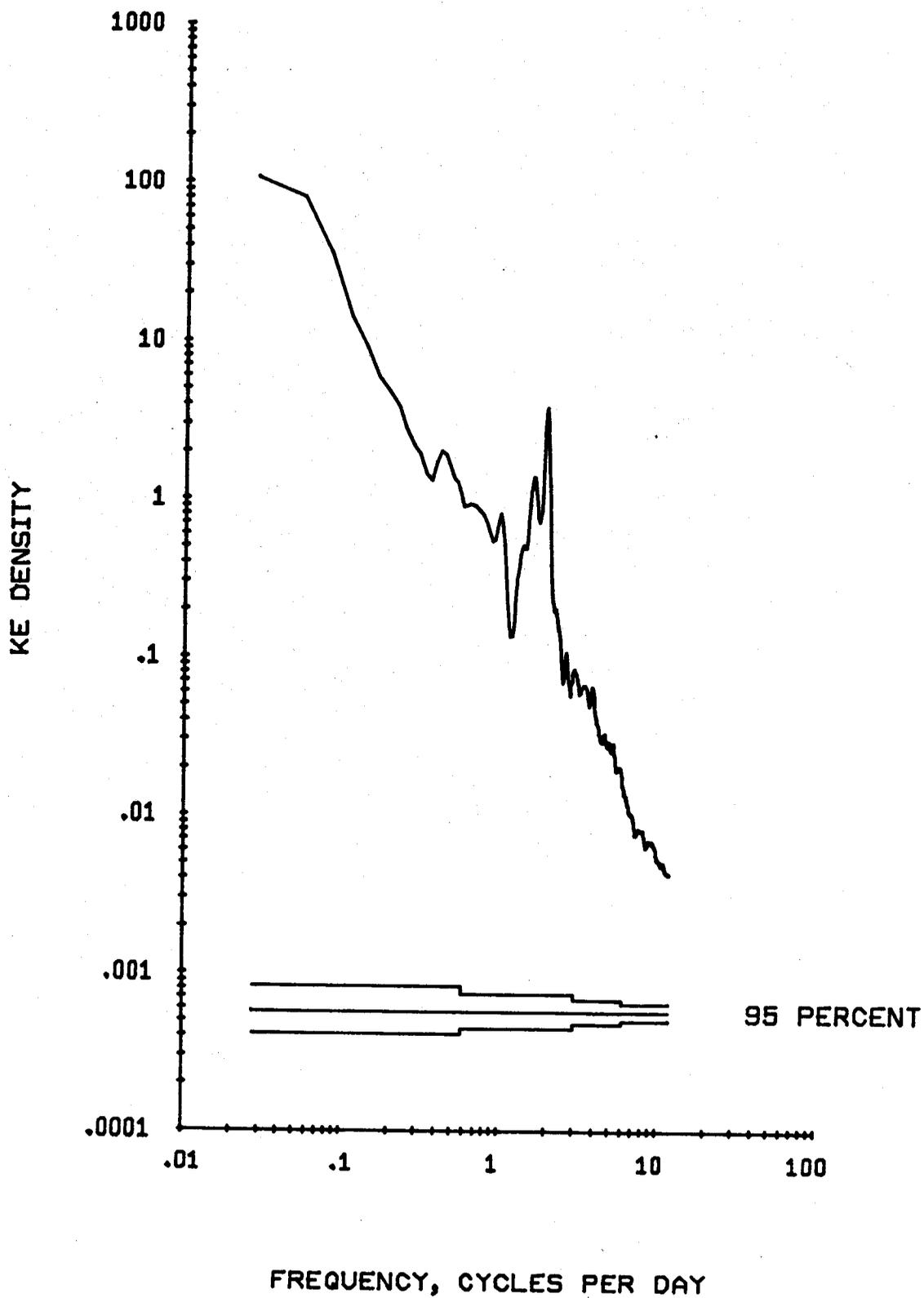
UNFILTERED CURRENT. 2013 METERS AT NGAIO.



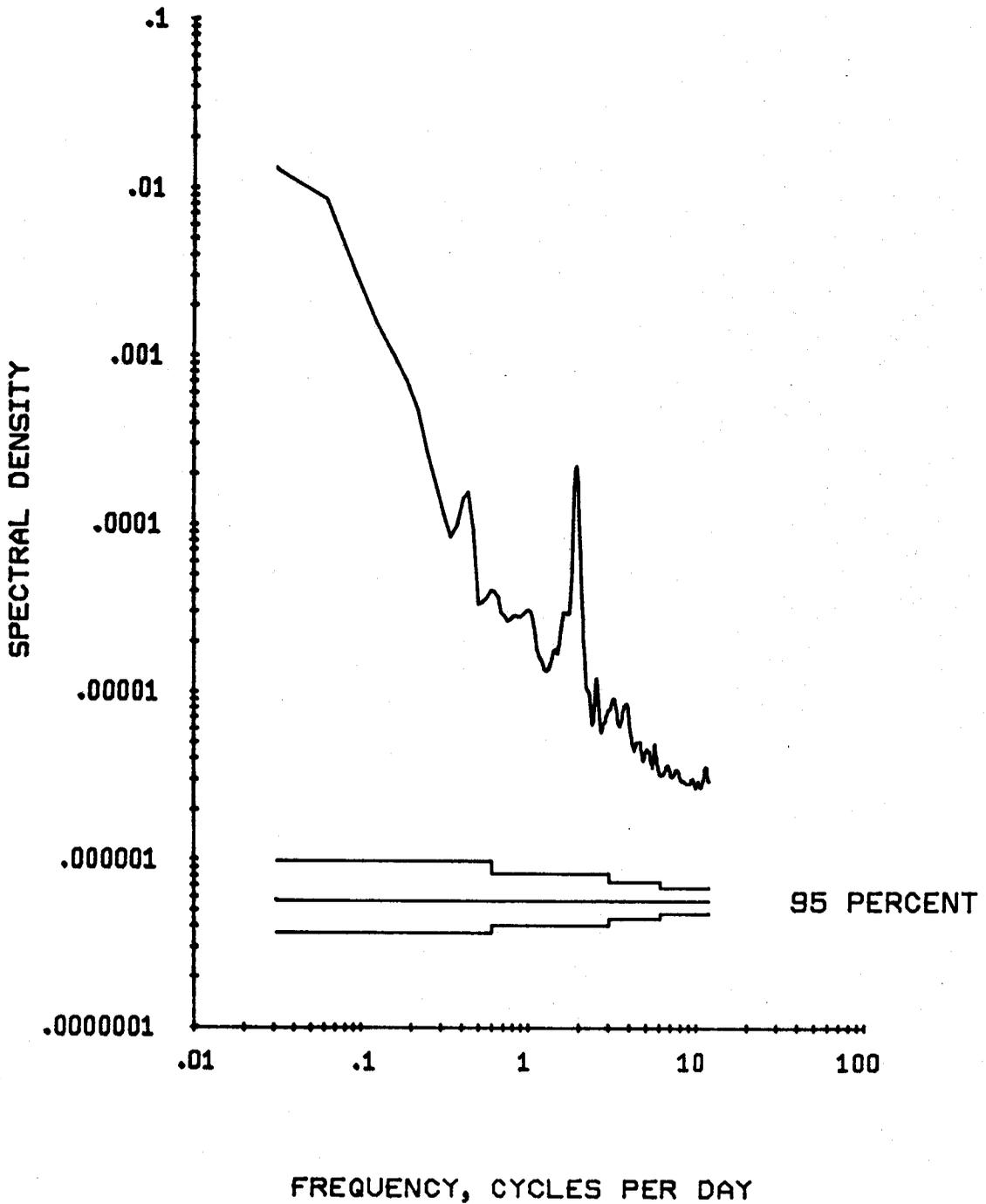
UNFILTERED CURRENT. 3972 METERS AT NGAIO.



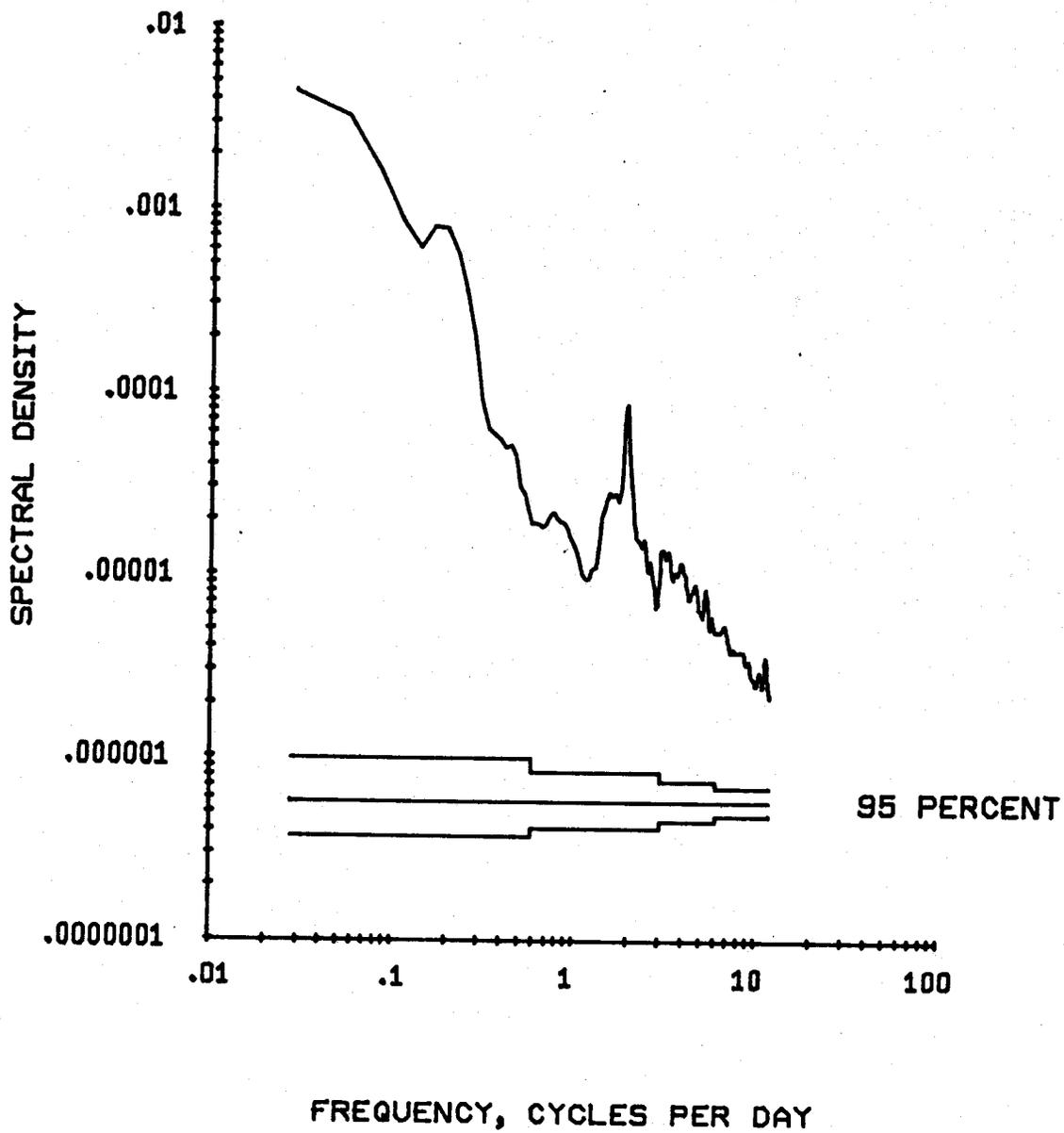
UNFILTERED CURRENT. 4951 METERS AT NGAIO.



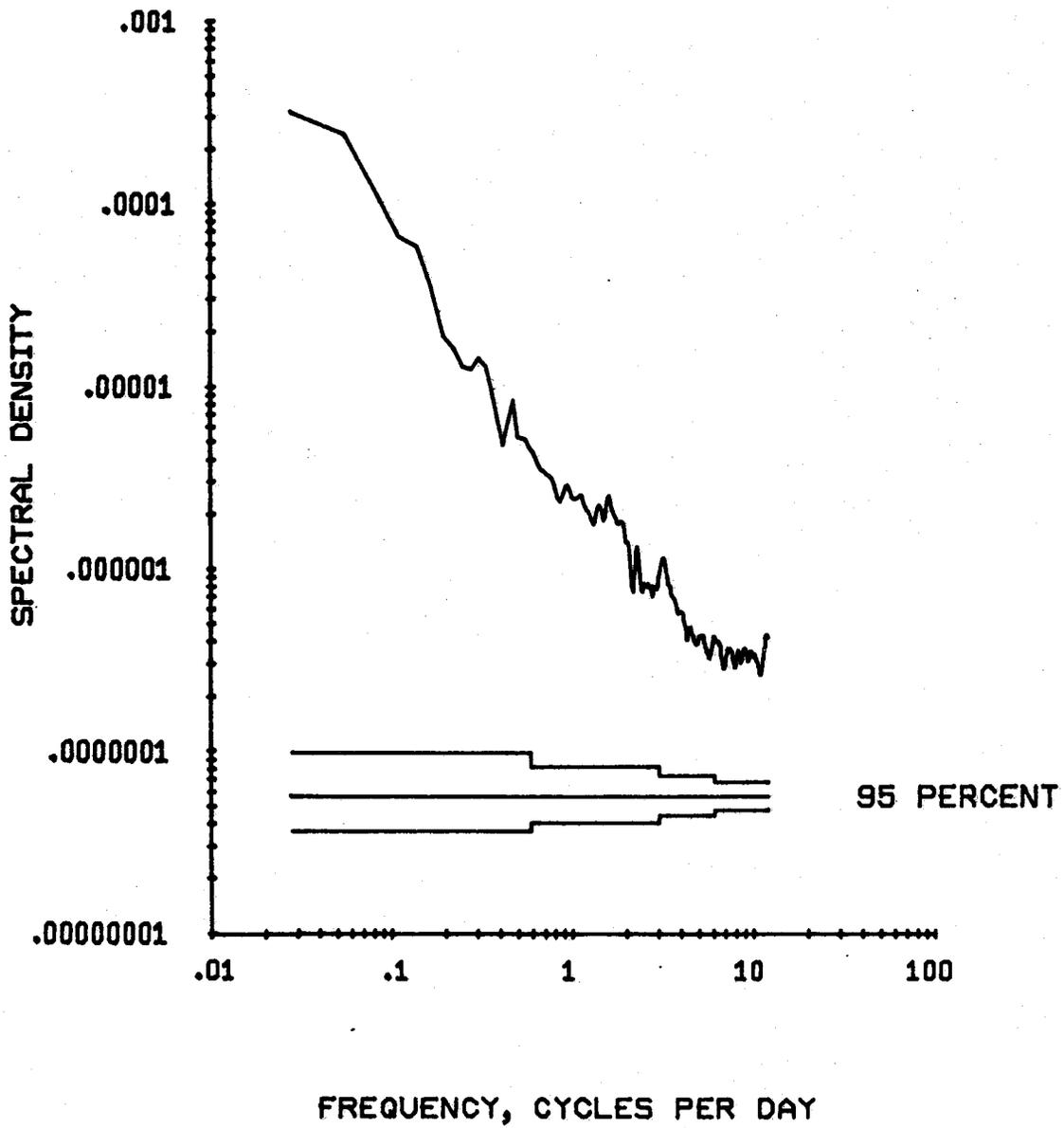
UNFILTERED TEMPERATURE. 2013 METERS AT NGAIO.



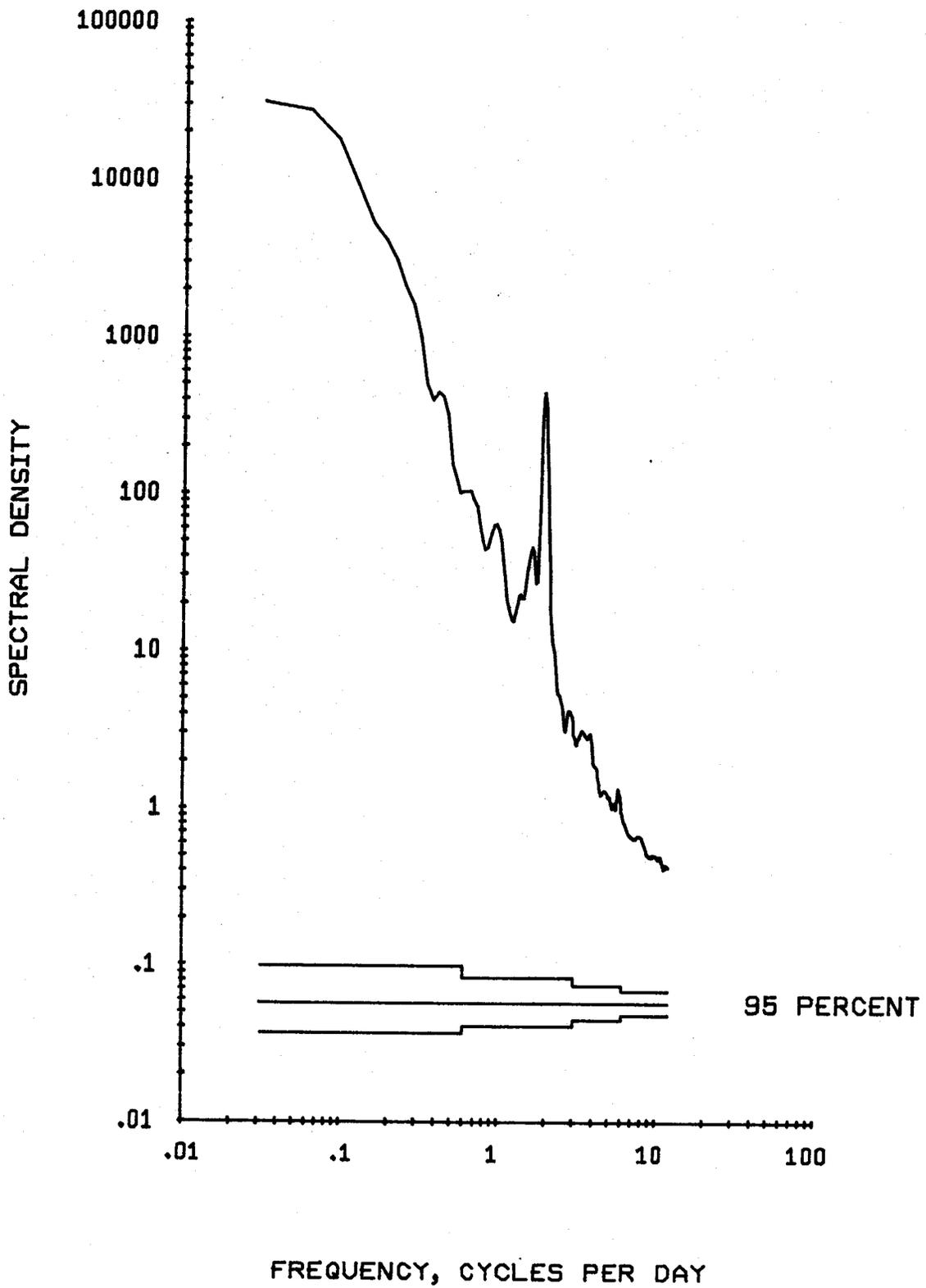
UNFILTERED TEMPERATURE. 3972 METERS AT NGAIO.

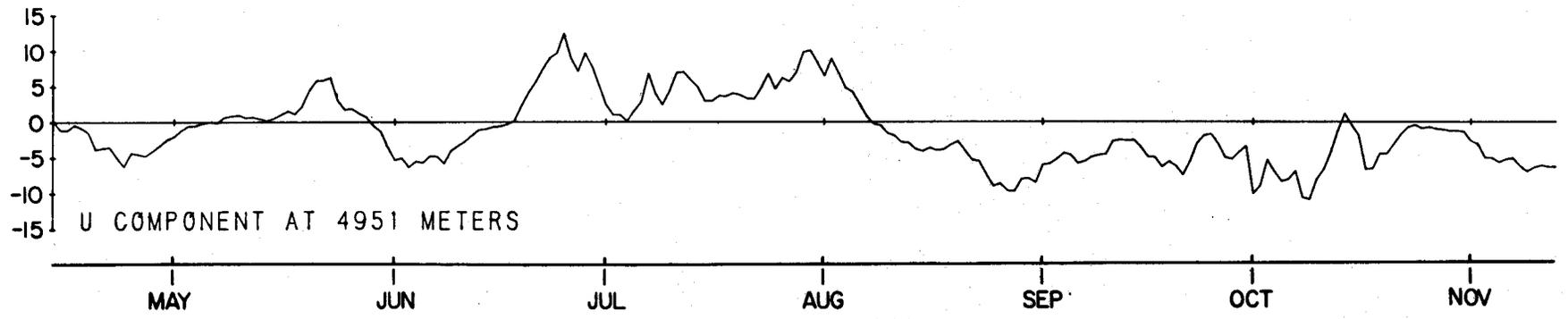
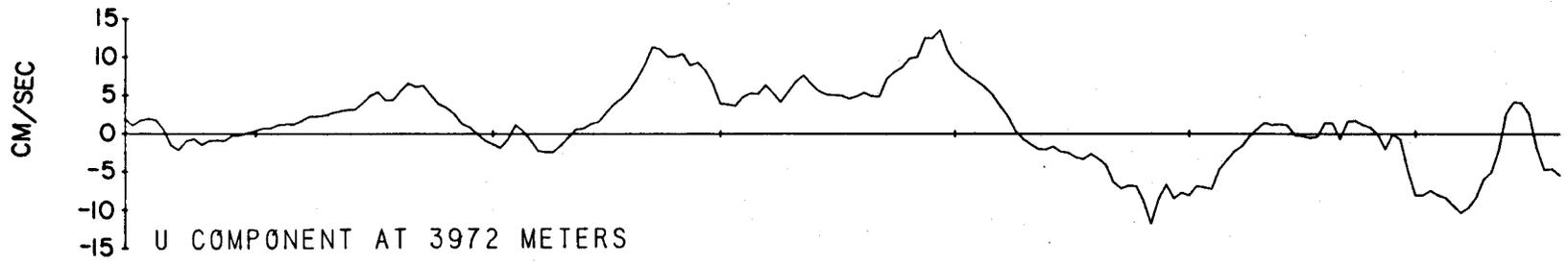
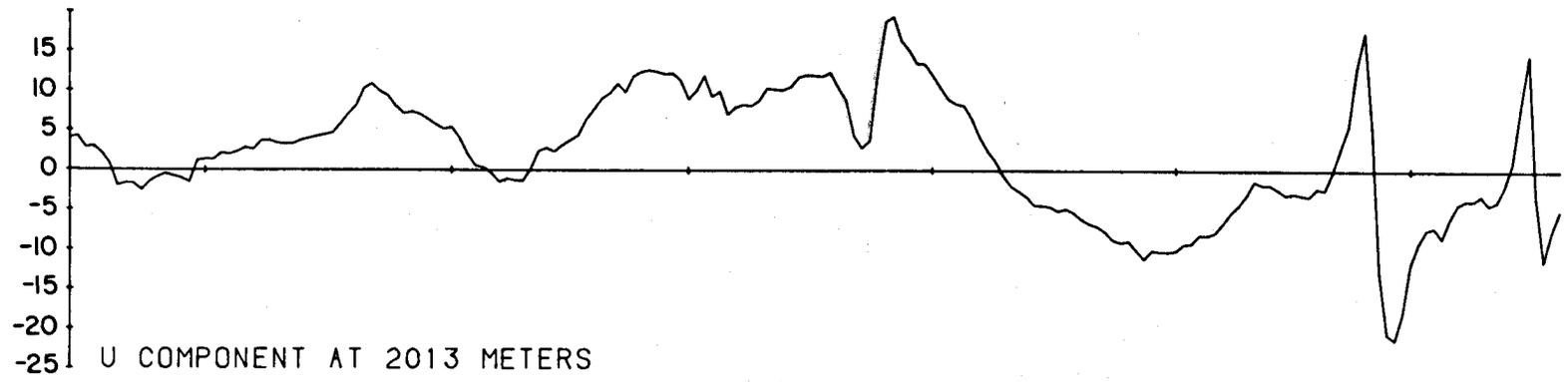


UNFILTERED TEMPERATURE. 4951 METERS AT NGAIO.

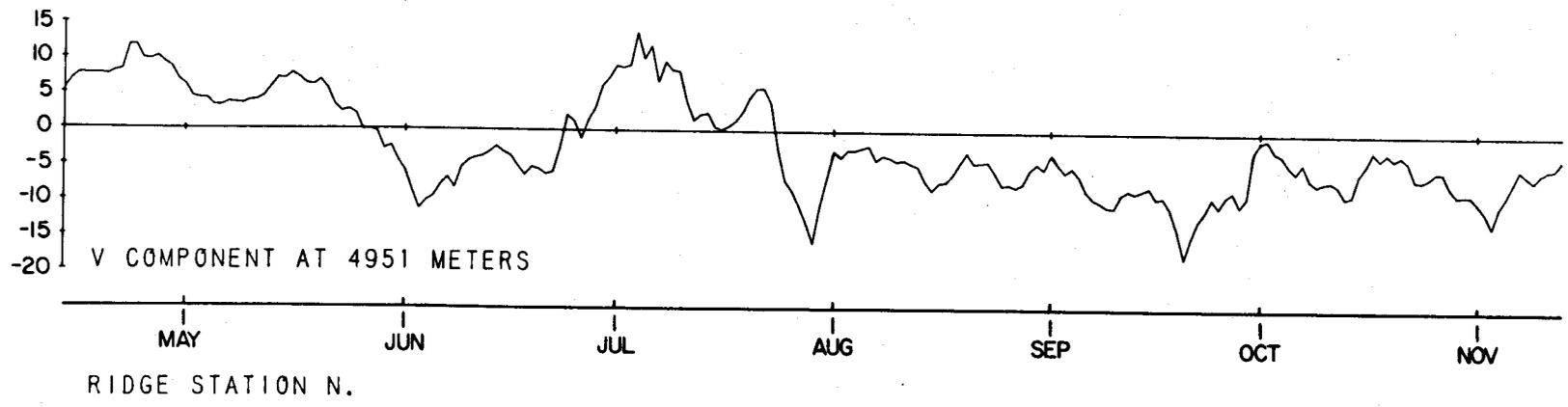
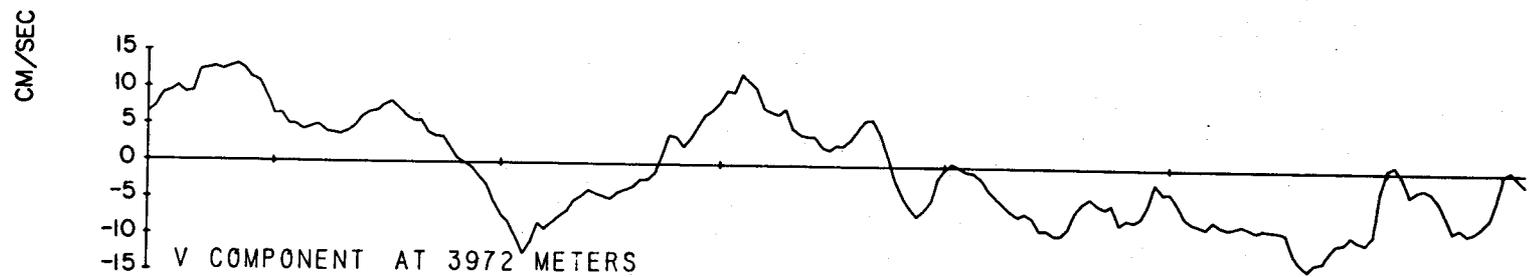
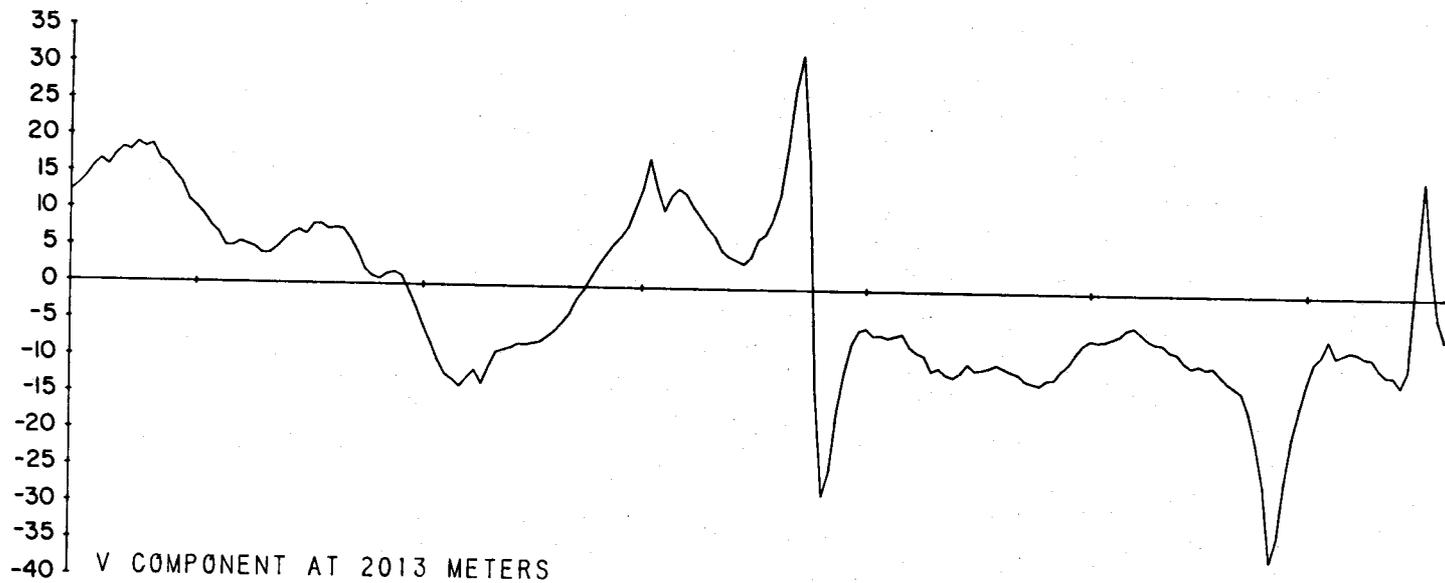


UNFILTERED PRESSURE. 2013 METERS AT NGAIO.





RIDGE STATION N.



MAY JUN JUL AUG SEP OCT NOV

RIDGE STATION N.

MANUKA

MANUKA

Position: 49°23.7'S, 169°57.0'W
 Depth of Water: 5265 m
 Set at: 0045 UCT 12 APR '78 by R/V TANGAROA
 Retrieved at: 0045 UCT 16 NOV '78 by R/V KNORR
 Data Interval: 0411 UCT 12 APR '78 to 2115 UCT 15 NOV '78

Instrumentation

<u>Intended Depth</u>	<u>RCM5 Serial No./Tape No.</u>
2000 m	493/37
4000 m	1968/13
4965 m	3122/6

Instrument 493 recorded speed, direction, temperature, and pressure once per hour until the instrument was recovered. The temperature and pressure records indicate that the mooring may have slipped down-slope about 80 m (vertically) late on 16 OCT '78, with about 10 meters of additional slippage during the next several days.

Instrument 1968 recorded speed, and temperature once per hour until the instrument was recovered. Good directions were recorded until 1614 UCT 7 NOV '78.

Instrument 3122 recorded speed, direction, and temperature once per hour until the instrument was recovered.

MANUKA

2074 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
S	11.04	6.21	1.62	6.37	37.70	.70	5226
U	1.81	7.21	1.30	5.89	36.00	-12.70	5226
V	-2.25	10.00	.07	3.21	23.80	-36.30	5226
T	2.33	.04	-.14	3.17	2.43	2.17	5226
P	20843675.	790138.	2.52	12.72	26051000.	20228000.	5226

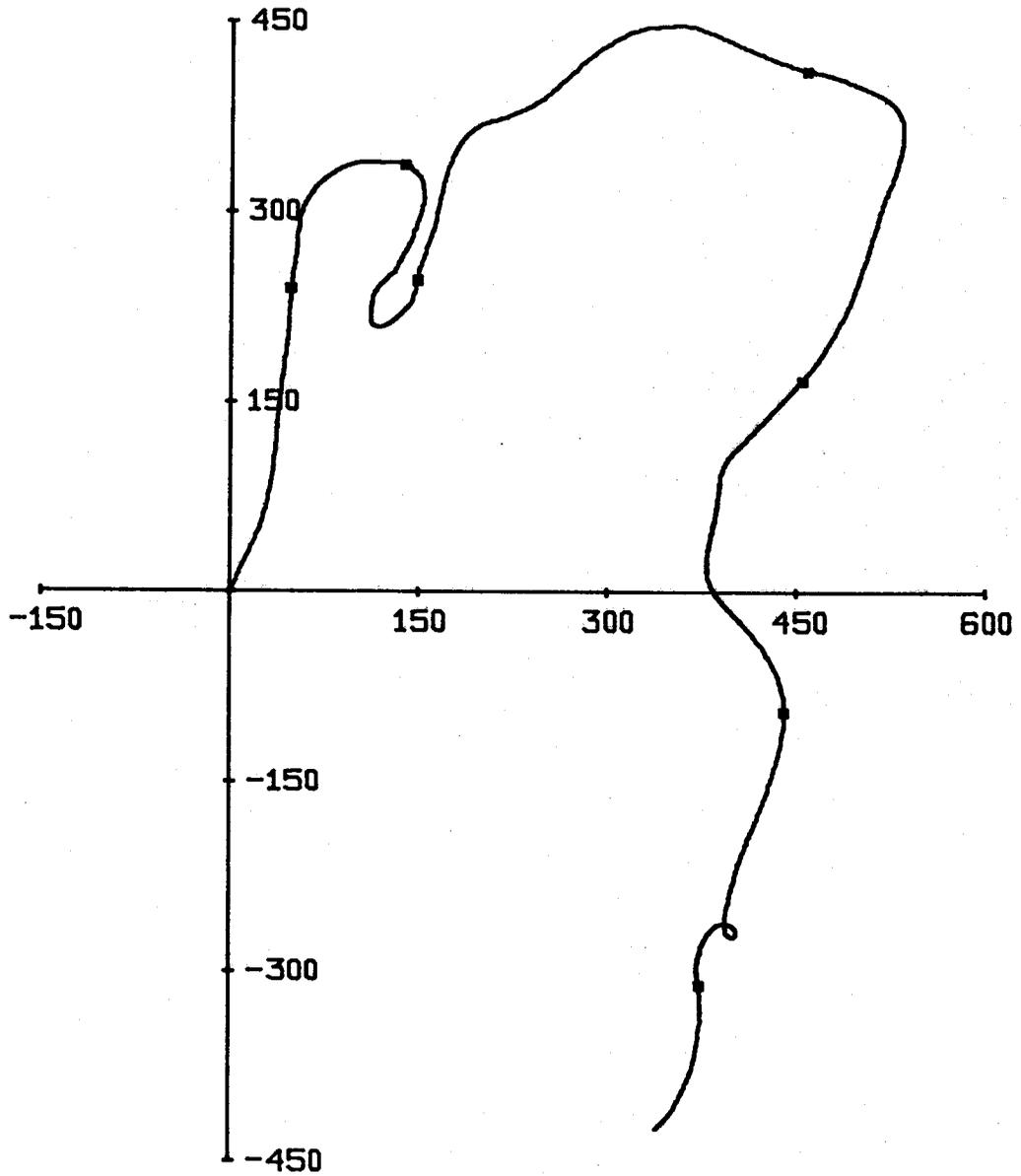
4038 m

S	7.14	3.85	.60	3.10	20.80	.70	5226
U	1.15	4.86	.76	3.97	19.70	-11.20	5029
V	.61	6.48	.63	2.44	18.40	-11.60	5029
T	1.04	.02	.45	3.05	1.13	.98	5226

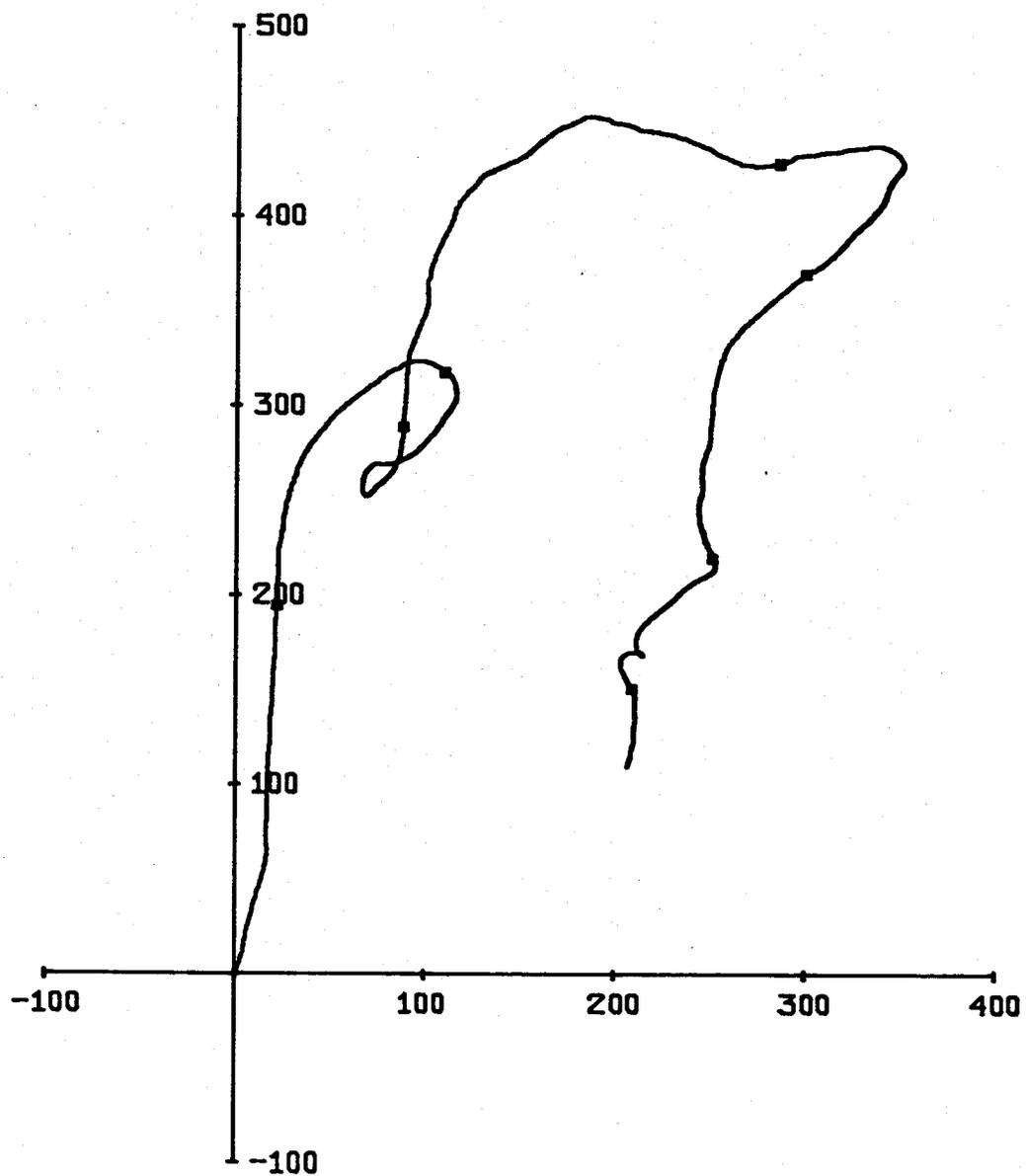
4986 m

S	7.73	4.21	.45	2.70	21.90	.70	5226
U	2.87	5.26	-.20	3.26	20.20	-12.90	5214
V	2.61	5.90	.28	2.33	20.40	-10.50	5216
T	.95	.01	-.31	2.23	.97	.92	5226

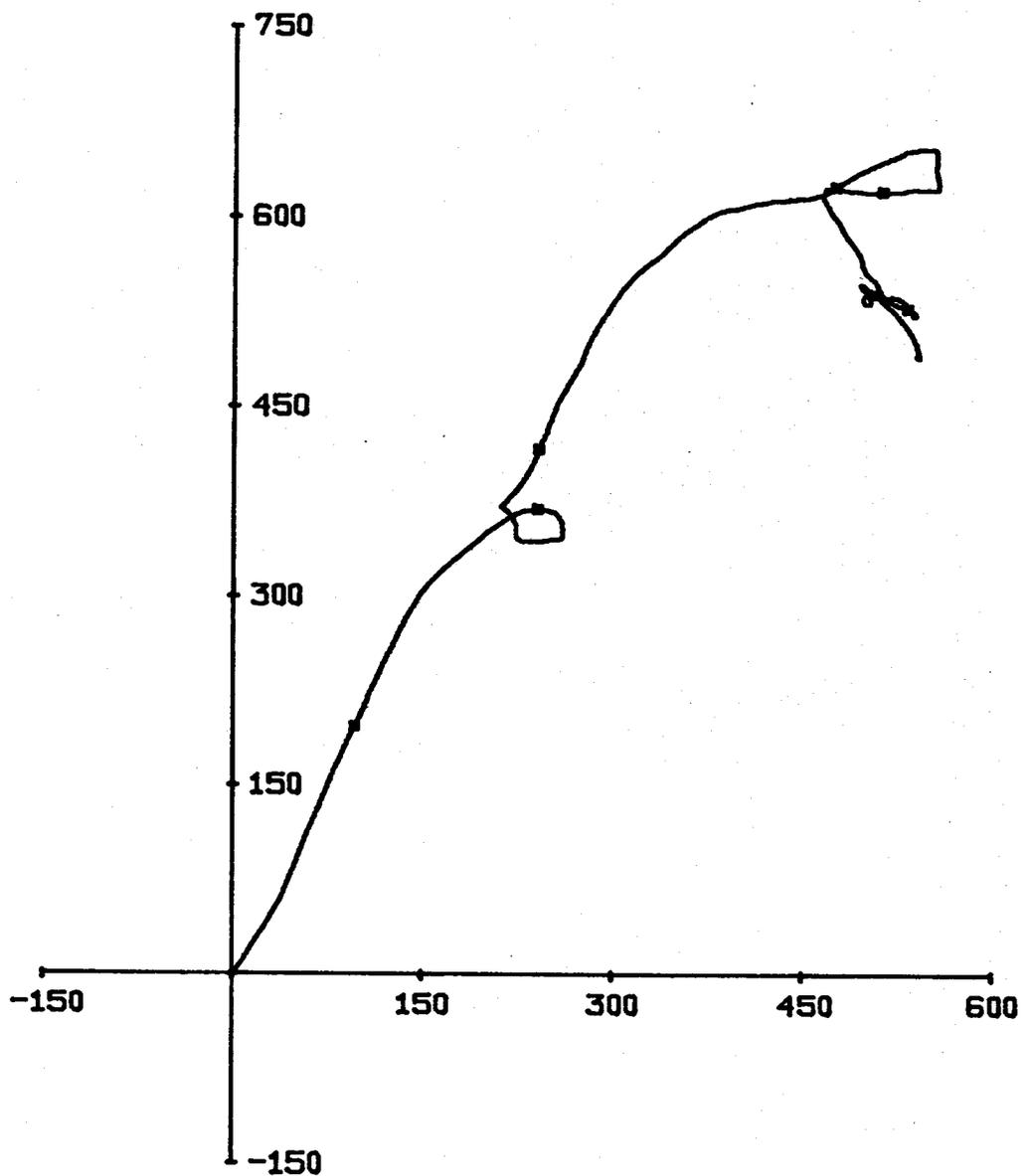
Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.



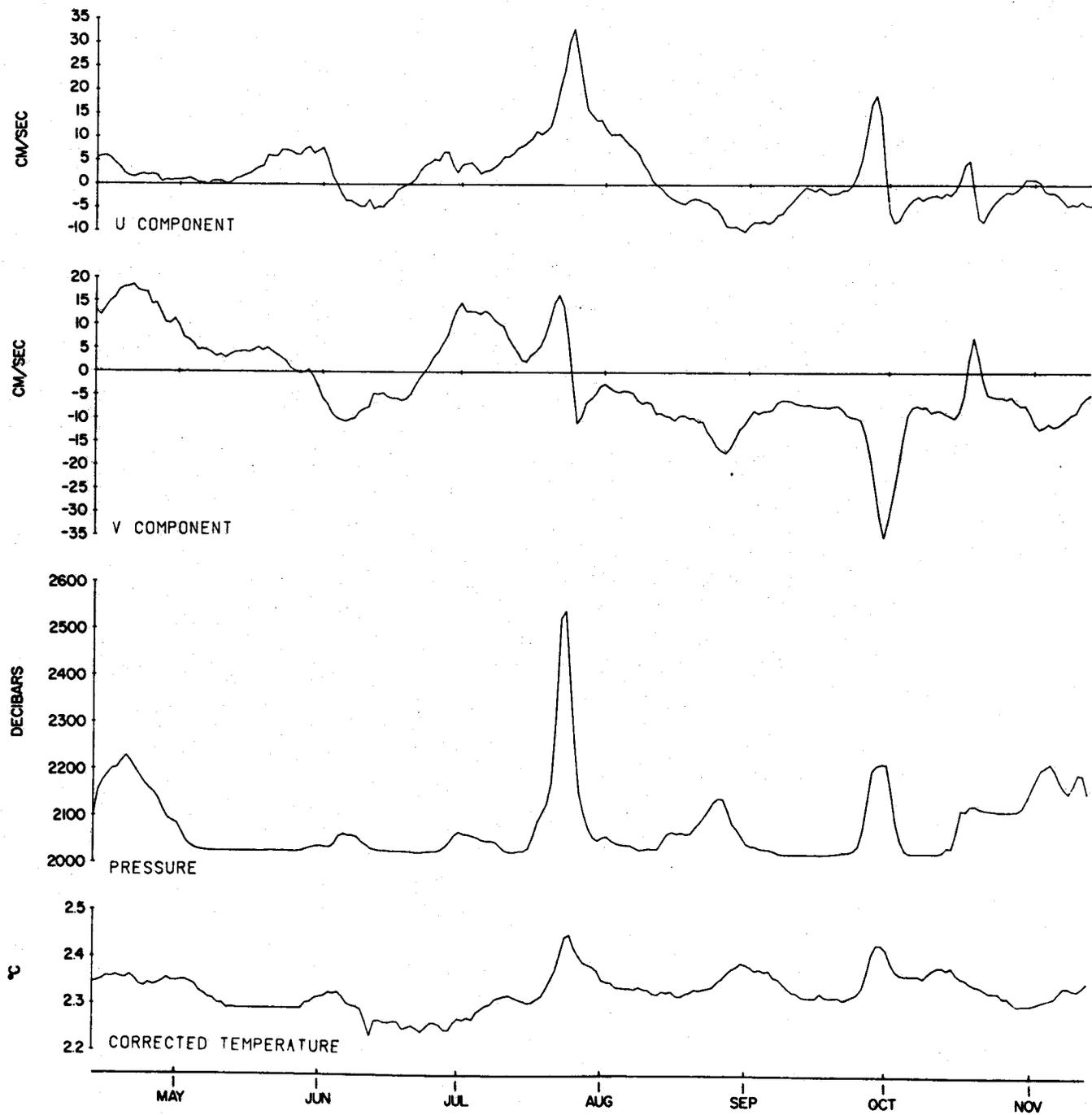
2074 METERS AT MANUKA. 12 APR 78 - 15 NOV 78.



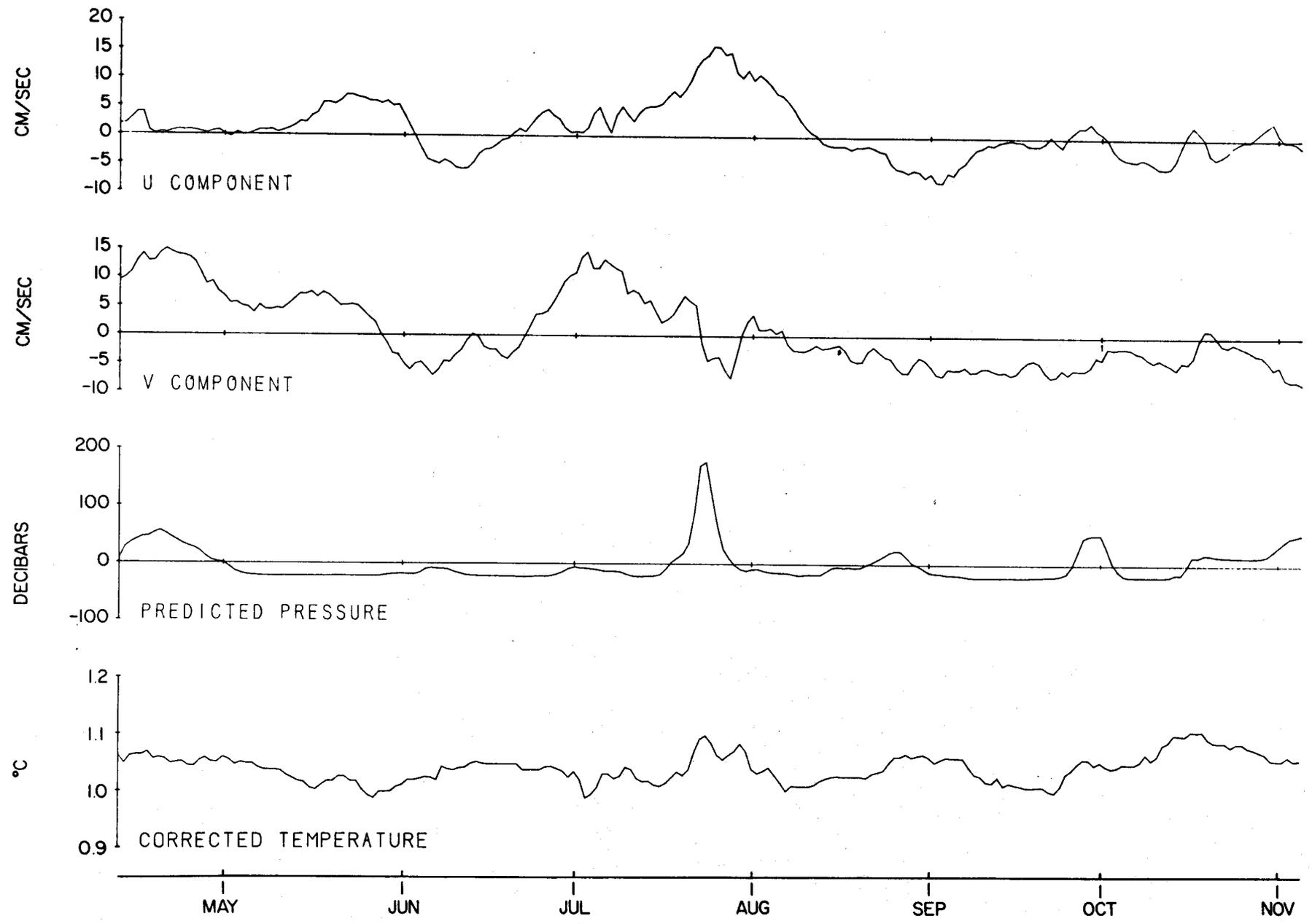
4038 METERS AT MANUKA. 12 APR 78 - 15 NOV 78.



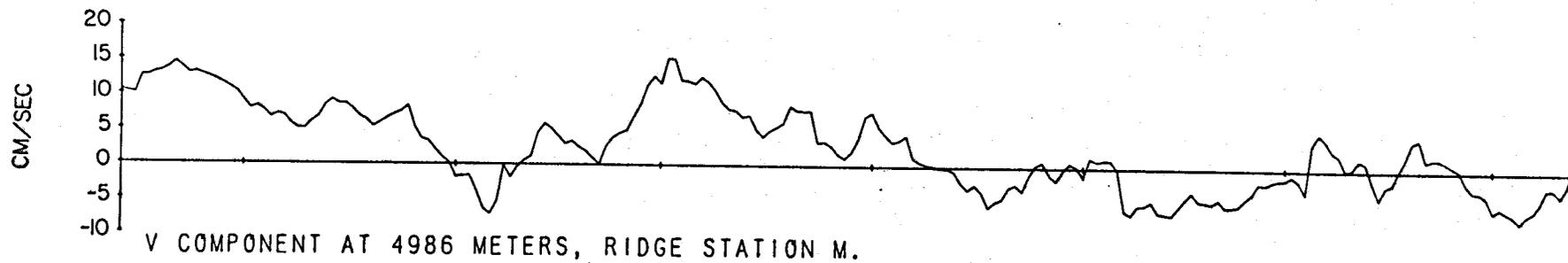
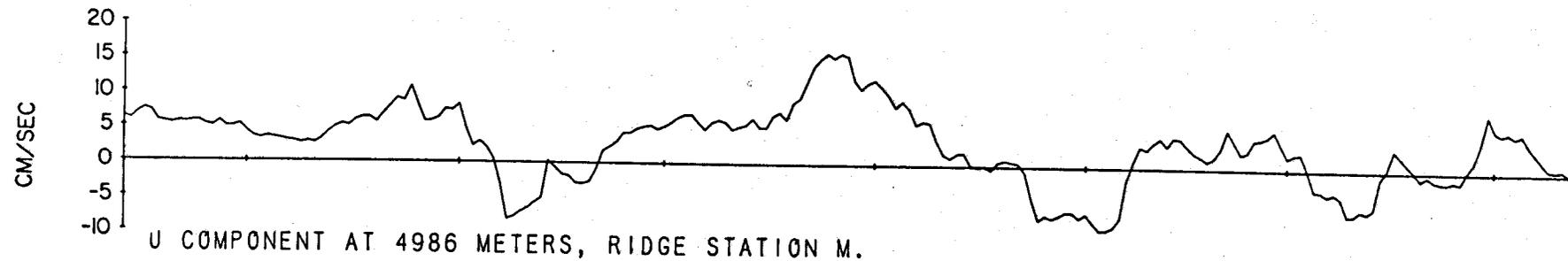
4986 METERS AT MANUKA. 12 APR 78 - 15 NOV 78.



RIDGE STATION M. AT 2074 METERS



RIDGE STATION M. AT 4038 METERS



MAY

JUN

JUL

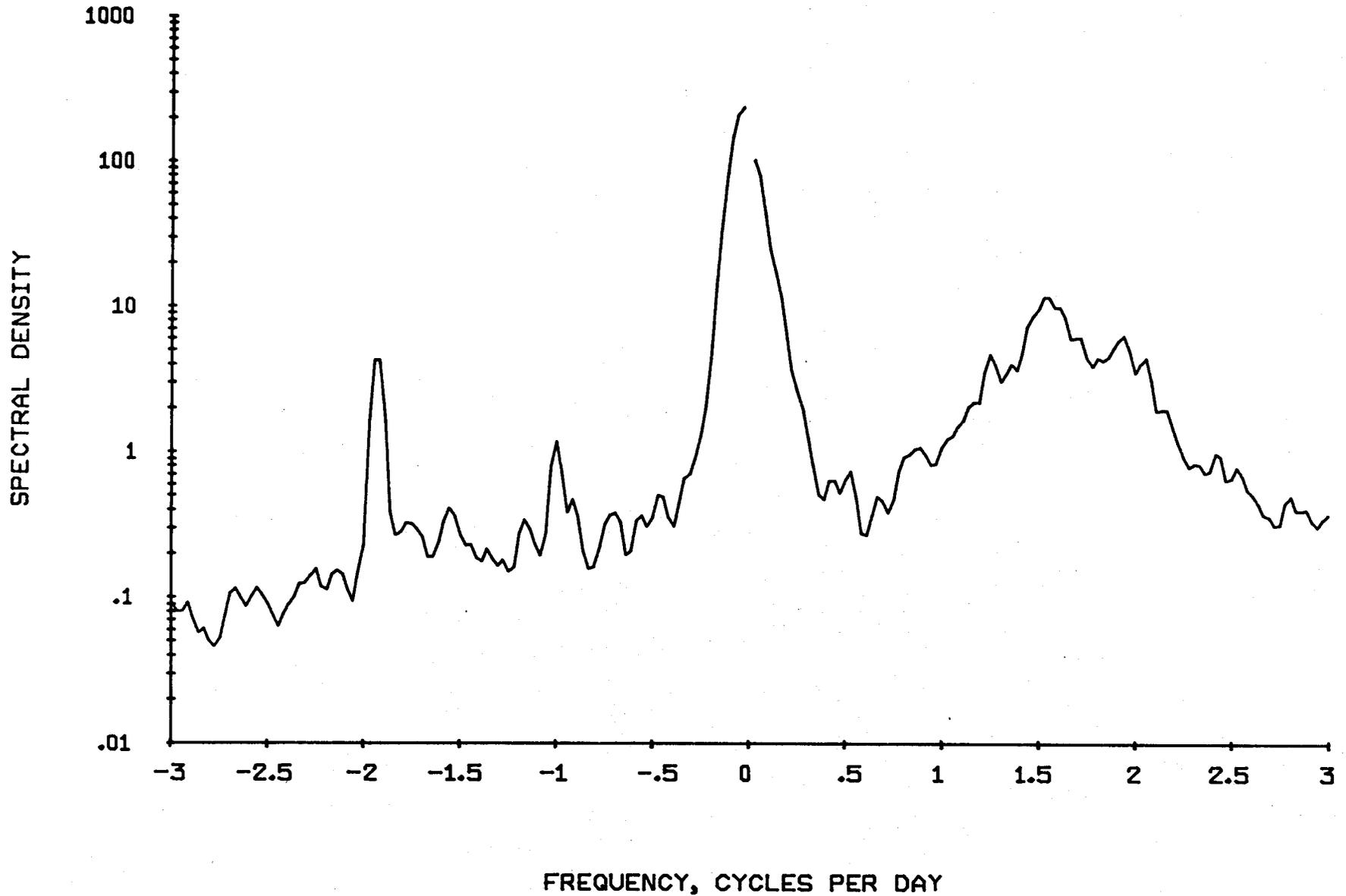
AUG

SEP

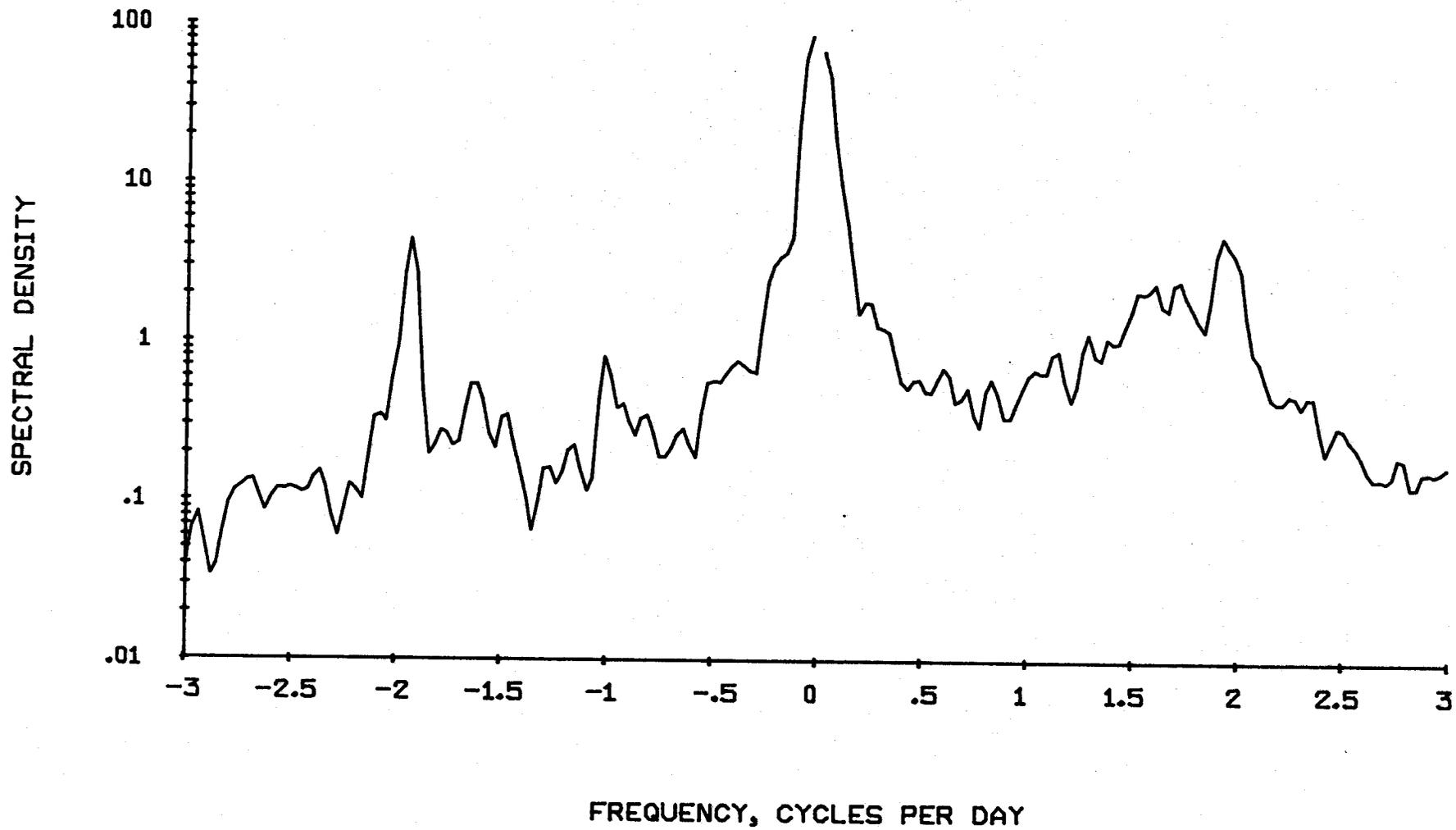
OCT

NOV

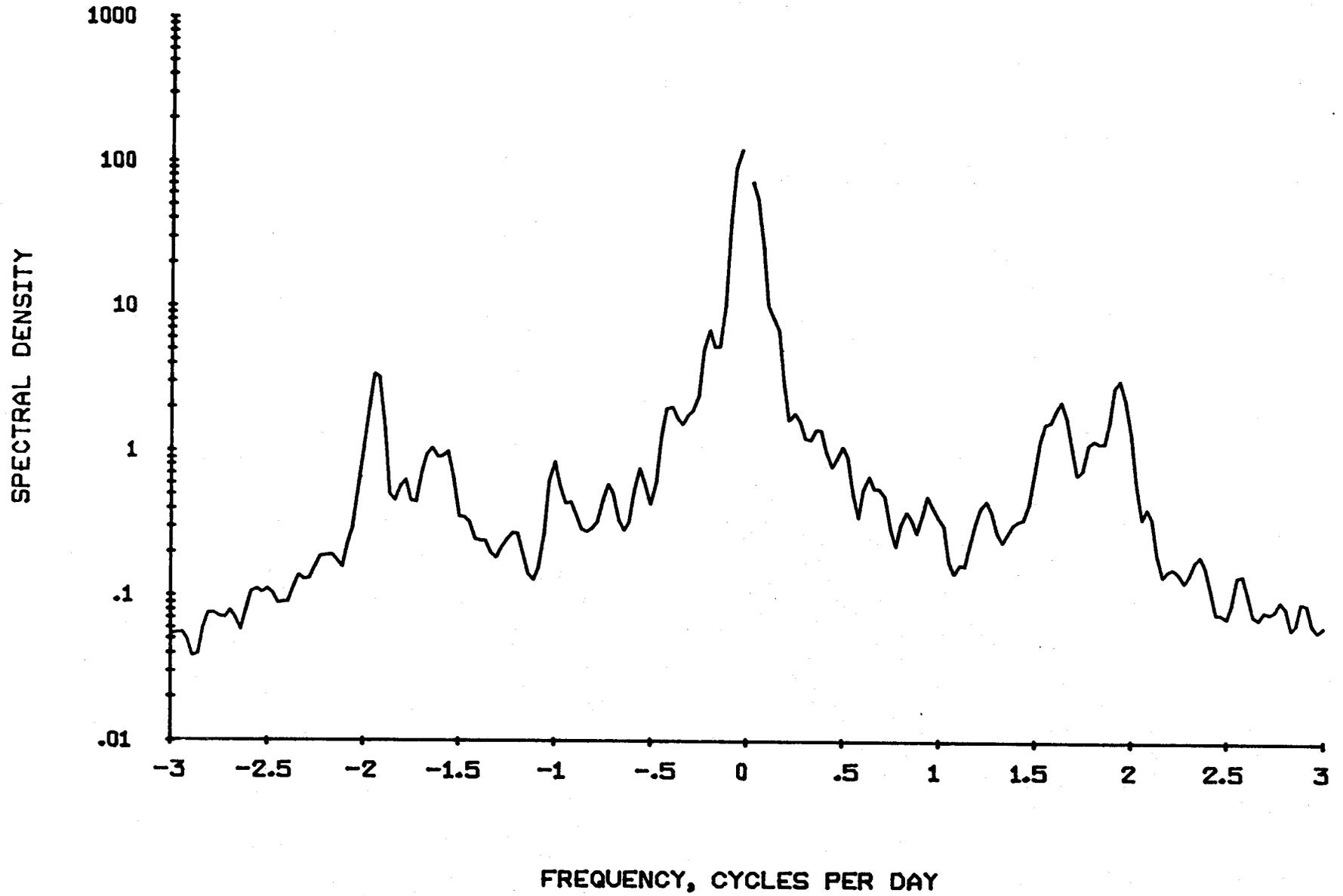
UNFILTERED CURRENT. 2074 METERS AT MANUKA.



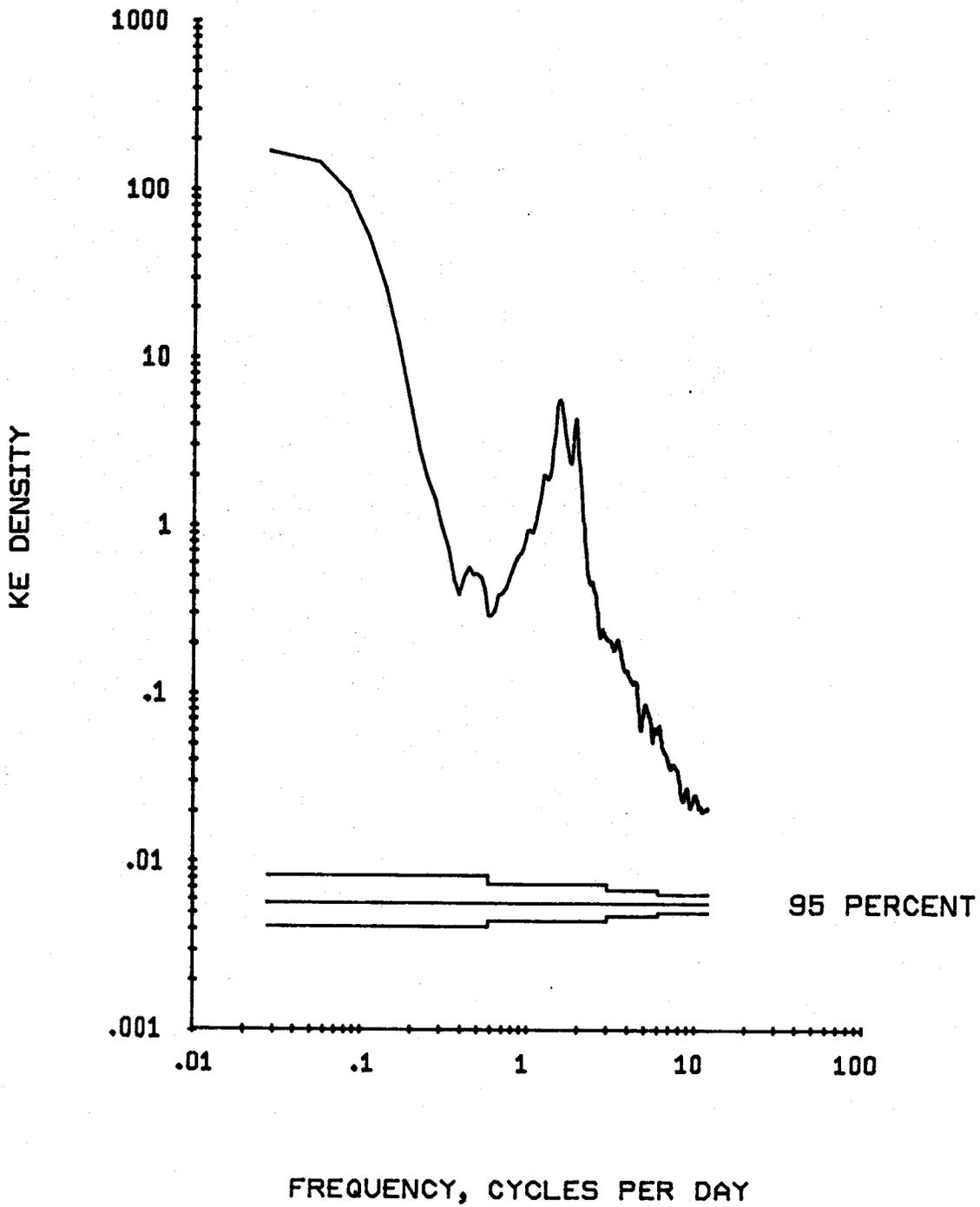
UNFILTERED CURRENT. 4038 METERS AT MANUKA.



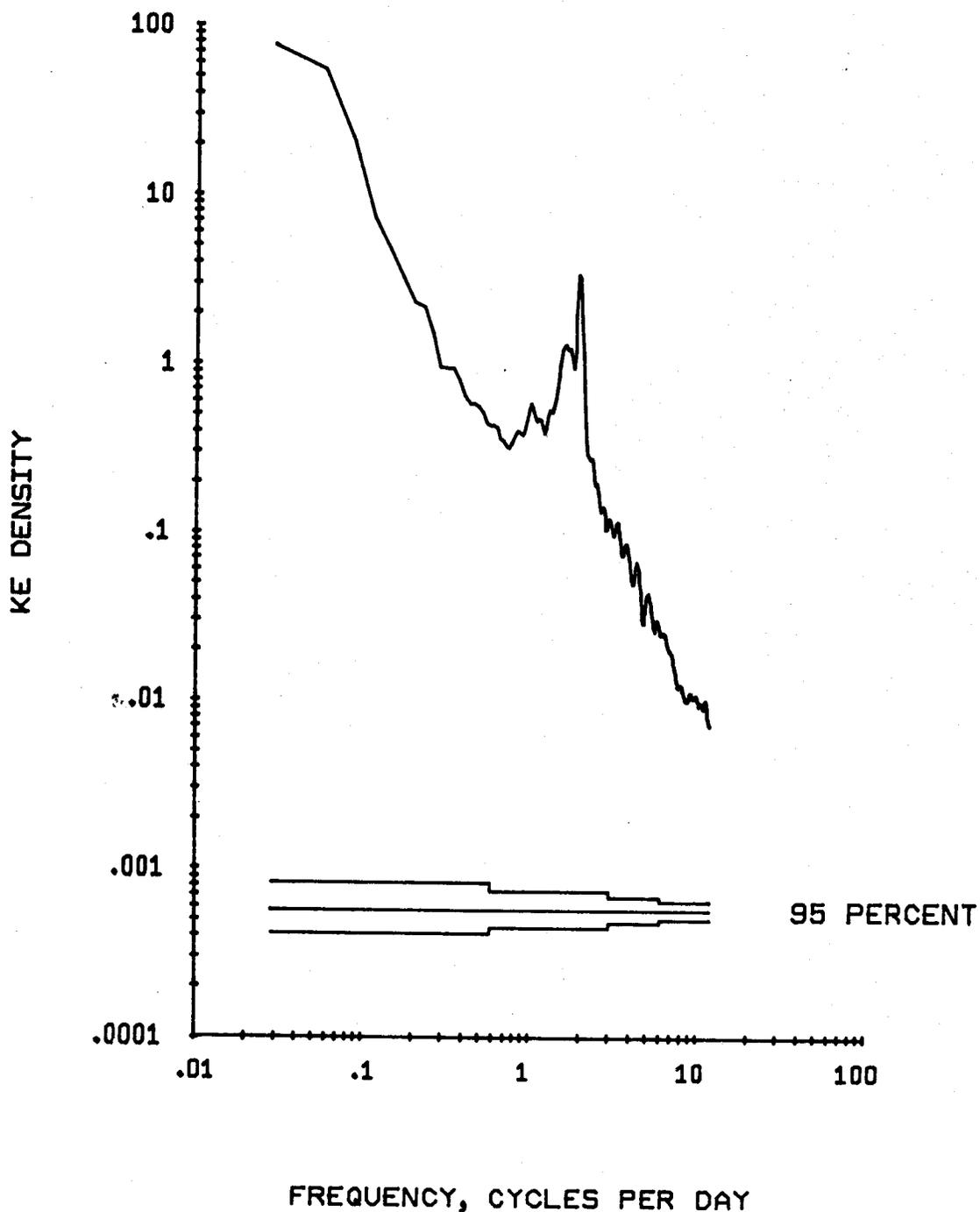
UNFILTERED CURRENT. 4986 METERS AT MANUKA.



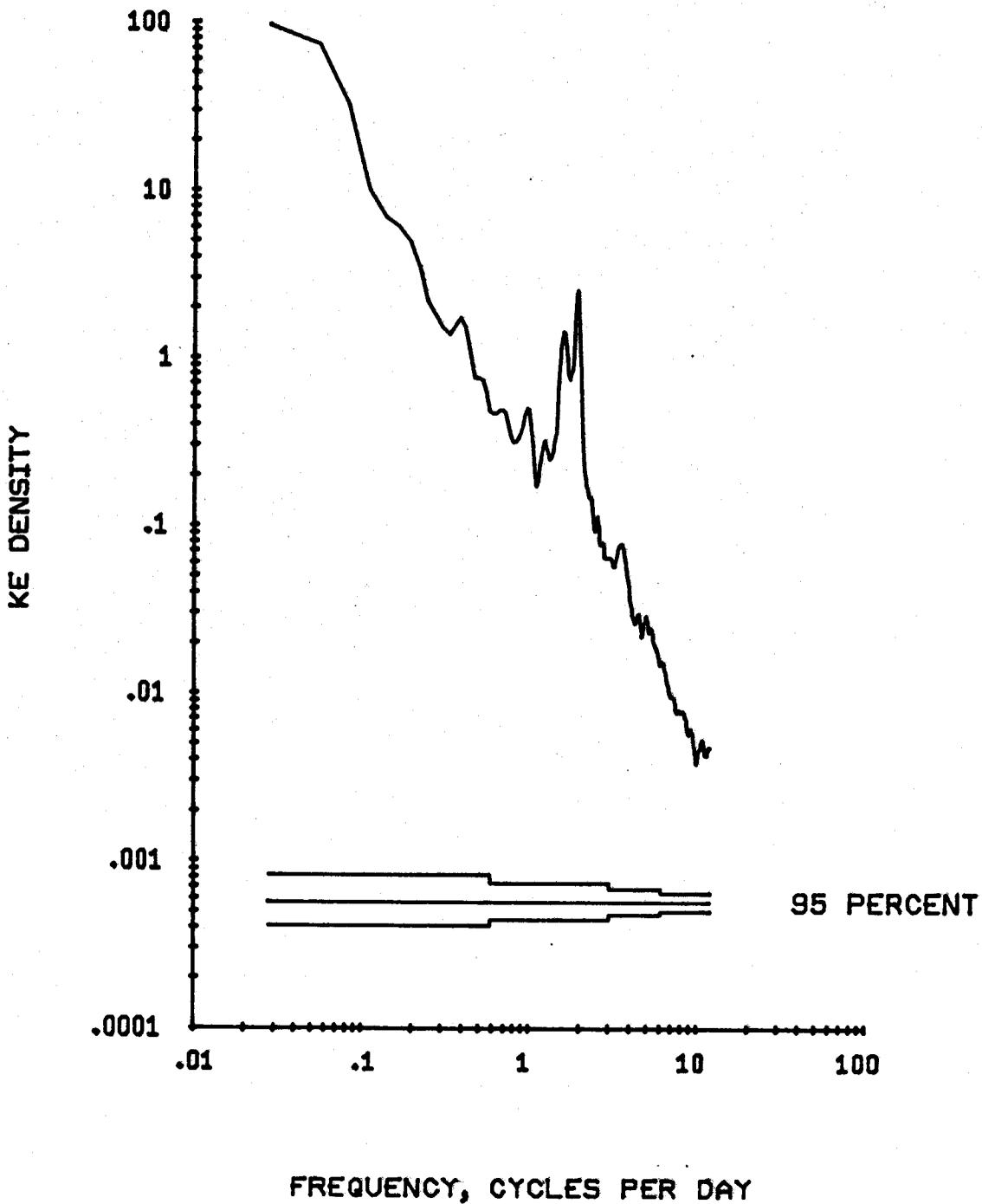
UNFILTERED CURRENT. 2074 METERS AT MANUKA.



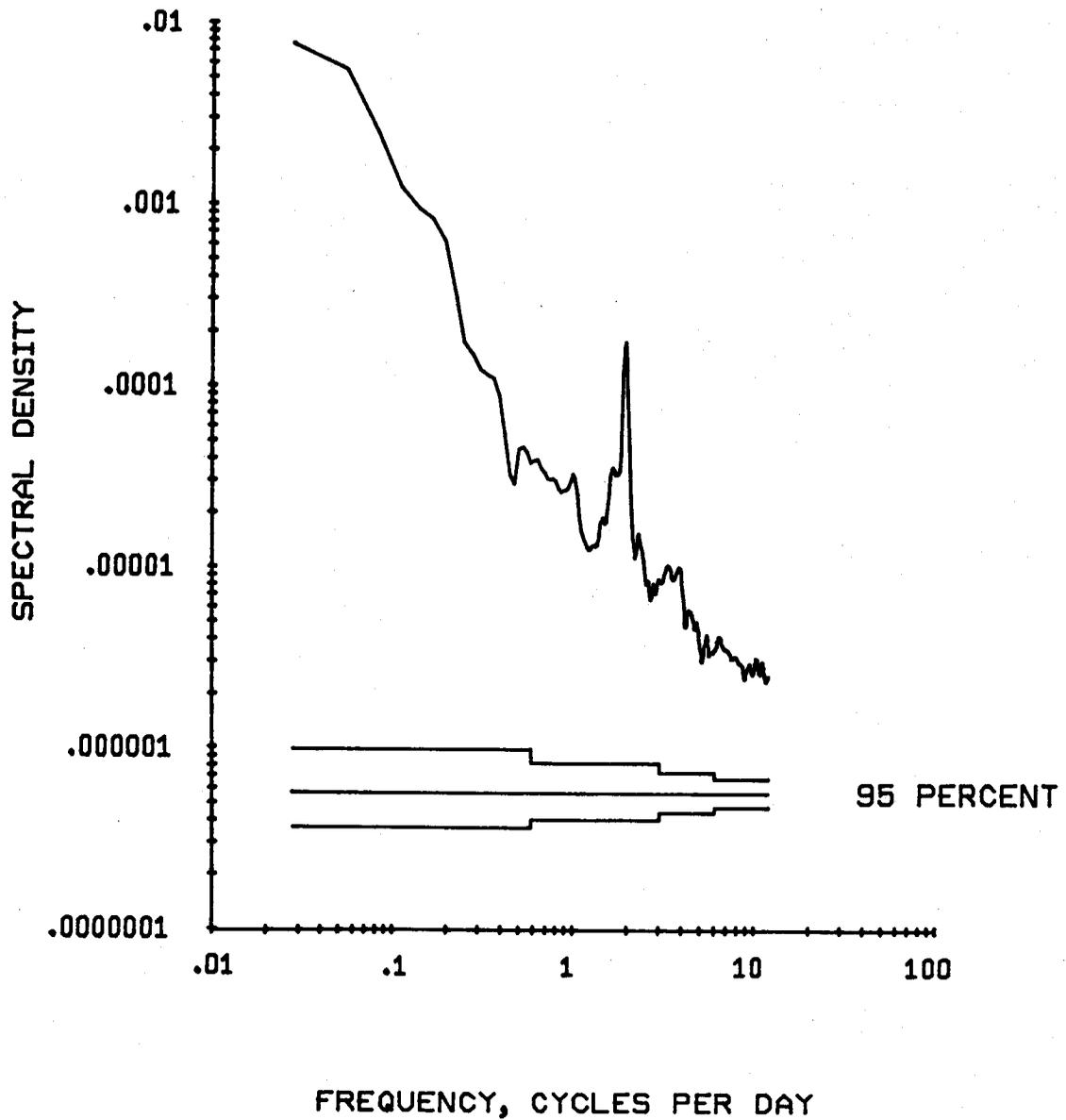
UNFILTERED CURRENT. 4038 METERS AT MANUKA.



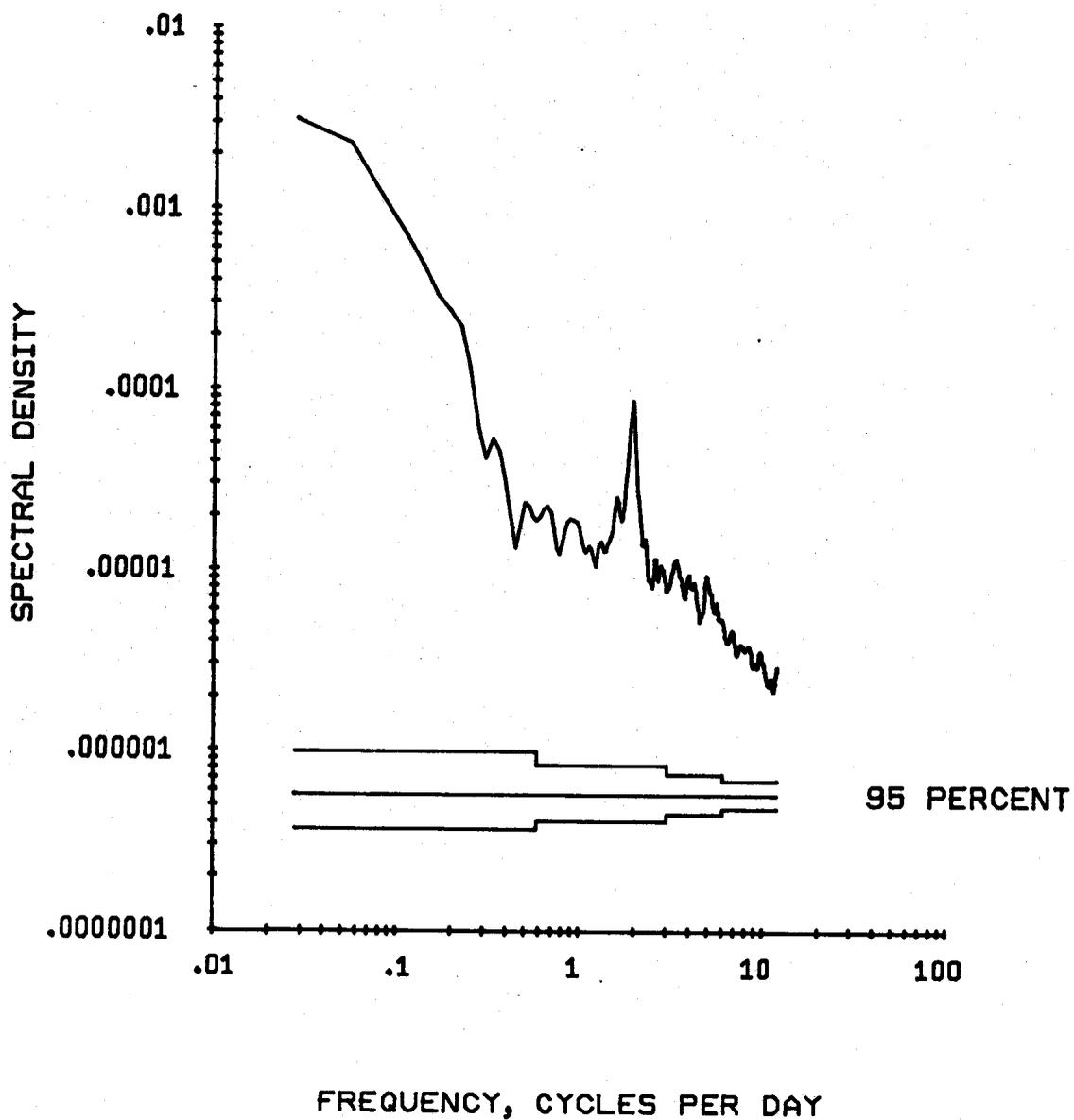
UNFILTERED CURRENT. 4986 METERS AT MANUKA.



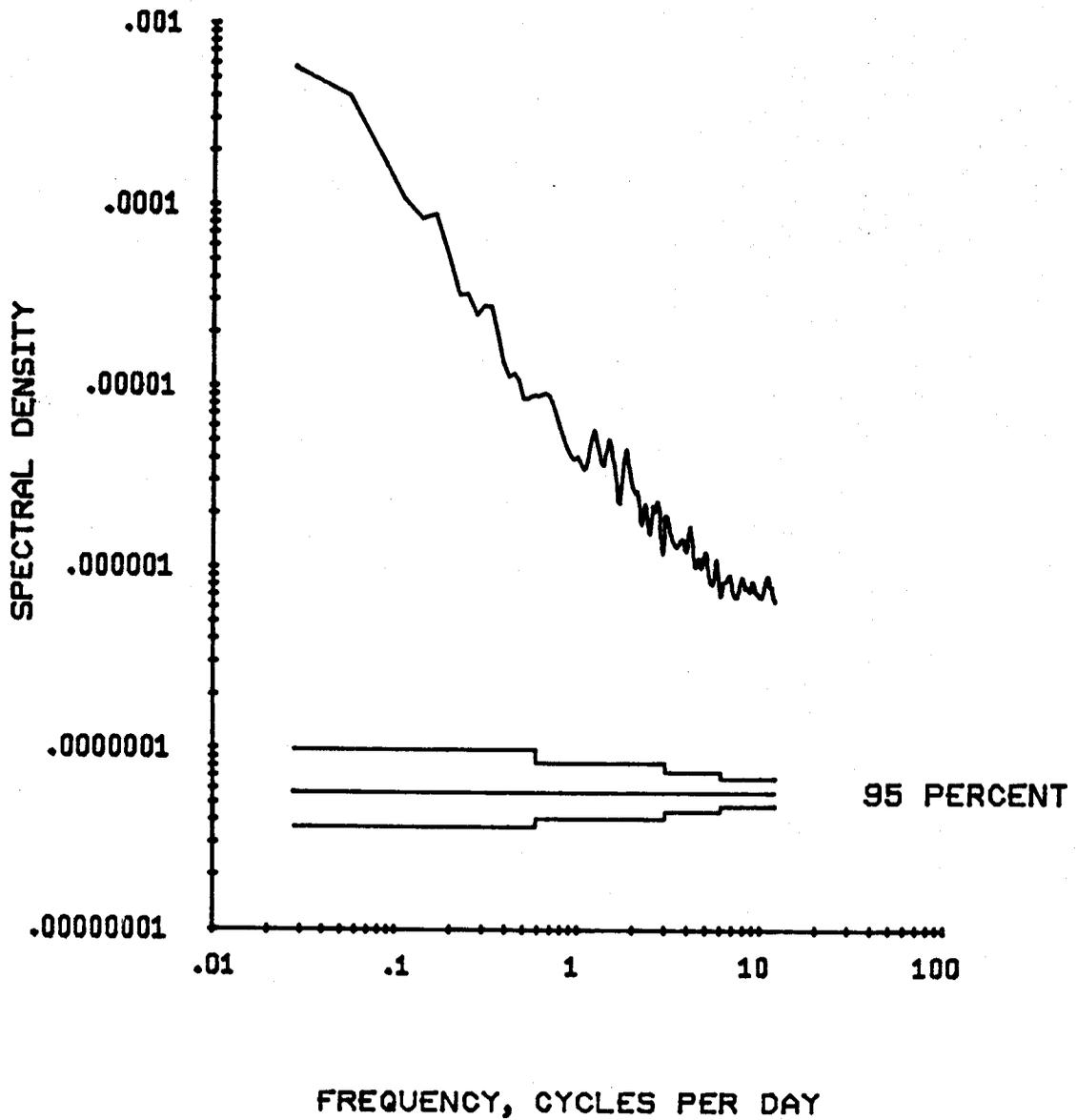
UNFILTERED TEMPERATURE. 2074 M AT MANUKA.



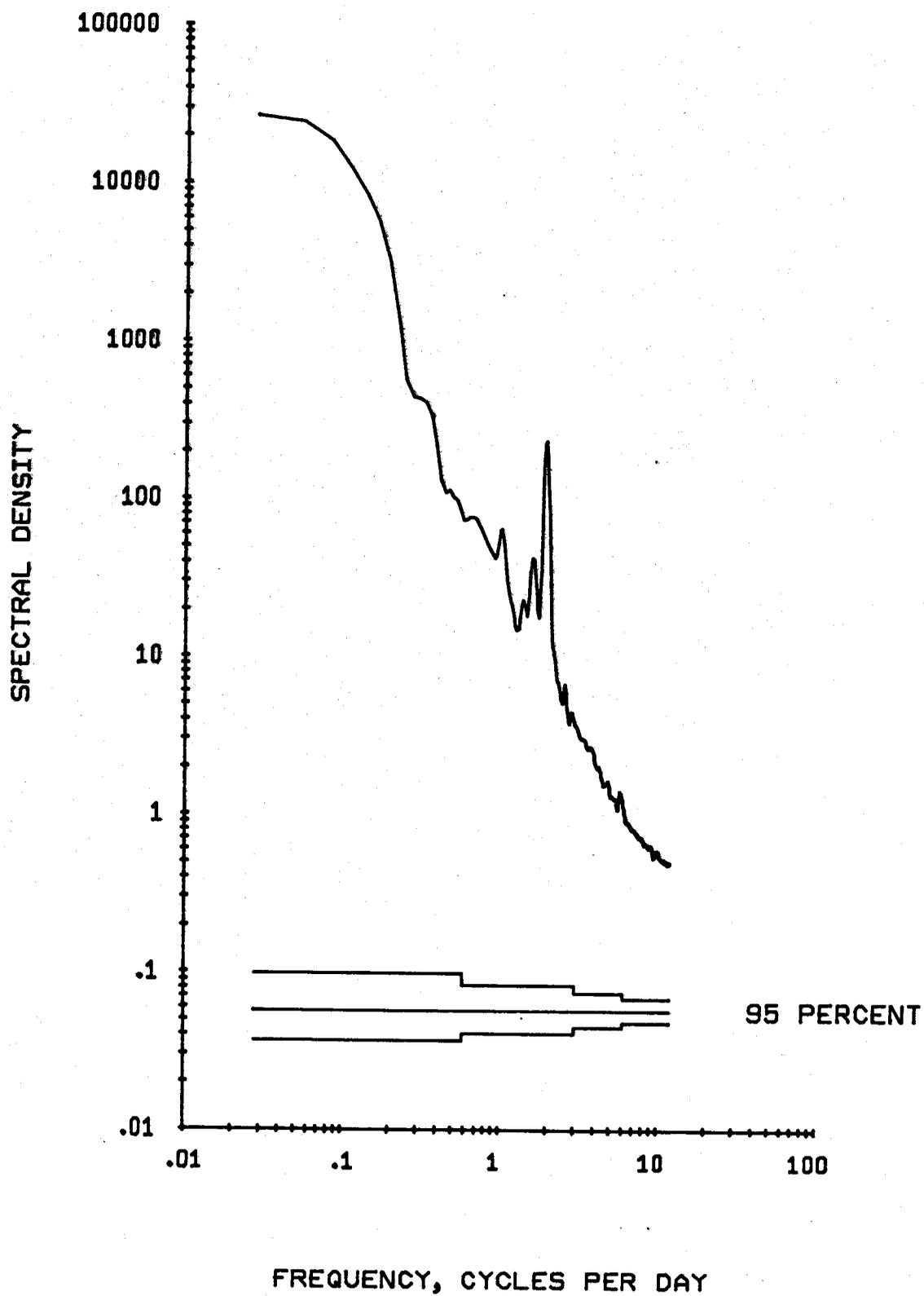
UNFILTERED TEMPERATURE. 4038 M AT MANUKA.

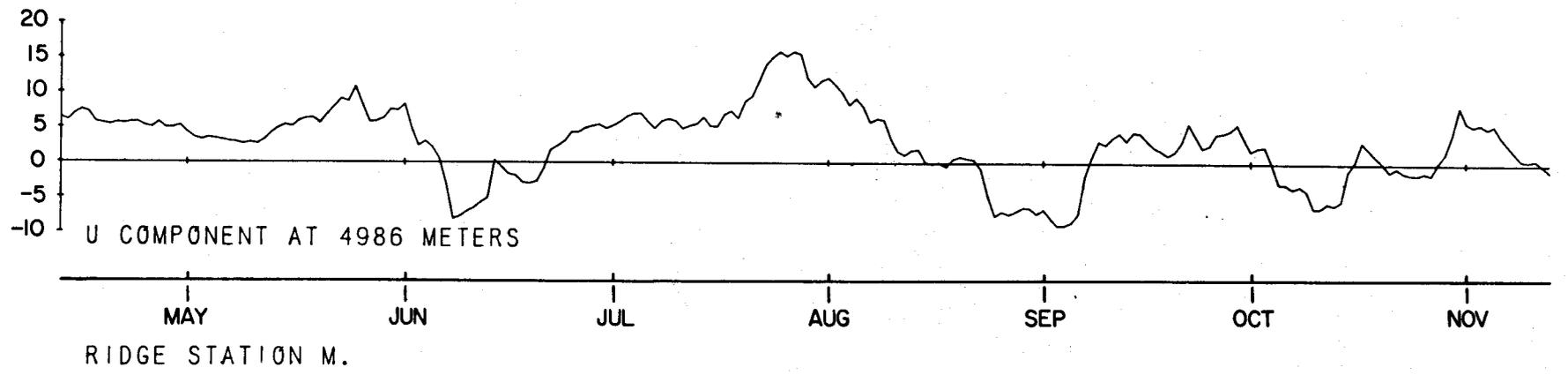
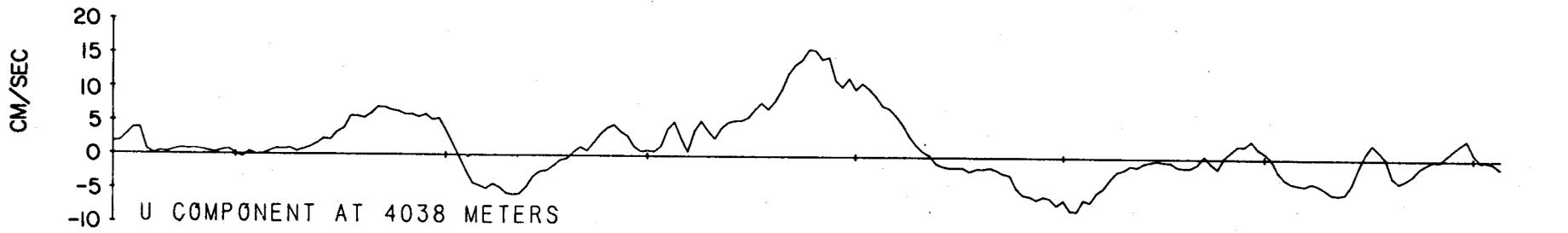
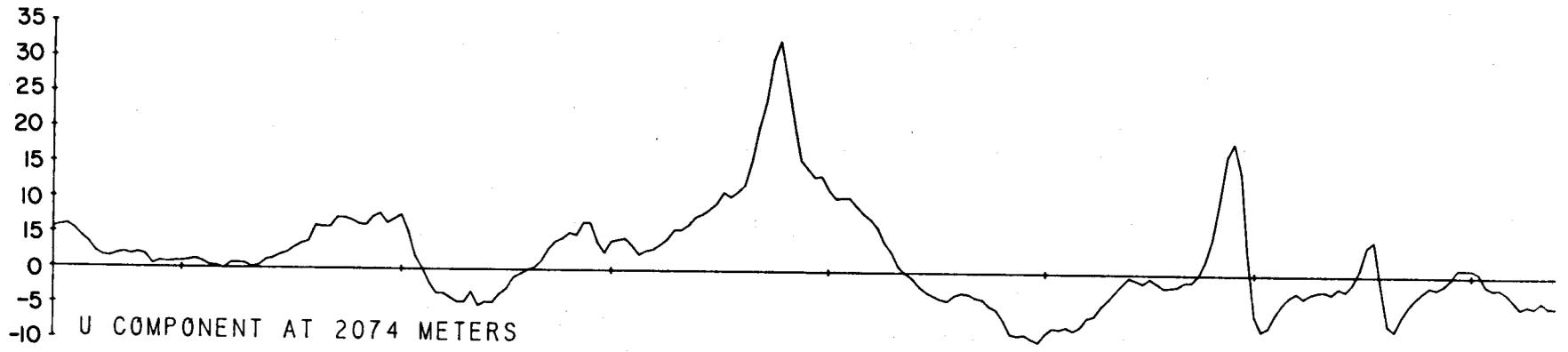


UNFILTERED TEMPERATURE. 4986 METERS AT MANUKA.

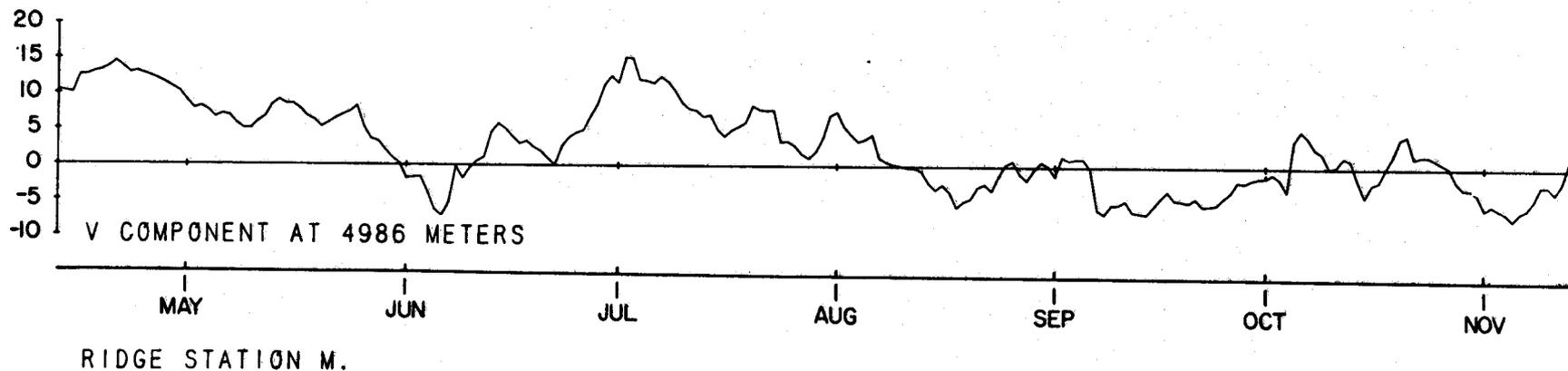
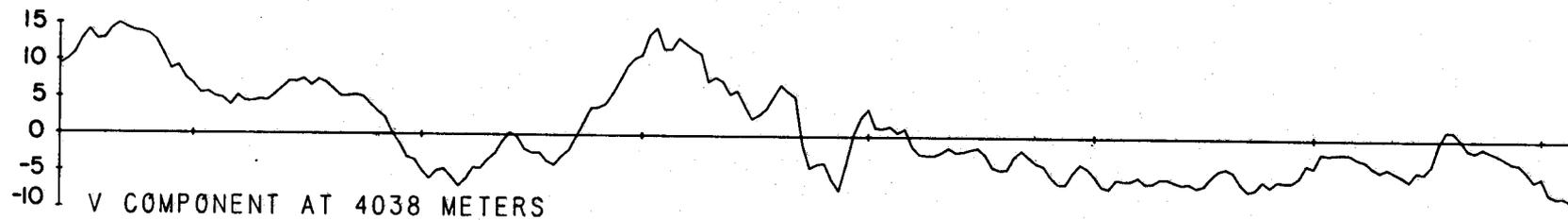
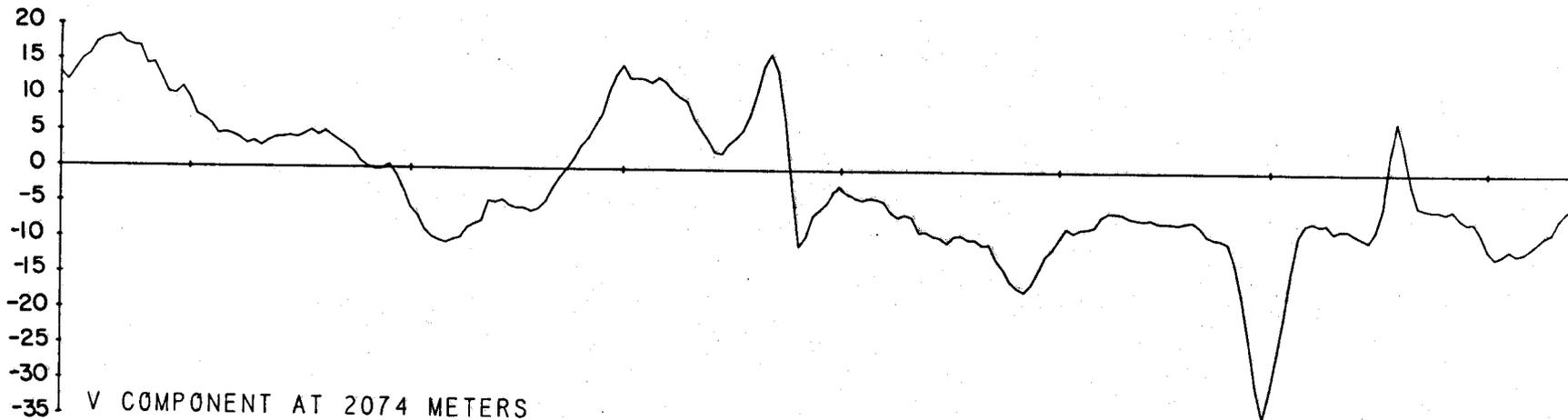


UNFILTERED PRESSURE. 2074 M AT MANUKA.





CM/SEC



BT

BT

Position: 51°09.8'S, 175°01.4'W
 Depth of Water: 1090 m
 Set at: 1057 UCT 19 APR '78 by R/V TANGAROA
 Retrieved at: 2142 UCT 21 NOV '78 by R/V KNORR
 Data Interval: 1410 UCT 19 APR '78 to 1110 UCT 30 SEP '78

InstrumentationCurrent MetersIntended DepthRCM5 Serial No./Tape No.

430 m
 1000 m

488/36
 1245/15

Instrument 488 recorded speed, and temperature until the instrument was recovered. Good directions were recorded until 0410 UCT 24 SEP '78.

Instrument 1245 recorded speed, temperature, and pressure until 1514 UCT 13 SEP '78. Good directions were recorded until 0614 UCT 4 SEP '78.

Thermistor ChainIntended DepthDatalogger Serial No./Tape No.

100 - 200 m
 210 - 310 m
 320 - 420 m
 440 - 540 m
 550 - 650 m

308/1
 309/1
 306/1
 310/1
 307/1

Instrument 308 leaked and recorded data until 13 MAY '78.

Instruments 309, 306, 310, and 307 recorded data until 21 NOV '78.

BT

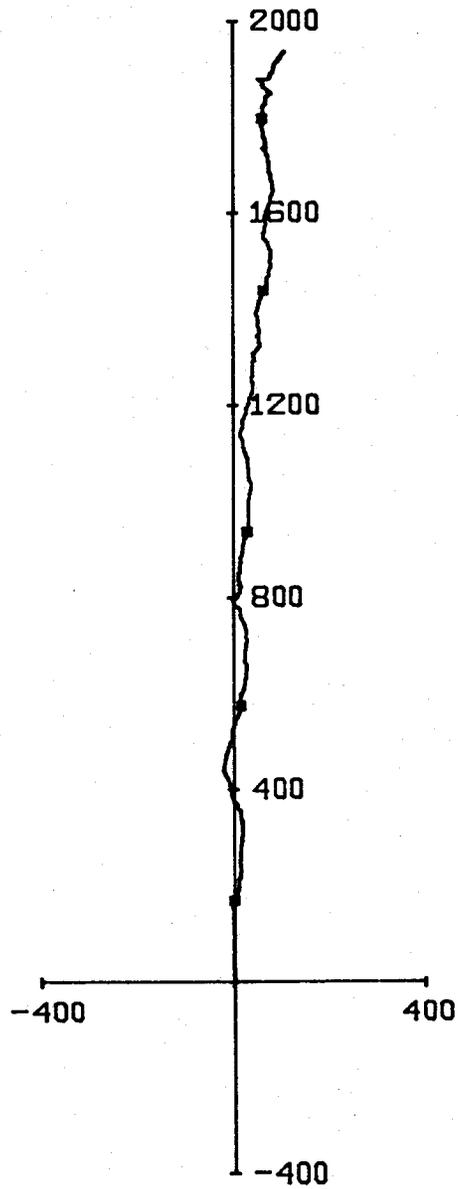
430 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
S	16.85	8.92	.90	3.91	53.00	.70	3934
U	.80	7.52	-.47	4.00	25.30	-38.20	3783
V	14.23	10.26	.48	3.45	50.10	-12.70	3783
T	8.11	.51	-1.00	4.42	9.13	5.48	3934

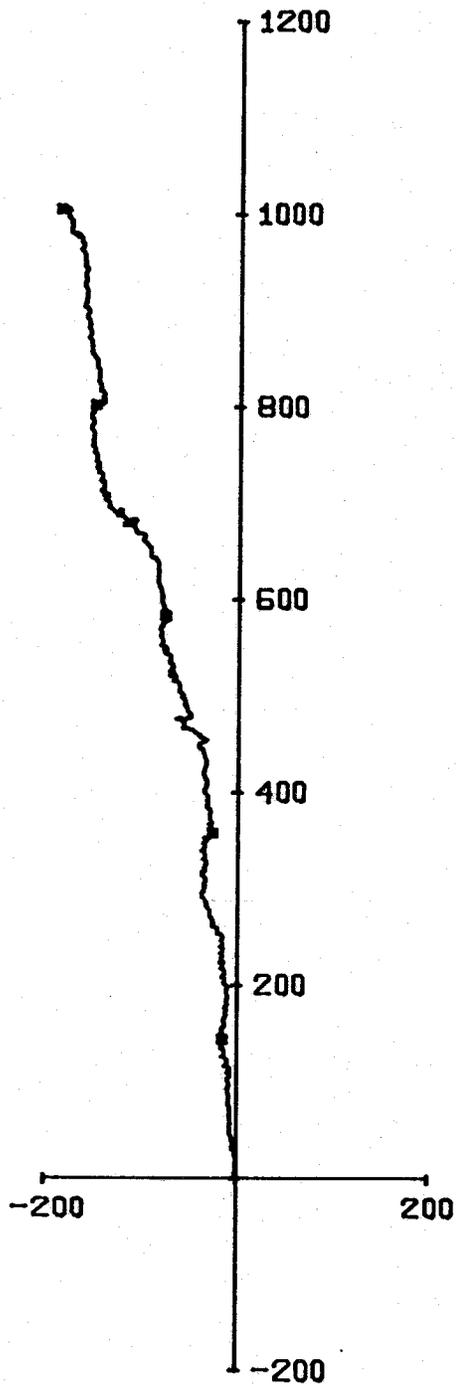
918 m

S	12.40	7.47	.49	2.87	40.10	.70	3530
U	-1.58	8.40	-.49	3.45	25.30	-37.30	3305
V	8.45	8.68	.21	2.79	36.90	-19.10	3304
T	4.70	.35	-.04	3.38	5.61	3.35	3530
P	9225822.	55908.	3.45	15.60	9583000.	9169000.	3530

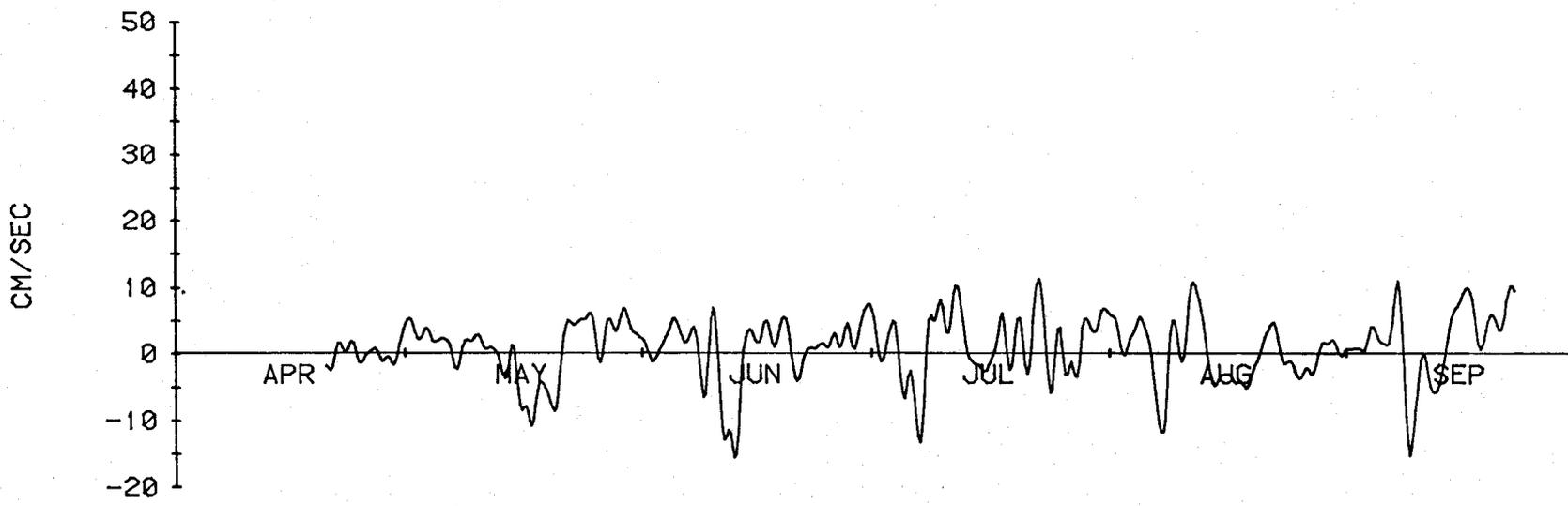
Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.



430 METERS AT BT. 19 APR 78 - 30 SEP 78.



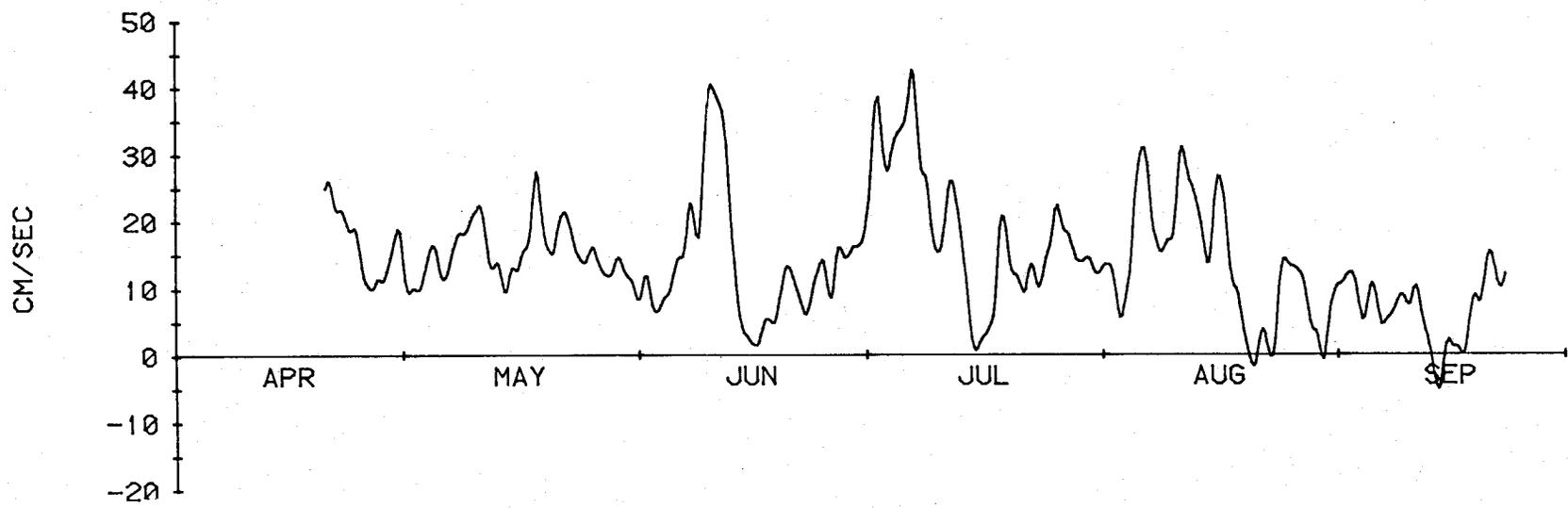
918 METERS AT BT. 19 APR 78 - 13 SEP 78.



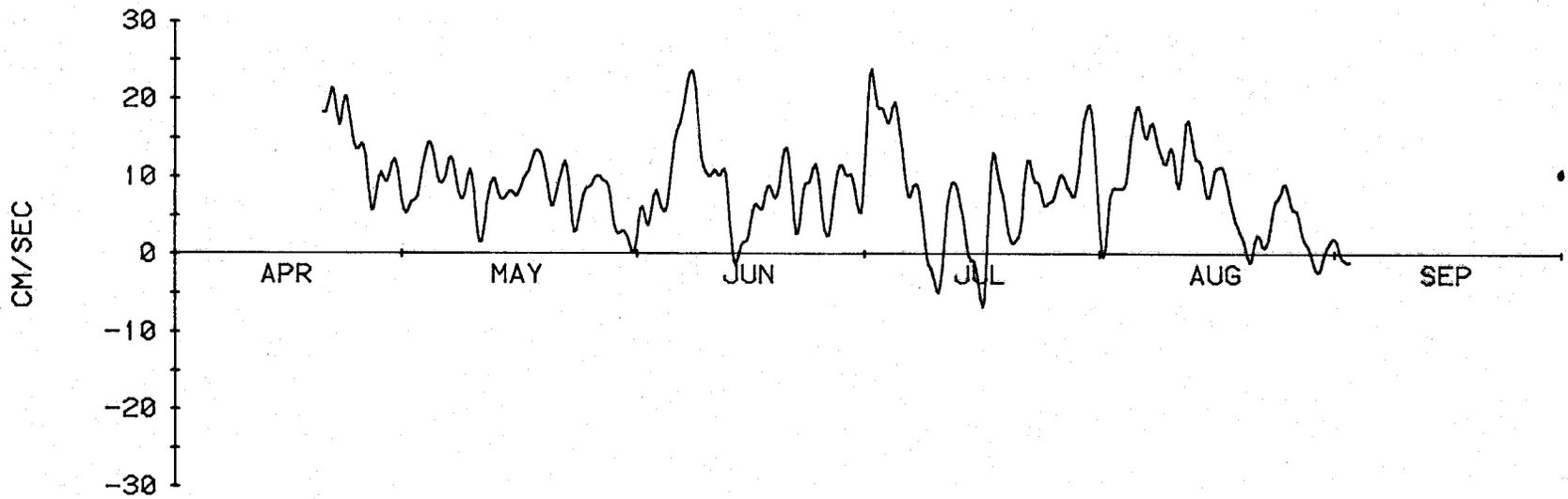
430 METERS AT BT
LLP FILTERED U COMPONENT



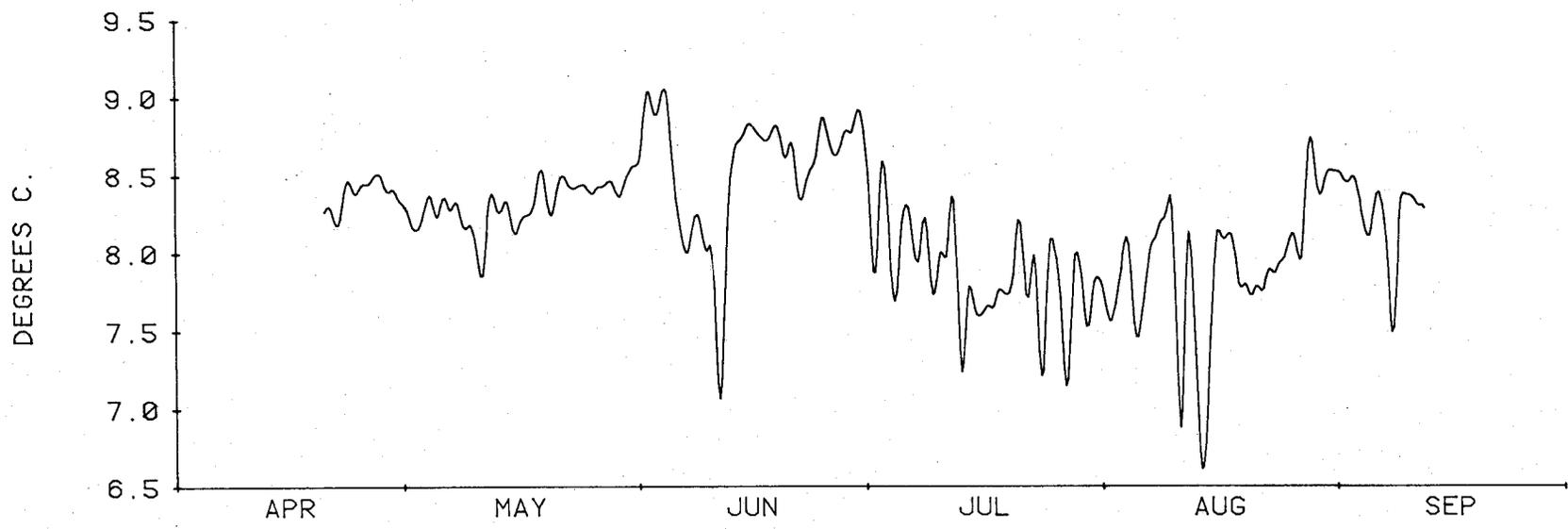
918 METERS AT BT
LLP FILTERED U COMPONENT



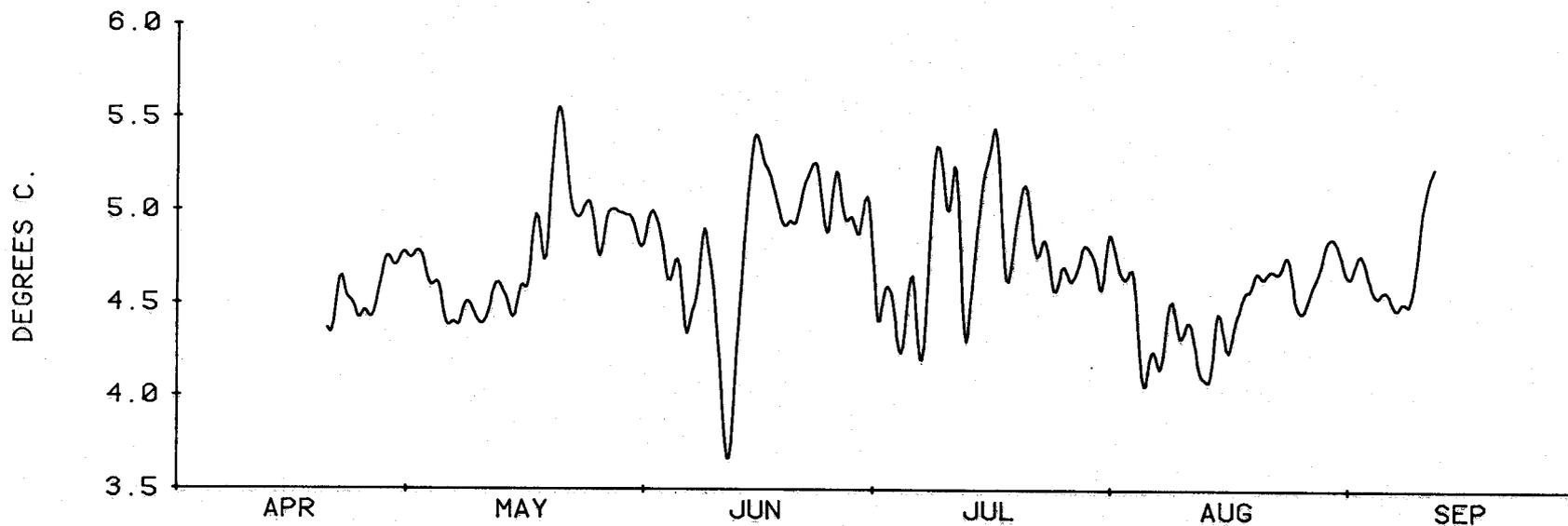
430 METERS AT BT
LLP FILTERED V COMPONENT



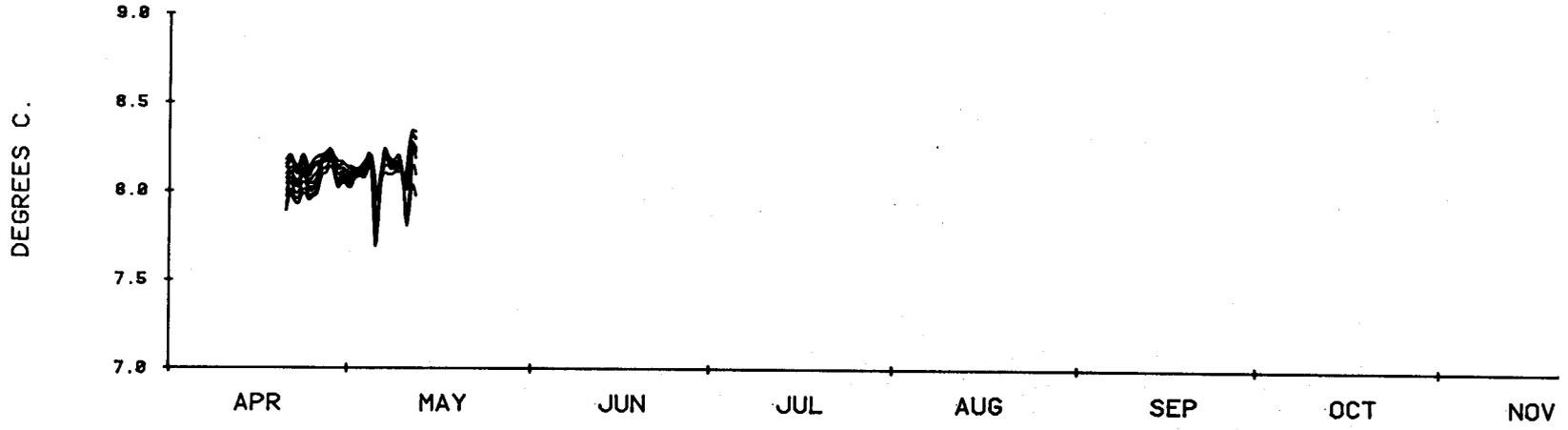
918 METERS AT BT
LLP FILTERED V COMPONENT



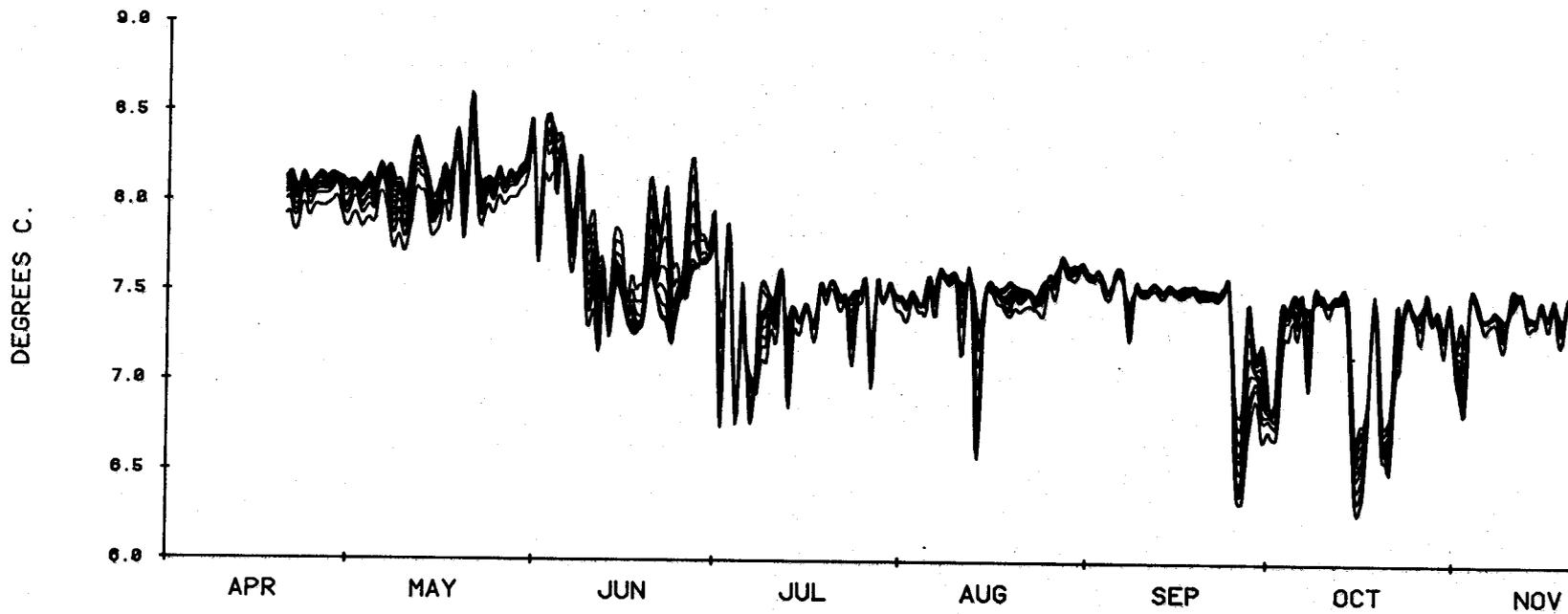
430 METERS AT BT
CORRECTED LLP FILTERED TEMPERATURE



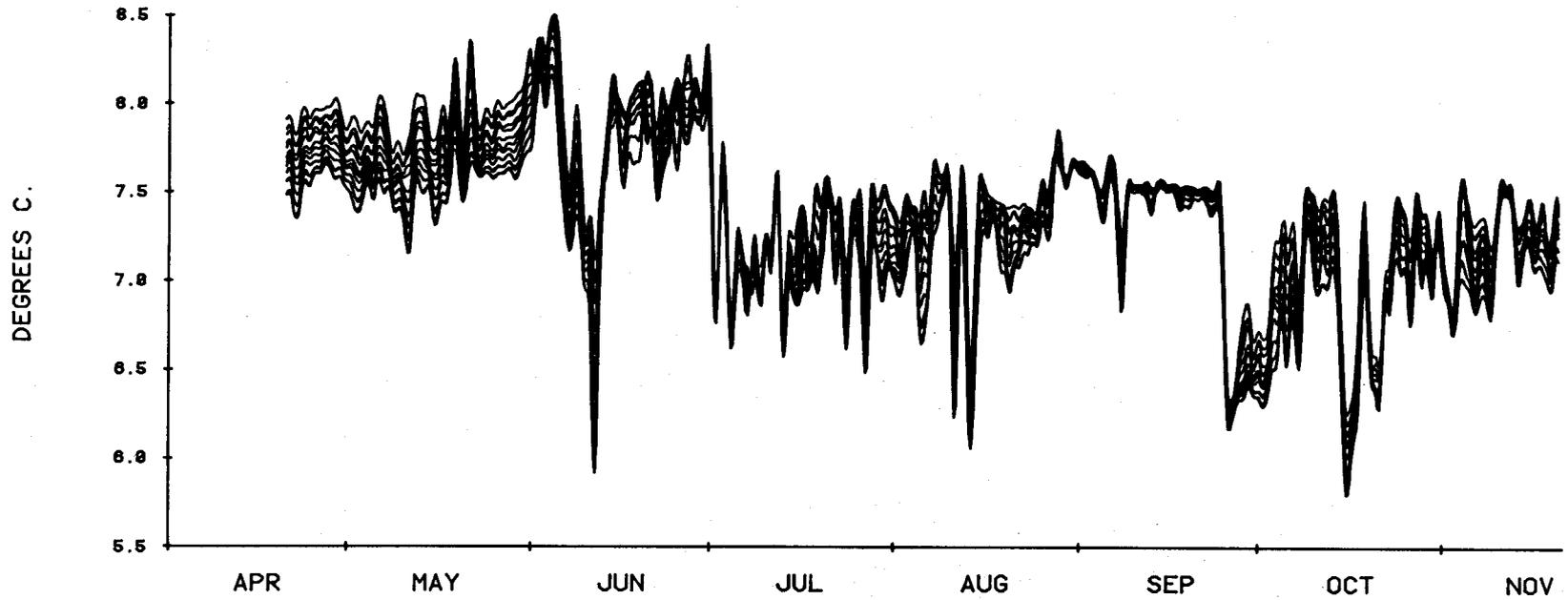
918 METERS AT BT
CORRECTED LLP FILTERED TEMPERATURE



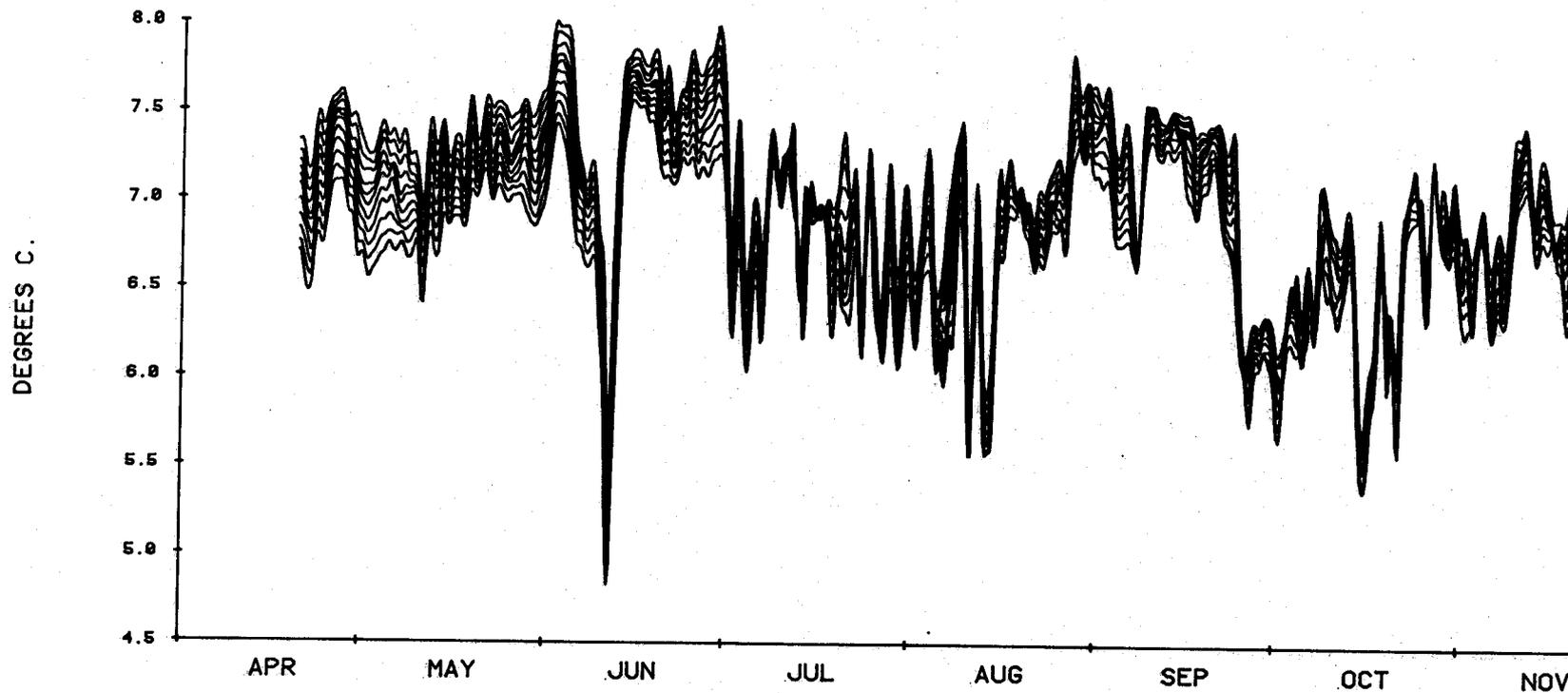
100 M - 200 M THERMISTOR CHAIN AT BT
LLP FILTERED TEMPERATURE



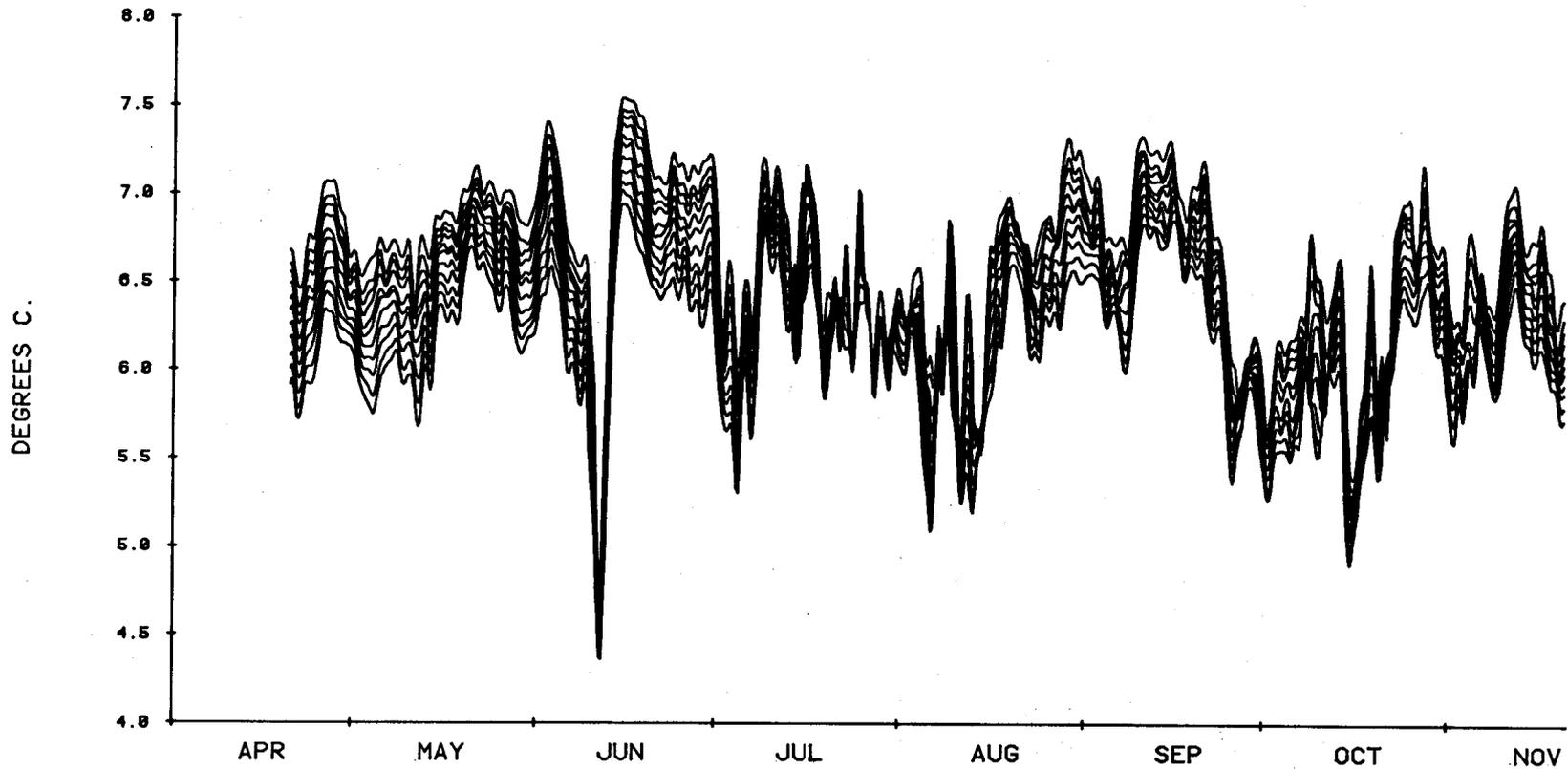
210 M - 310 M THERMISTOR CHAIN AT BT
LLP FILTERED TEMPERATURE



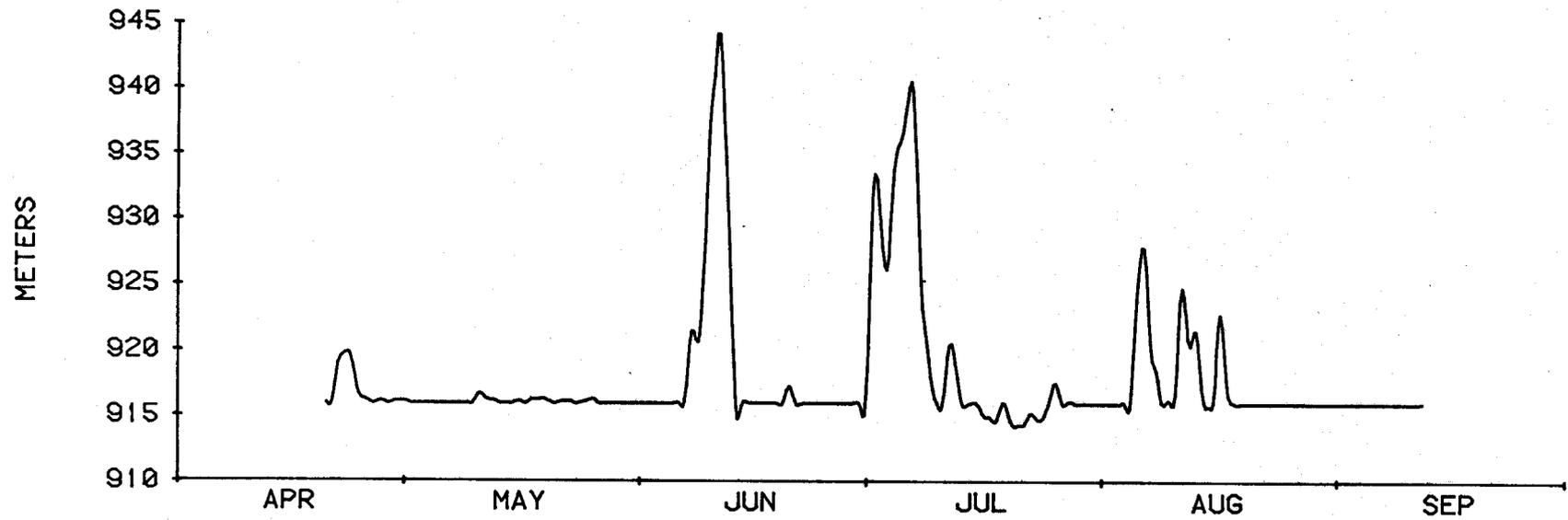
320 M - 420 M THERMISTOR CHAIN AT BT
LLP FILTERED TEMPERATURE



440 M - 540 M THERMISTOR CHAIN AT BT
LLP FILTERED TEMPERATURE

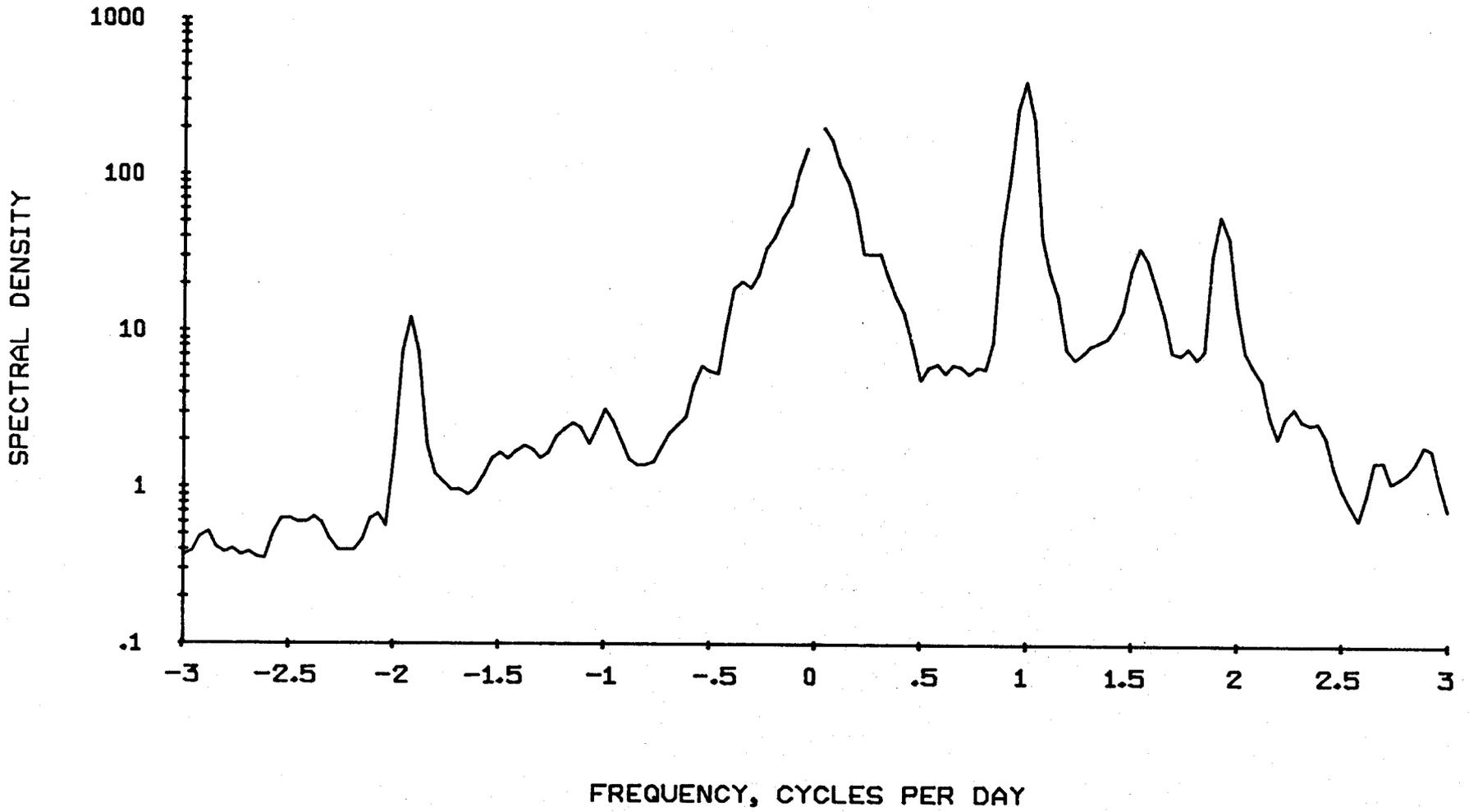


550 M - 650 M THERMISTOR CHAIN AT BT
LLP FILTERED TEMPERATURE

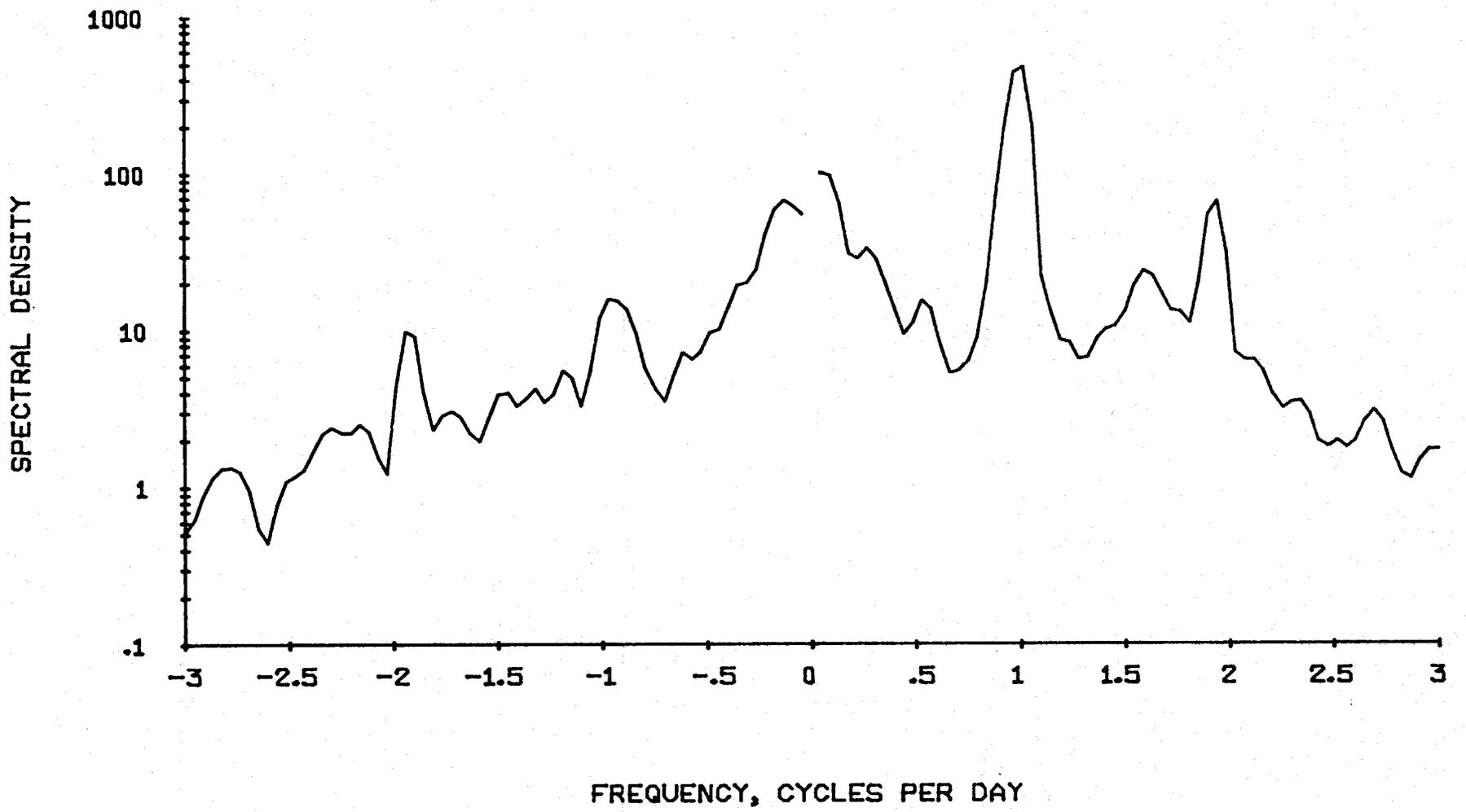


918 METERS AT BT
LLP FILTERED PRESSURE.

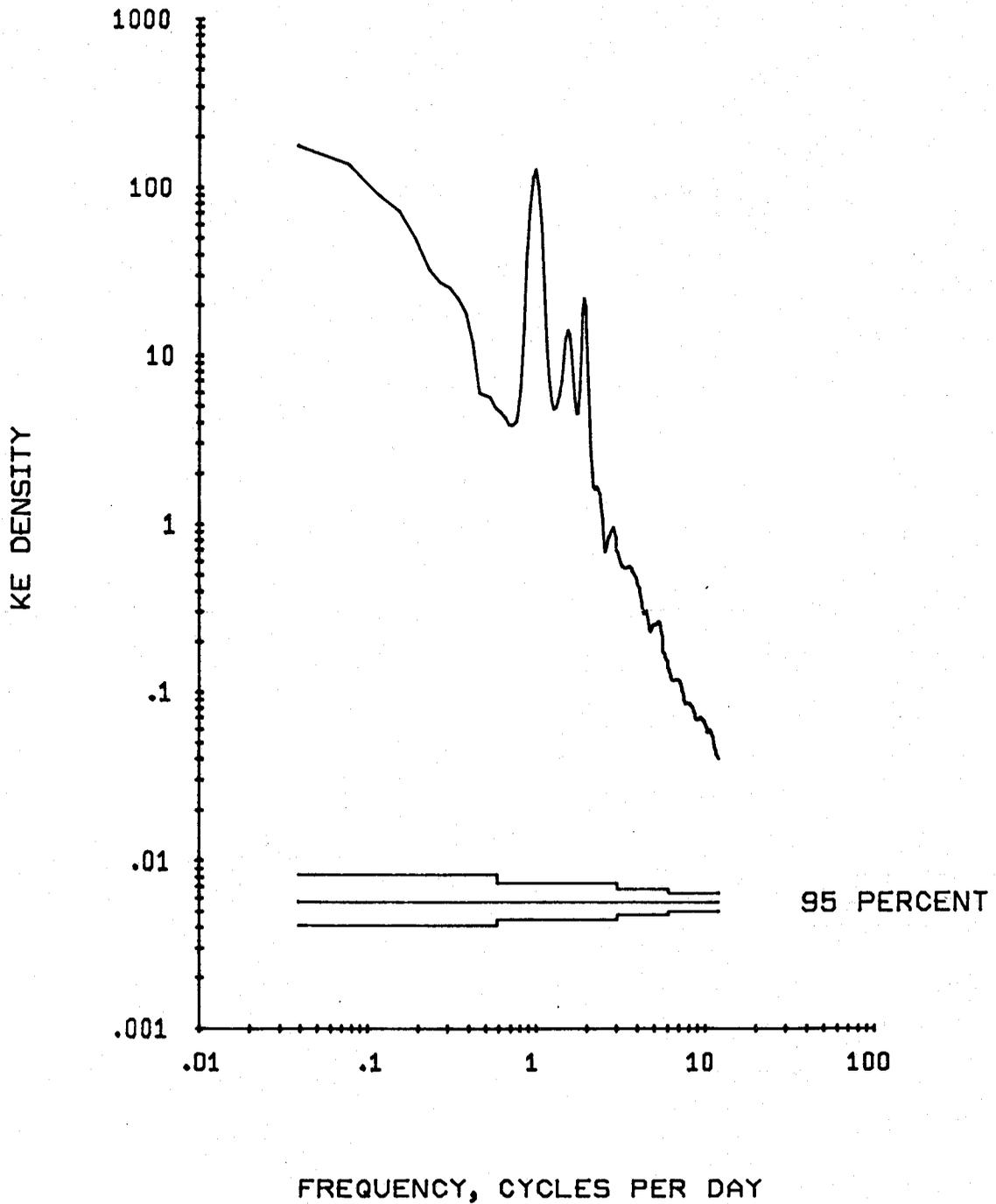
UNFILTERED CURRENT. 430 METERS AT BT.



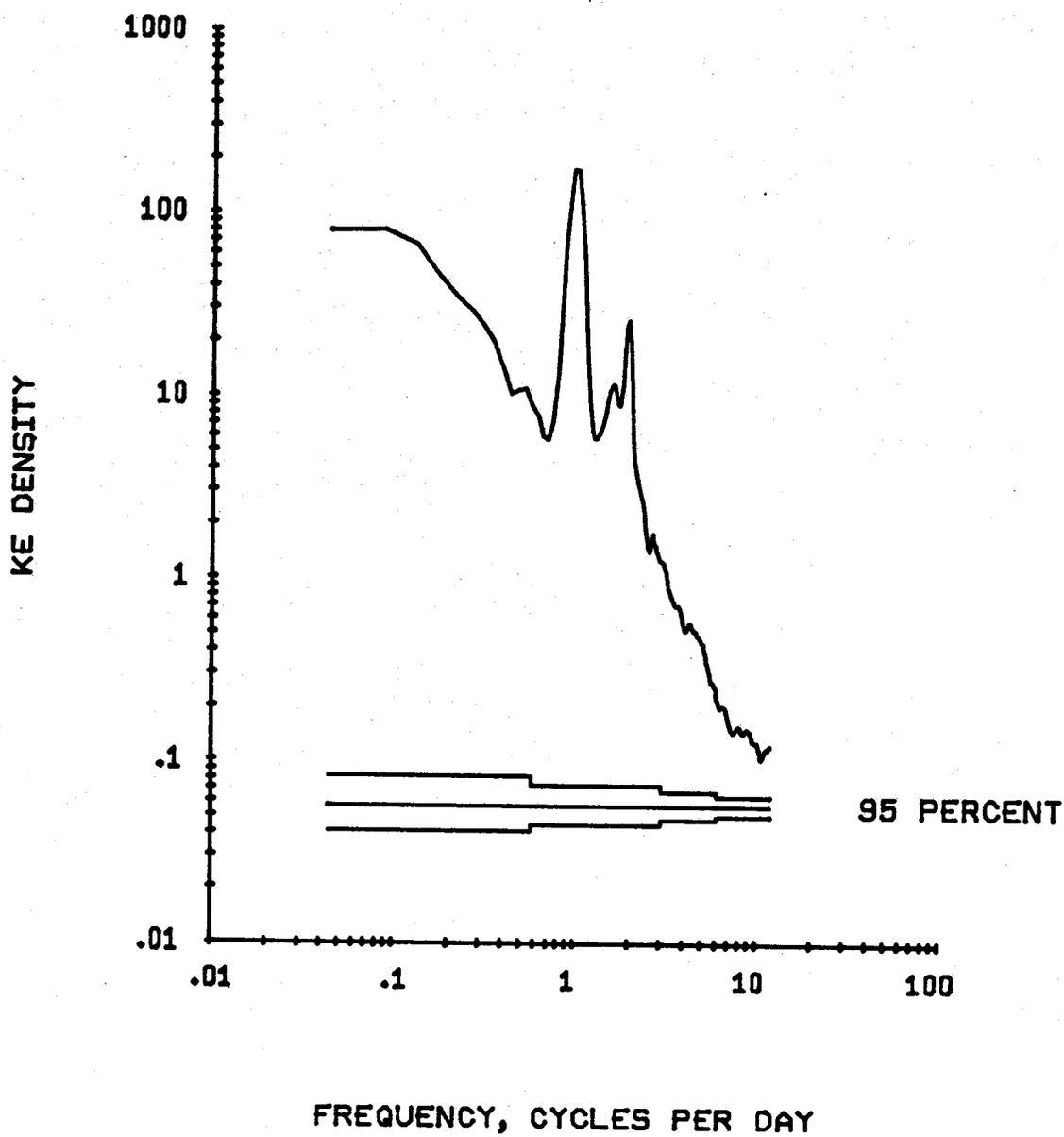
UNFILTERED CURRENT. 918 METERS AT BT.



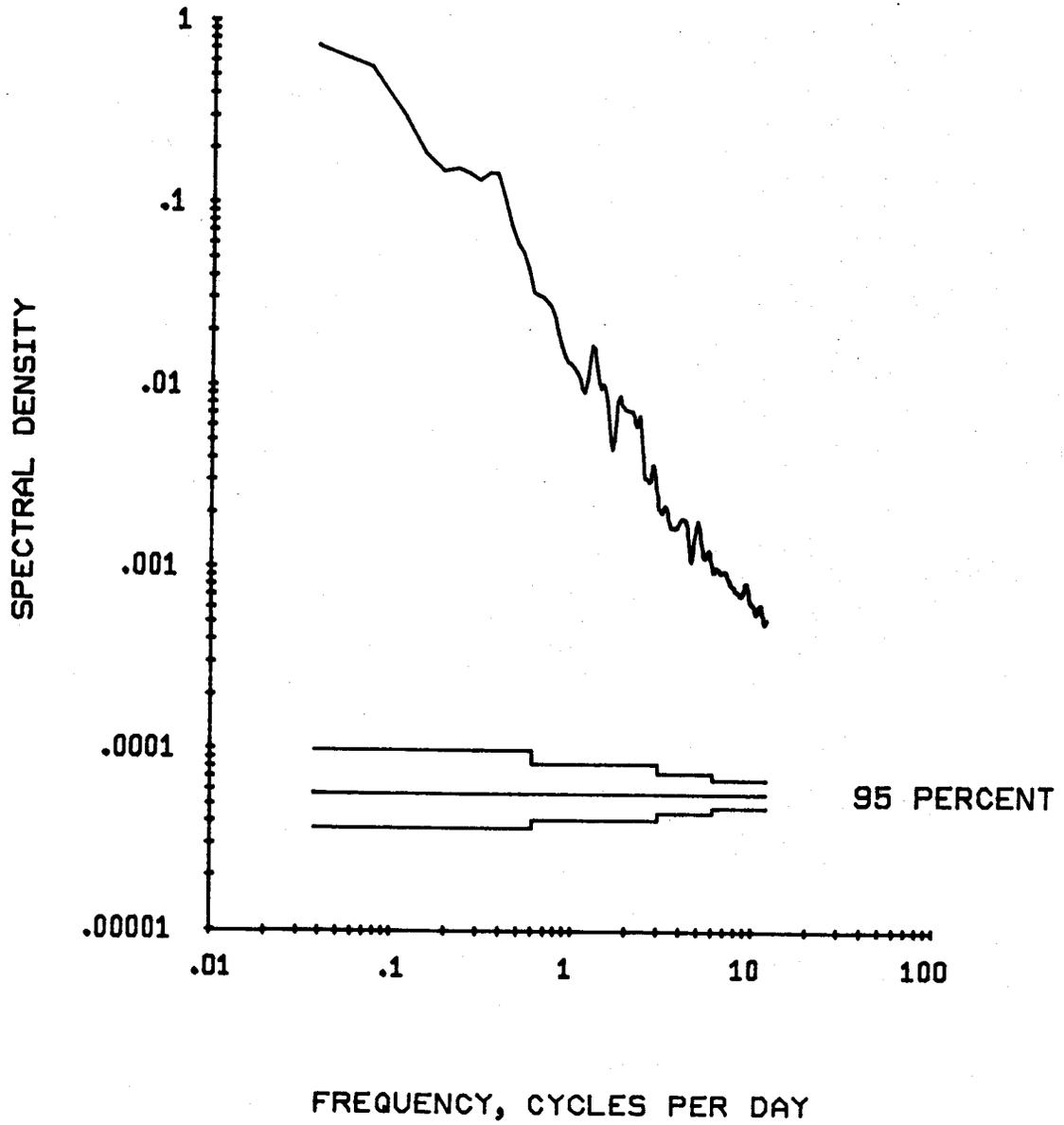
UNFILTERED CURRENT. 430 METERS AT BT.



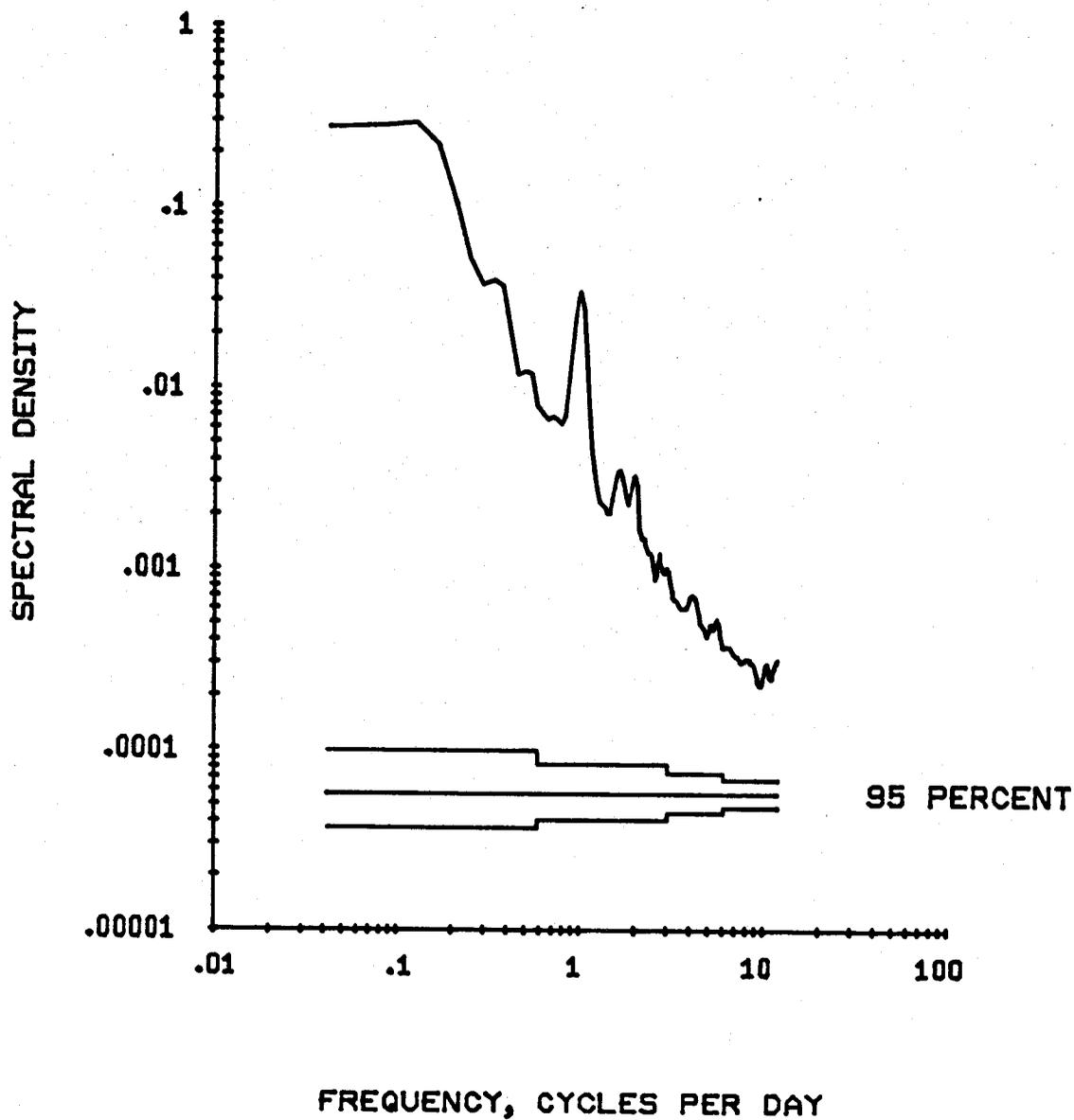
UNFILTERED CURRENT. 918 METERS AT BT.



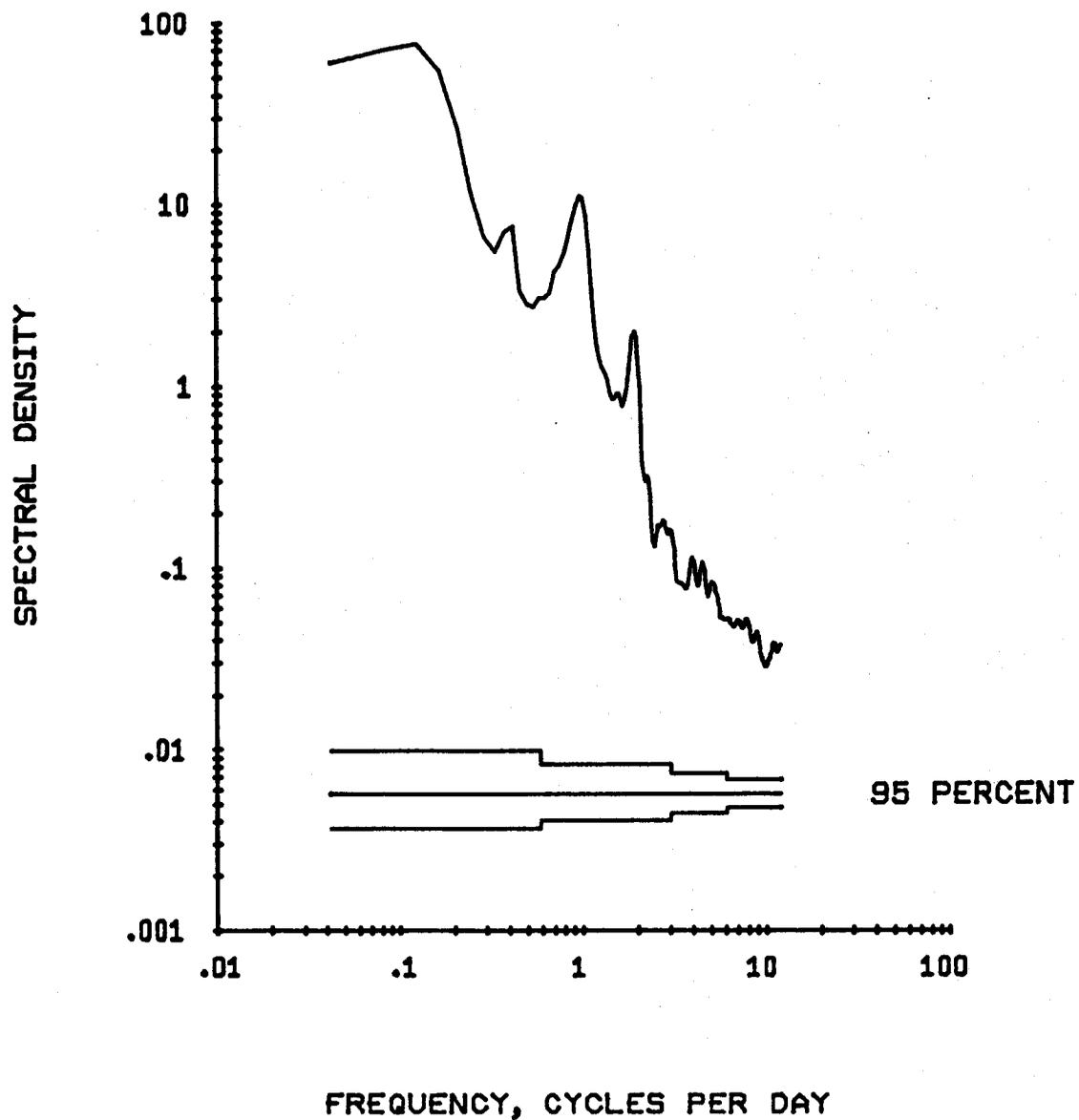
UNFILTERED TEMPERATURE. 430 METERS AT BT.

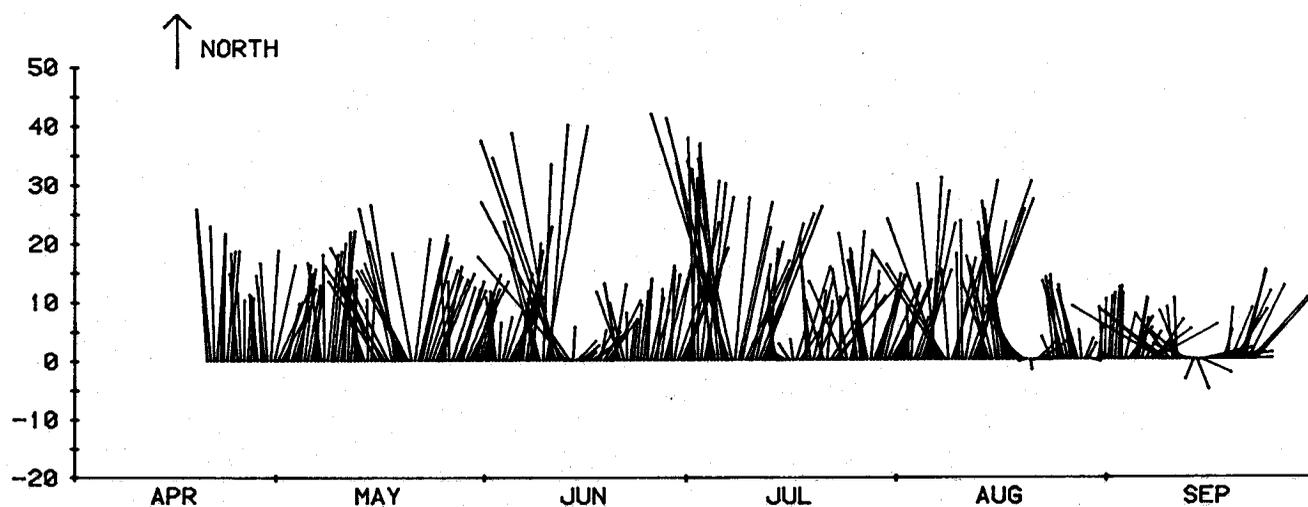


UNFILTERED TEMPERATURE. 918 METERS AT BT.

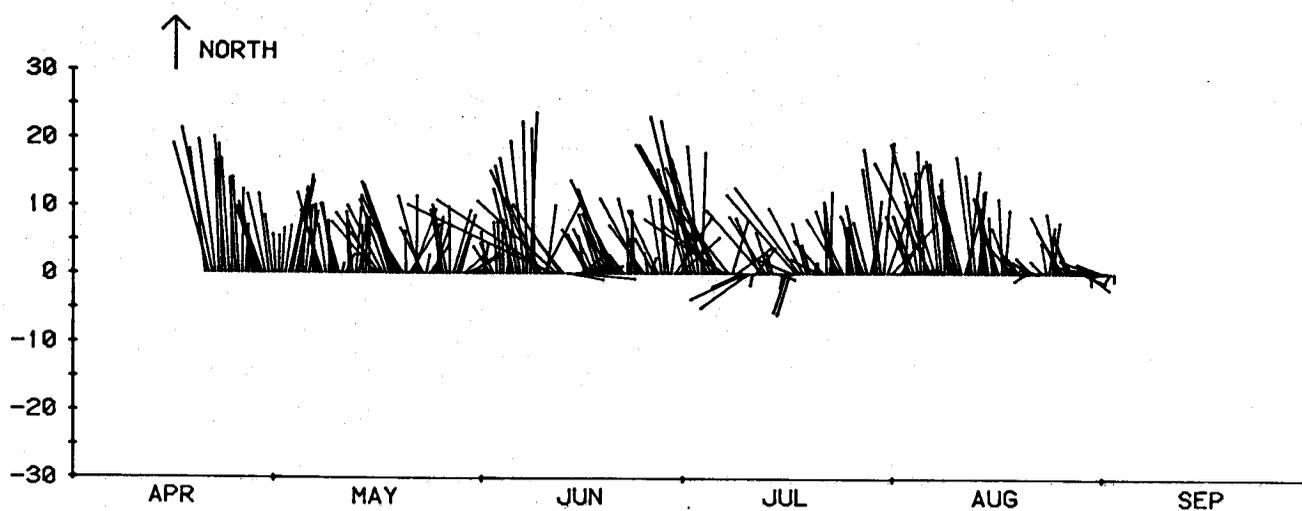


UNFILTERED PRESSURE. 918 METERS AT BT.





430 METERS AT BT
LLP FILTERED CURRENT



918 METERS AT BT
LLP FILTERED CURRENT

PIKOPIKO

PIKOPIKO

Position: 49° 23.5'S, 170° 30.0'W

Depth of Water: 5110 m

Set at: 2300 UCT 18 NOV '78 by R/V KNORR

Retrieved at: 0035 UCT 2 MAY '80 by R/V TANGAROA

Data Interval: 0207 UCT 19 NOV '78 to 2208 UCT 1 MAY '80

InstrumentationIntended DepthRCM5 Serial No./Tape No.

1000 m

497/44

2000 m

1237/17

4000 m

1236/18

Instrument 497 recorded speed, direction, temperature, and pressure once per hour until the instrument was recovered.

Instrument 1237 recorded speed, direction, temperature, and pressure once per hour until the instrument was recovered.

Instrument 1236 recorded speed, direction, and temperature once per hour until the instrument was recovered.

PIKOPIKO

1055 m

	MEAN	S.D.	SKEW	KURT	MAX	MIN	N
S	18.54	9.49	0.01	2.07	46.40	0.70	12716
U	8.09	14.30	-0.27	2.27	38.60	-29.60	12716
V	3.04	12.43	-0.07	2.69	38.80	-33.00	12716
T	3.99	0.54	0.23	3.09	5.48	2.61	12716
P	10600400.	1021700.	1.98	7.16	16150000.	9782000.	12716

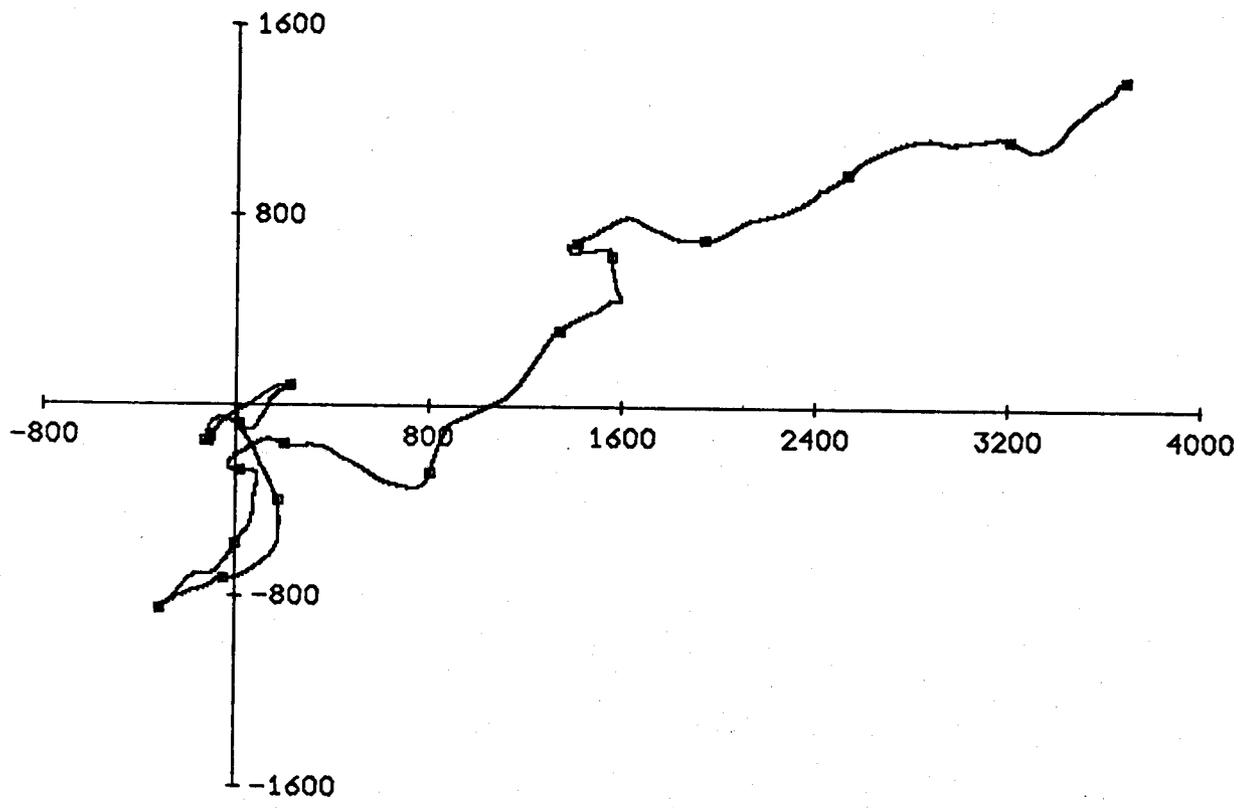
2058 m

S	11.11	5.53	0.41	2.67	30.40	0.70	12716
U	4.20	8.61	-0.22	2.49	28.10	-21.80	12716
V	3.10	7.25	-0.07	2.61	24.40	-22.60	12716
T	2.32	0.06	-1.16	6.40	2.50	1.99	12716
P	20686900.	835700.	2.08	7.45	25168000.	20075000.	12716

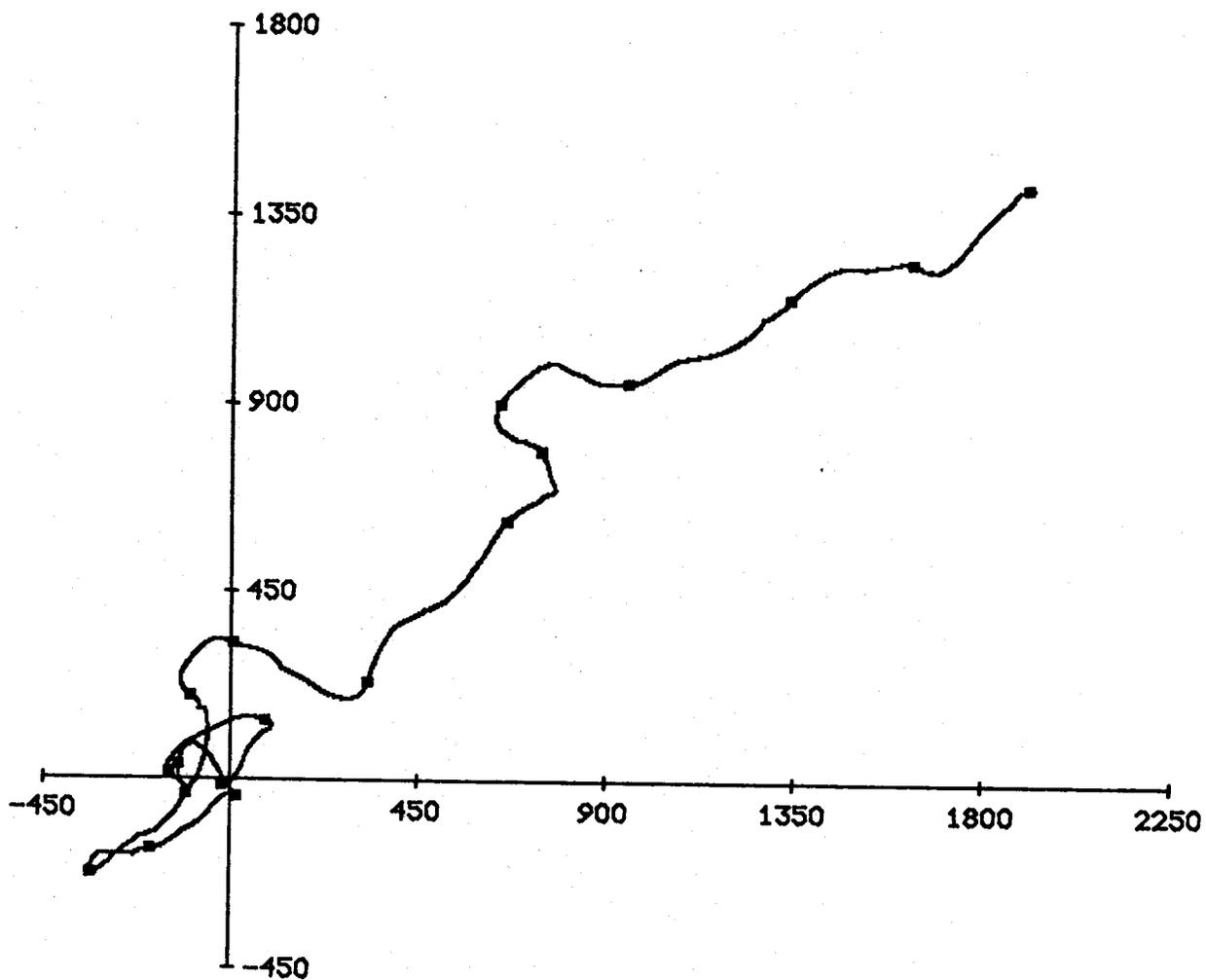
4058 m

S	9.49	4.59	0.69	3.30	27.90	0.70	12716
U	4.11	6.61	-0.10	2.82	27.10	-14.20	12716
V	3.66	1.09	-0.09	2.63	23.90	-15.10	12716
T	1.00	0.03	0.11	2.47	1.09	0.90	12716

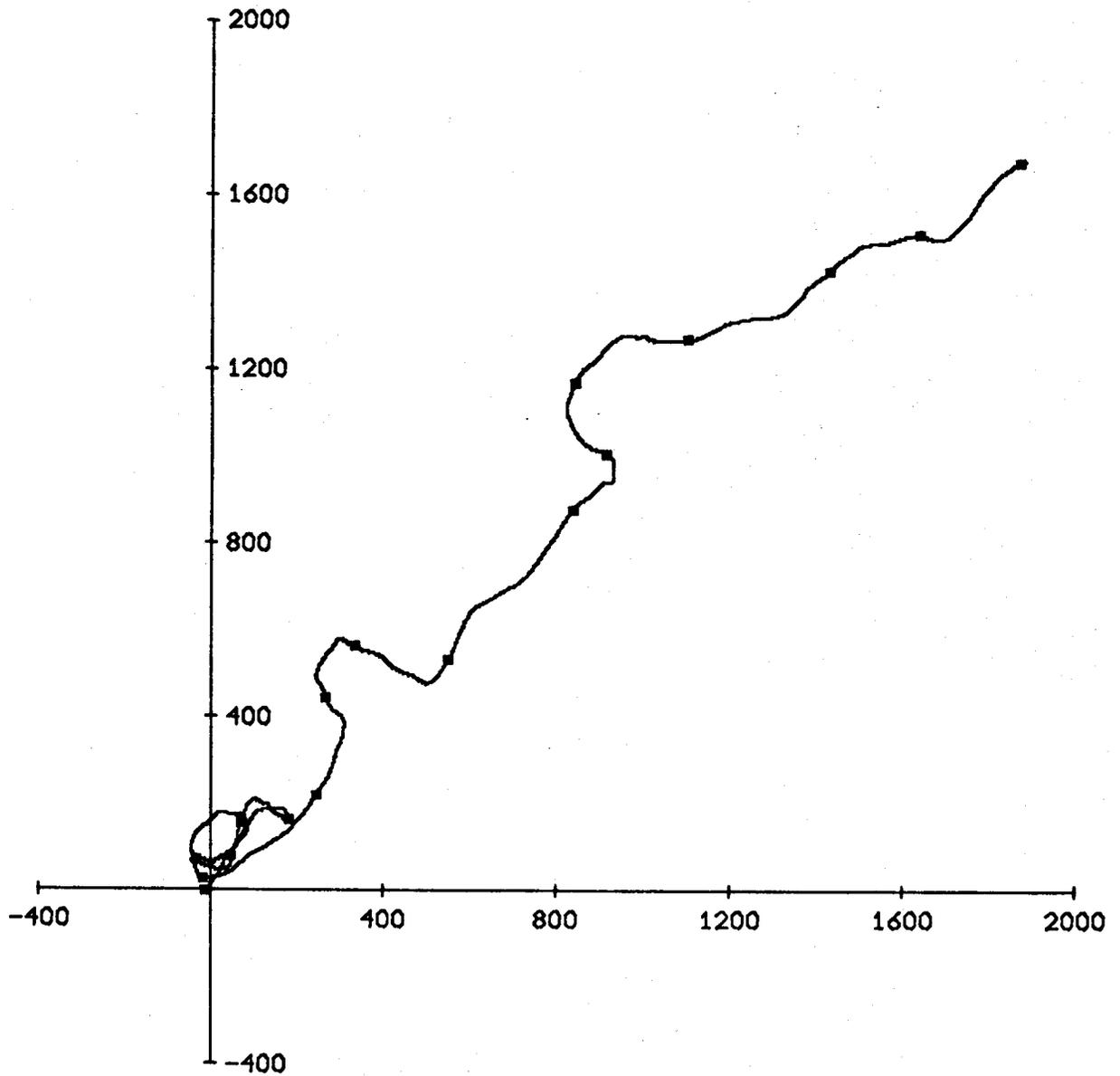
Speed, u, and v are given in cm/sec; temperature in degrees centigrade; and pressure in pascals.



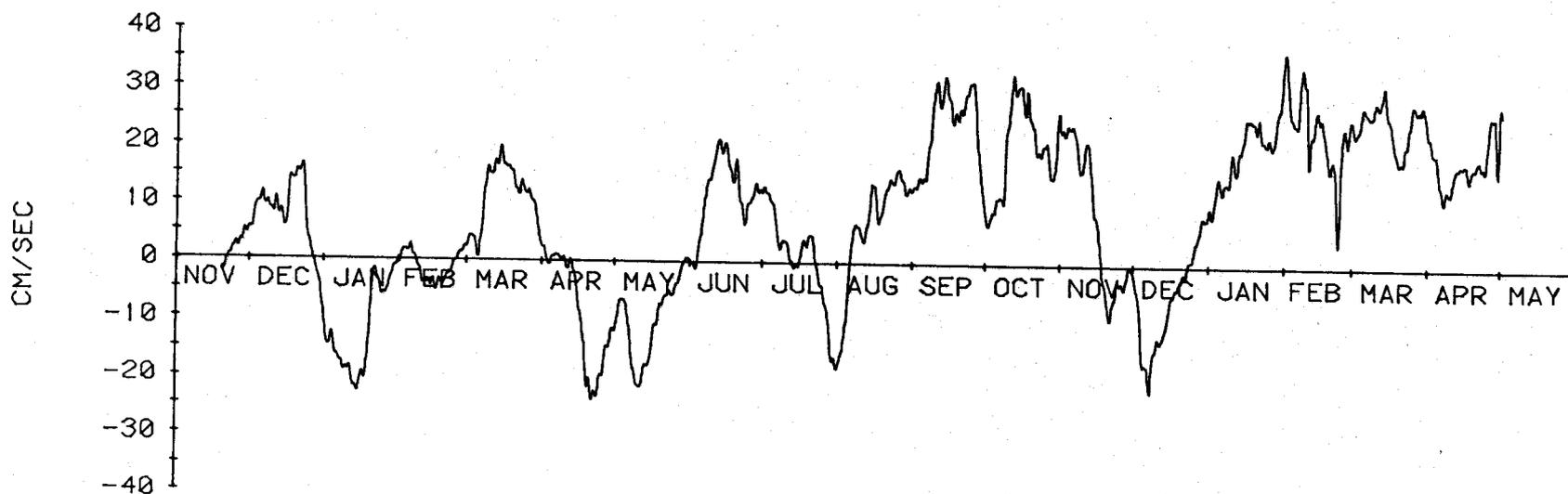
1055 M AT STN PIKOPIKO. 529.8 DAYS STARTING 209 19 NOV 78.



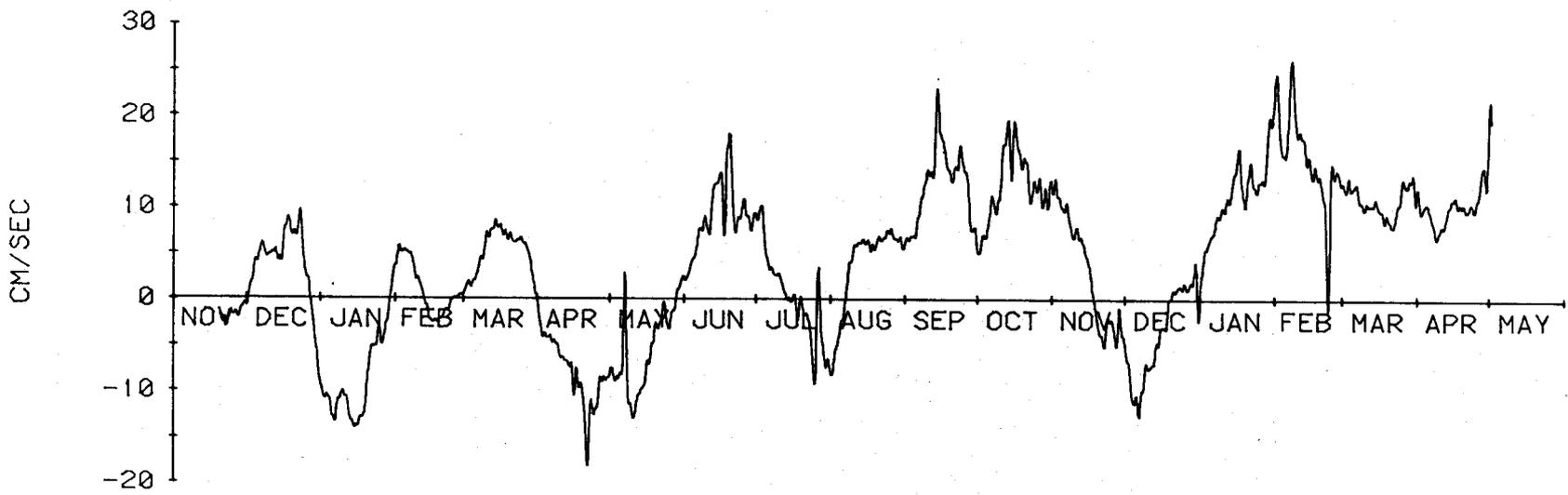
2058 M AT STN PIKOPIKO. 529.8 DAYS STARTING 308 19 NOV 78.



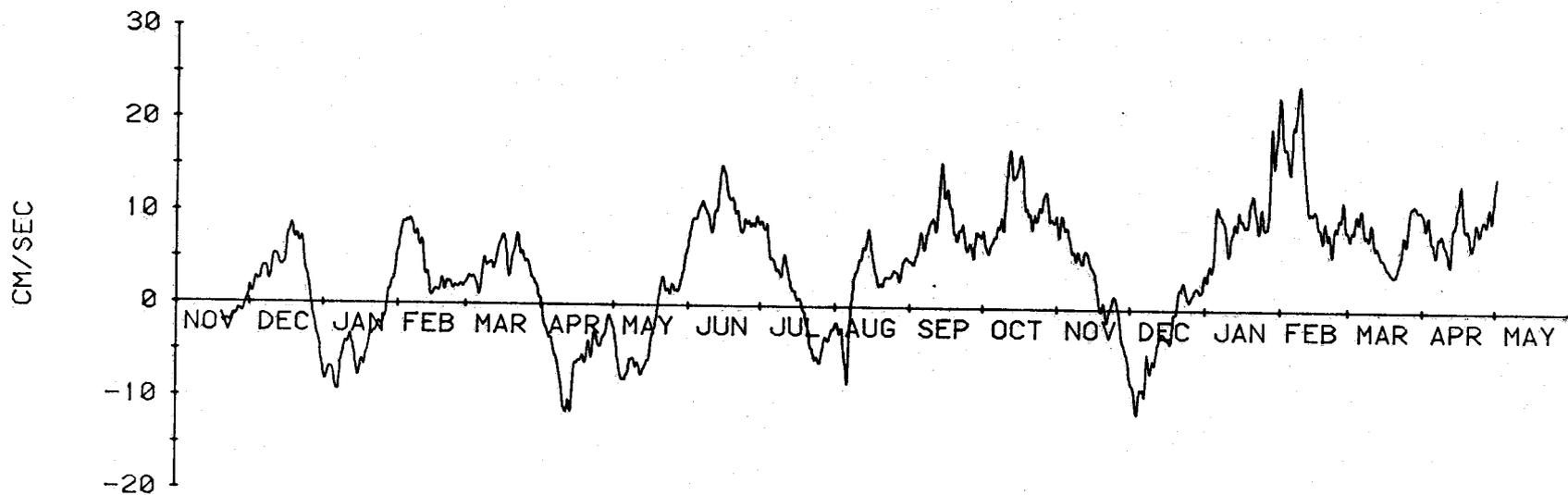
4058 M AT STN PIKOPIKO. 529.8 DAYS STARTING 207 19 NOV 78.



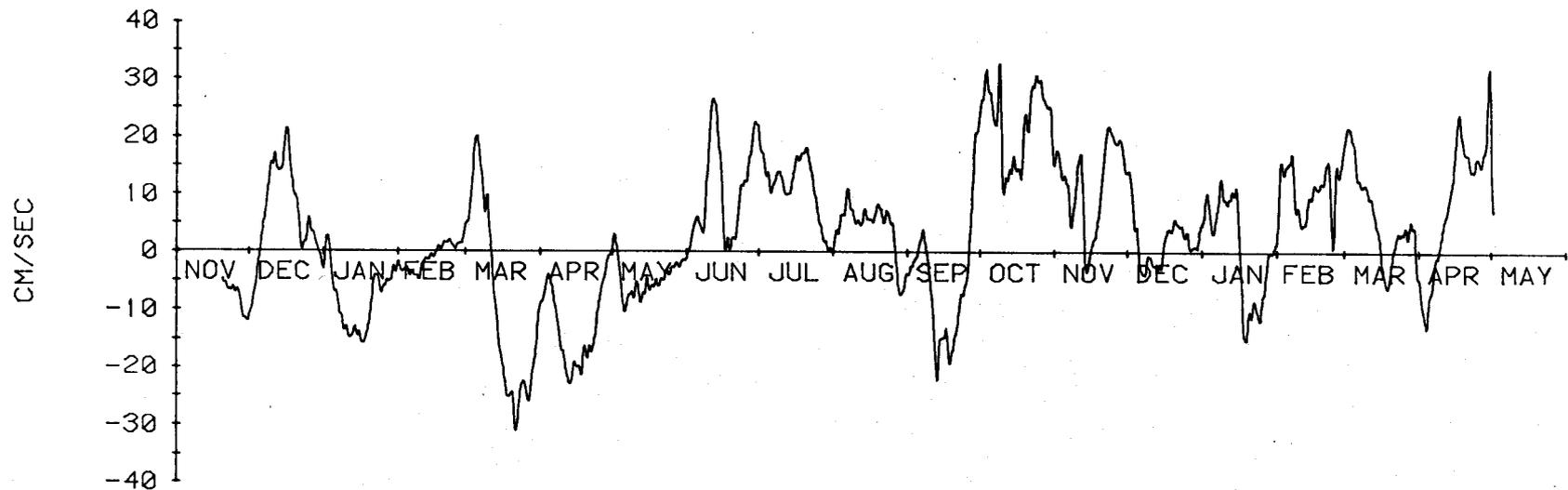
1055 METERS AT PIKOI KO
LLP FILTERED U COMPONENT



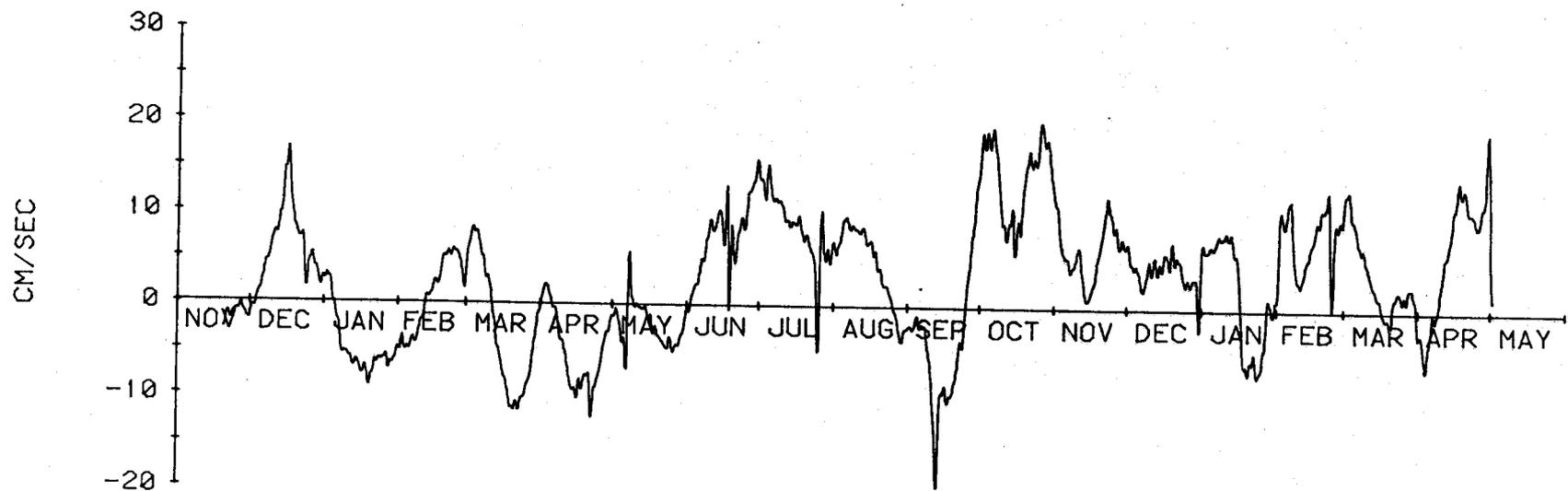
2058 METERS AT PIKOPIKO
LLP FILTERED U COMPONENT



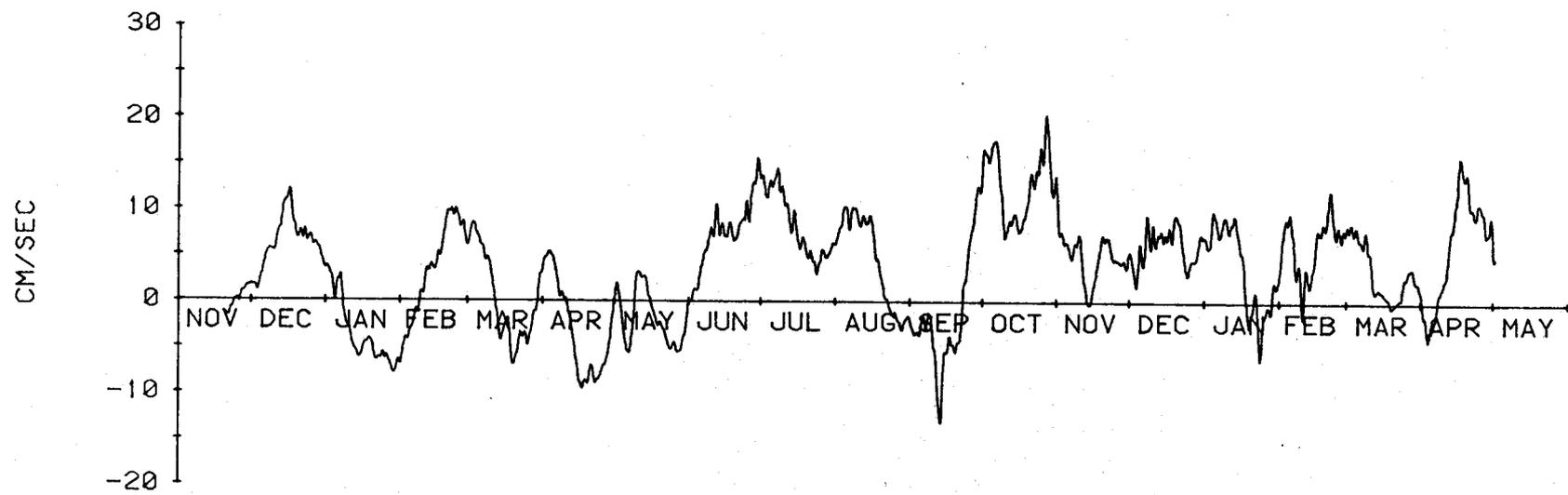
4058 METERS AT PIKOPIKO
LLP FILTERED U COMPONENT



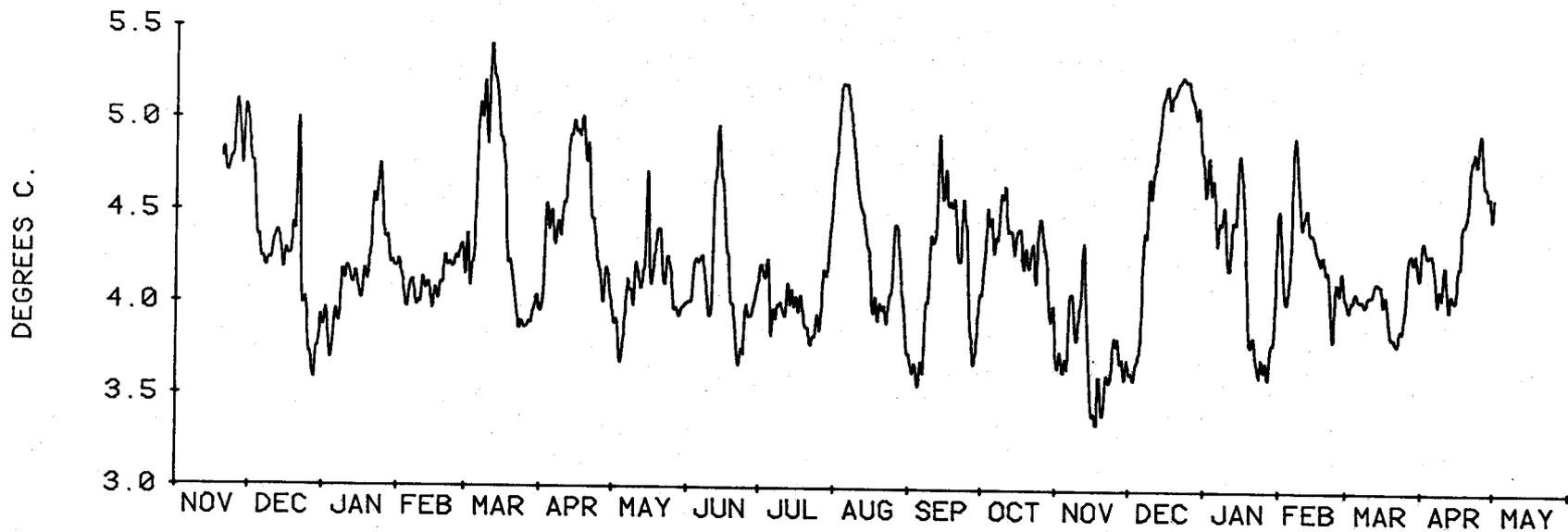
1055 METERS AT PIKOPIKO
LLP FILTERED V COMPONENT



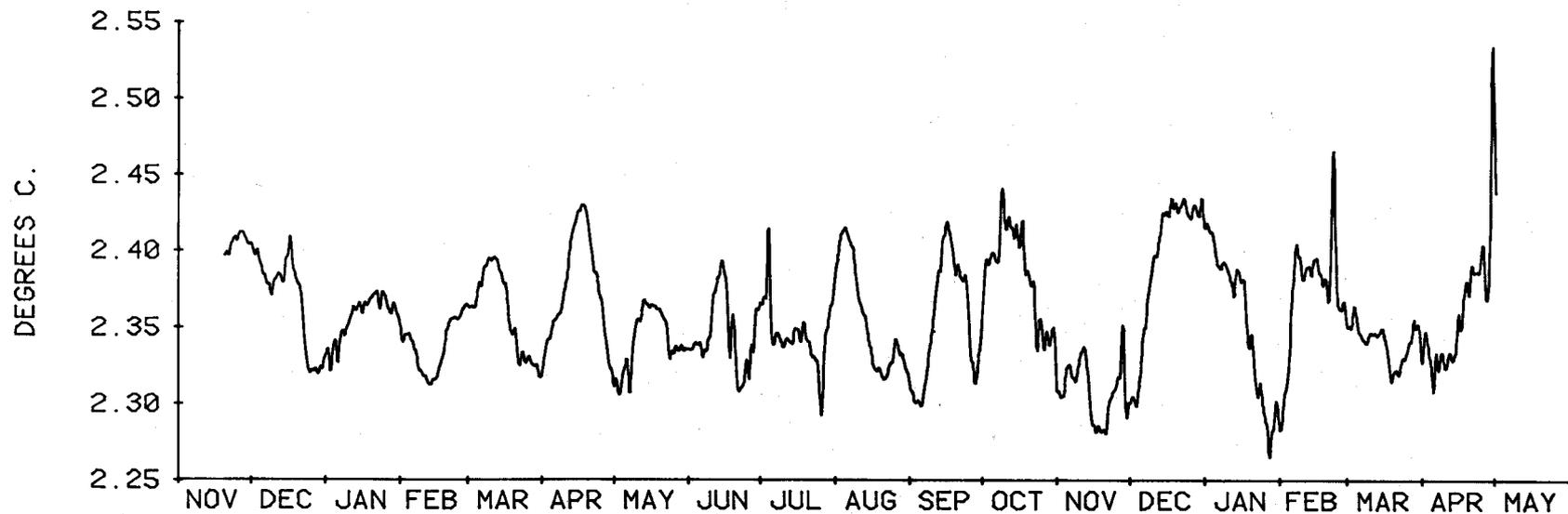
2058 METERS AT PIKOPIKO
LLP FILTERED V COMPONENT



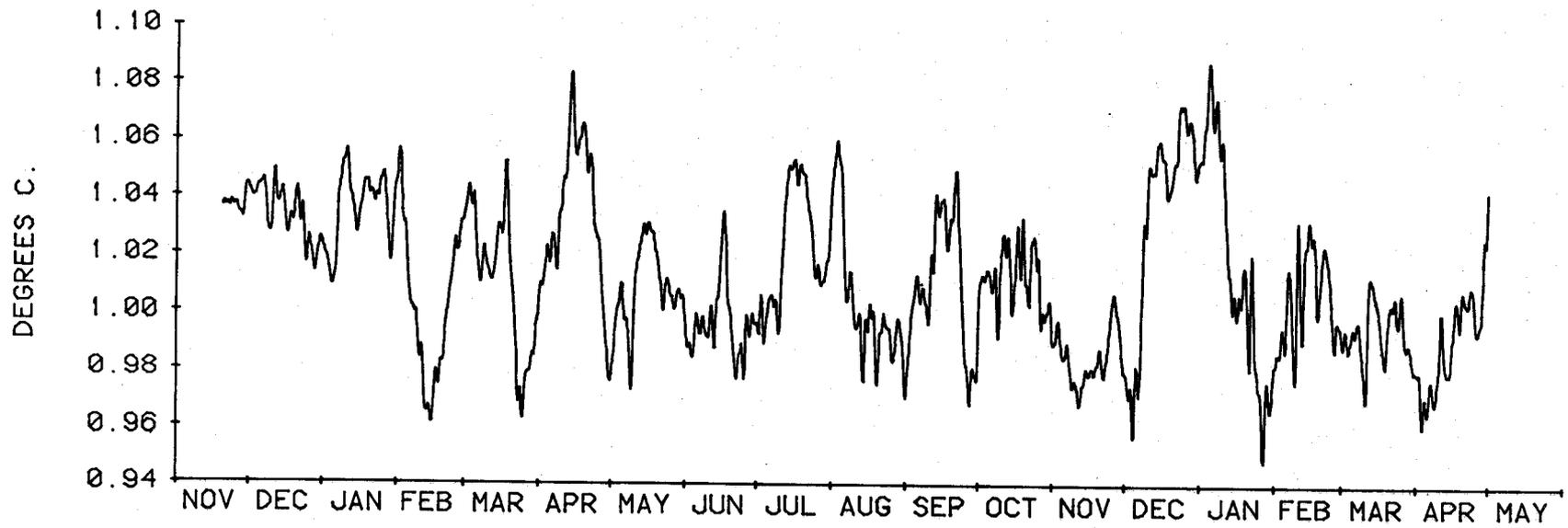
4058 METERS AT PIKOPIKO
LLP FILTERED V COMPONENT



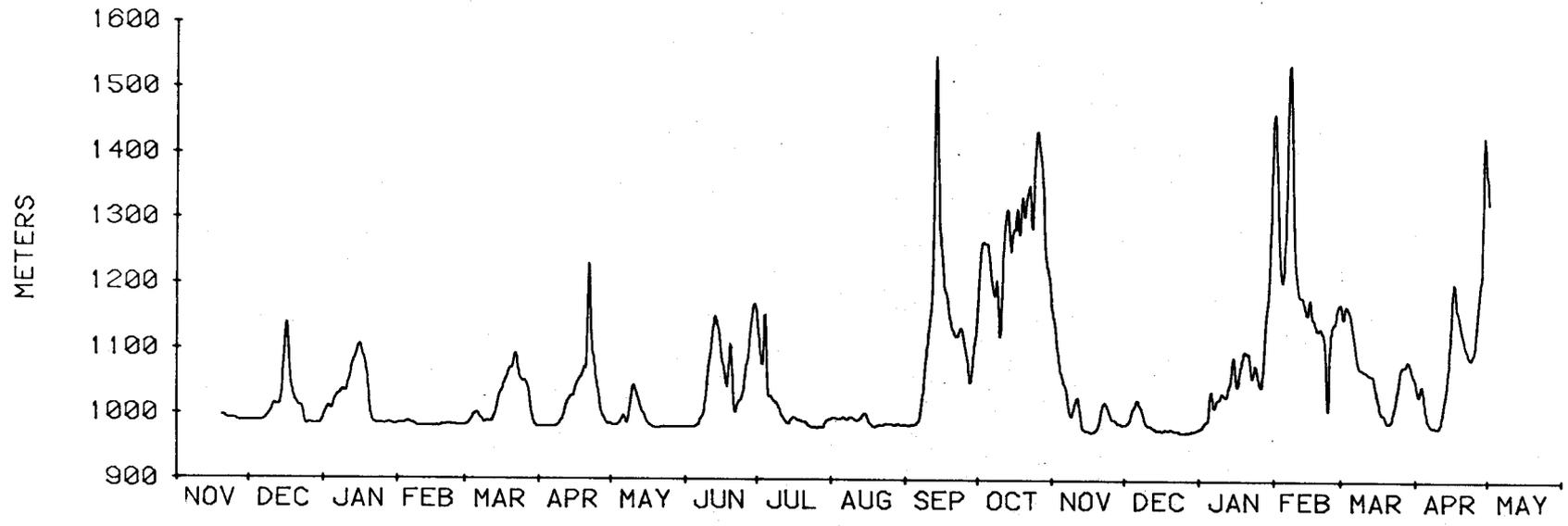
1055 METERS AT PIKOPIKO
CORRECTED LLP FILTERED TEMPERATURE



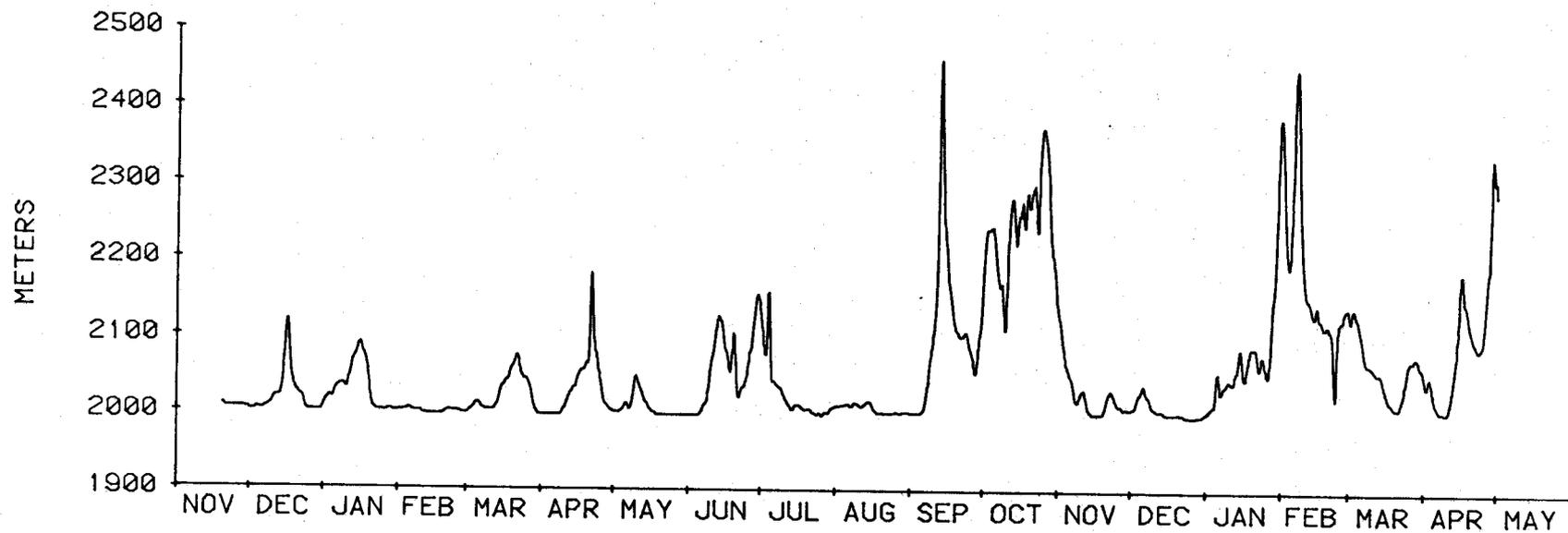
2058 METERS AT PIKOPIKO
CORRECTED LLP FILTERED TEMPERATURE



4058 METERS AT PIKOPIKO
CORRECTED LLP FILTERED TEMPERATURE



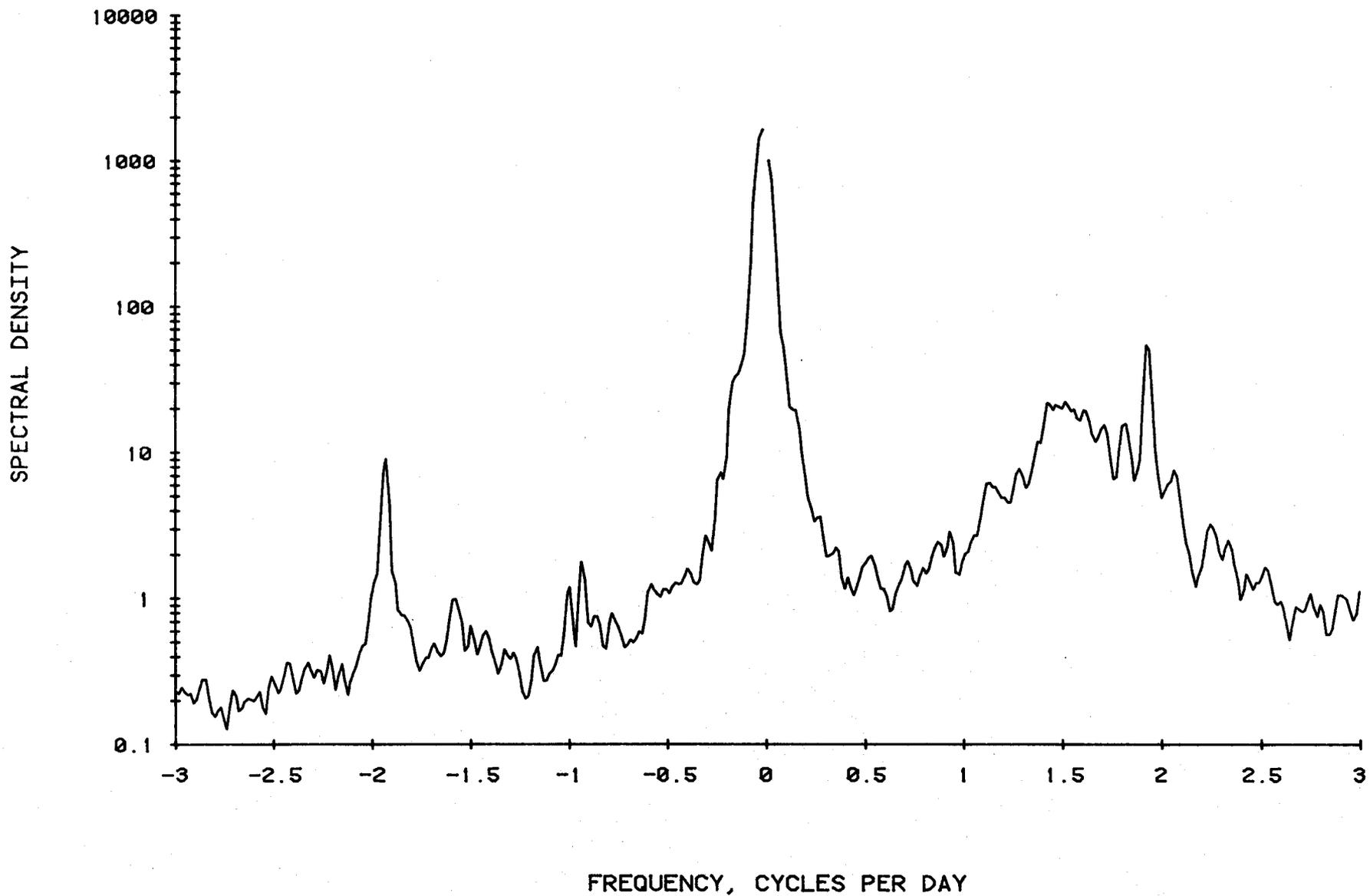
1055 METERS AT PIKOPIKO
LLP FILTERED PRESSURE



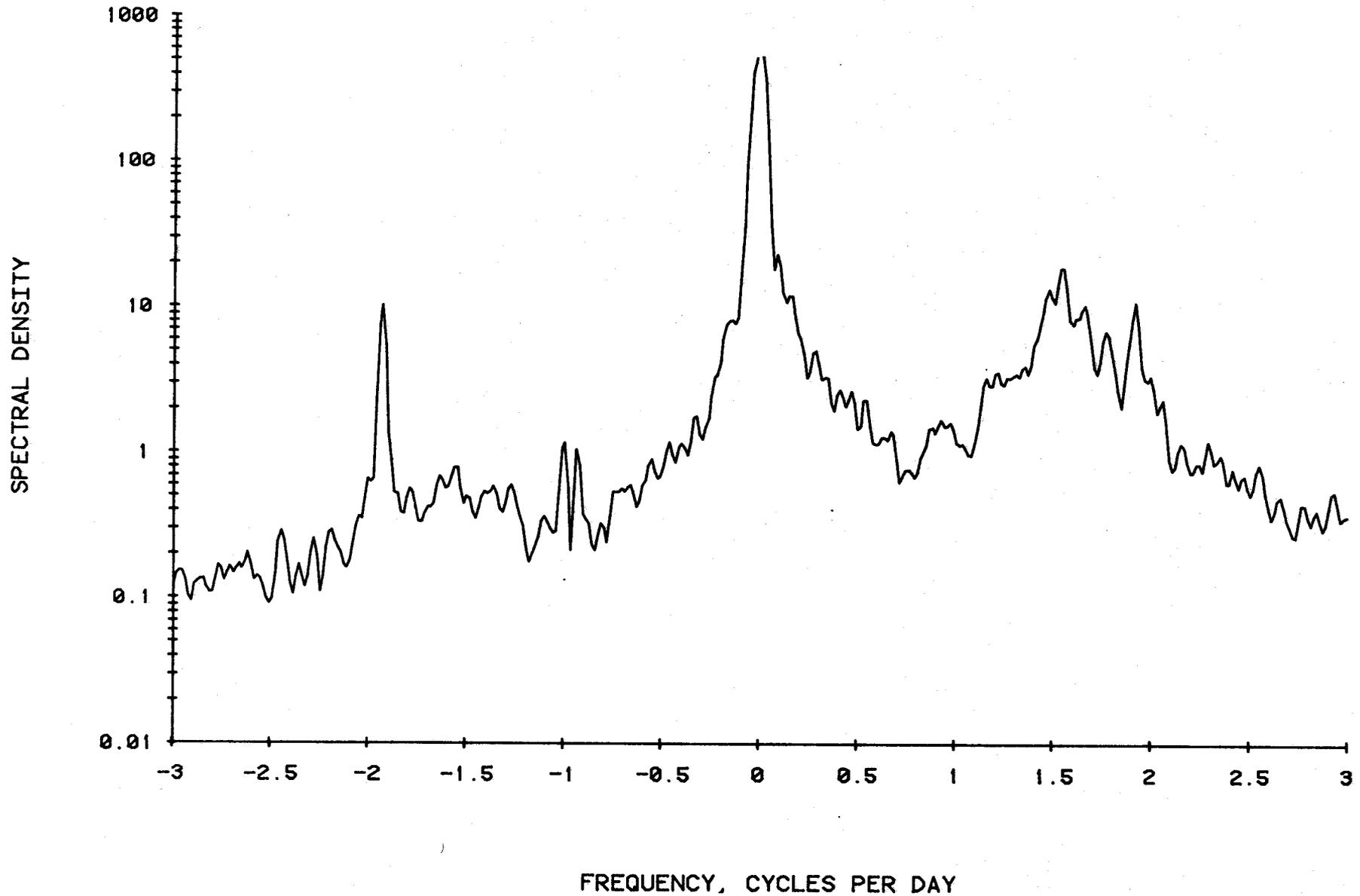
2058 METERS AT PIKOPIKO
LLP FILTERED PRESSURE

UNFILTERED CURRENT. 1055 METERS AT PIKOPIKO.

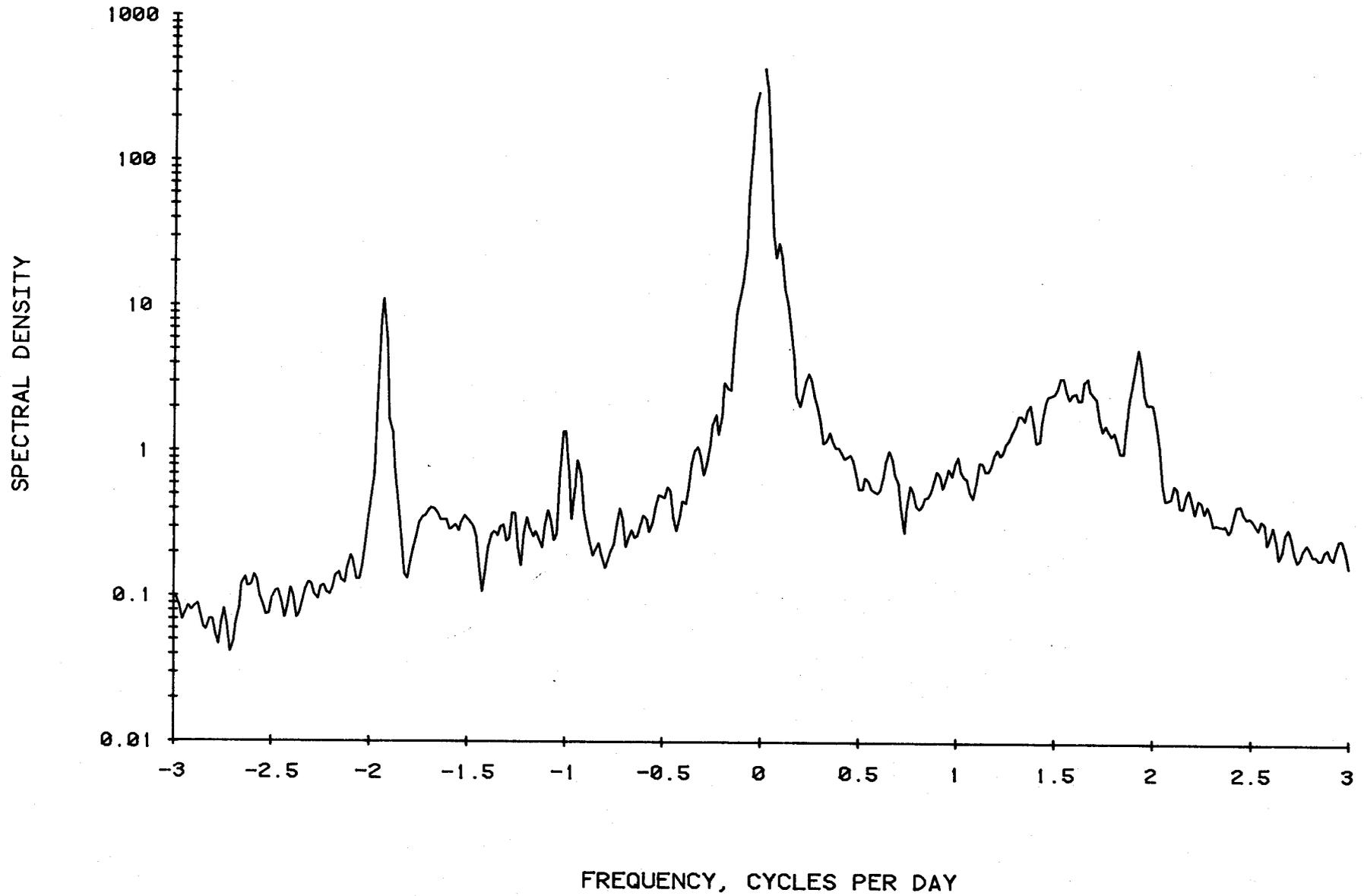
142



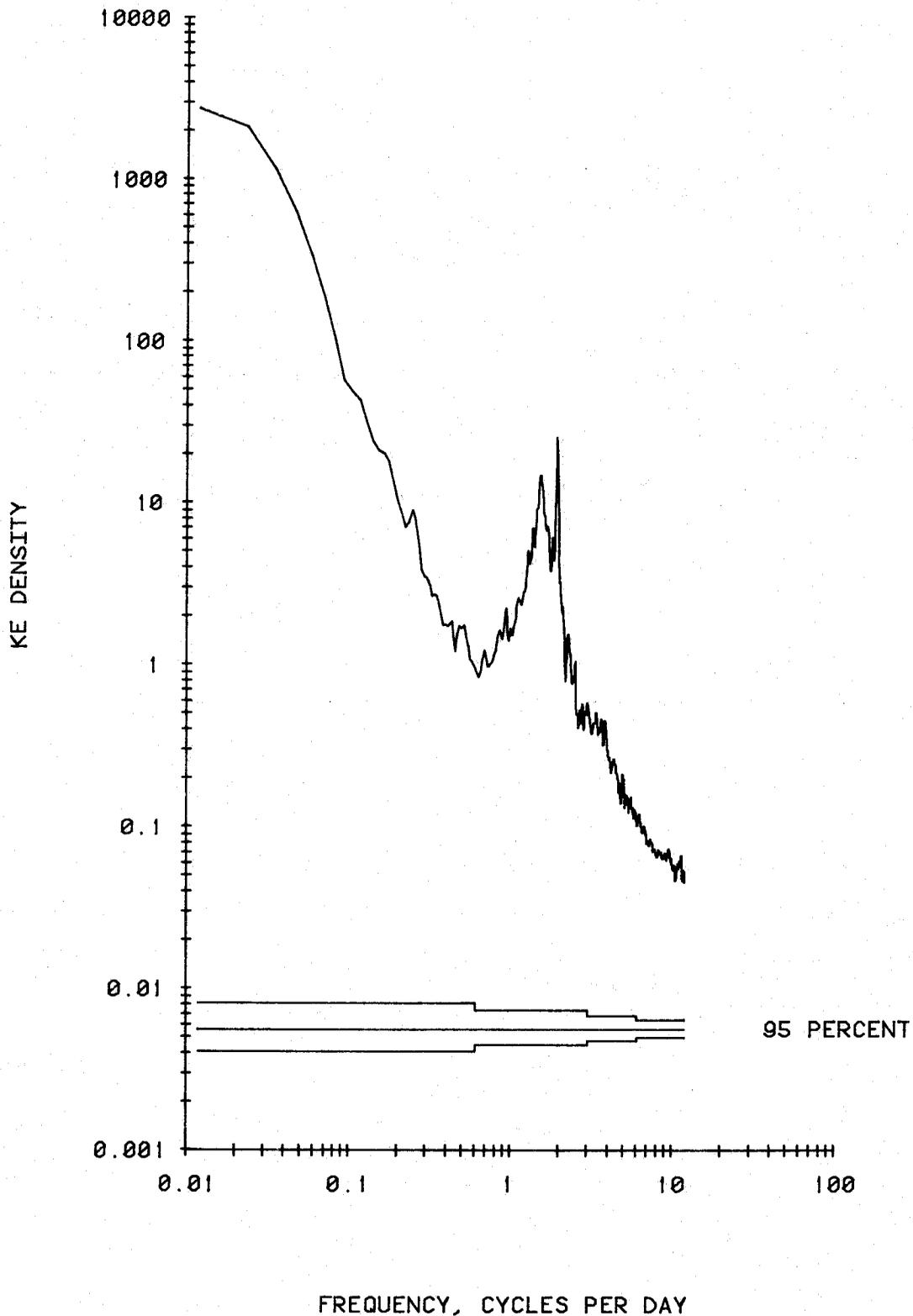
UNFILTERED CURRENT. 2058 METERS AT PIKOPIKO.



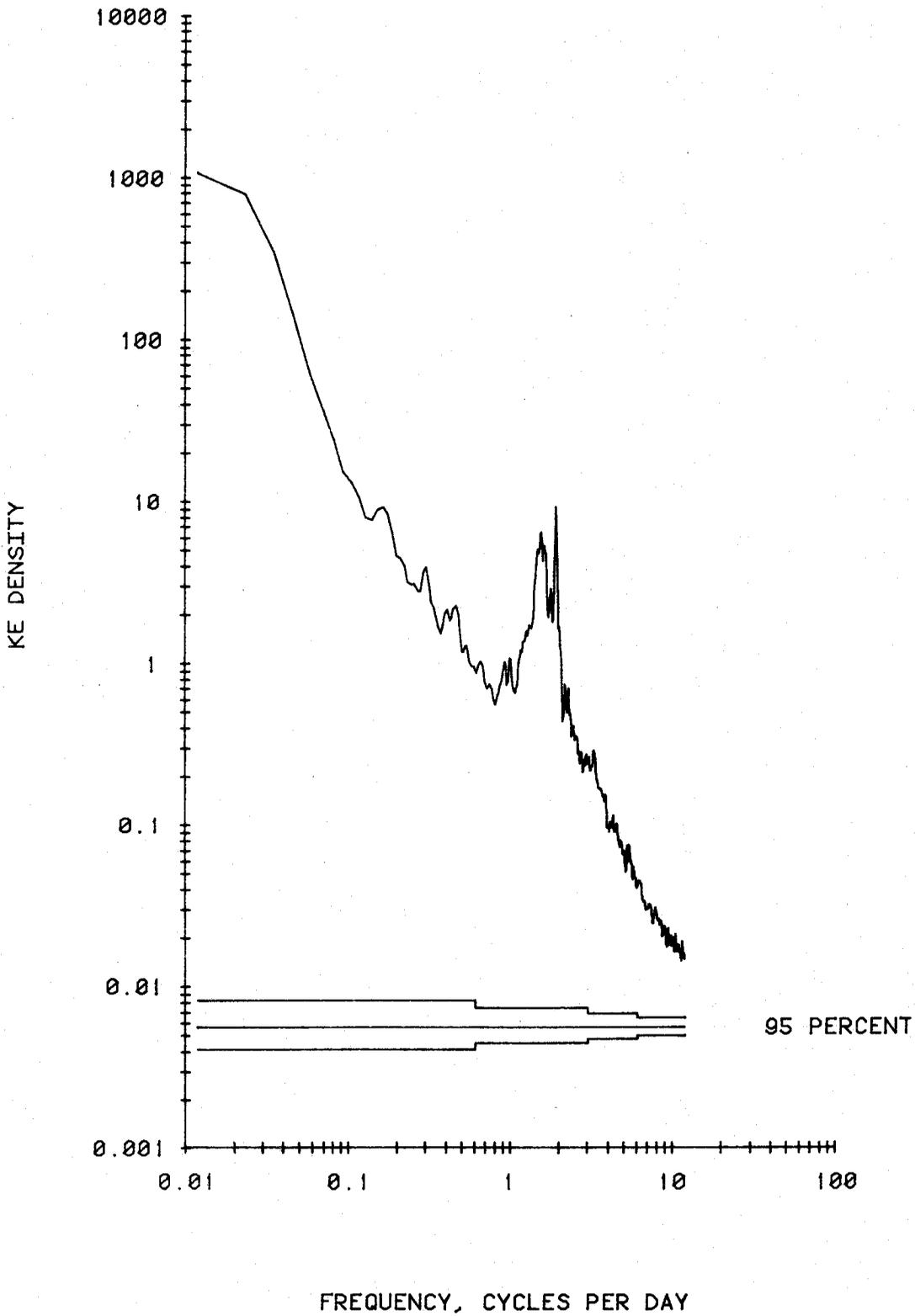
UNFILTERED CURRENT. 4058 METERS AT PIKOPIKO.



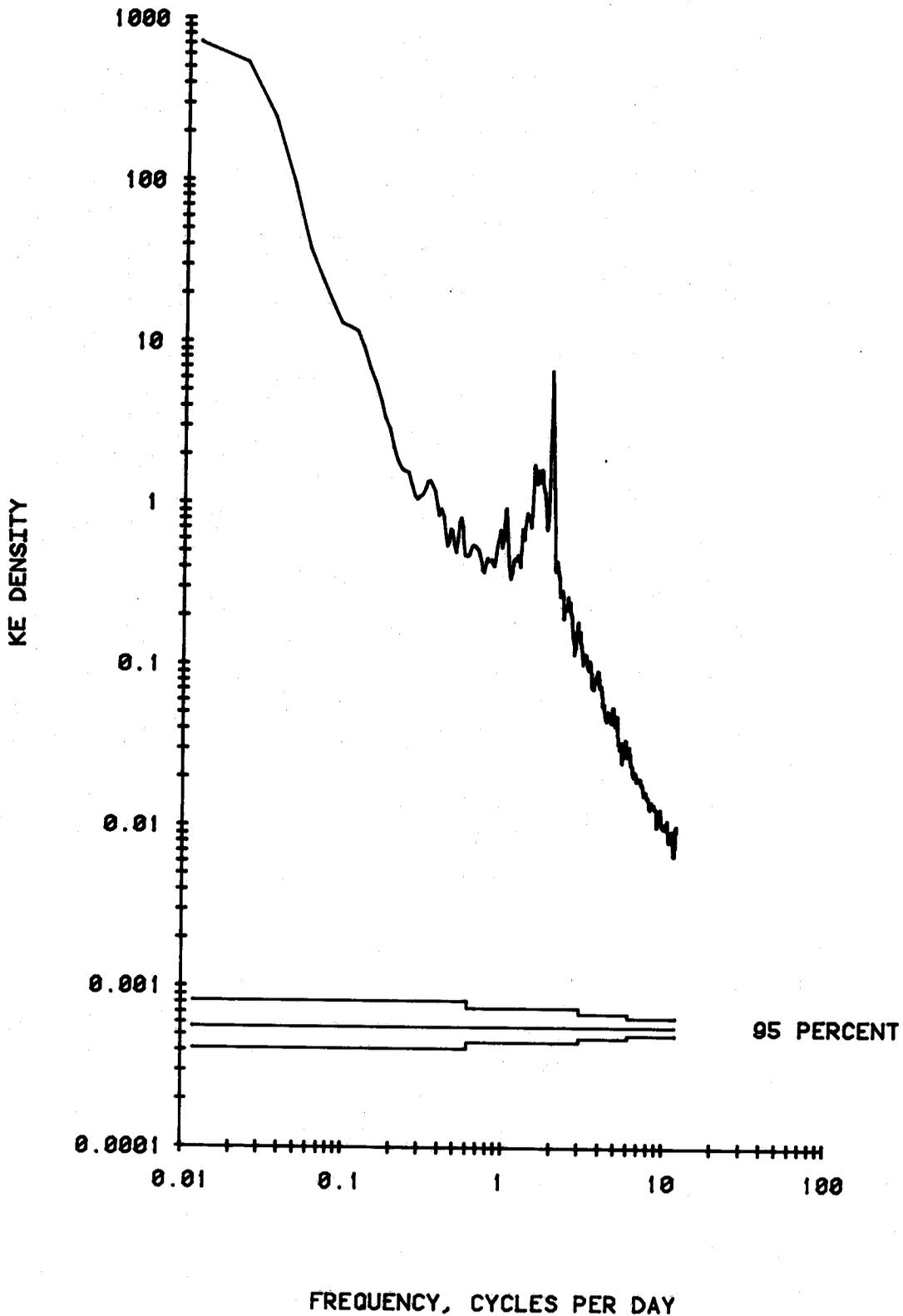
UNFILTERED CURRENT. 1055 M AT PIKOPIKO.



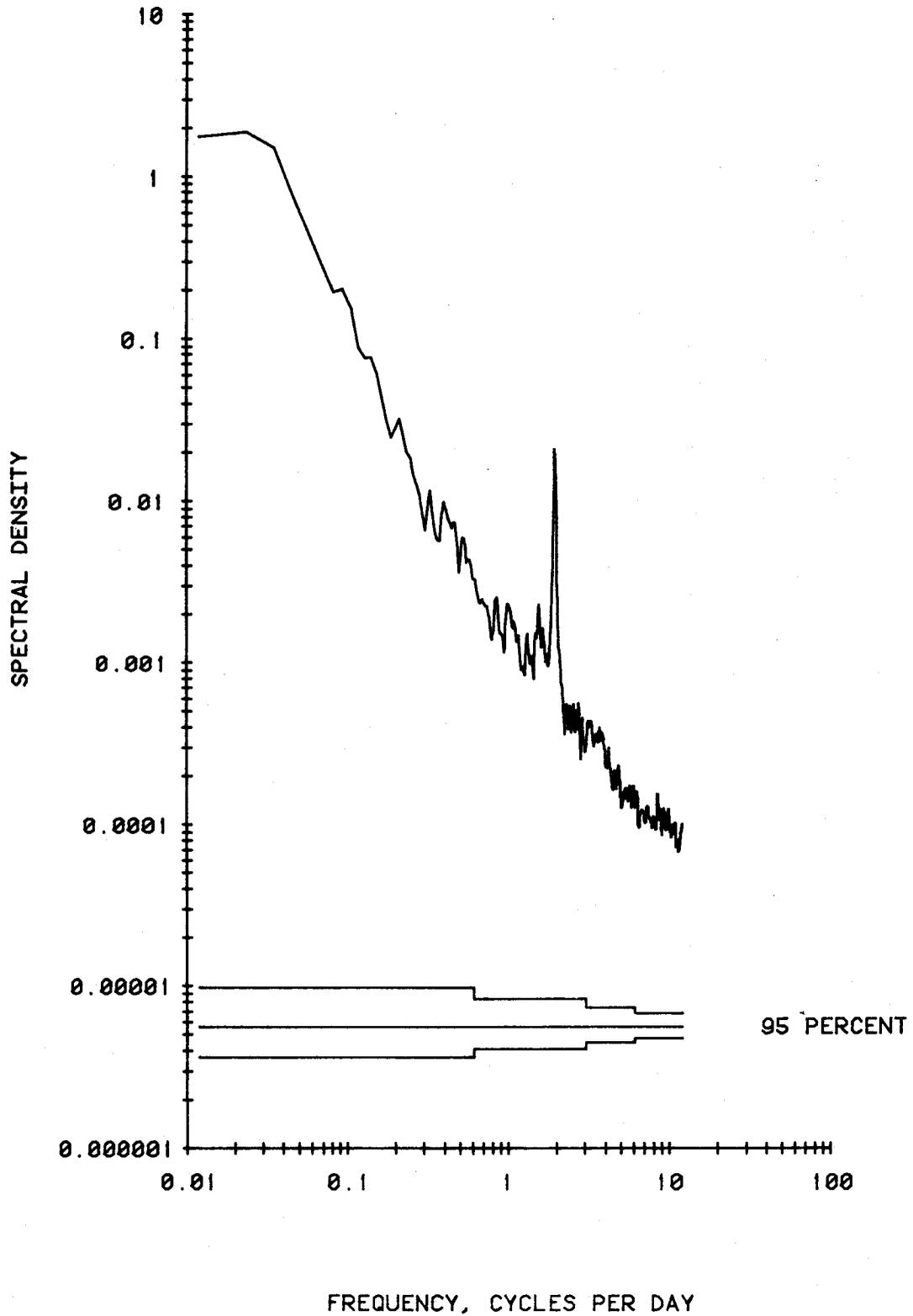
UNFILTERED CURRENT. 2058 M AT PIKOPIKO.



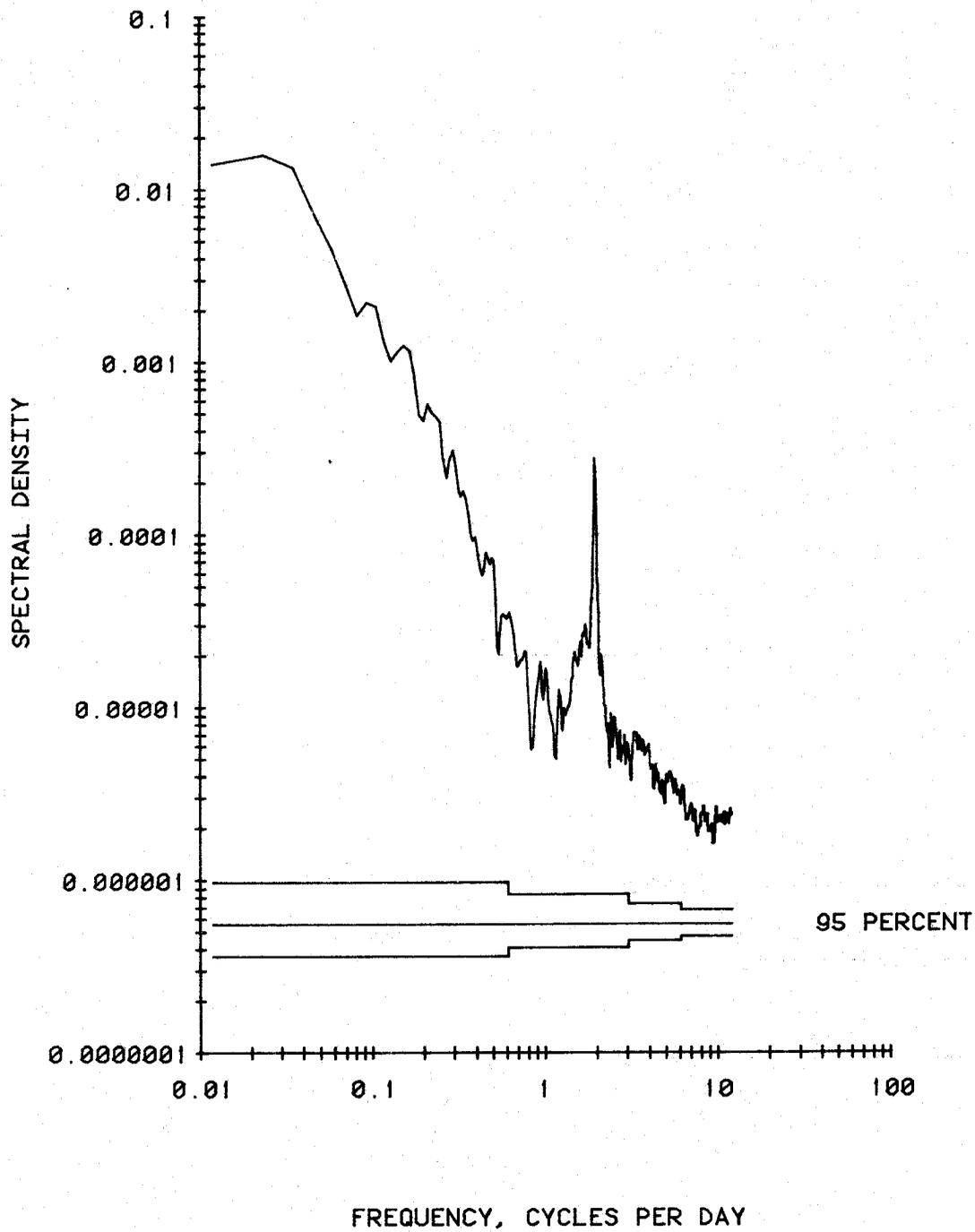
UNFILTERED CURRENT. 4058 M AT PIKOPIKO.



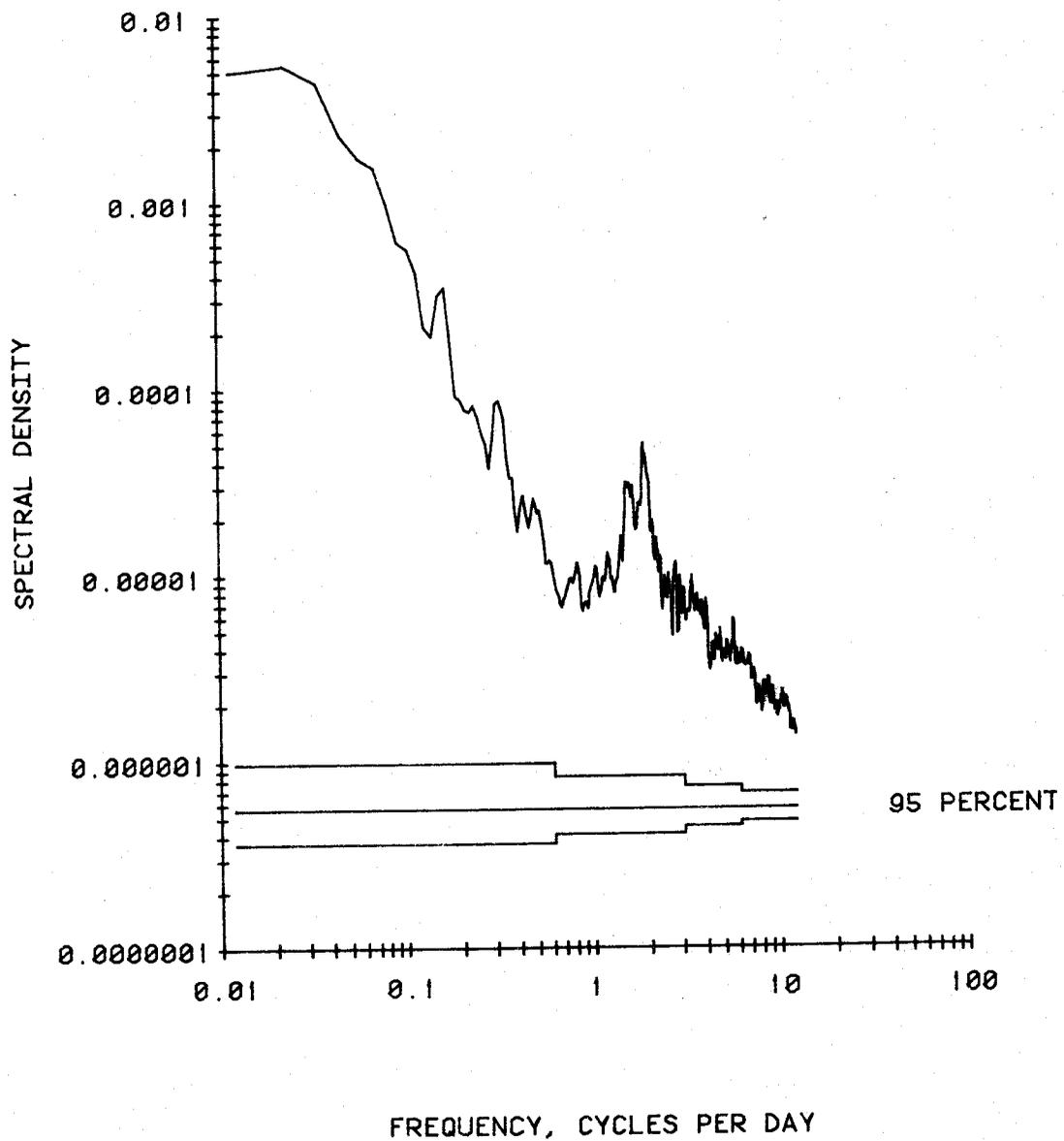
UNFILTERED TEMPERATURE. 1055 M AT PIKOPIKO.

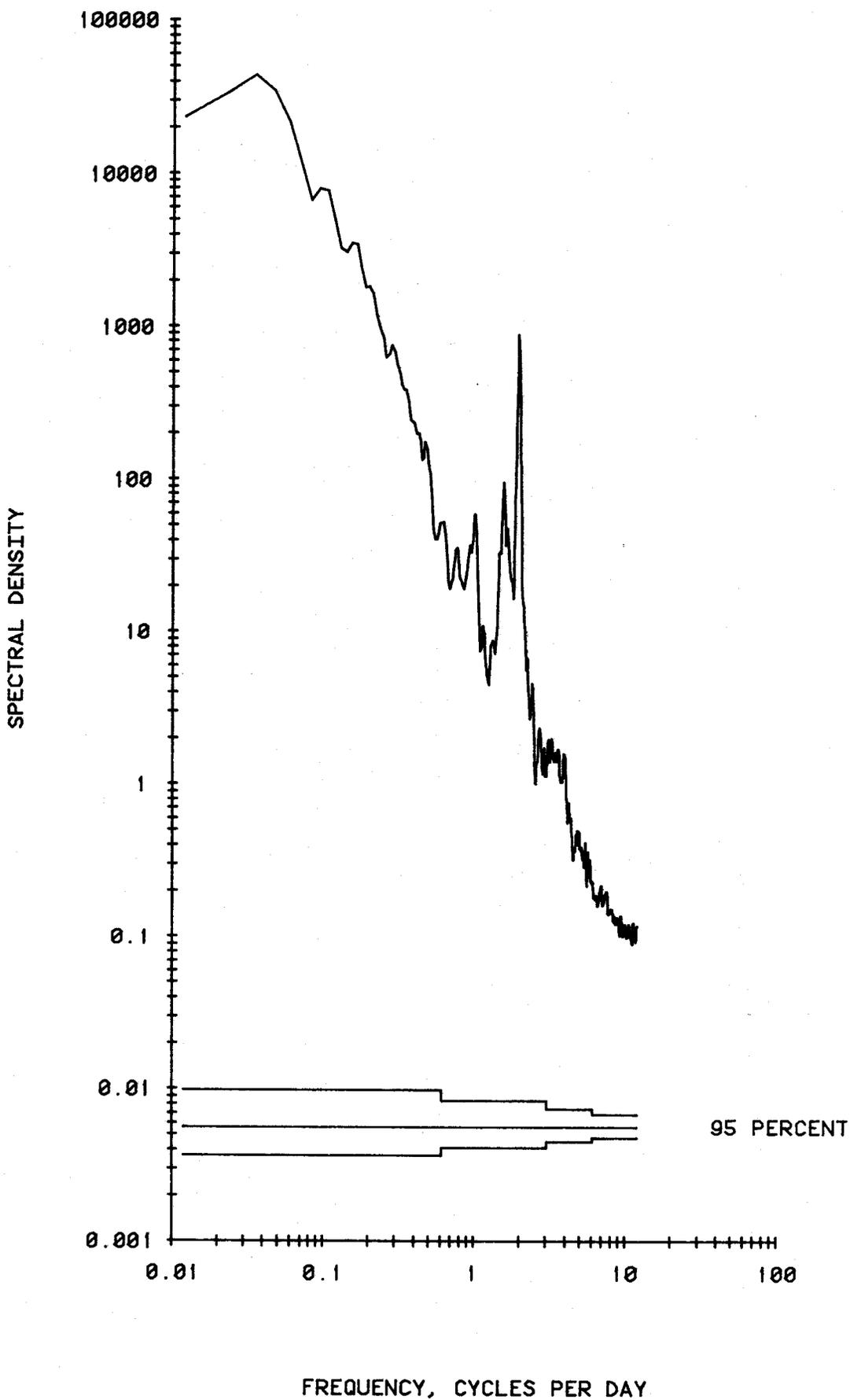


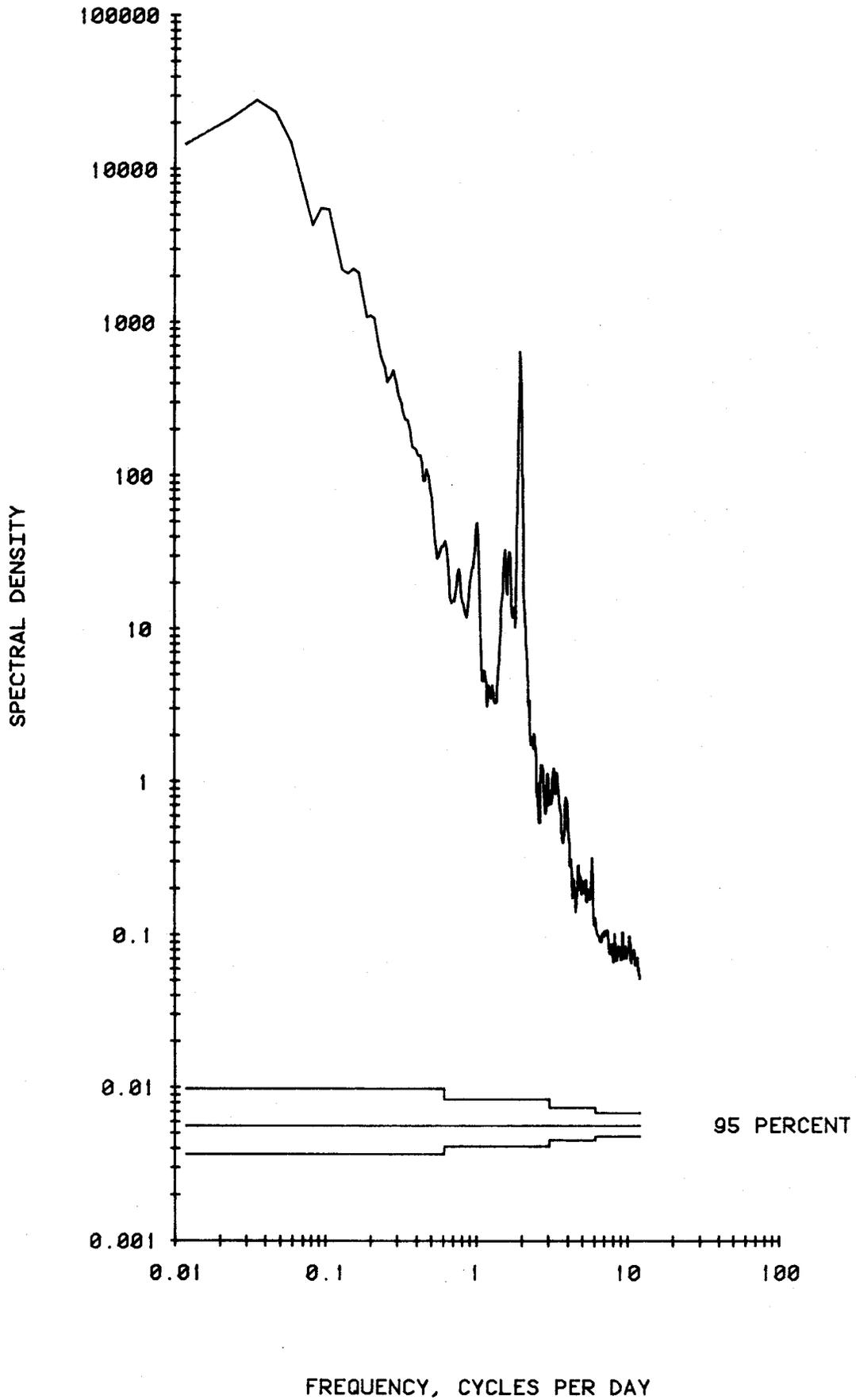
UNFILTERED TEMPERATURE. 2058 M AT PIKOPIKO.

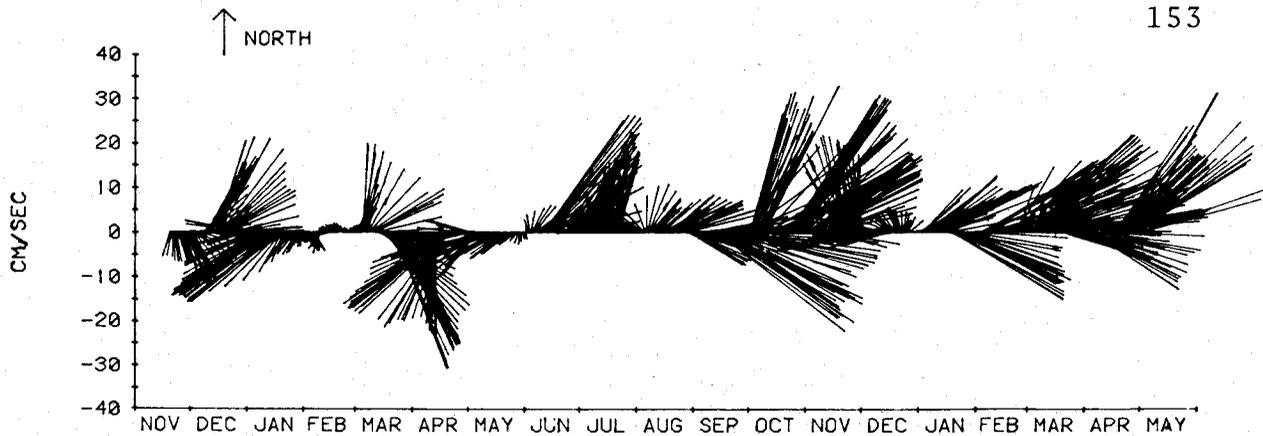


UNFILTERED TEMPERATURE. 4058 M AT PIKOPIKO.

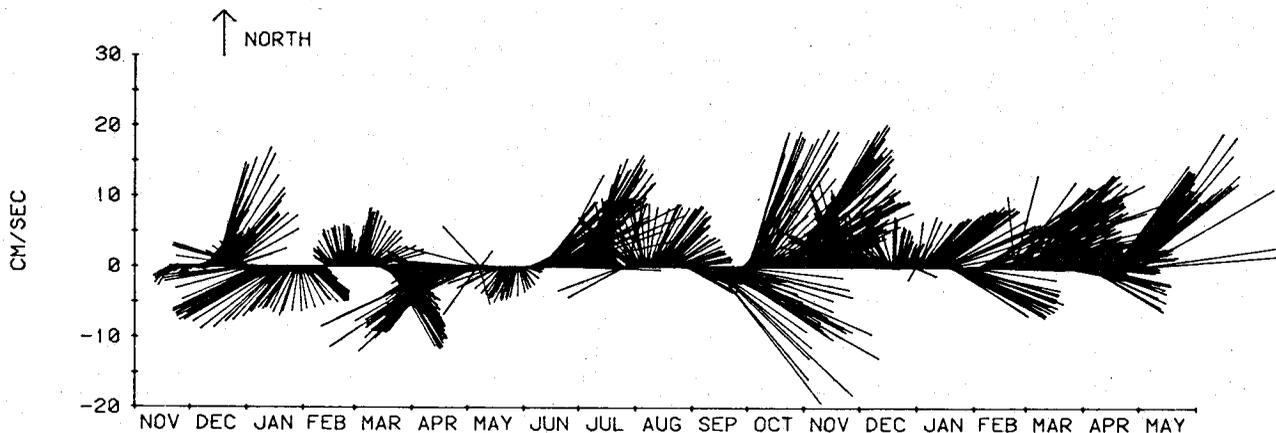




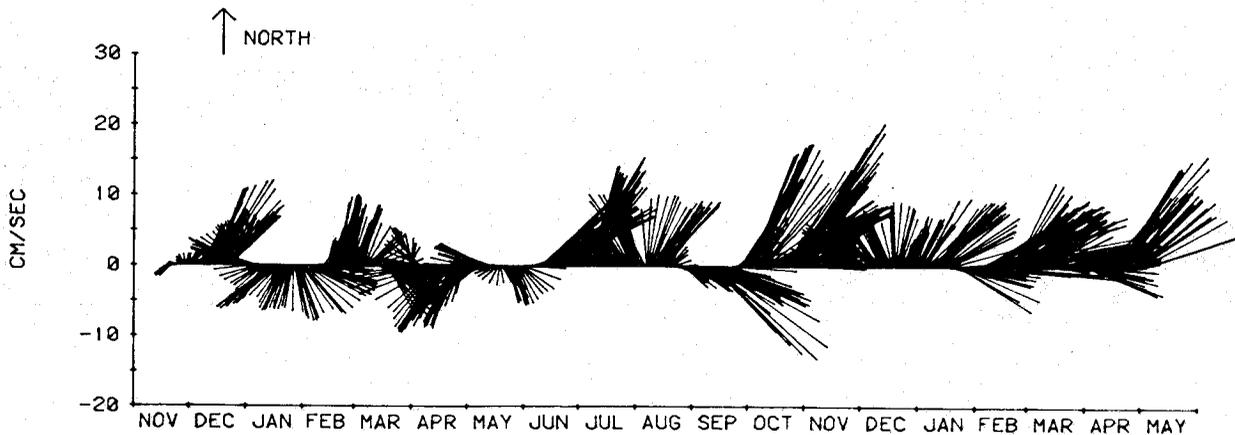




1055 METERS AT PIKOPIKO
LLP FILTERED CURRENT



2058 METERS AT PIKOPIKO
LLP FILTERED CURRENT



4058 METERS AT PIKOPIKO
LLP FILTERED CURRENT

SECTION II

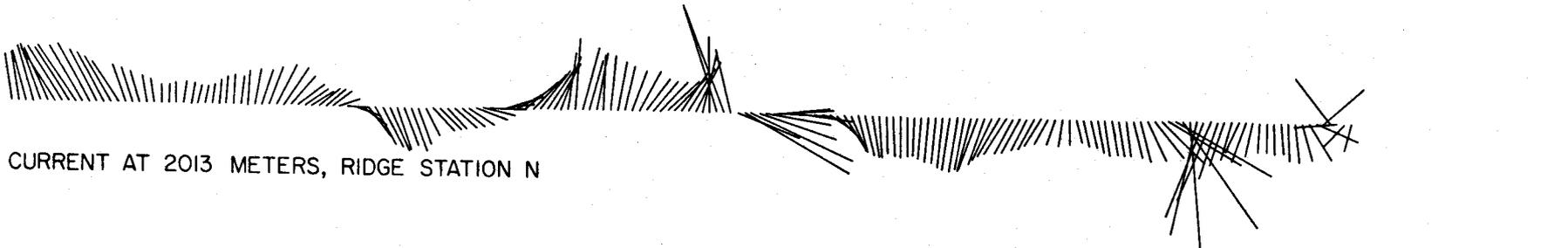
HORIZONTAL SCALE INFORMATION

27° TRUE

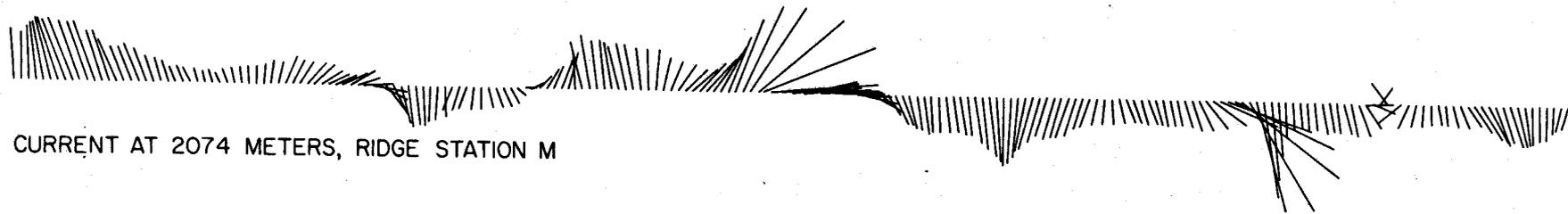


20 cm/sec

CURRENT AT 2040 METERS, RIDGE STATION W



CURRENT AT 2013 METERS, RIDGE STATION N



CURRENT AT 2074 METERS, RIDGE STATION M



CURRENT AT 2065 METERS, RIDGE STATION S

MAY

JUN

JUL

AUG

SEP

OCT

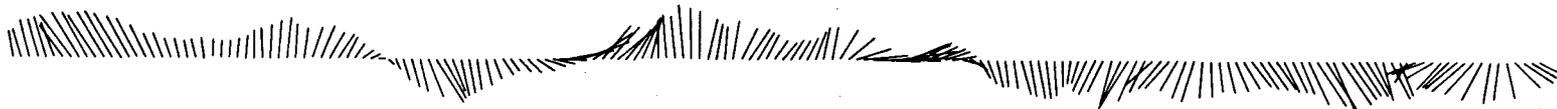
NOV

27° TRUE



CURRENT AT 4012 METERS, RIDGE STATION W

20 CM/SEC



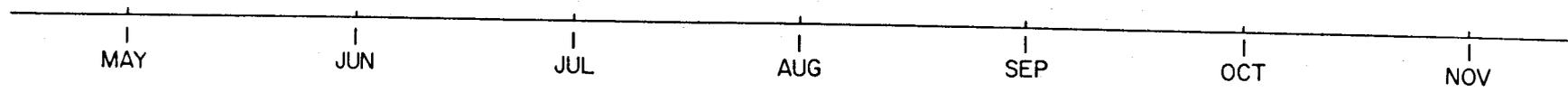
CURRENT AT 3972 METERS, RIDGE STATION N



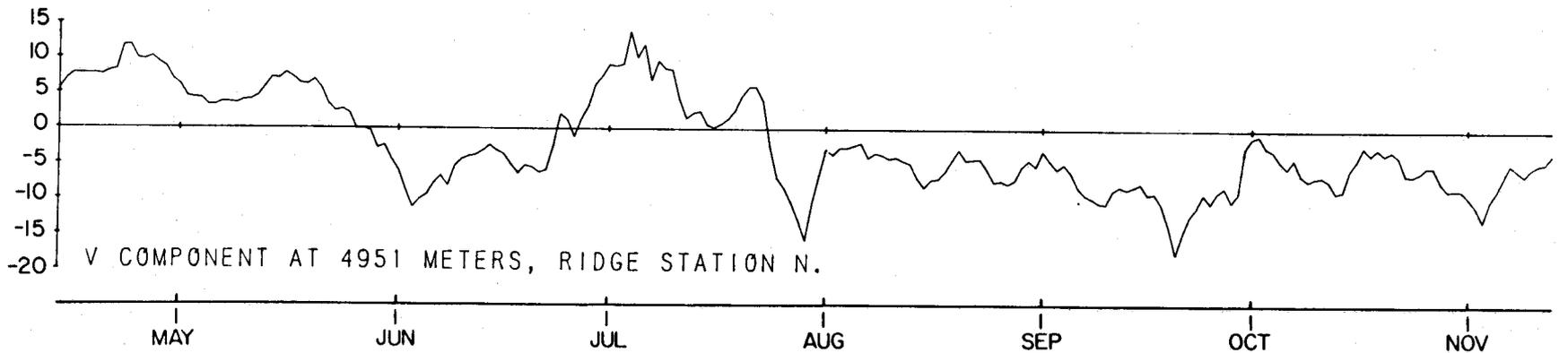
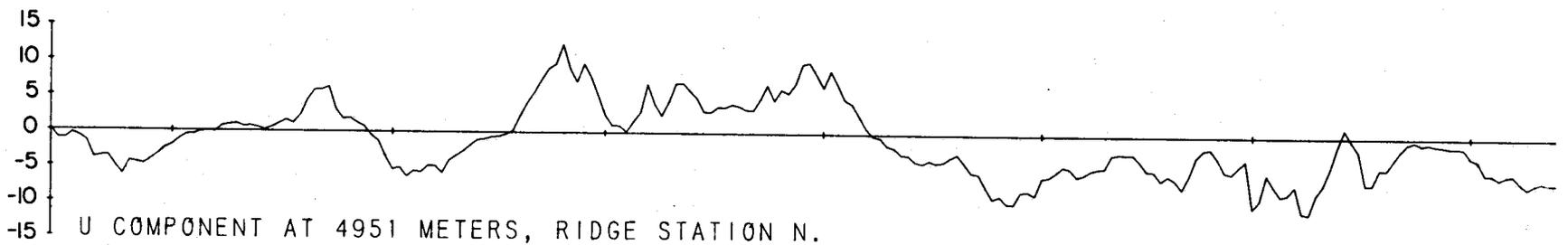
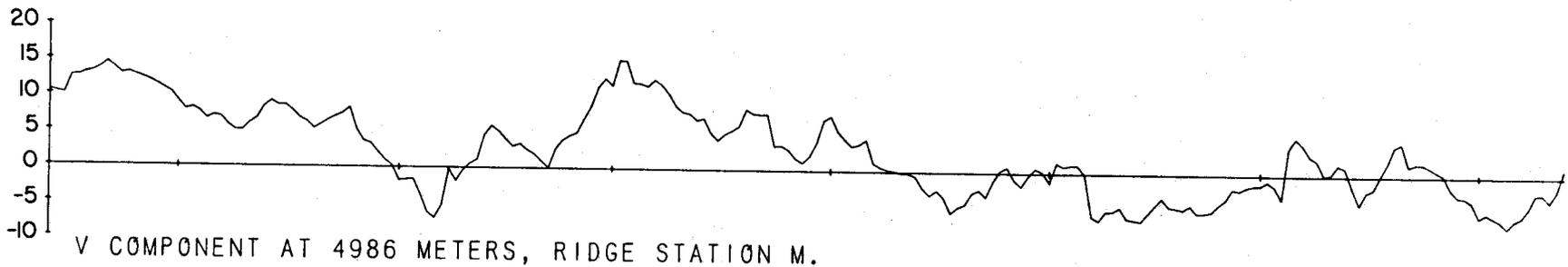
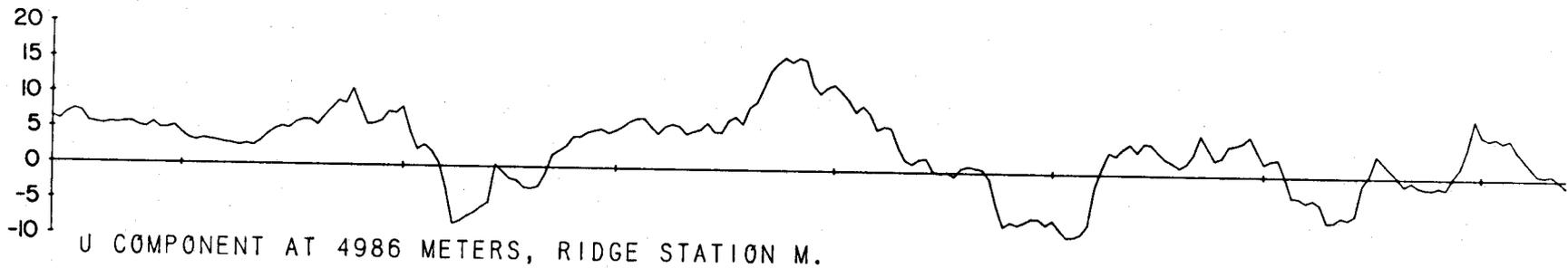
CURRENT AT 4038 METERS, RIDGE STATION M

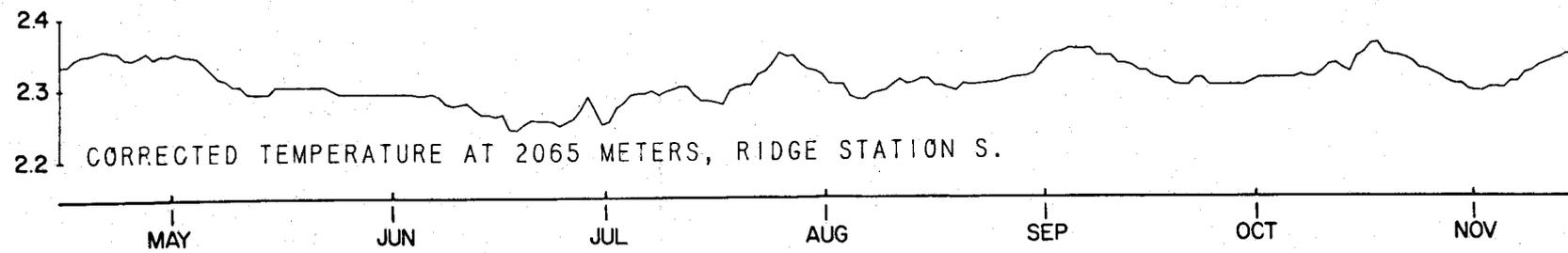
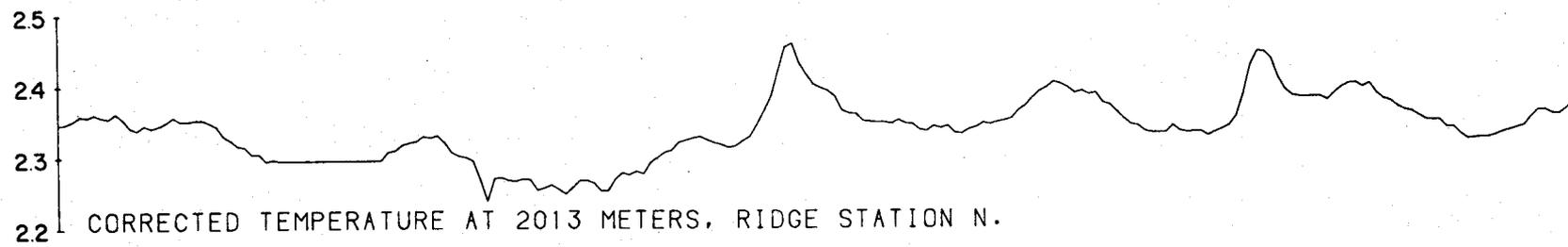
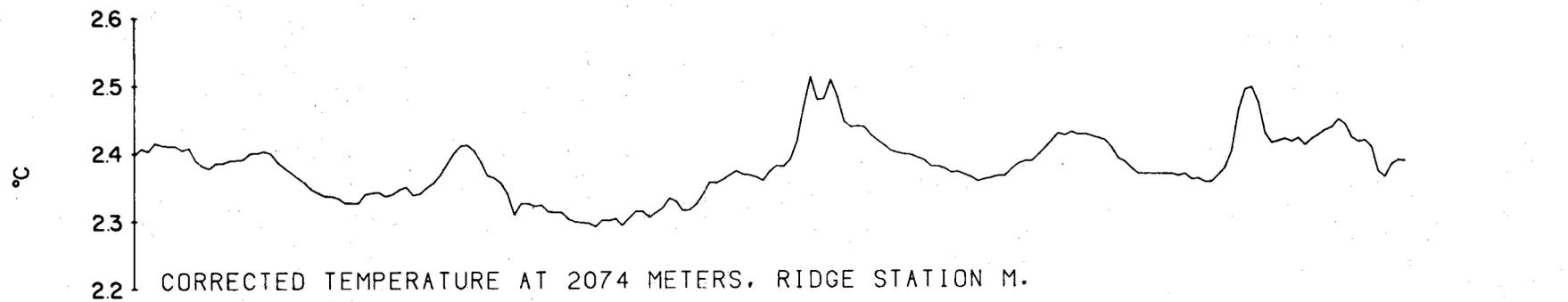
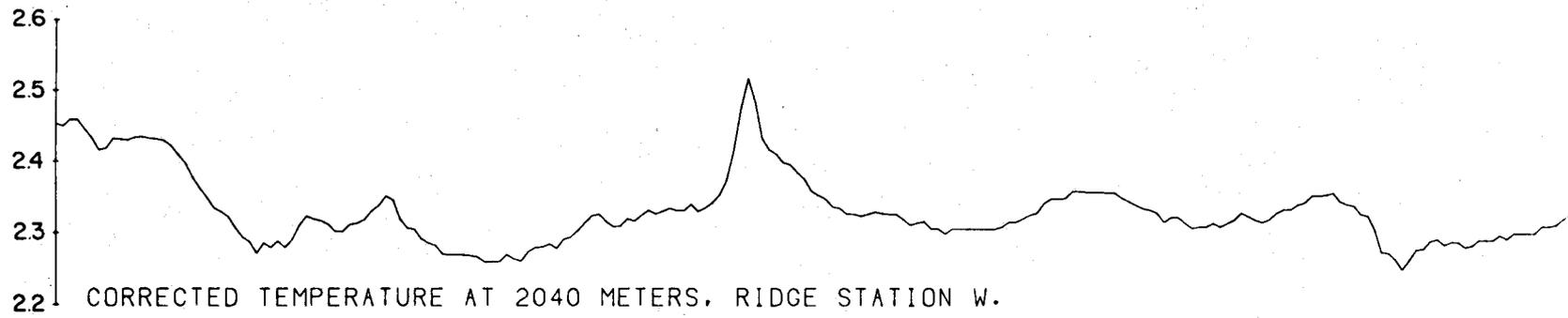


CURRENT AT 4000 METERS, RIDGE STATION K



CM/SEC





MAY

JUN

JUL

AUG

SEP

OCT

NOV

