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**A COMPILATION OF
OBSERVATIONS FROM
MOORED CURRENT METERS**

VOLUME XV

**CURRENTS, TEMPERATURE, AND
PRESSURE COLLECTED NEAR THE
EMPEROR SEA MOUNTS**

June 1982-November 1983

by
R. D. Pillsbury
J. S. Bottero
E. A. Selfert
D. C. Root

Date Report 118
Reference 85-13
September, 1985

National Science Foundation
Grant No. OCE 80-18227

College of Oceanography
Oregon State University
Corvallis, OR 97331

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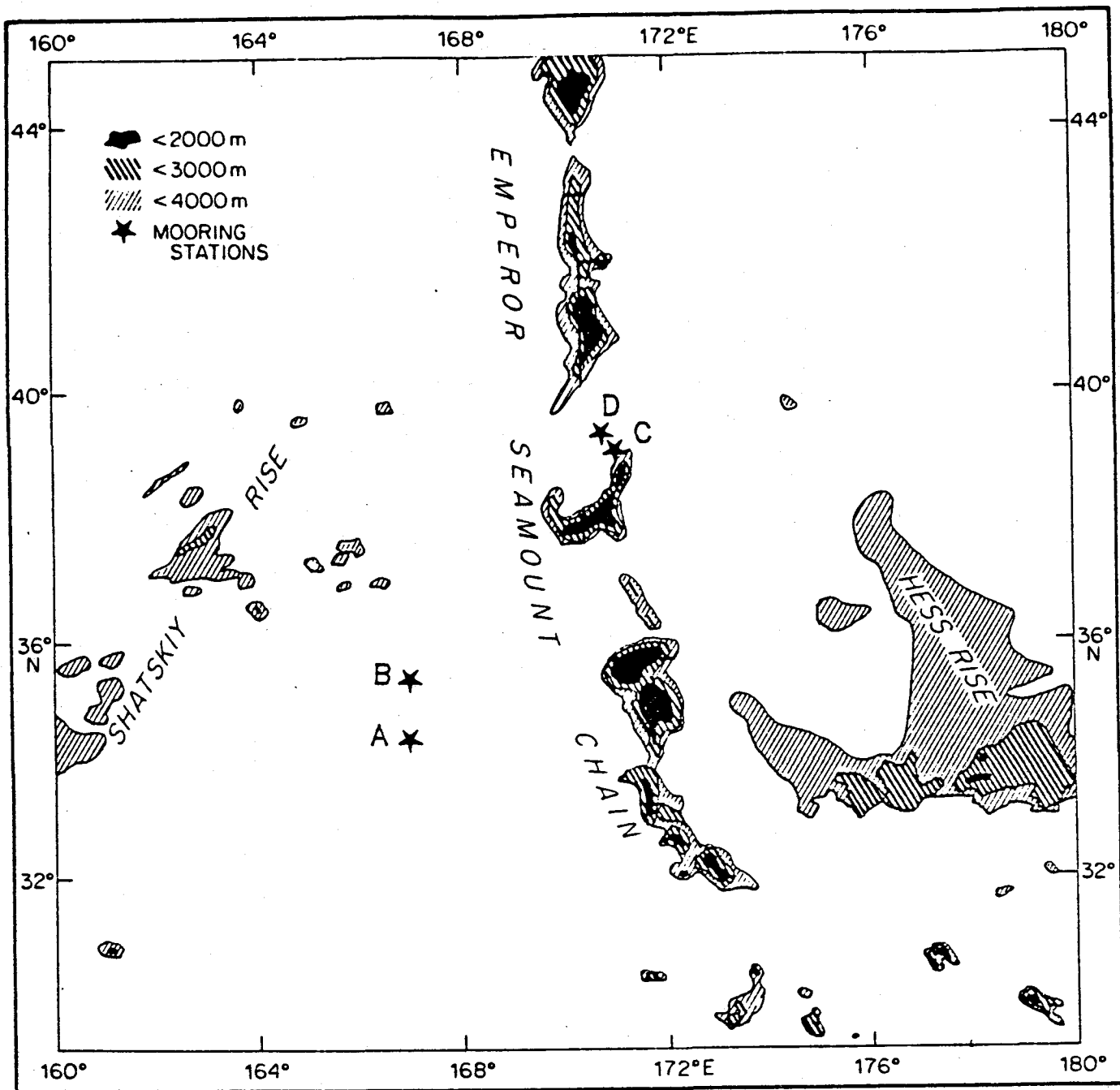
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Introduction

Emperor moorings A, B, C, and D were installed on Cruise No. 11168 aboard the R/V THOMPSON in June and July of 1982. They were recovered on Cruise No. 178 aboard the R/V THOMPSON seventeen months later in November 1983.

Moorings B and C were recovered in their entirety. Mooring A had been severed just below RCM 3135. The remaining line had dropped and become tangled in the rest of the mooring line below the acoustic release. When the release was fired the mooring rose slightly then fell back down. The bottom meter on mooring A was eventually recovered by dragging. During recovery mooring D behaved in the same manner as Mooring A.

In all, eight meters were recovered. Seven gave good data, one flooded. While the amount of data recovered from this experiment was not as complete as we would like, there are several reasons for the data loss. Due to a change in ship schedule the moorings were deployed 17 months rather than the 12 months initially planned. The deployment period exceeded the capacity of the current meters for data storage and for battery life. The recovery cruise was made in severe weather under tight time constraints. These conditions made grappling for mooring D impossible. An attempt made a year later was not successful.

These moorings were installed to collect data as a part of a more extensive experiment which included hydrographic

observations and analysis of historic data in the region of the Emperor Seamounts. The Emperor Seamount Chain is the major topographic feature which the Kuroshio and Subarctic fronts cross. The data from the moorings will provide a picture of changes in mean and eddy kinetic energy and velocity shear between the basins separated by the Seamounts.

For the reader who is not familiar with the operation of the Aanderaa current meter, the general calibration techniques for these meters are presented in Pillsbury, et al (1974). The pressure calibration techniques and the latest techniques for compass calibration are presented in Pillsbury, et al (1980).

The general design of the mooring follows that of the intermediate mooring developed at Woods Hole Oceanographic Institution (Heinmiller and Walden, 1973).

Description of the Processed Data

For each mooring a header page summarizes the mooring information and meter performance. On that page the depth of the instrument is recorded. Depths were obtained by one of 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 which 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. In every case the depths were rounded to the nearest ten or fifty meters depending on the range and accuracy of the pressure sensor.

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, maximum value, minimum value, and the number of hourly values of the record length for each variable measured. Positive east (u) is the true east-west velocity component and positive north (v) is the true north-south velocity component.

Progressive vector diagrams, speed, direction, temperature, and pressure histograms; progressive vector diagrams; stick figures; real time plots; rotary spectra; and conventional power spectra follow.

The stick figures and the time series plots were made from filtered data. Although the original measurements were made every hour, plots which show each point are too long to be easily included in this report. To reduce the plots and still present the important low frequency fluctuations, 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 6-hour intervals. Time series plots of u , v , T , and P are presented. The stick figures were made from filtered u and v . For clarity only two sticks per day are plotted.

The rotary (two-sided) spectra have 32 degrees of freedom, which yields a 95% confidence interval of about 4.3 decibels. Confidence intervals for the other spectra (kinetic energy, temperature, and pressure) vary with frequency and are shown explicitly on the plots.

ACKNOWLEDGEMENTS

The funds for the current meter mooring work and this data report came from a National Science Foundation grant OCE 80-18227 which is gratefully acknowledged. Appreciation is also expressed to the Captain and crew of the R/V THOMPSON. The installation of the moorings was done under the supervision of E. A. Seifert. He and Dennis Root along with members of the WHOI buoy group are acknowledged for the effort on the recovery cruise.

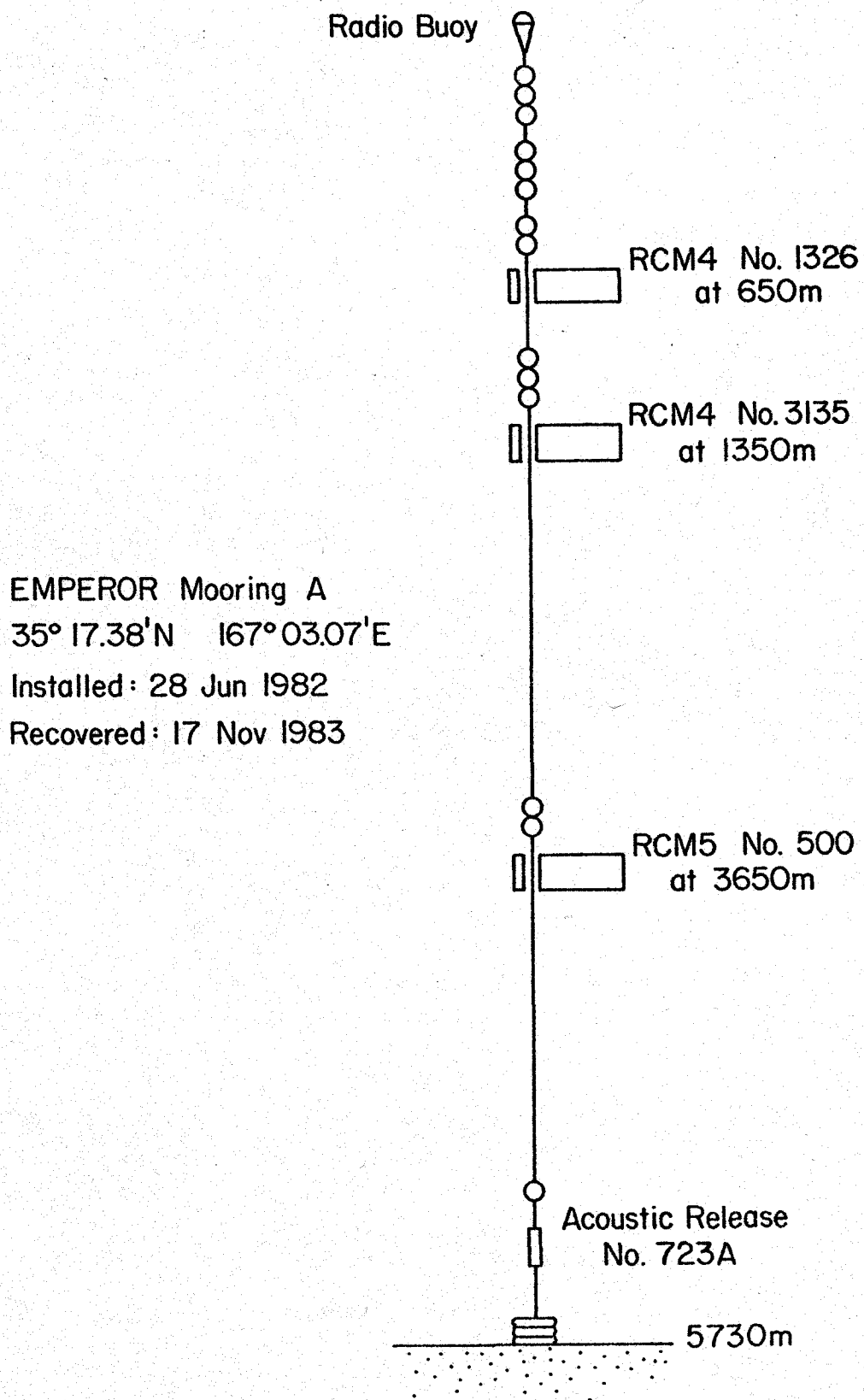
References

Heinmiller, R. G. and R. G. Walden. 1973. Details of Woods Hole Moorings. Woods Hold Oceanographic Institution Technical Report 73-71. 19pp.

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.

Pillsbury, R. D., F. Sciremammano, Jr., J. S. Bottero, R. E. Still. 1980. A Compilation of Observations from Moored Current Meters, Vol. XII, Currents, Temperature and Pressure in the Drake Passage during FDRAKE '77, '78. Oregon State University, School of Oceanography, Corvallis. Data Report 82. Reference 80-11.

MOORING A.



EMPEROR MOORING A

Position: 35°17.38 N, 167°03.76 E
Depth of Water: 5730 m
Set at: 0447 UCT 28 JUN '82 by R/V T.G. THOMPSON
Retrieved at: 1932 UCT 17 NOV '83 by R/V T.G. THOMPSON
Data Interval: 0903 UCT 28 JUN '82 to 2303 UCT 9 SEP '83

Instrumentation

<u>Depth</u>	<u>Serial No./Tape No.</u>
650 m	RCM4 1326/
1350 m	RCM4 3135/
3650 m	RCM5 500/62

Instrument 1326 was not recovered.

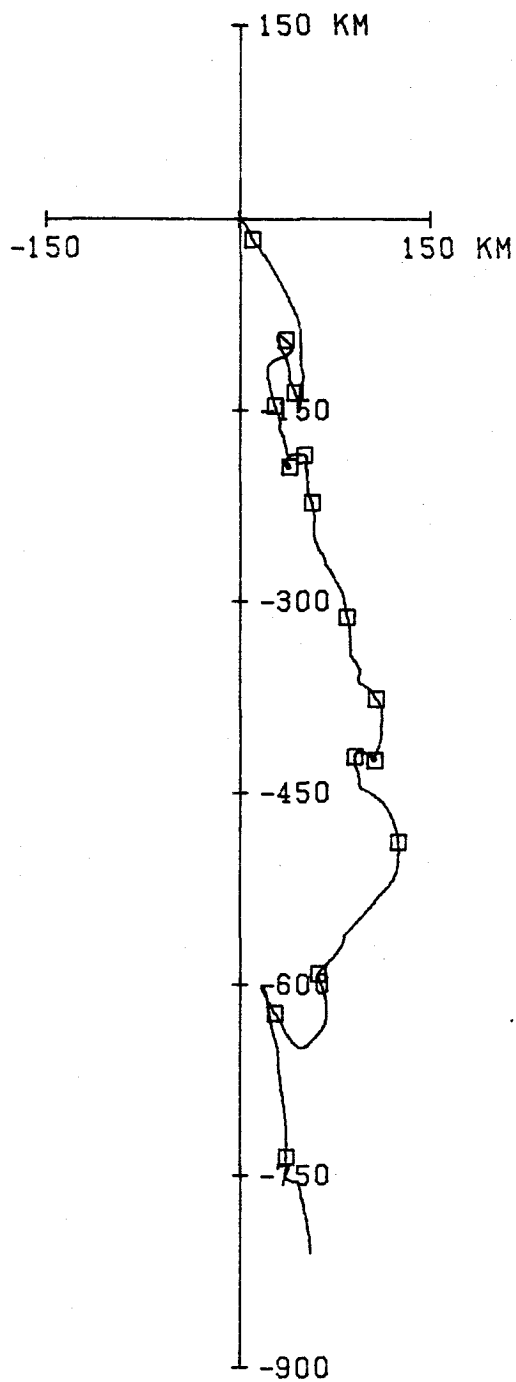
Instrument 3135 was not recovered.

Instrument 500 recorded speed, direction, temperature and pressure until 2303 UCT 9 SEP '83 when the battery apparently failed. Due to instrument malfunction one section of the temperature record has been set to zero: lines 6664 (0003 UCT 2 APR 83) through 8434 (2303 UCT 14 JUN '83).

EMPEROR MOORING A

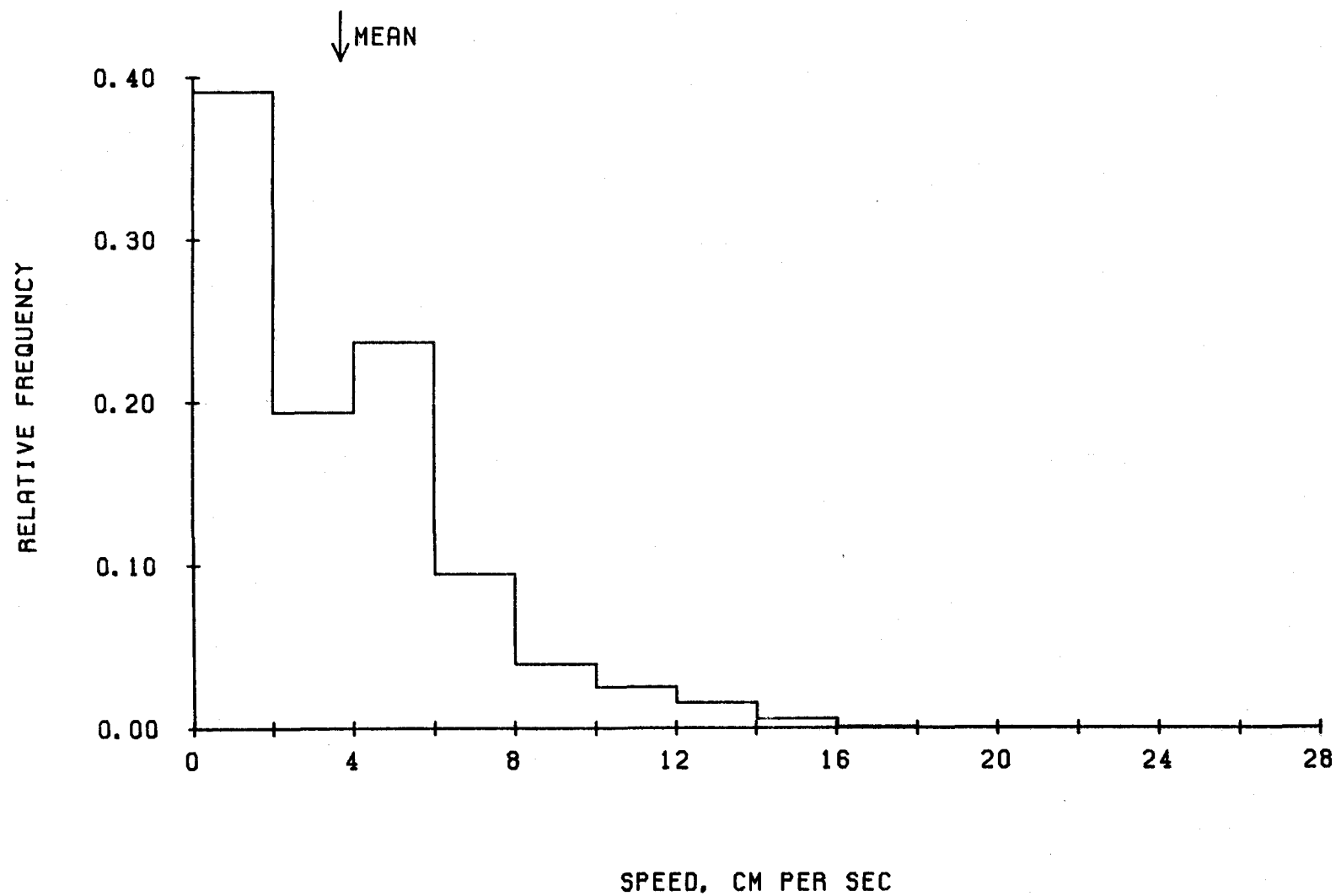
3650 METERS

	MIN	MEAN	MAX	SD	N
S(cm/sec)	0.70	3.67	16.80	2.98	10527
u(cm/sec)	-8.80	0.15	14.90	2.24	10527
v(cm/sec)	-16.70	-2.14	8.90	3.56	10527
T(°C)	1.44	1.46	1.52	0.01	8756
P(decibars)	3702.00	3769.10	4201.00	62.92	10527

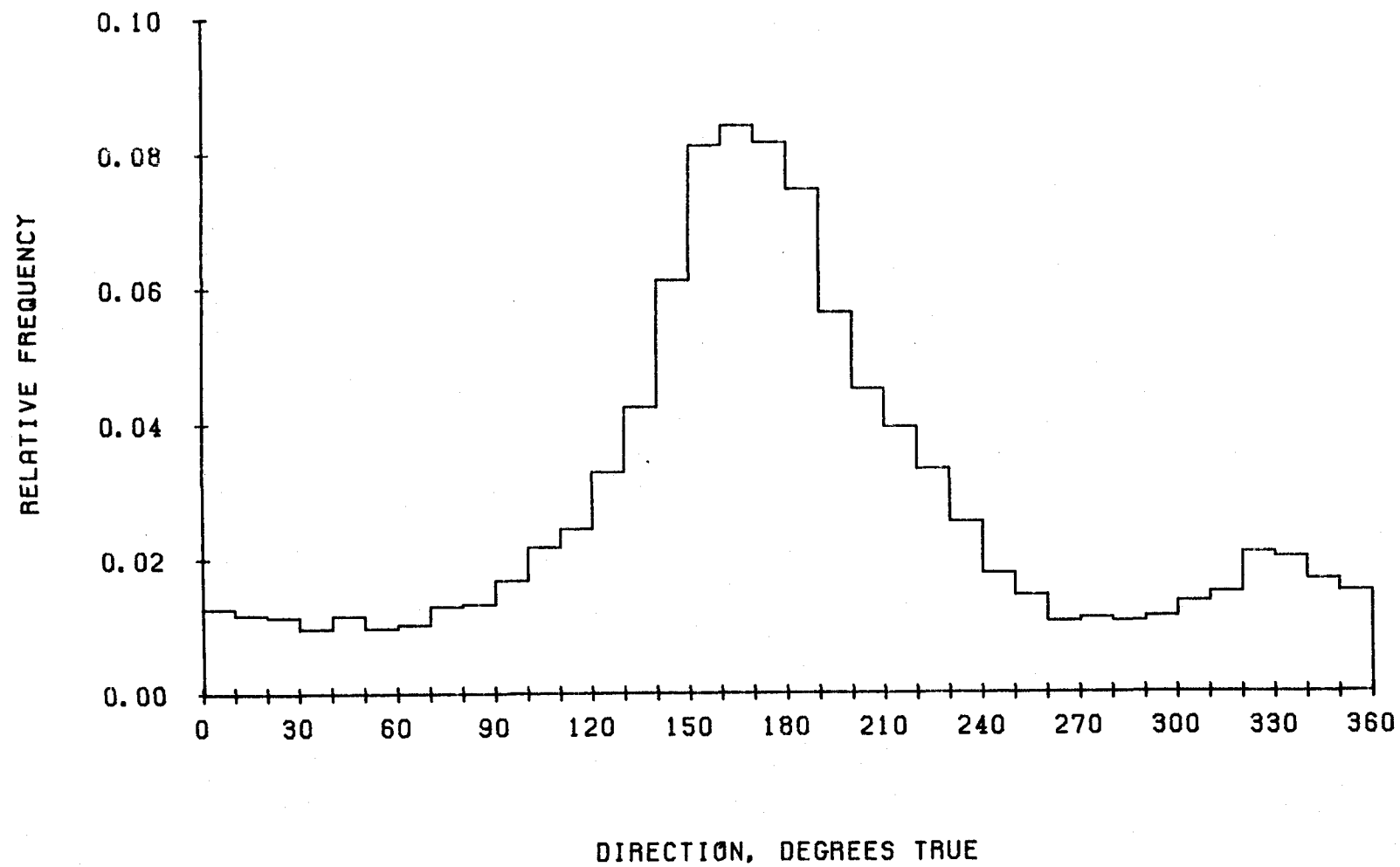


3650 M AT EMPEROR MOORING A. 28 JUN 82 - 9 SEP 83.

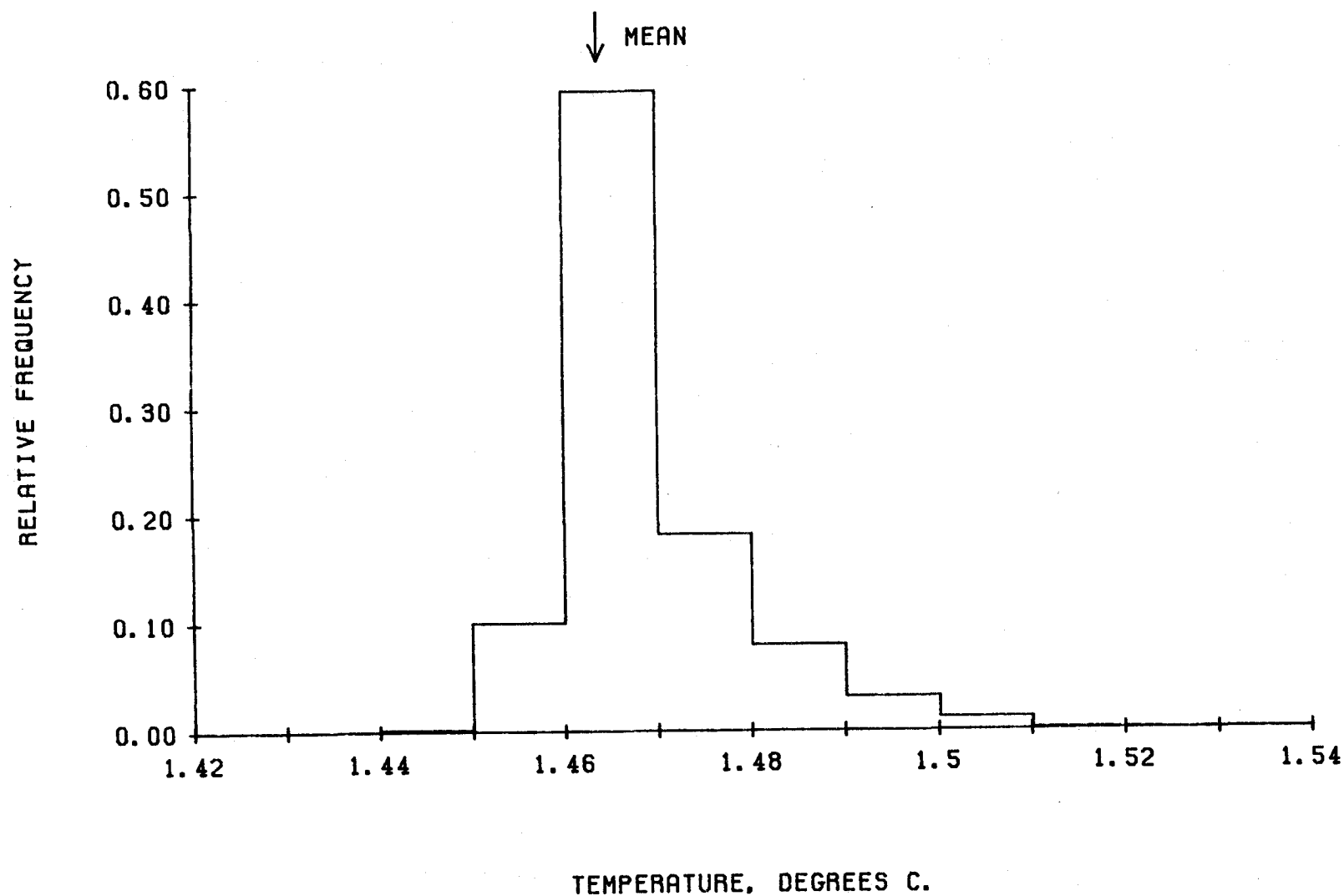
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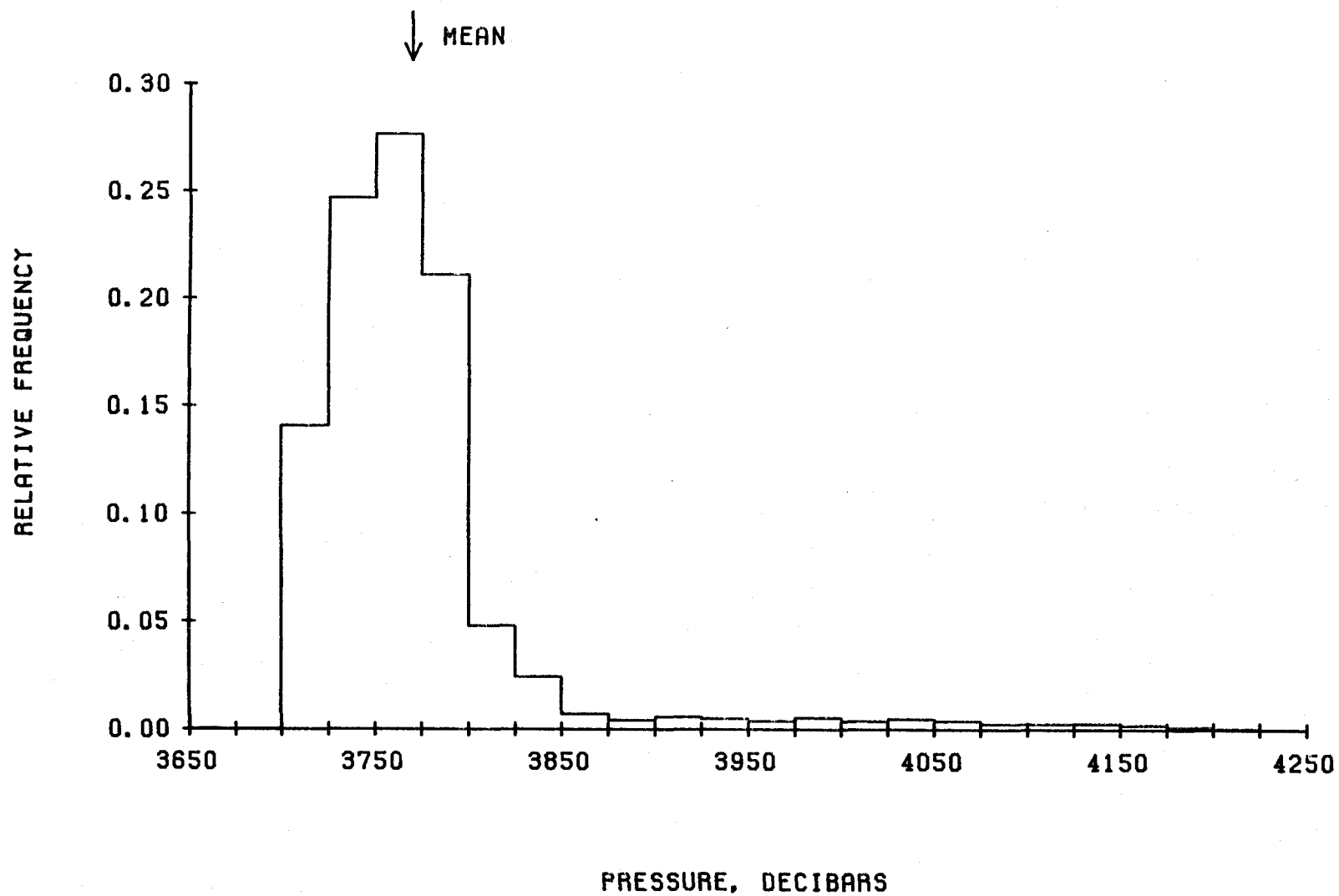
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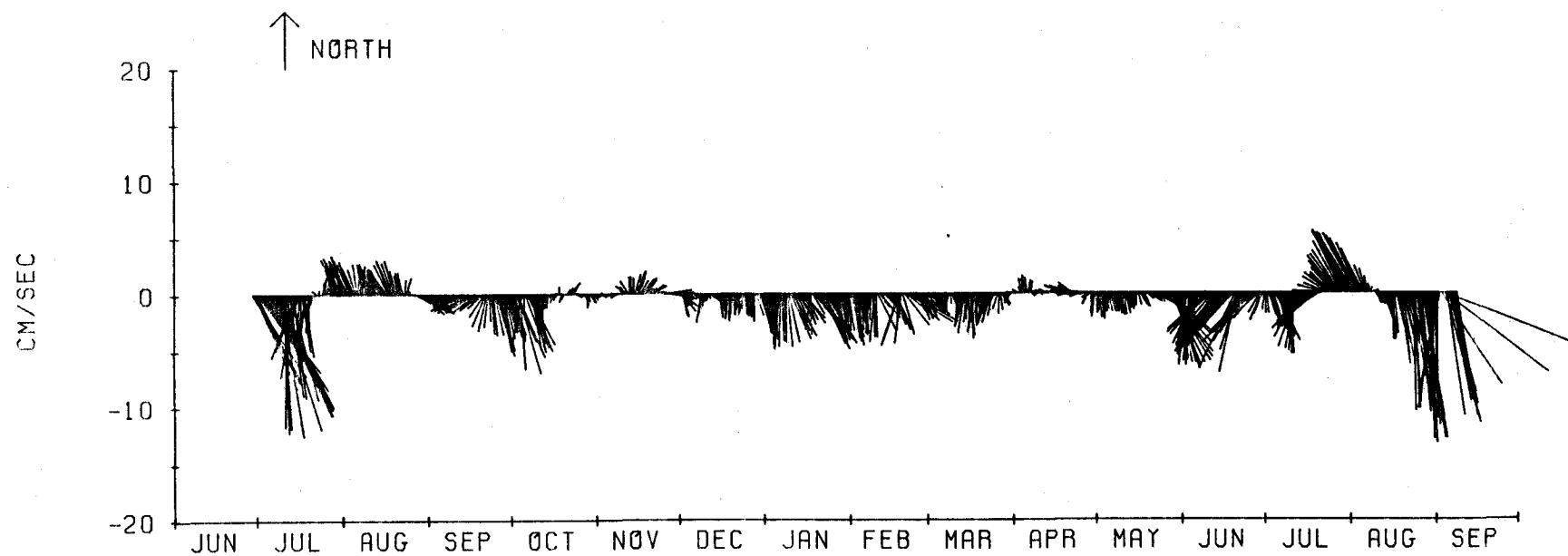


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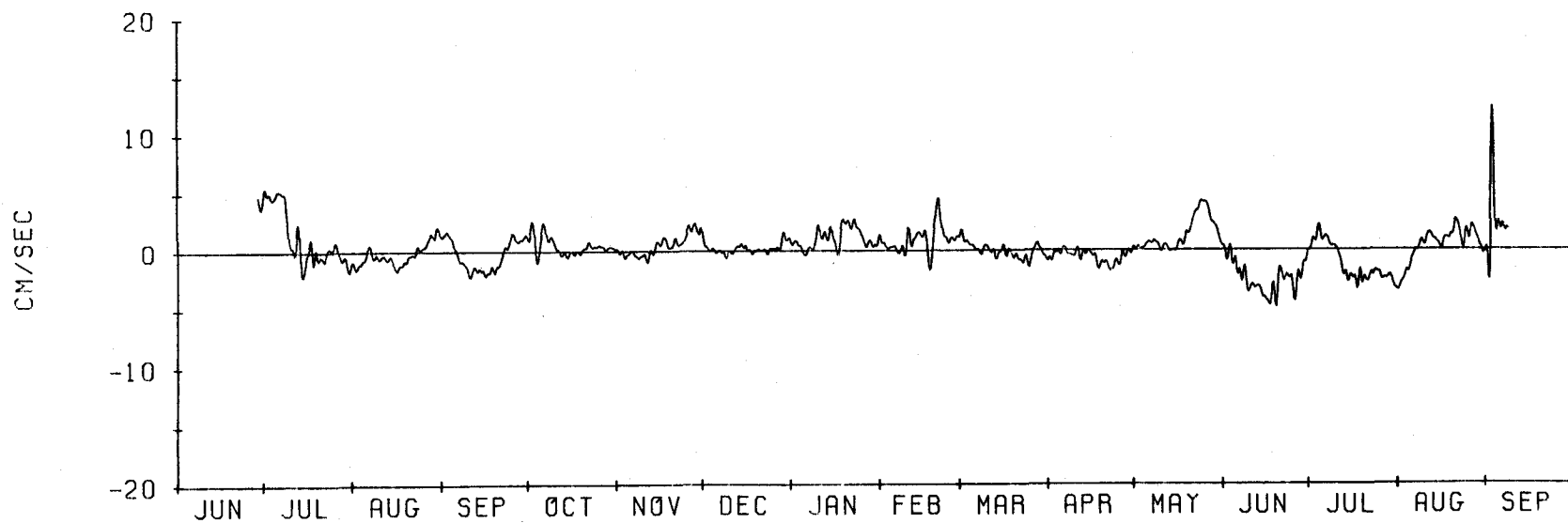


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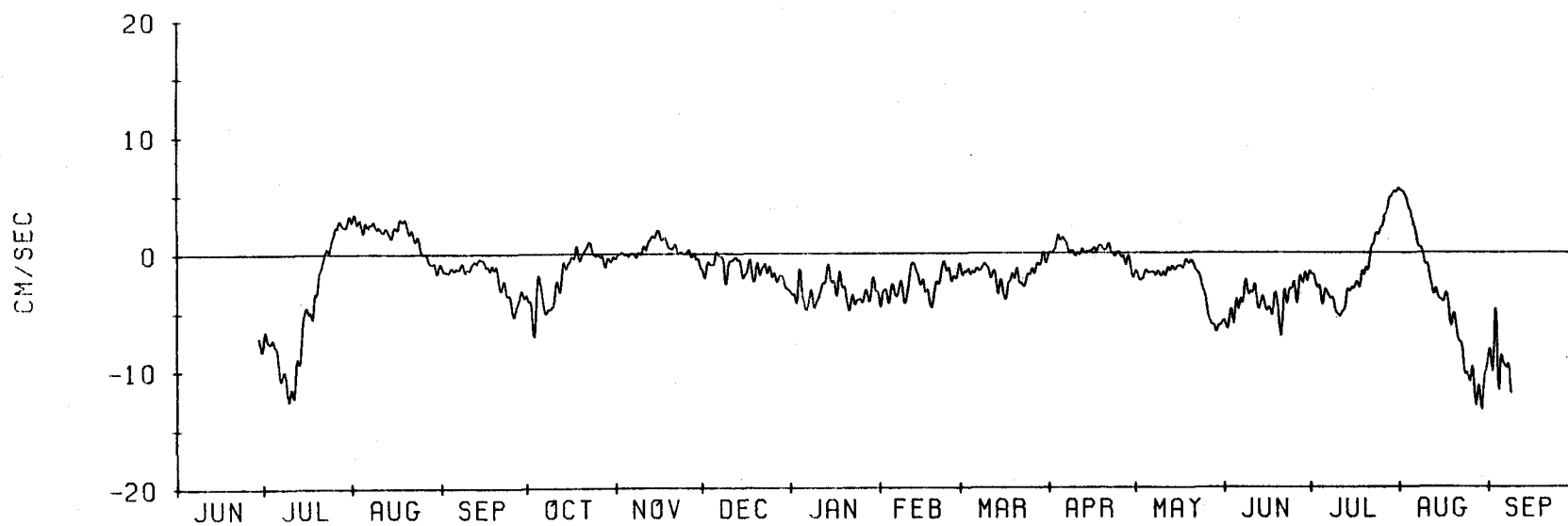




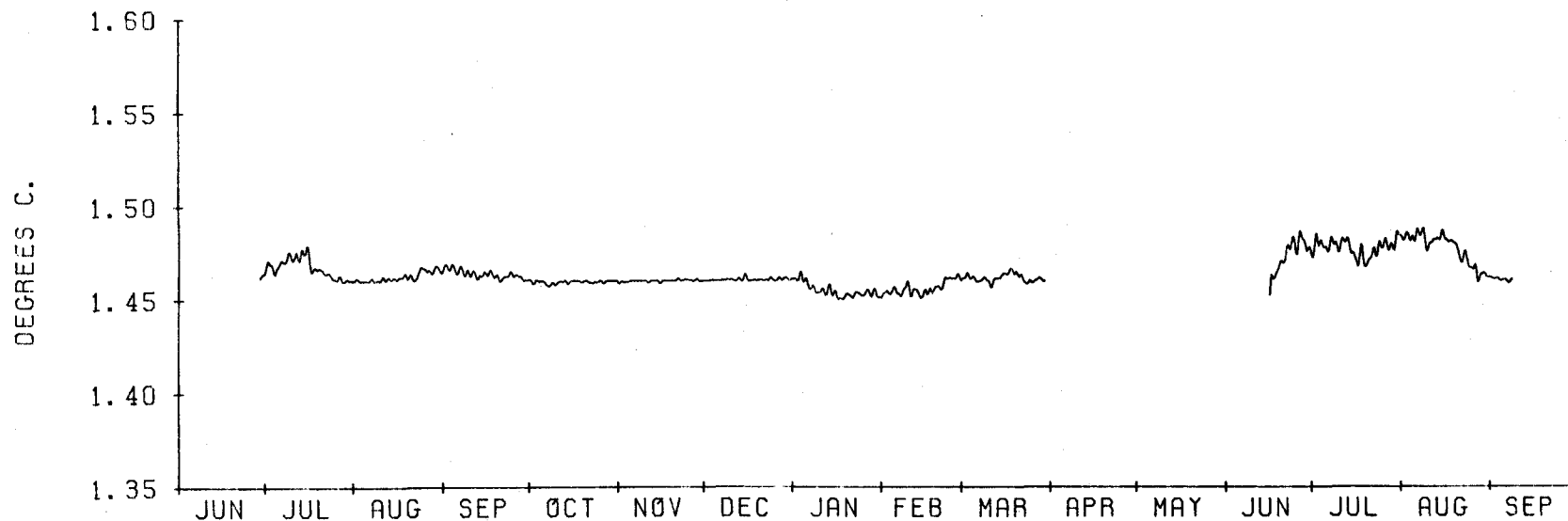
3650 METERS AT EMPEROR MOORING A.
LLP FILTERED CURRENT



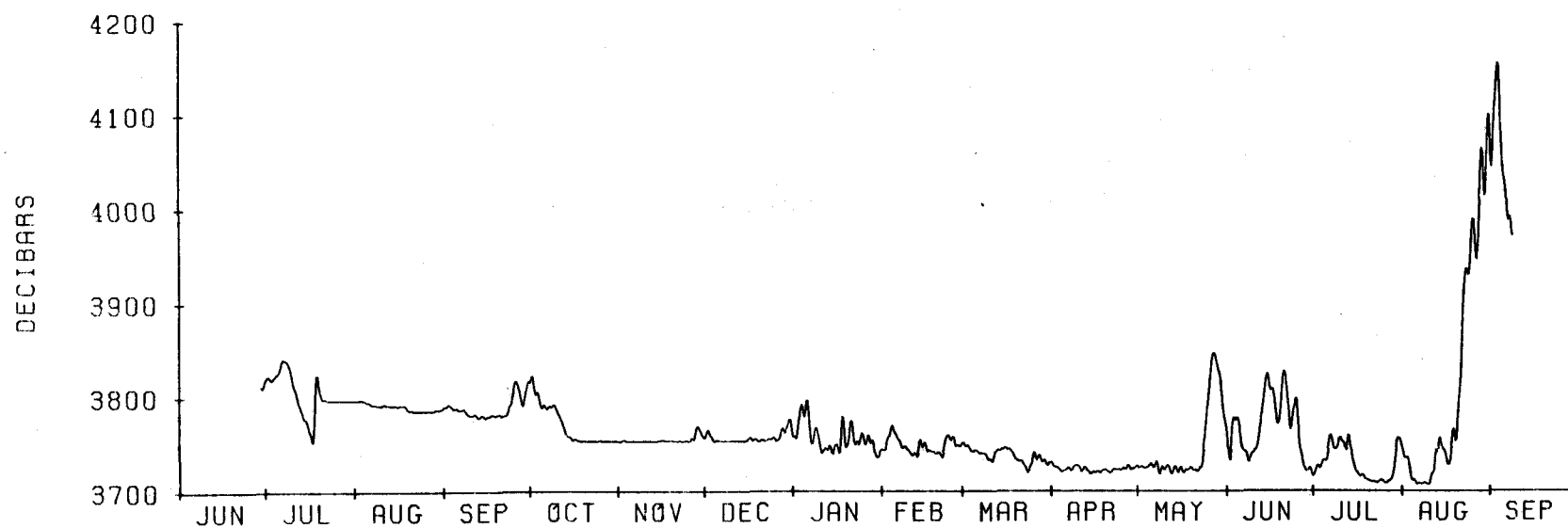
3650 METERS AT EMPEROR MOORING A.
LLP FILTERED U COMPONENT



3650 METERS AT EMPEROR MOORING A.
LLP FILTERED V COMPONENT

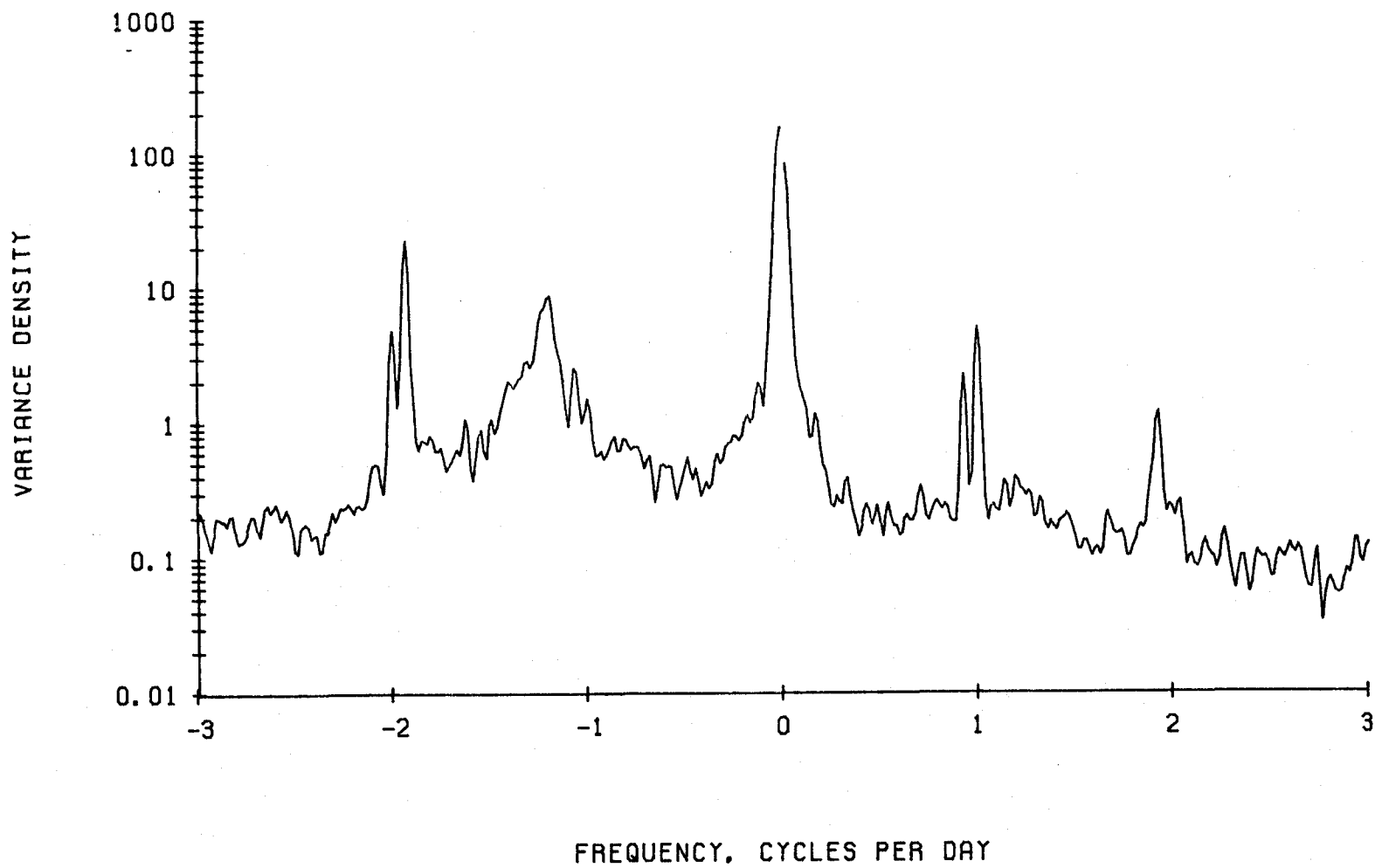


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LLP FILTERED TEMPERATURE

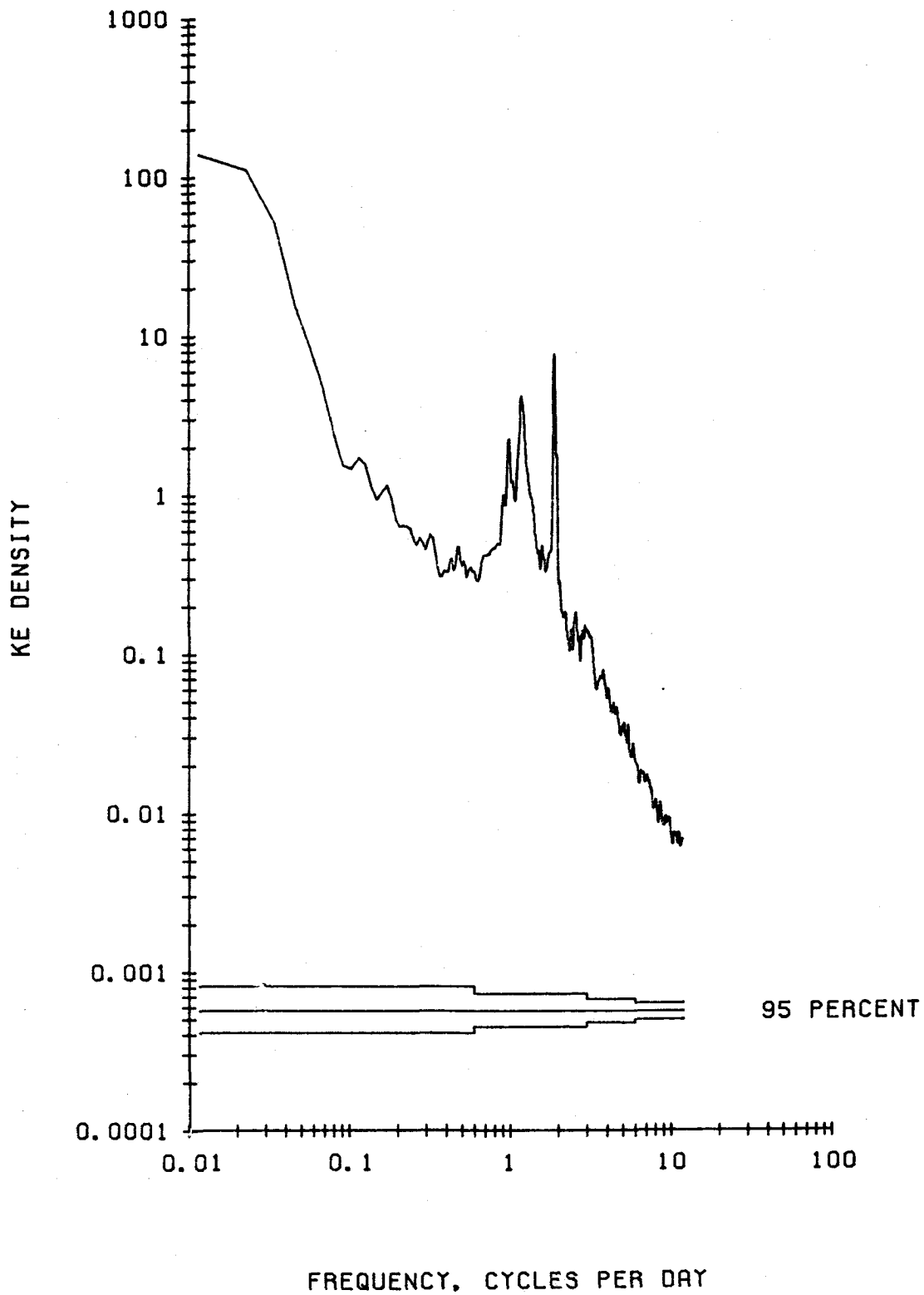


3650 METERS AT EMPEROR MOORING A.
LLP FILTERED PRESSURE

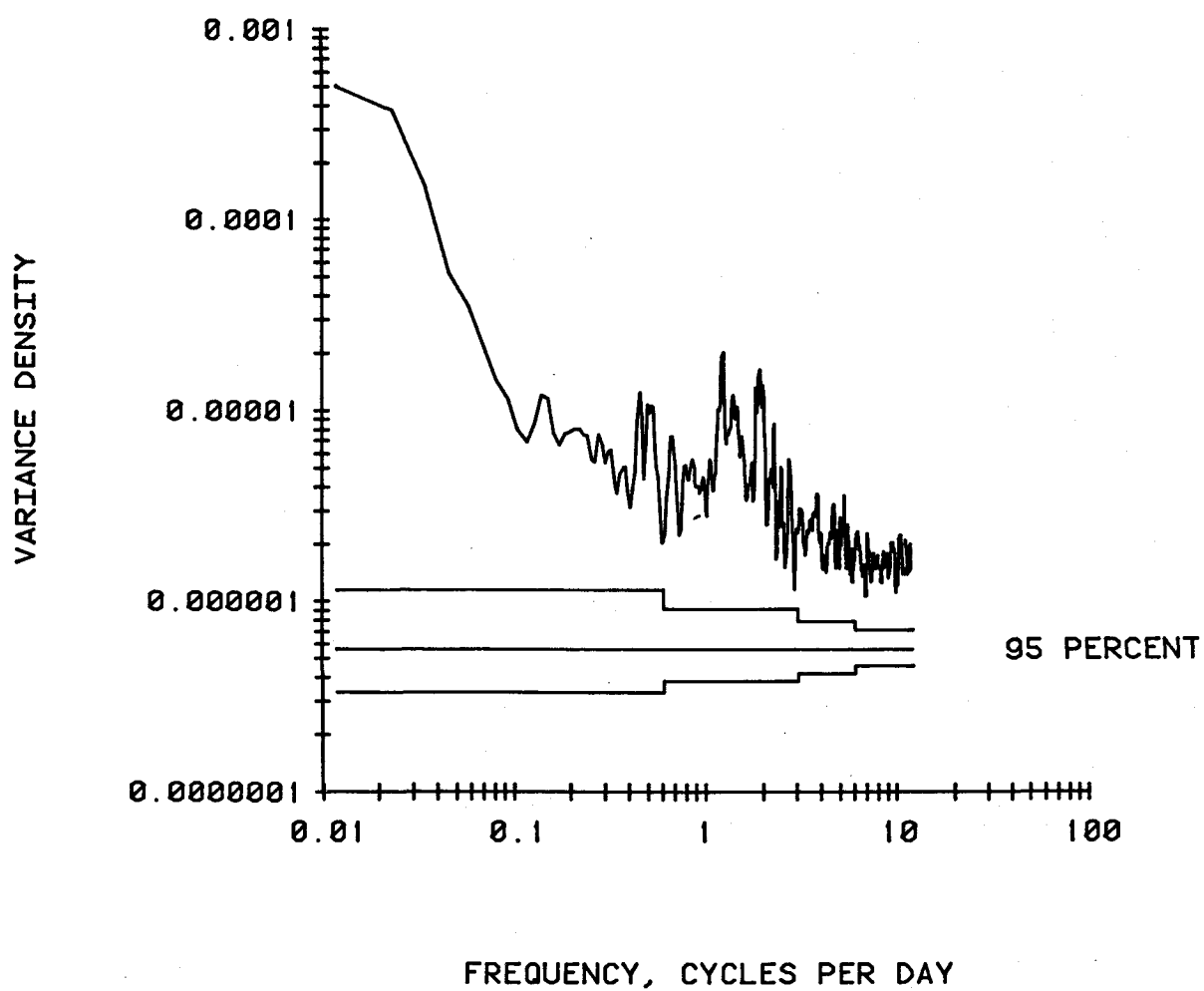
UNFILTERED CURRENT. 3650 M AT EMPEROR MOORING A.



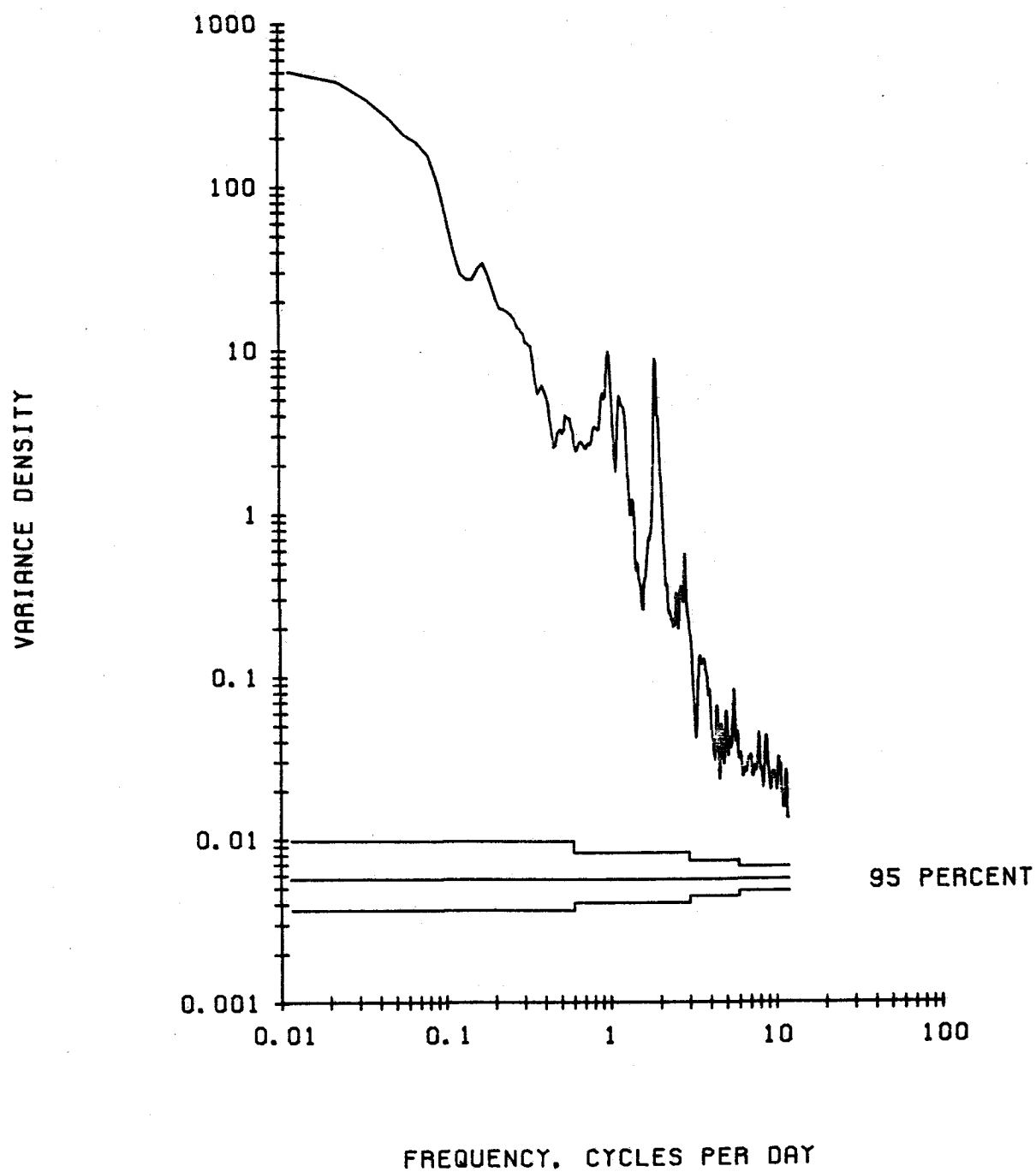
UNFILTERED CURRENT. 3650 M AT EMPEROR MOORING A.



UNFILTERED TEMPERATURE. 3650 M AT EMPEROR MOORING A.

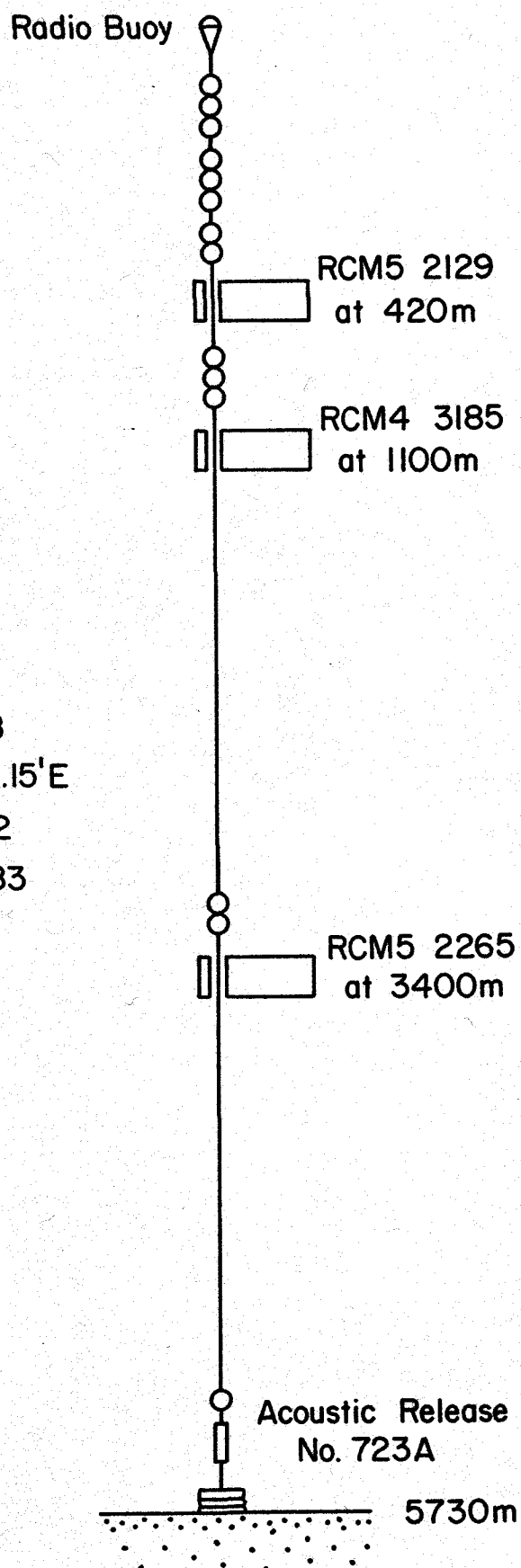


UNFILTERED PRESSURE. 3650 M AT EMPEROR MOORING A.



MOORING B.

EMPEROR Mooring B
34° 19.71' N 167° 02.15' E
Installed: 30 Jun 1982
Recovered: 16 Nov 1983



EMPEROR MOORING B

Position: 34°19.71'N, 167°02.15'E
Depth of Water: 5730
Set at: 0406 UCT 30 JUN '82 by R/V T.G. THOMPSON
Retrieved at: 0119 UCT 16 NOV '83 by R/V T.G. THOMPSON
Data Interval: 0800 UCT 30 JUN '82 to 0102 UCT 16 NOV '83

Instrumentation

<u>Depth</u>	<u>Serial No./Tape No.</u>
420 m	RCM5 2129/3
1100 m	RCM4 3185/9
3400 m	RCM5 2265/17

Instrument 2129 recorded speed, direction, temperature, and pressure until 2100 UCT 13 AUG '83 after which time the battery apparently failed.

Instrument 3185 recorded speed, direction, temperature, and pressure until the instrument was recovered.

Instrument 2265 recorded speed, direction, temperature and pressure until 0000 UCT 13 JUN '83 when the battery apparently failed. The raw direction histogram showed spikes at multiples of 32. These values were removed by interpolation. The resulting distribution of directions still shows an anomalous periodicity.

EMPEROR MOORING B

420 METERS

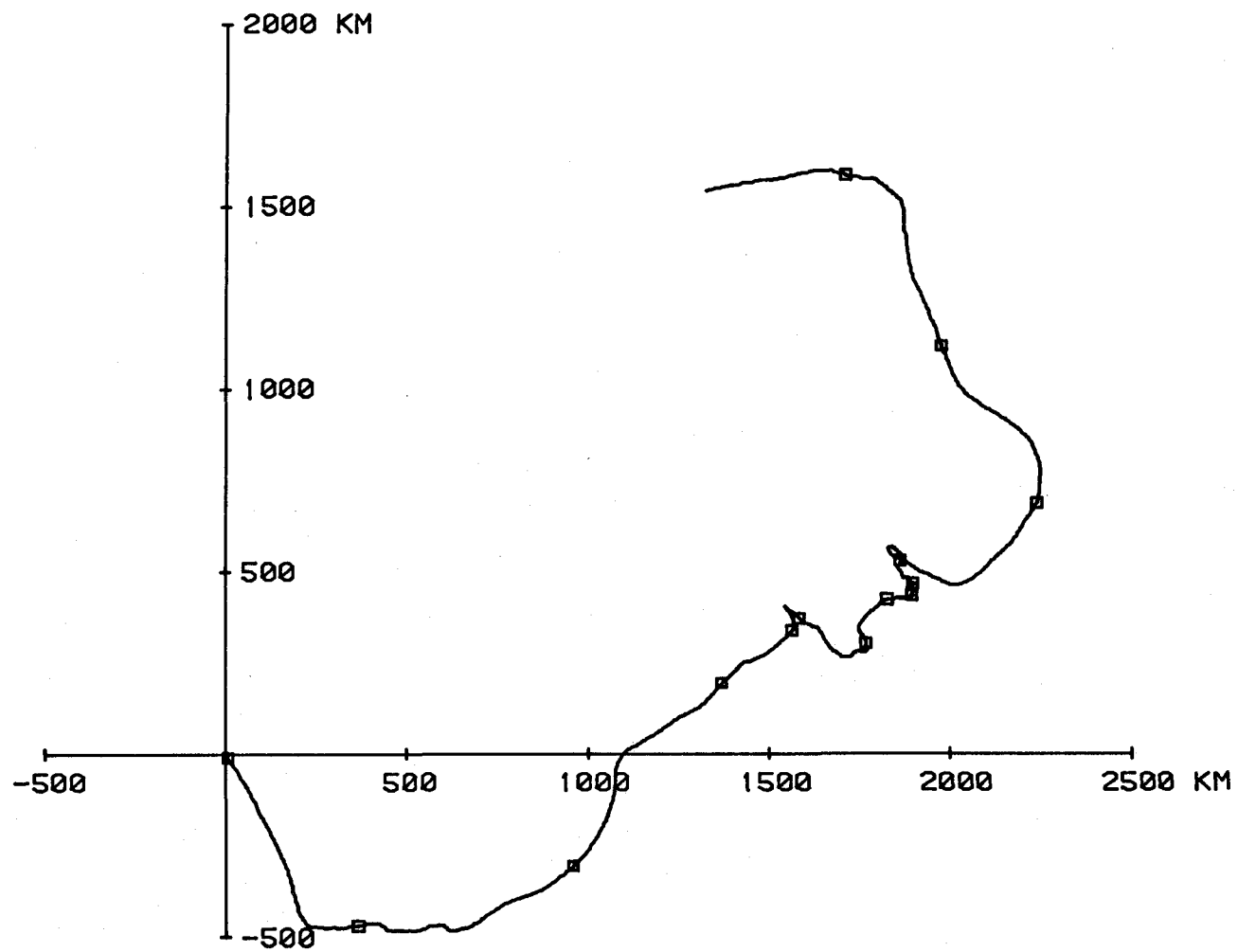
	MIN	MEAN	MAX	SD	N
S(cm/sec)	0.80	16.45	45.90	10.26	9829
u(cm/sec)	-45.50	3.73	43.80	13.61	9829
v(cm/sec)	-39.90	4.35	40.80	12.56	9829
T(°C)	5.30	7.55	13.25	1.95	9829
P(decibars)	428.20	442.73	563.30	20.89	9829

1100 METERS

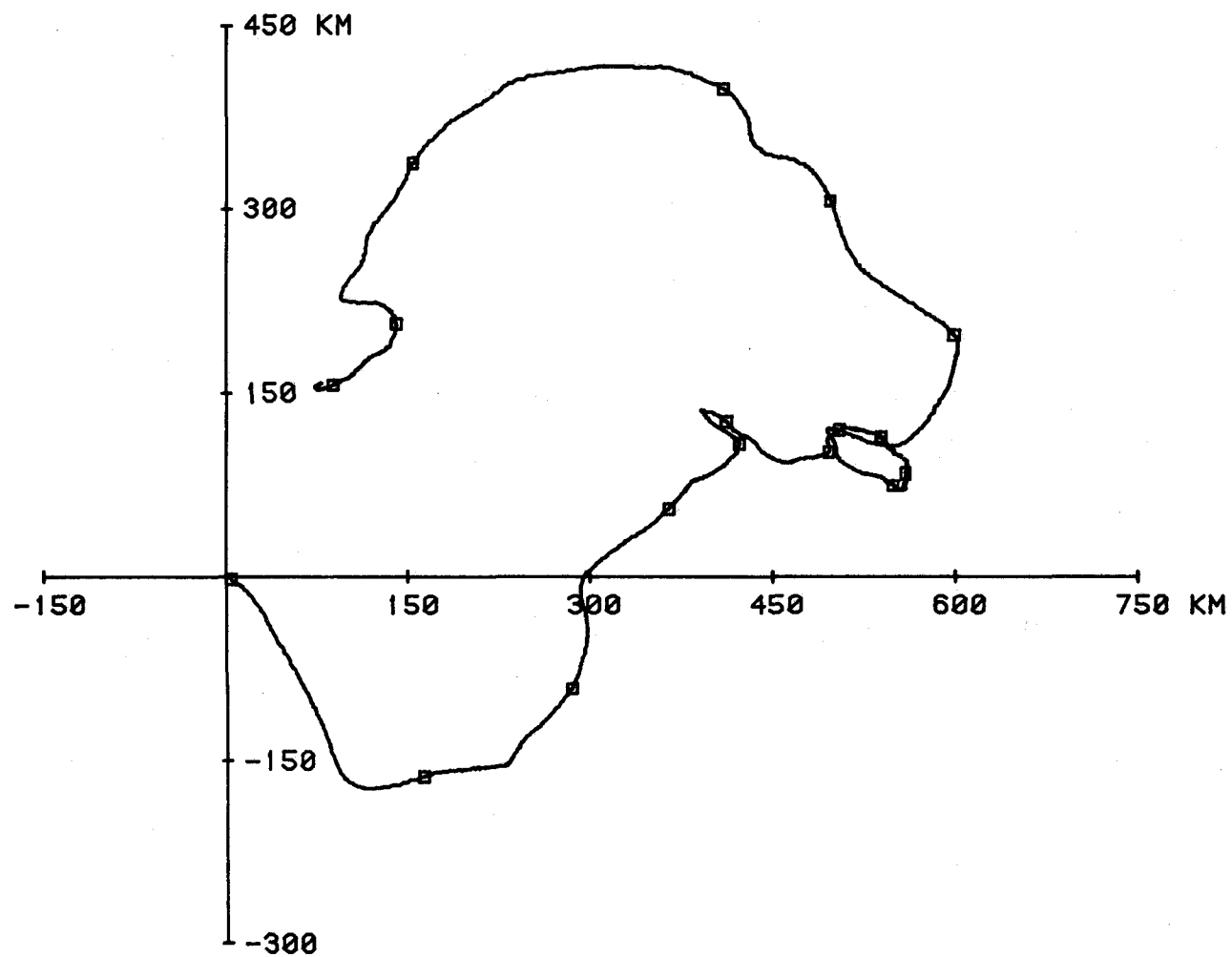
S(cm/sec)	0.80	6.55	23.60	3.45	12089
u(cm/sec)	-23.40	0.18	20.10	5.40	12089
v(cm/sec)	-18.50	0.36	18.40	5.04	12089
T(°C)	2.69	2.96	3.50	0.17	12089
P(decibars)	1135.50	1155.59	1267.70	21.16	12089

3400 METERS

S(cm/sec)	0.80	3.18	12.70	2.03	8345
u(cm/sec)	-8.30	0.13	10.50	2.55	8345
v(cm/sec)	-10.40	-0.71	8.40	2.69	8345
T(°C)	1.46	1.49	1.54	0.01	8345
P(decibars)	3425.00	3439.27	3478.00	6.58	8345

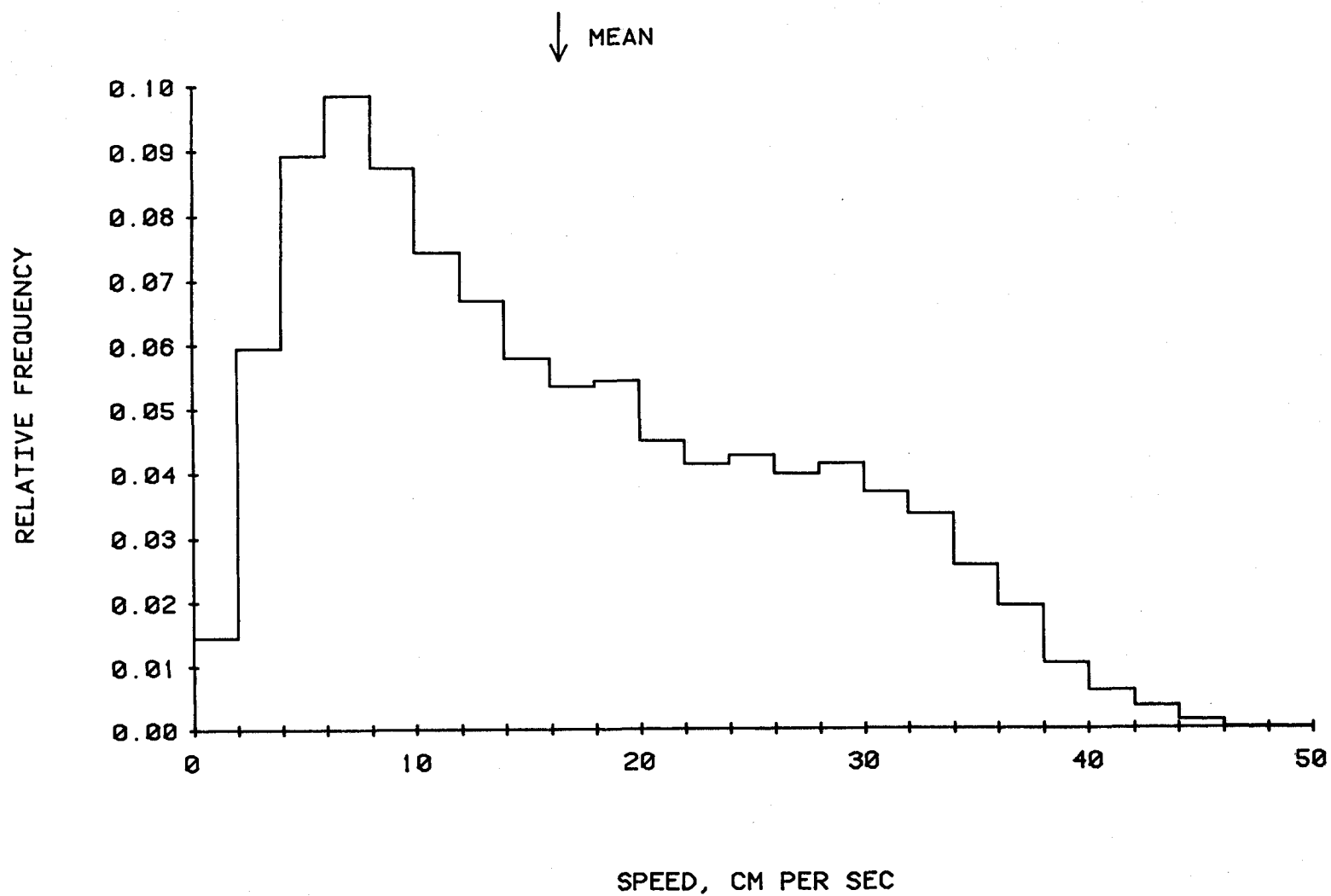


420 METERS AT EMPEROR MOORING B. 30 JUN 82 - 13 AUG 83.

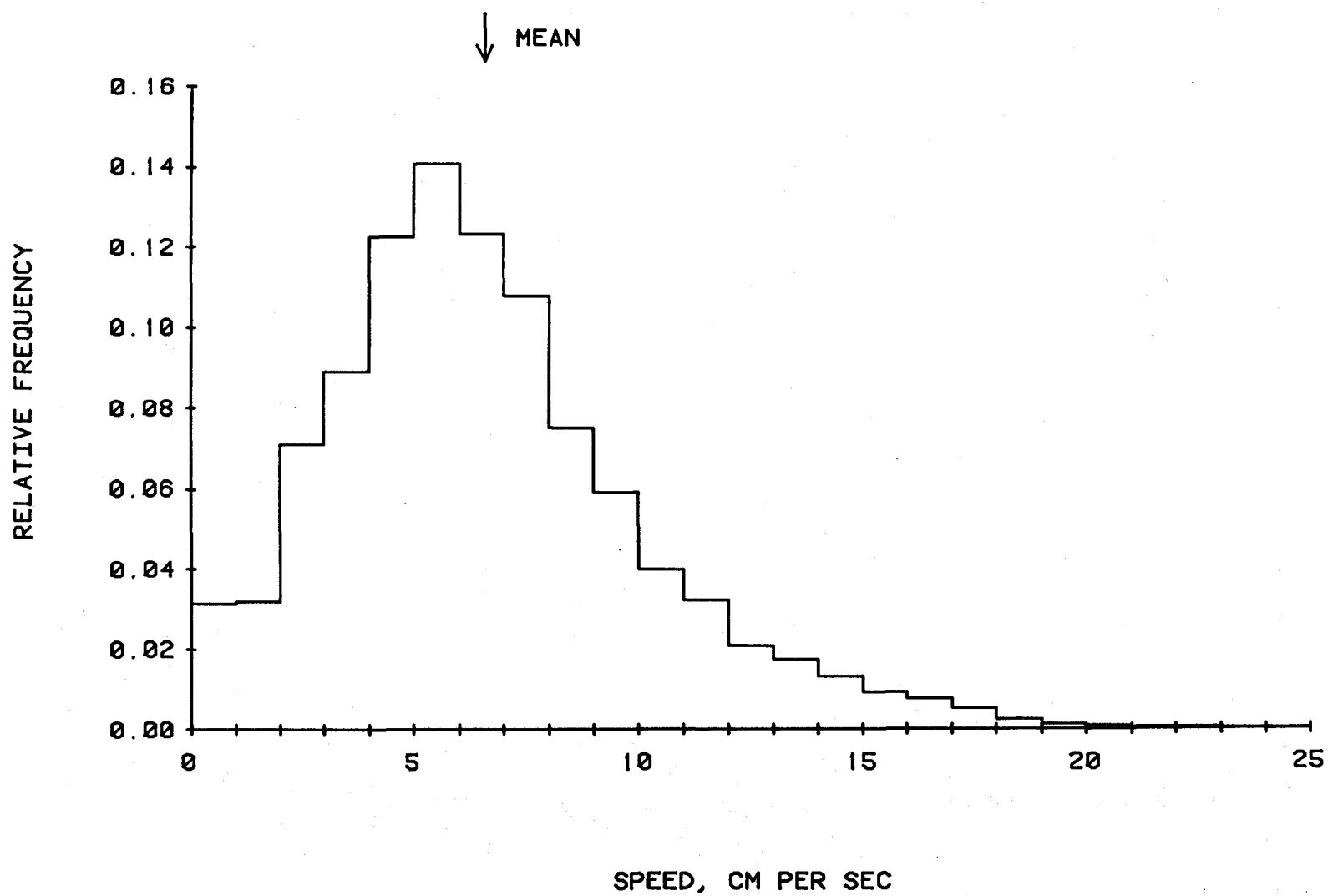


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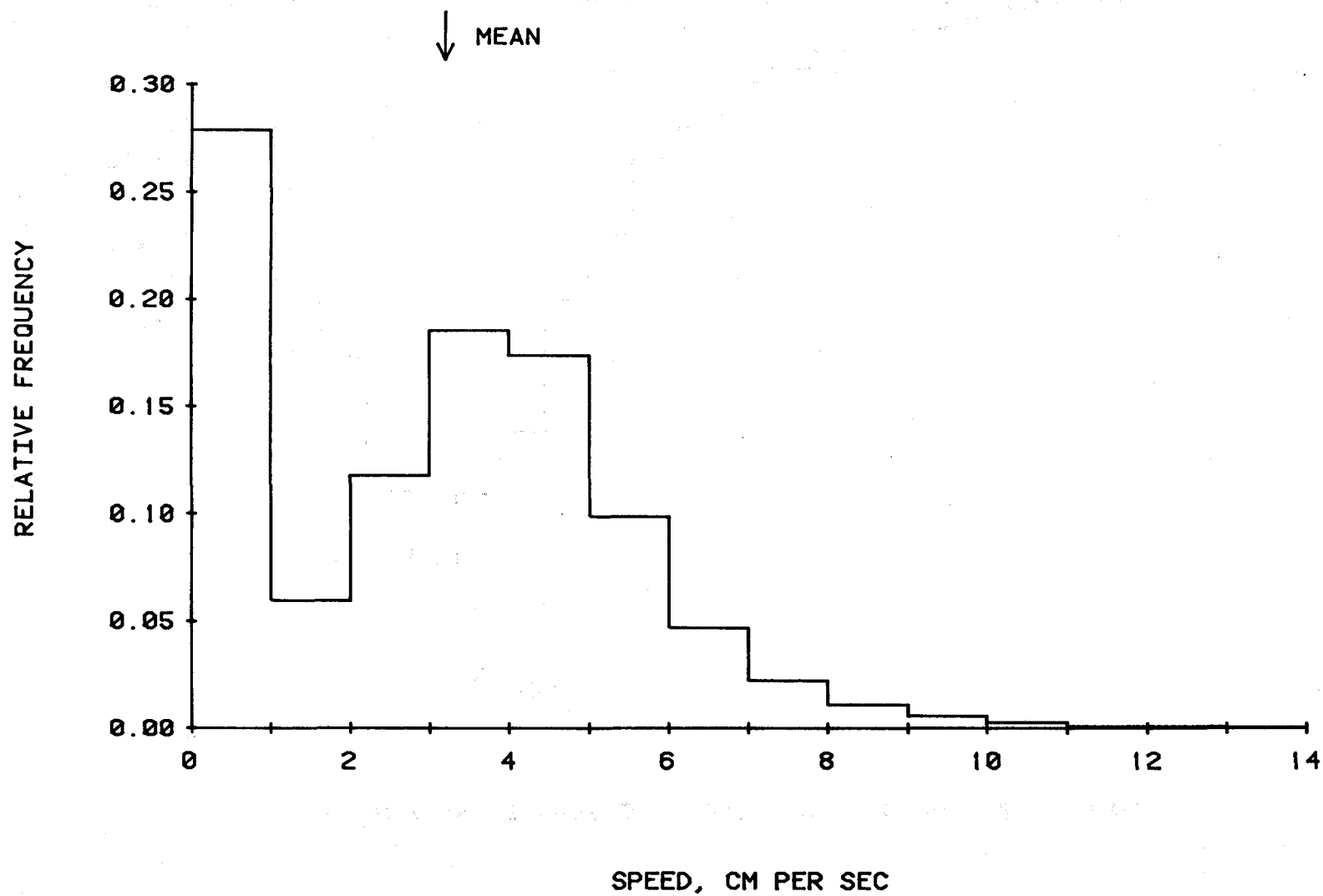
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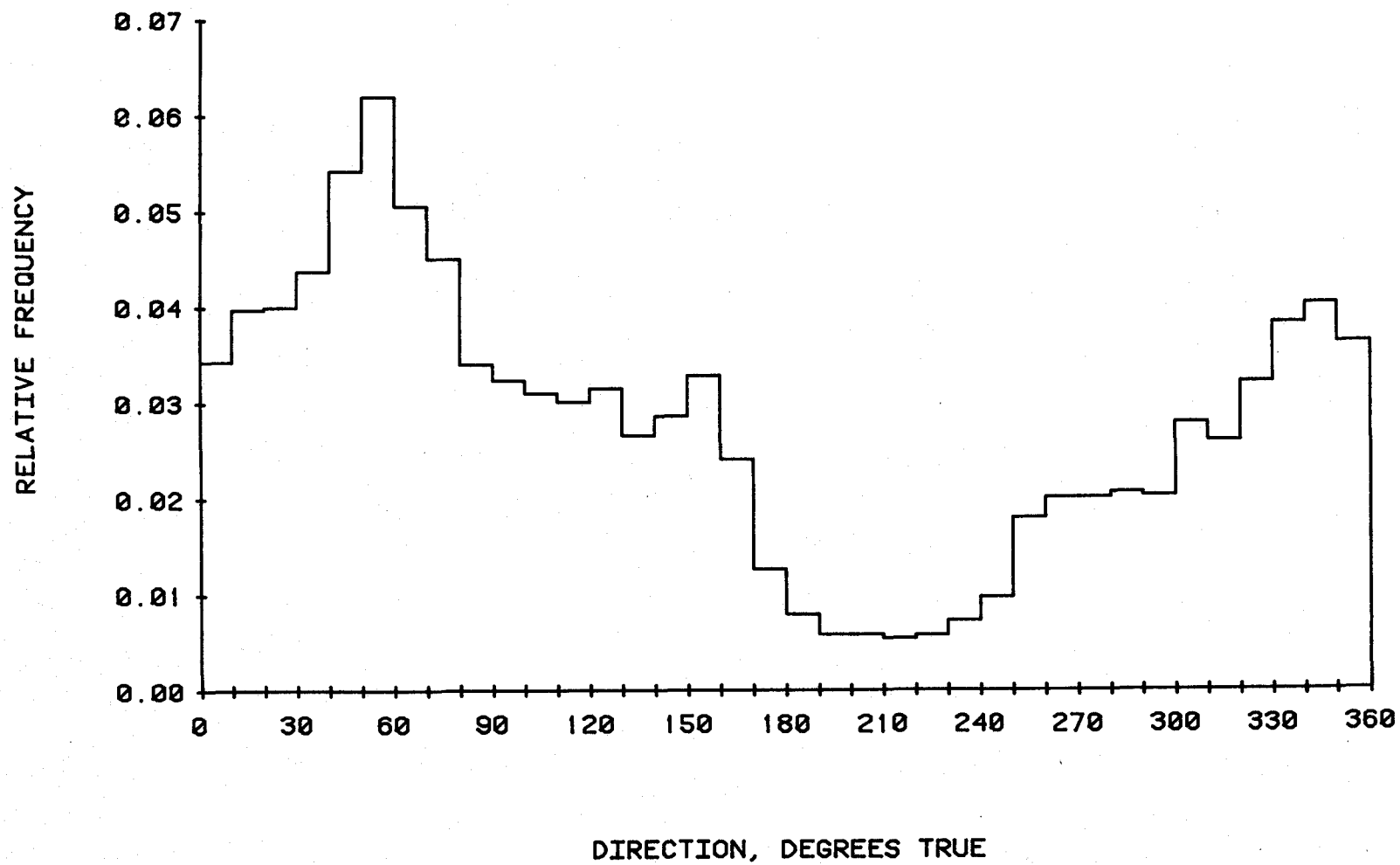
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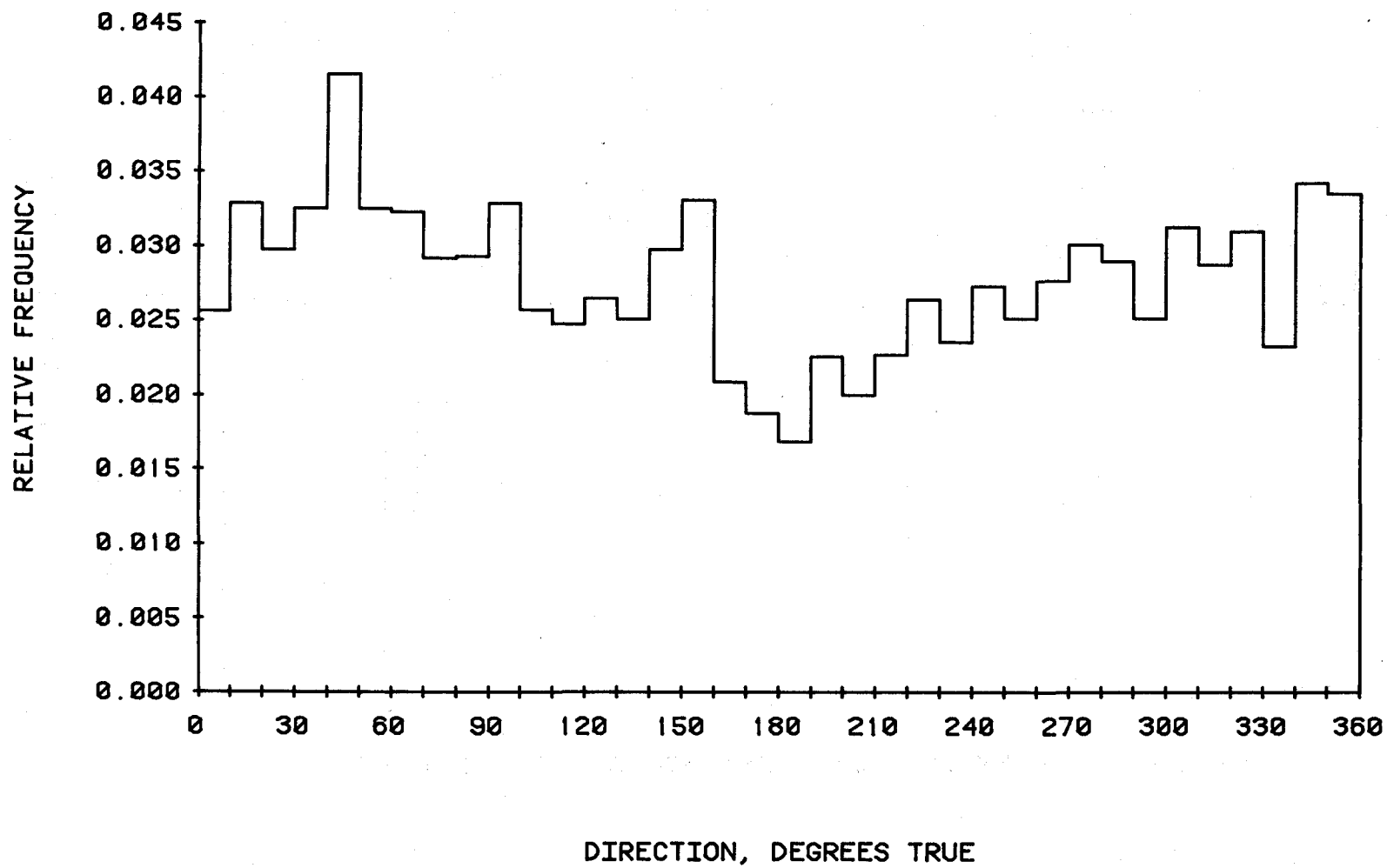
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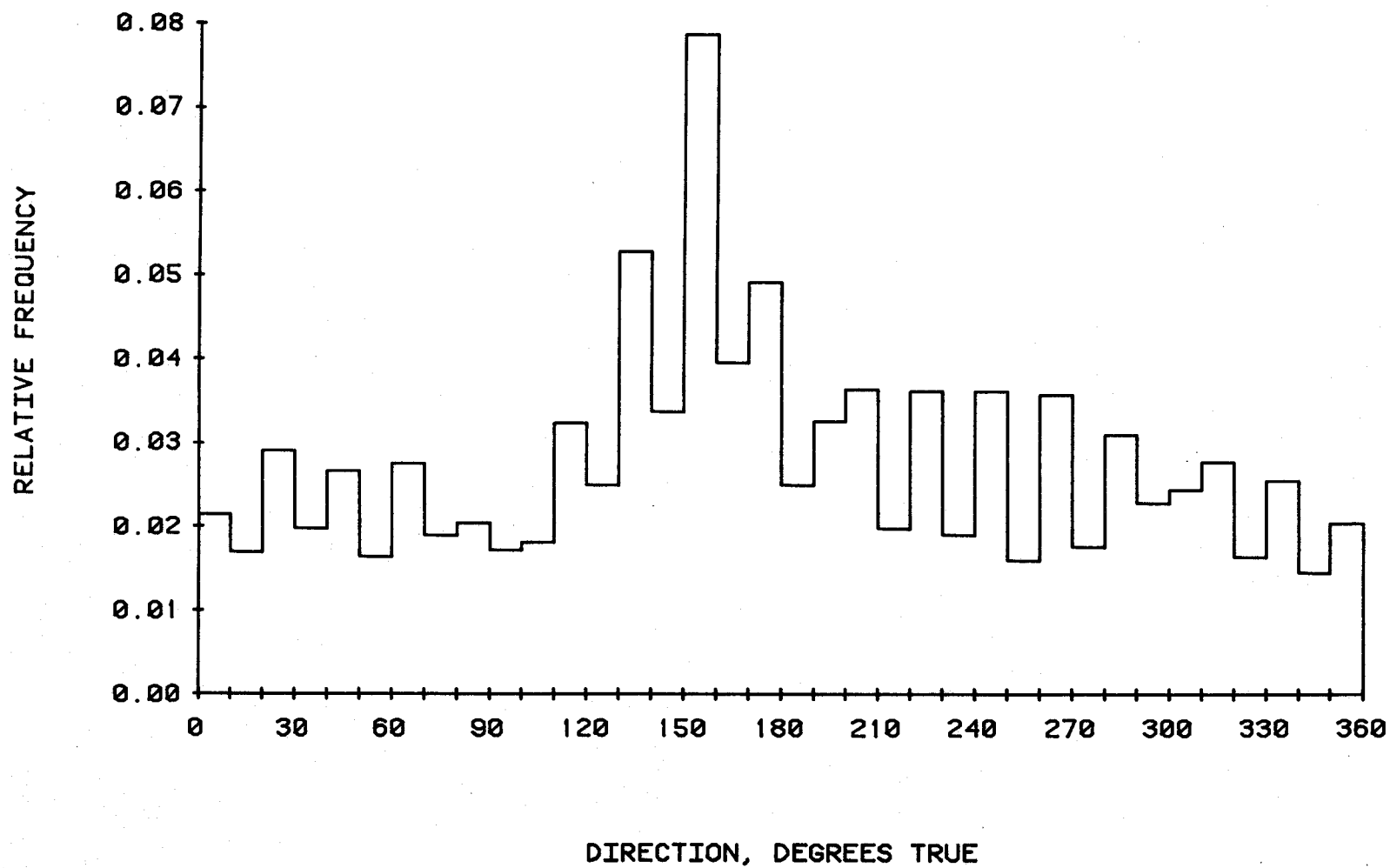
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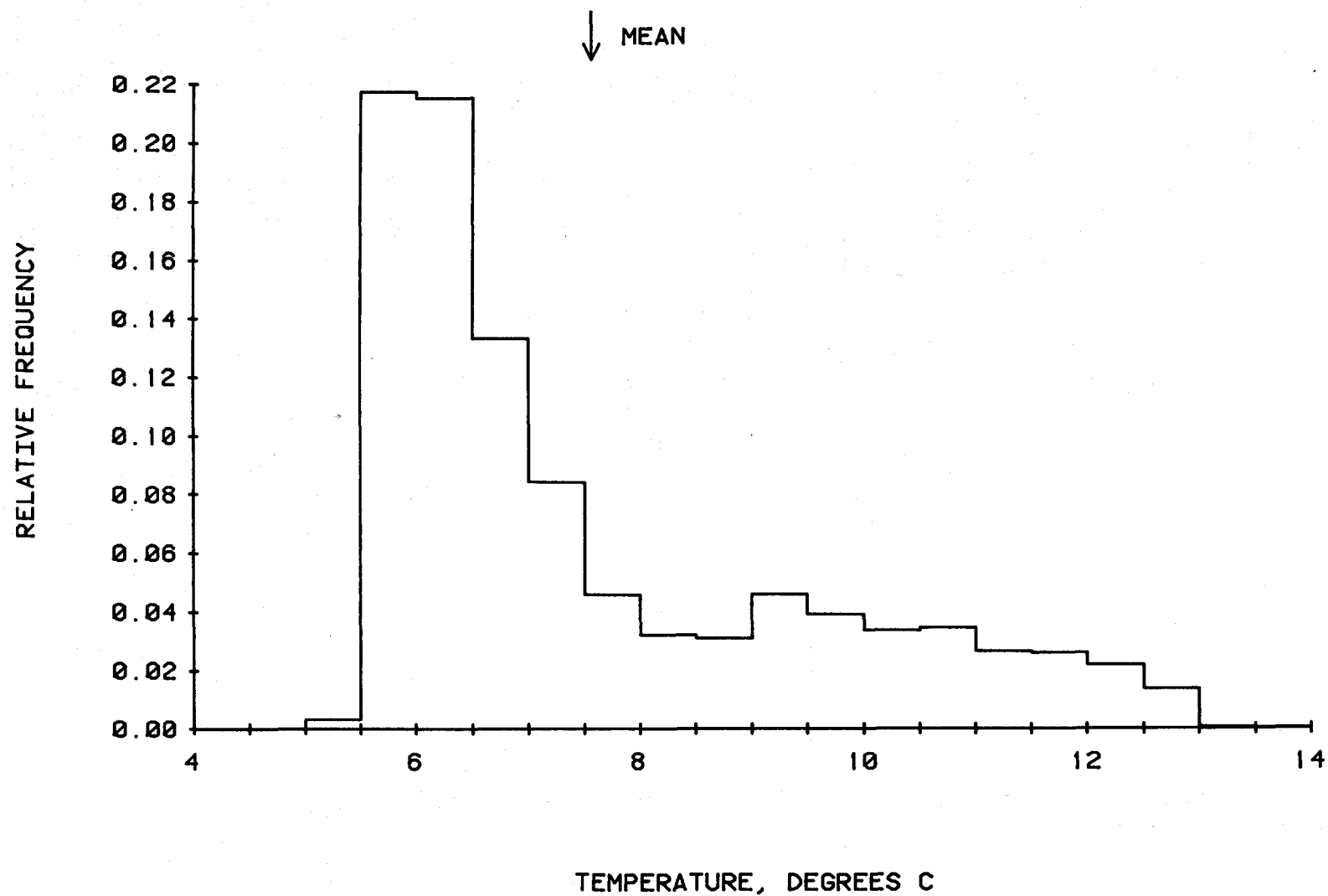
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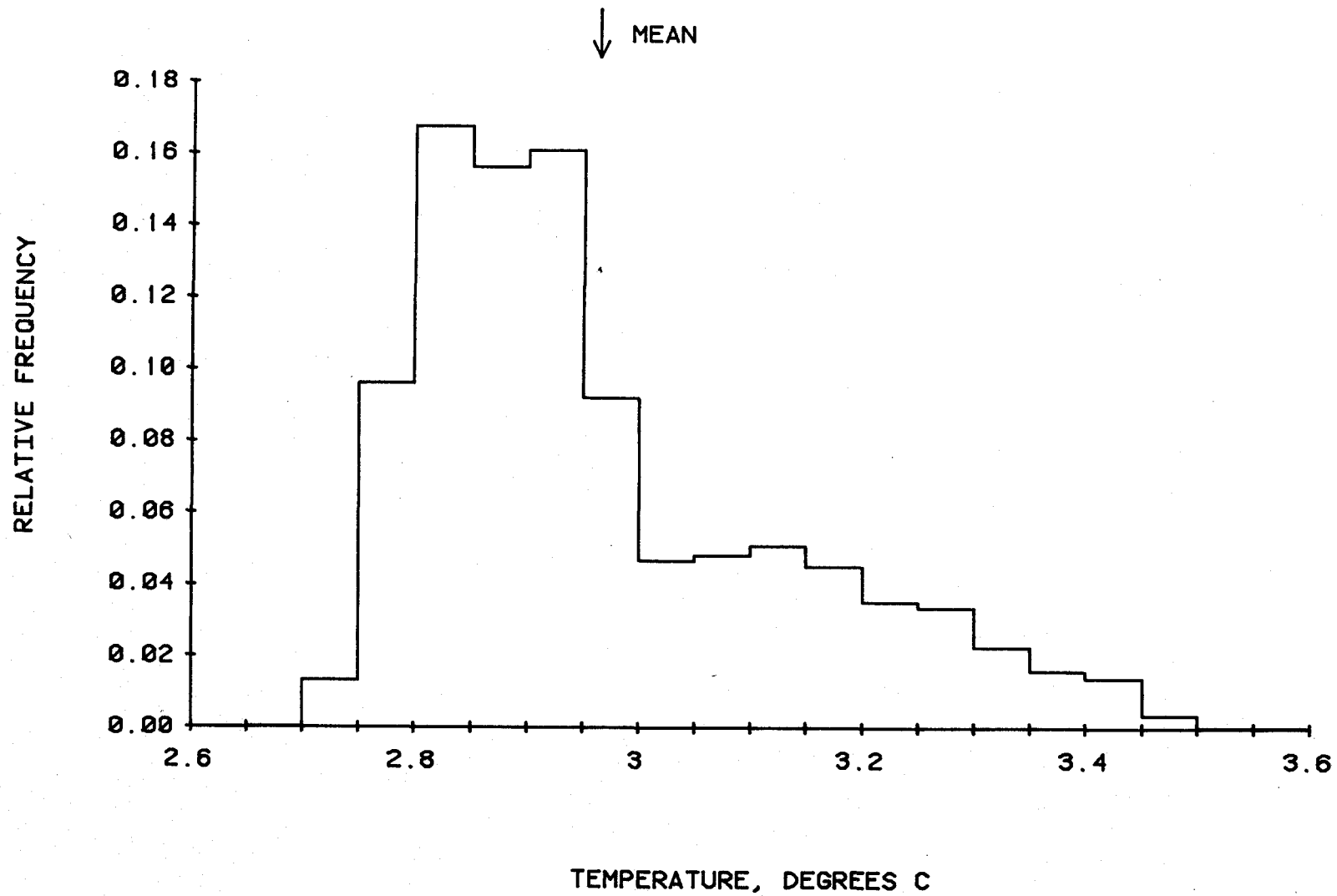
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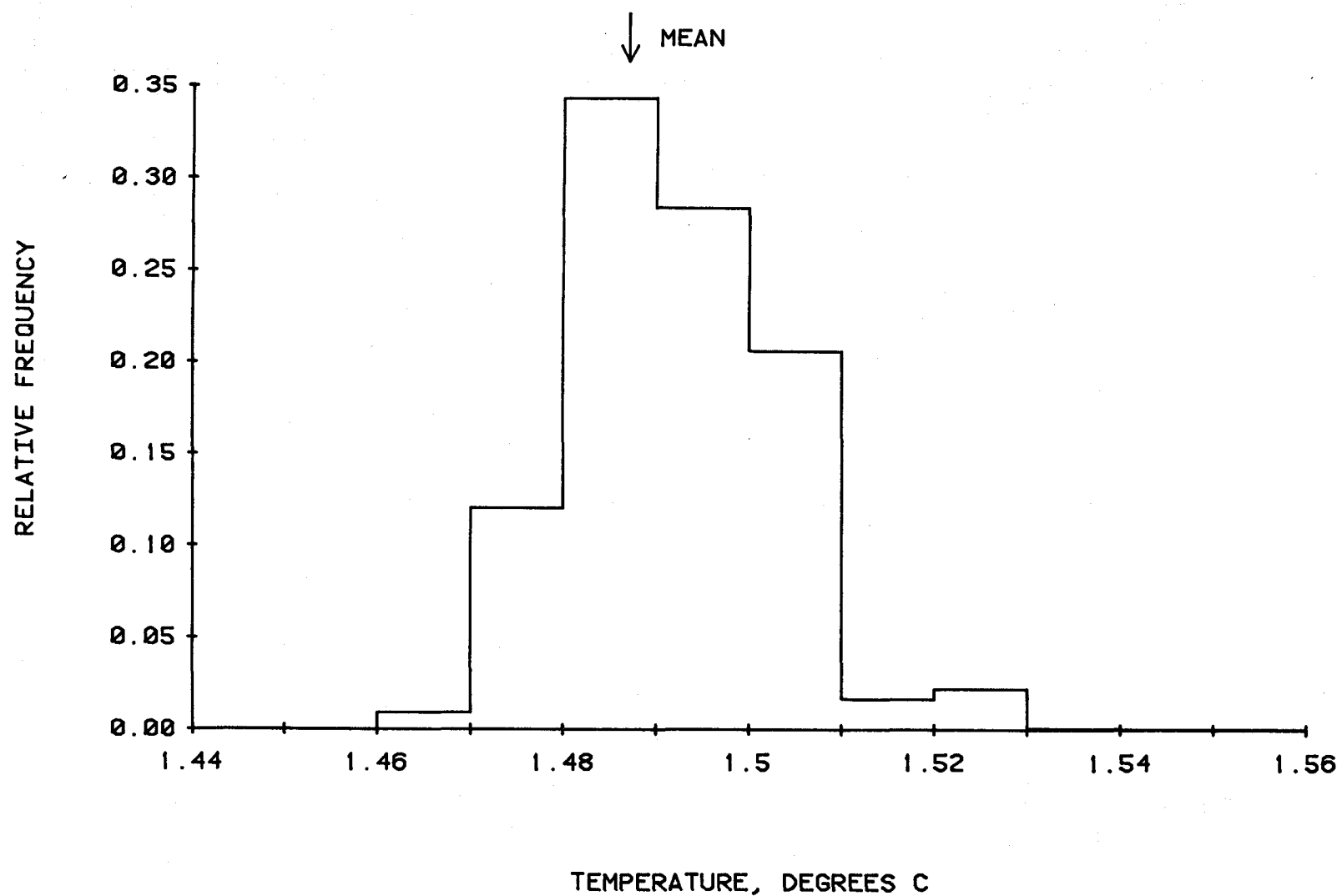
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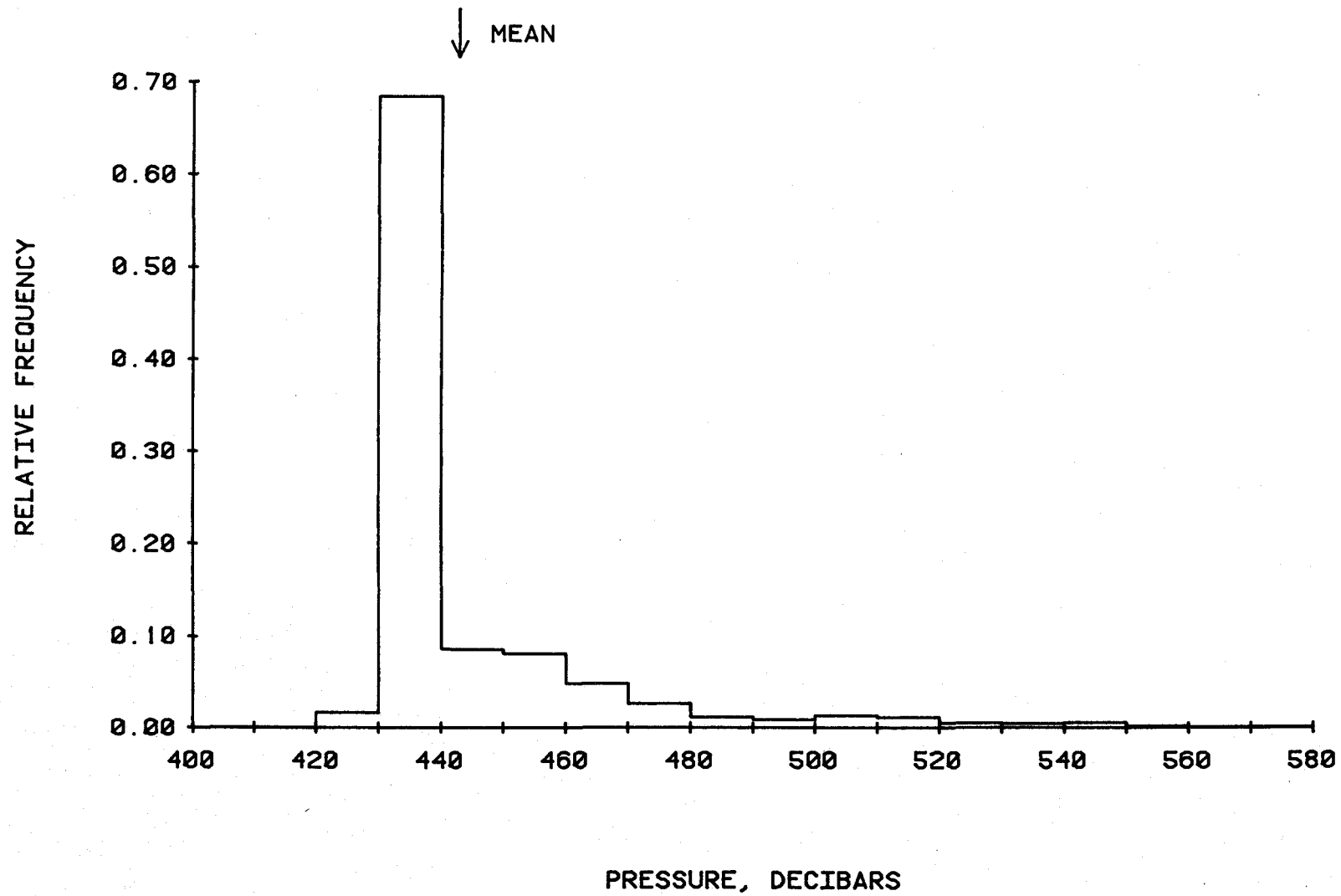
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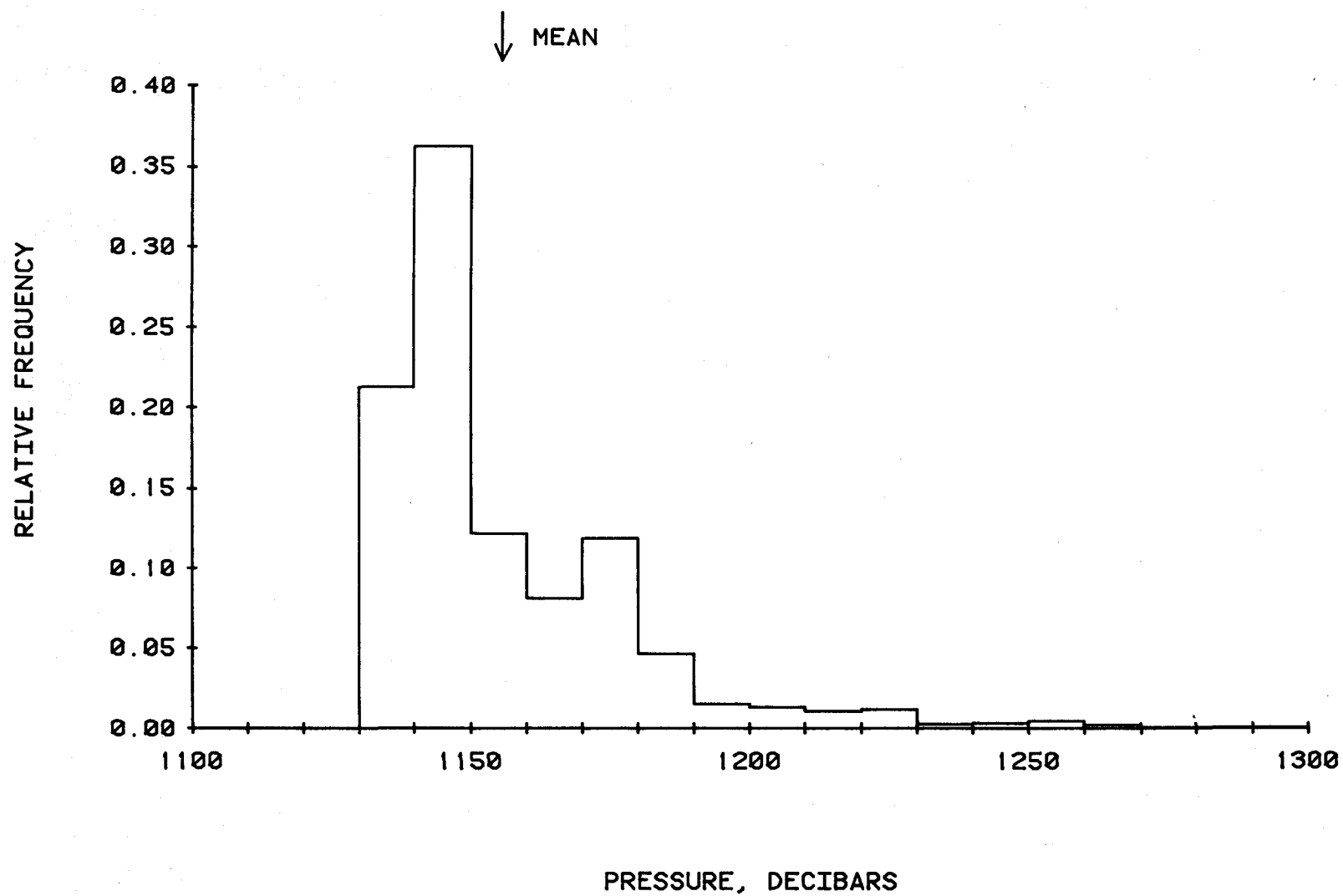
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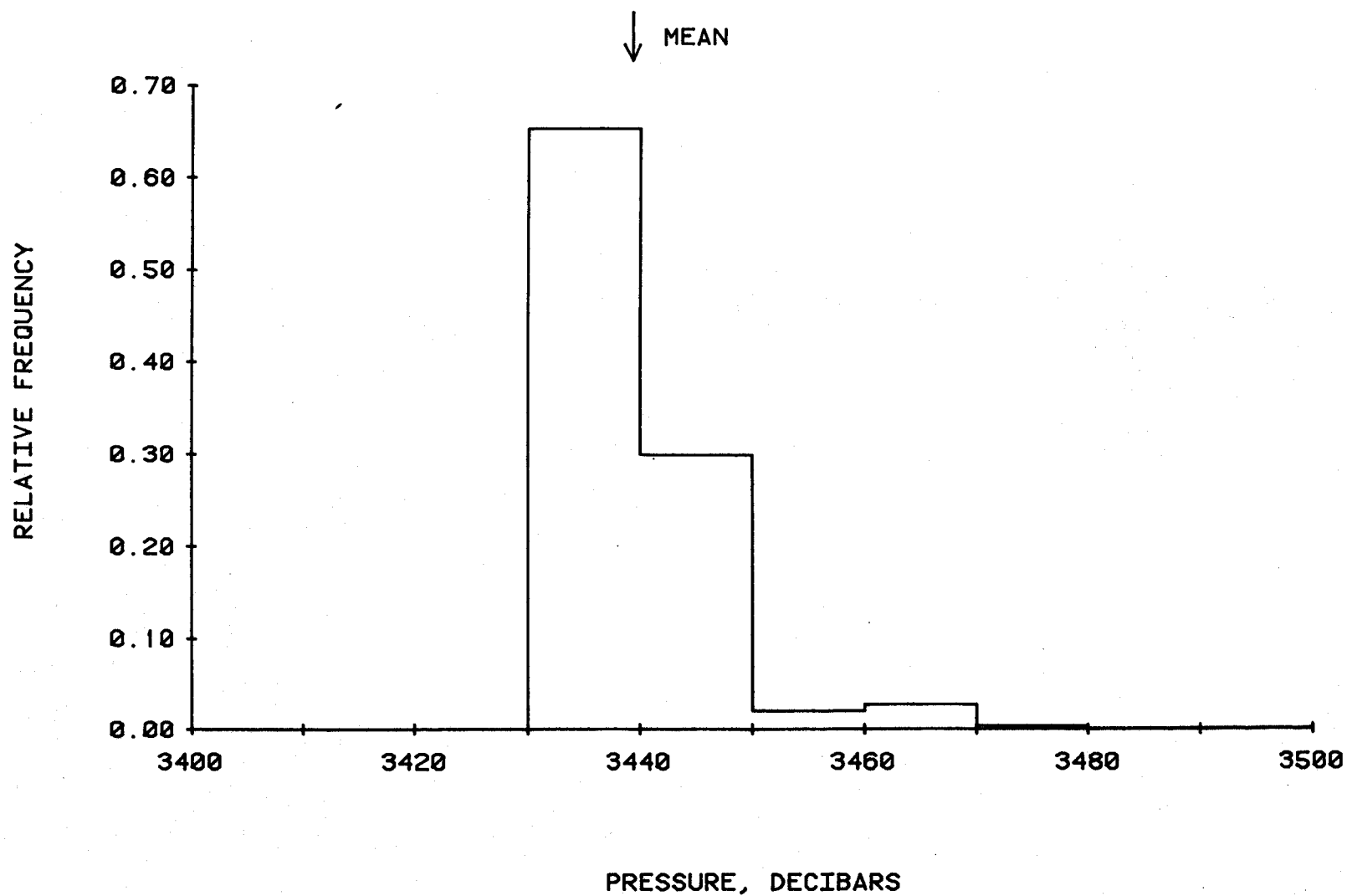
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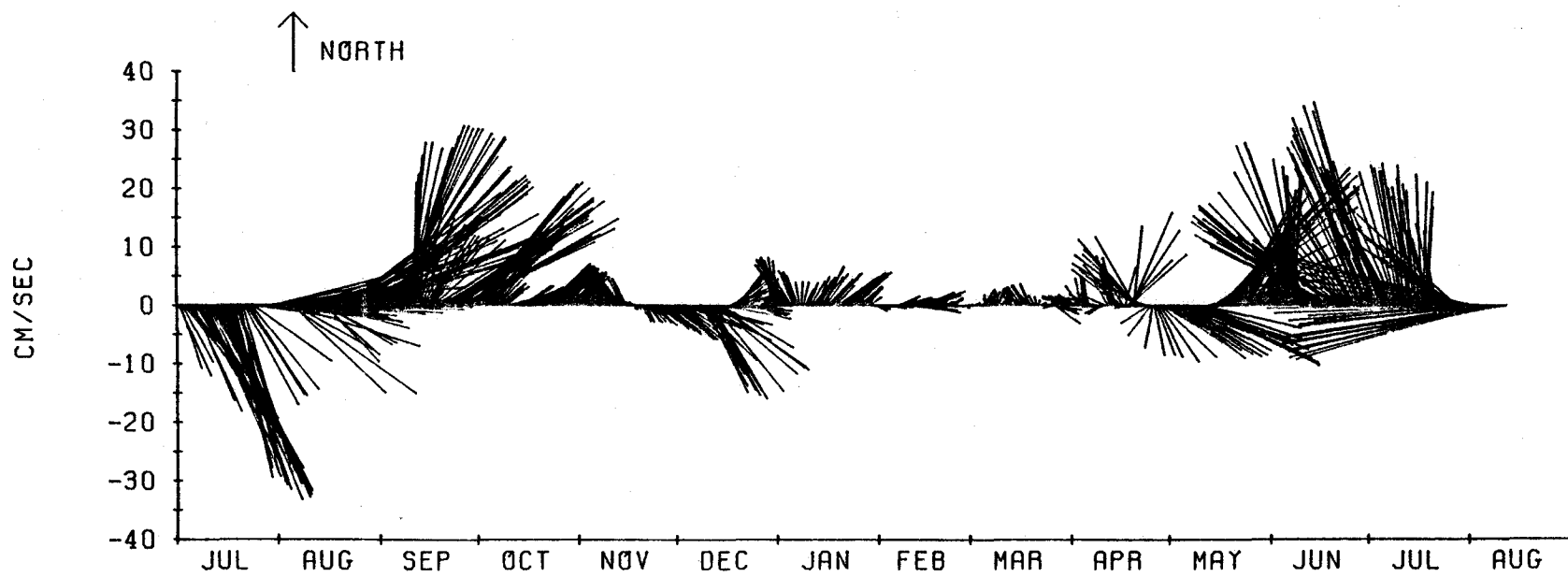


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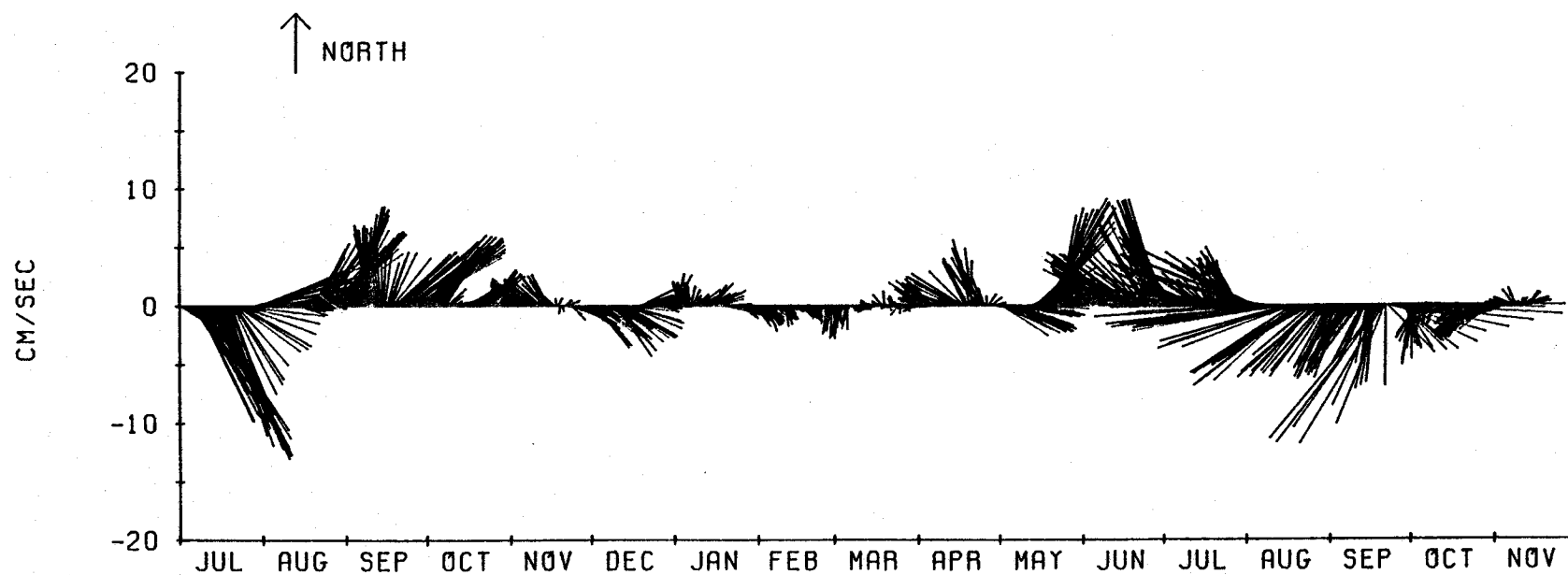


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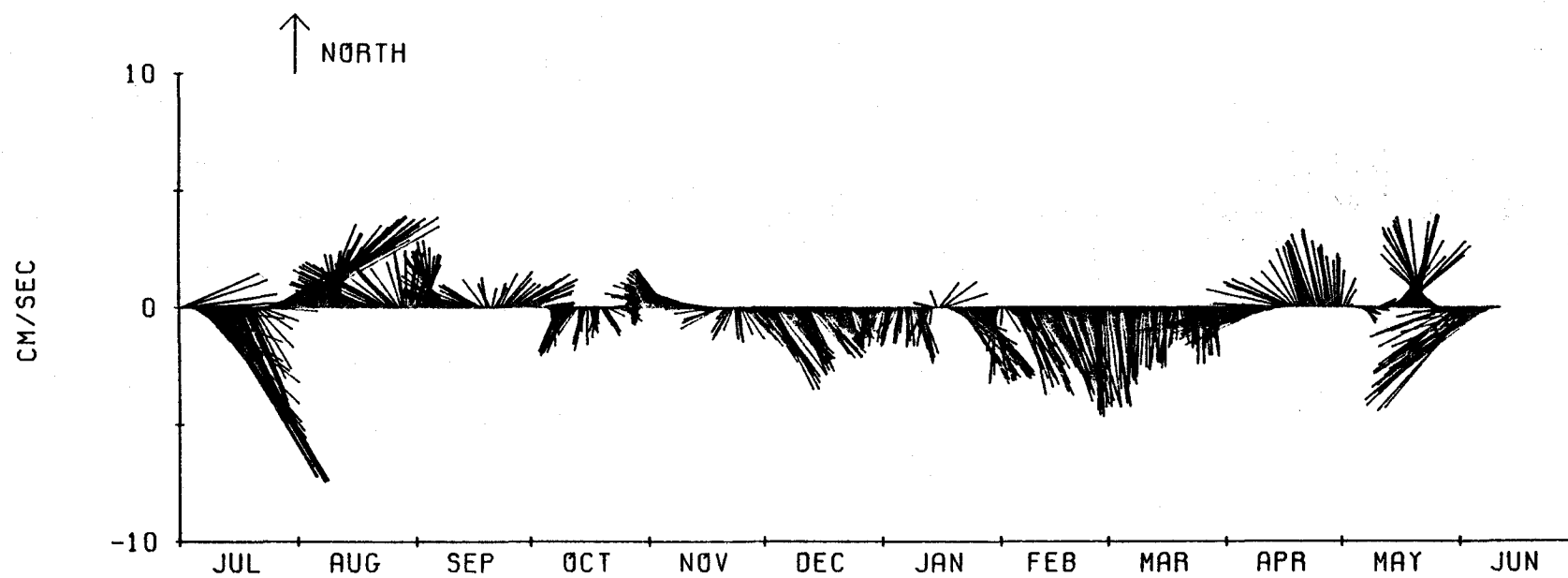




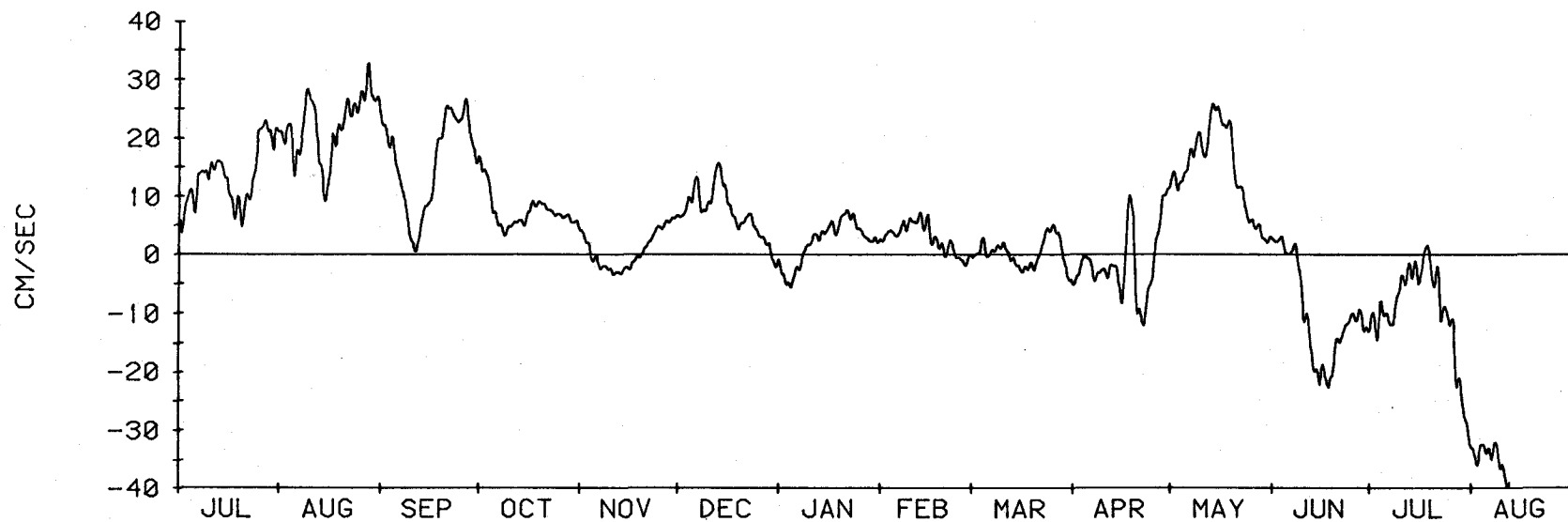
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LLP FILTERED CURRENT



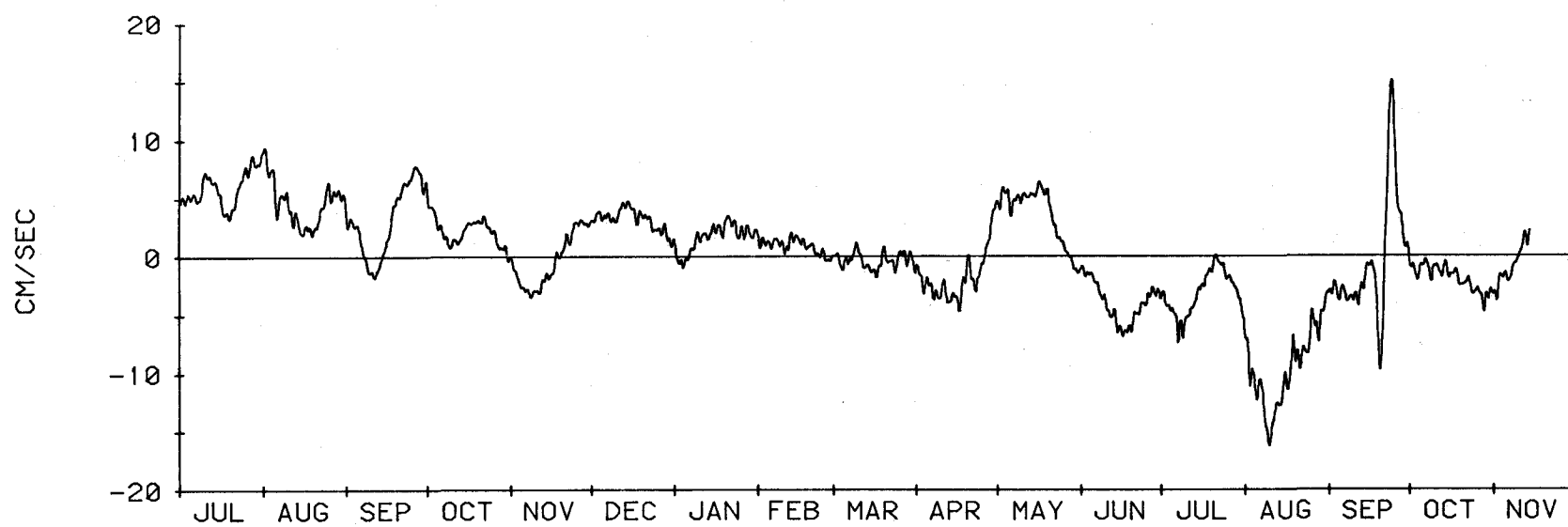
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LLP FILTERED CURRENT



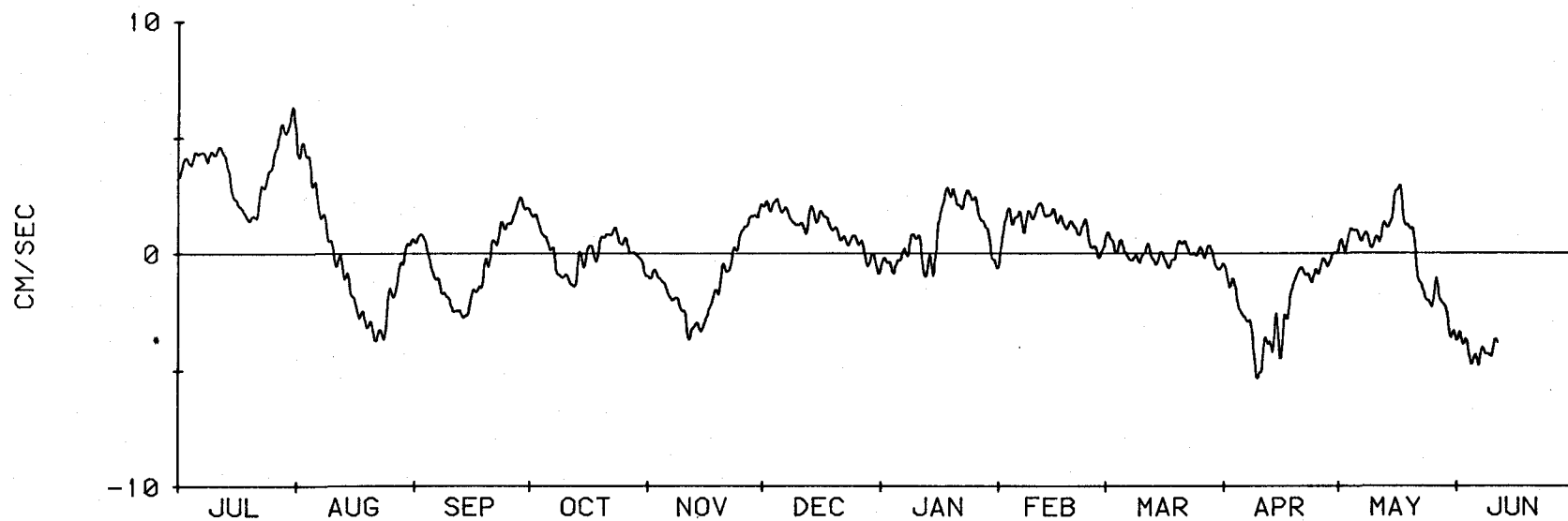
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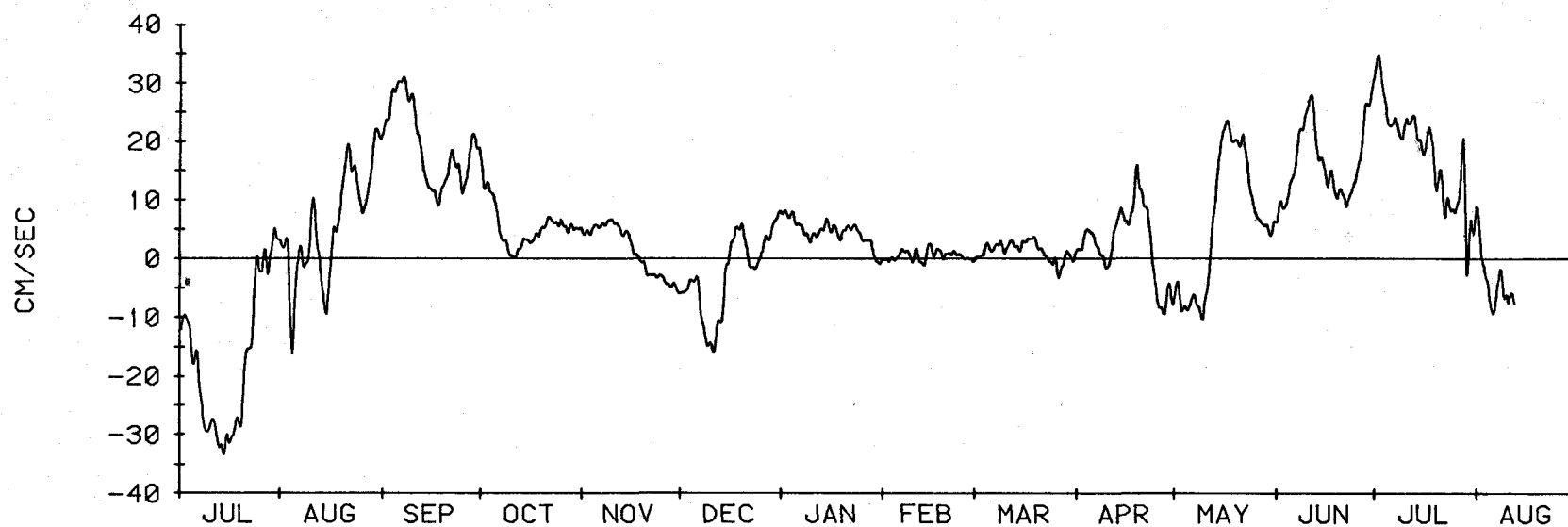
420 METERS AT MOORING B
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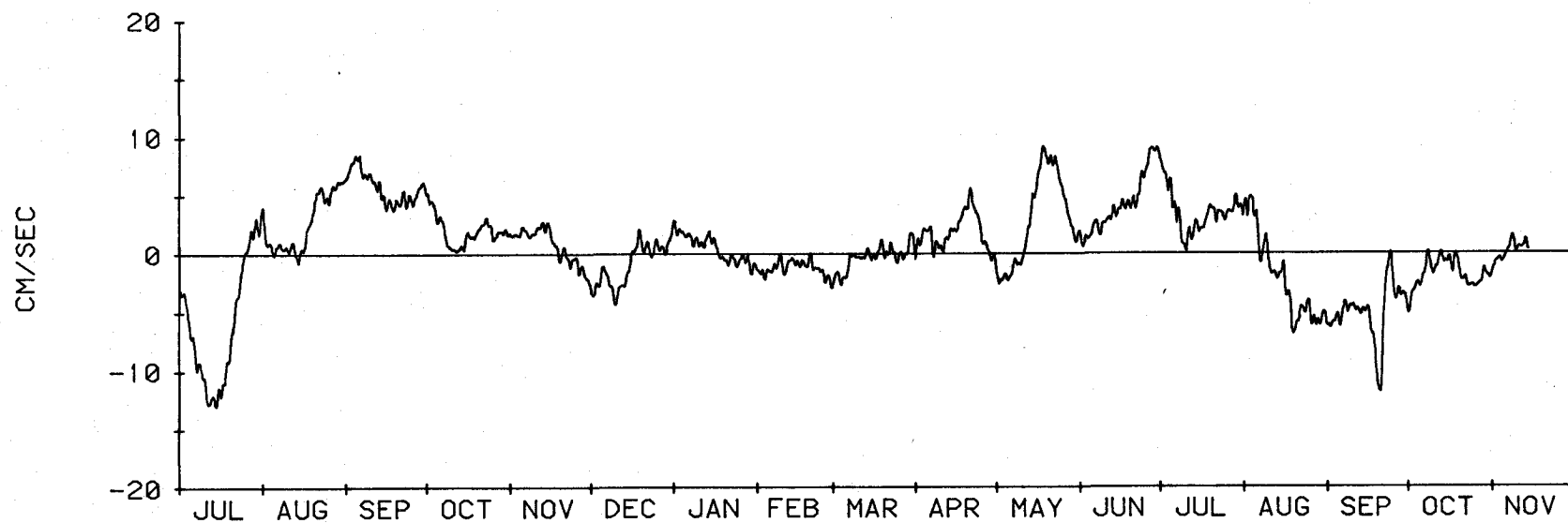
1100 METERS AT MOORING B
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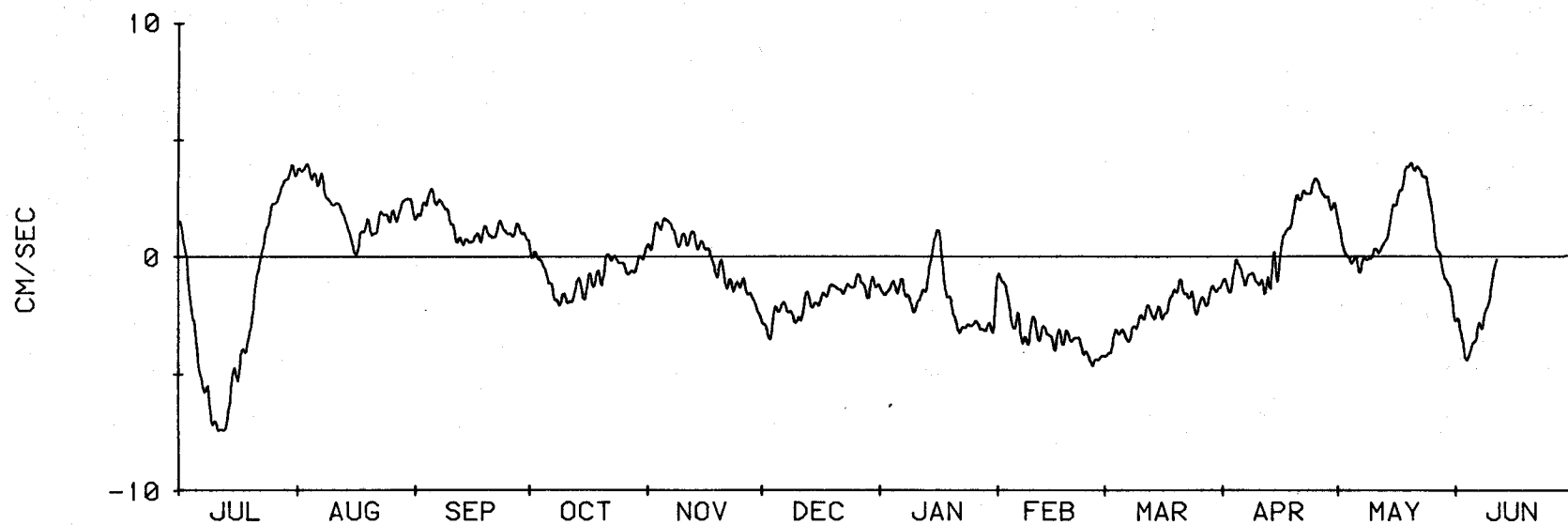
3400 METERS AT MOORING B
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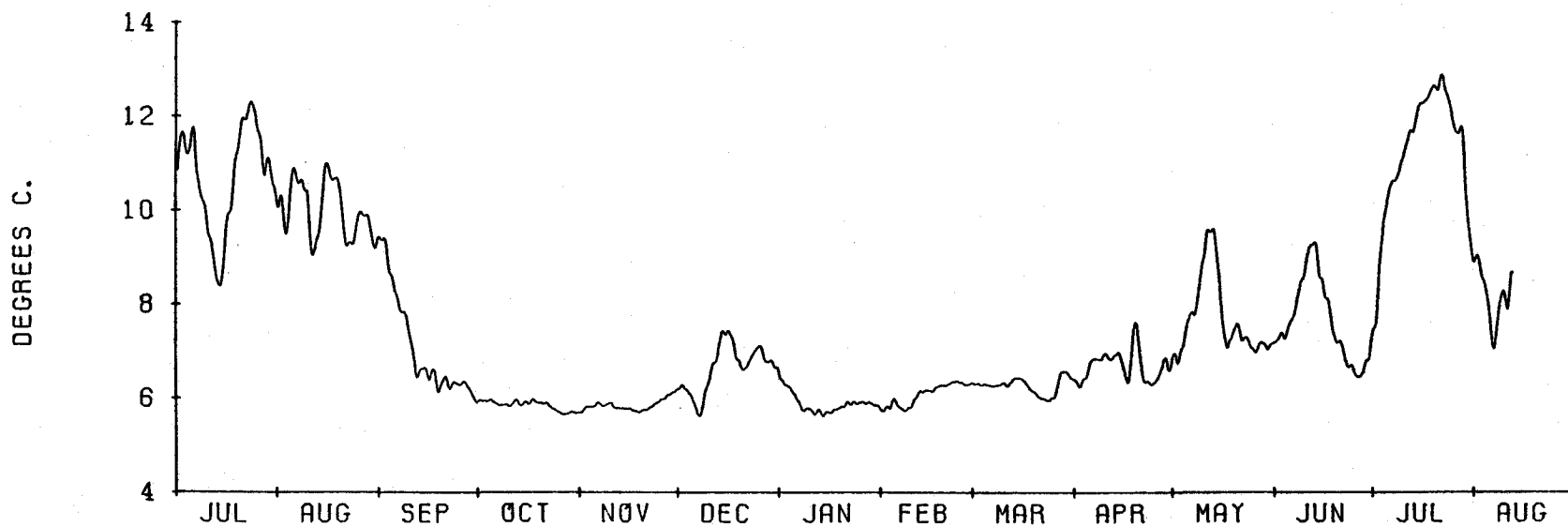
420 METERS AT MOORING B
LLP FILTERED V COMPONENT



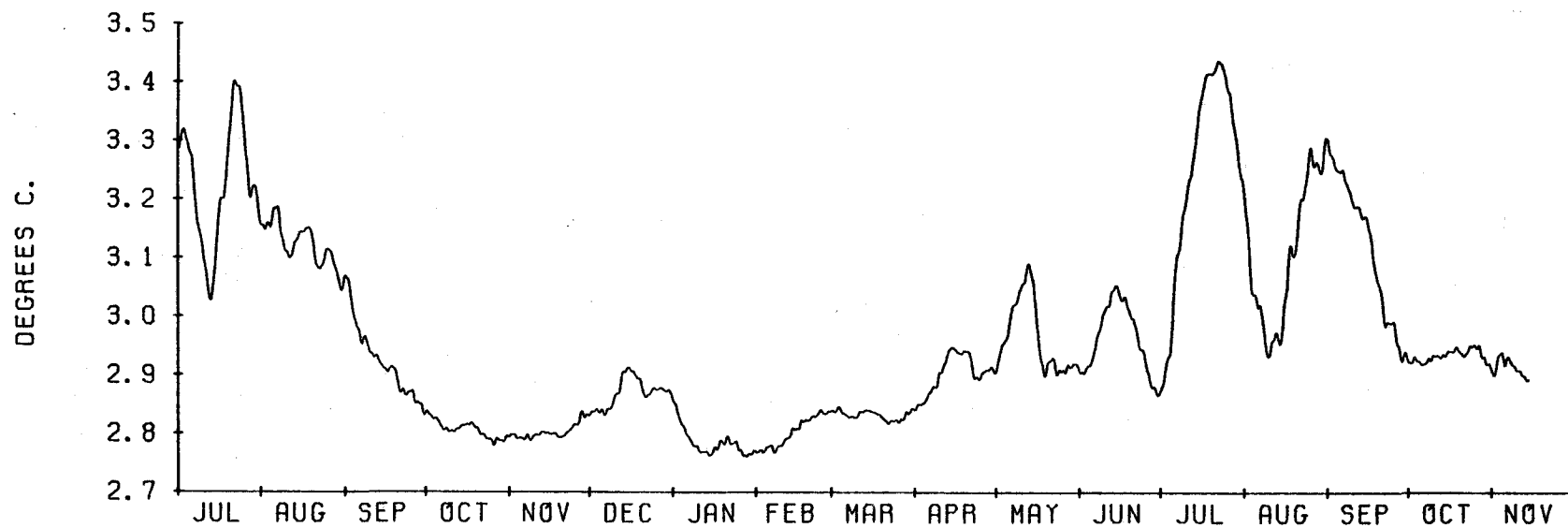
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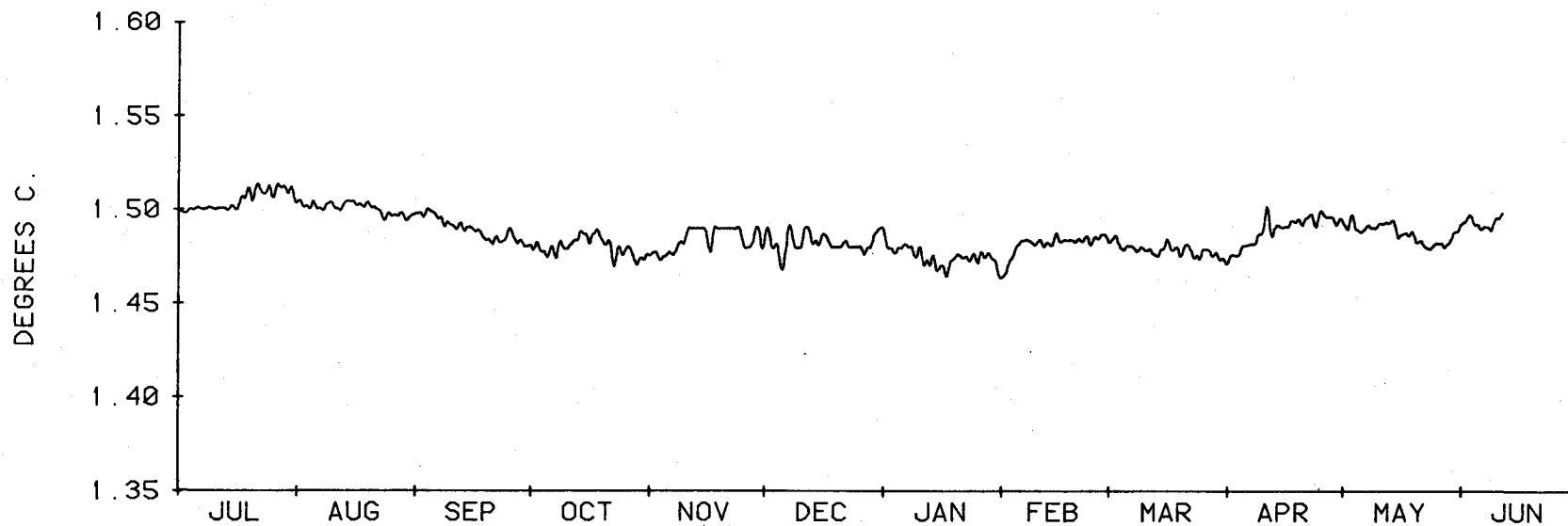
3400 METERS AT MOORING B
LLP FILTERED V COMPONENT



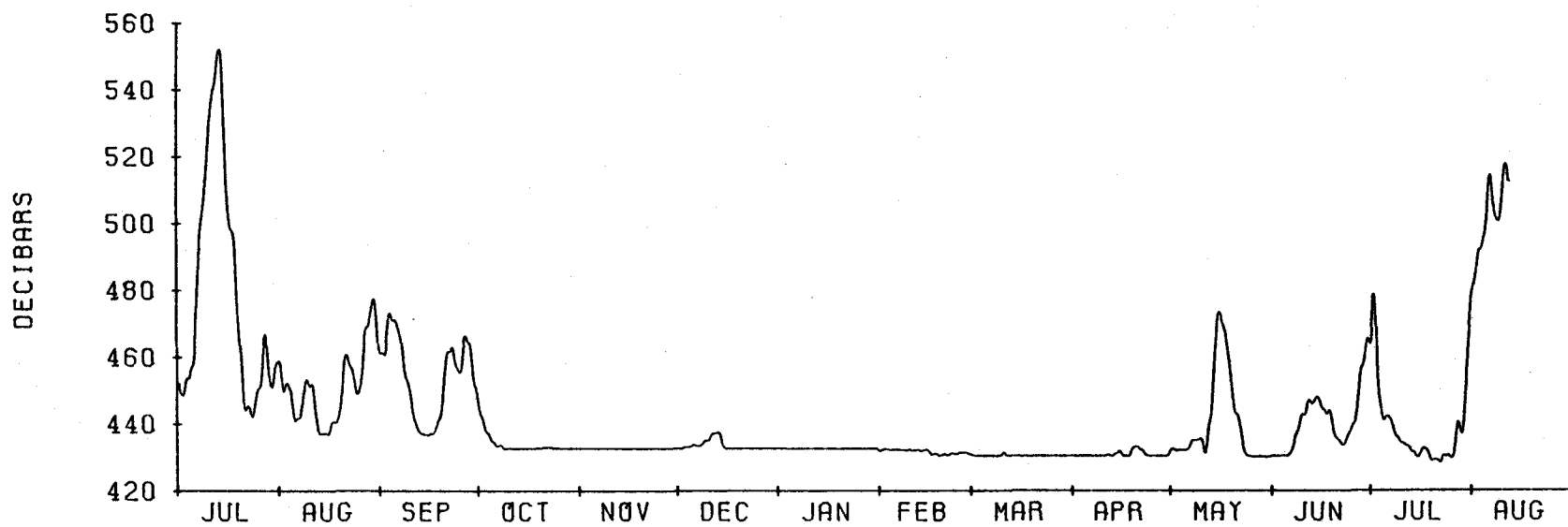
420 METERS AT MOORING B.
LLP FILTERED TEMPERATURE



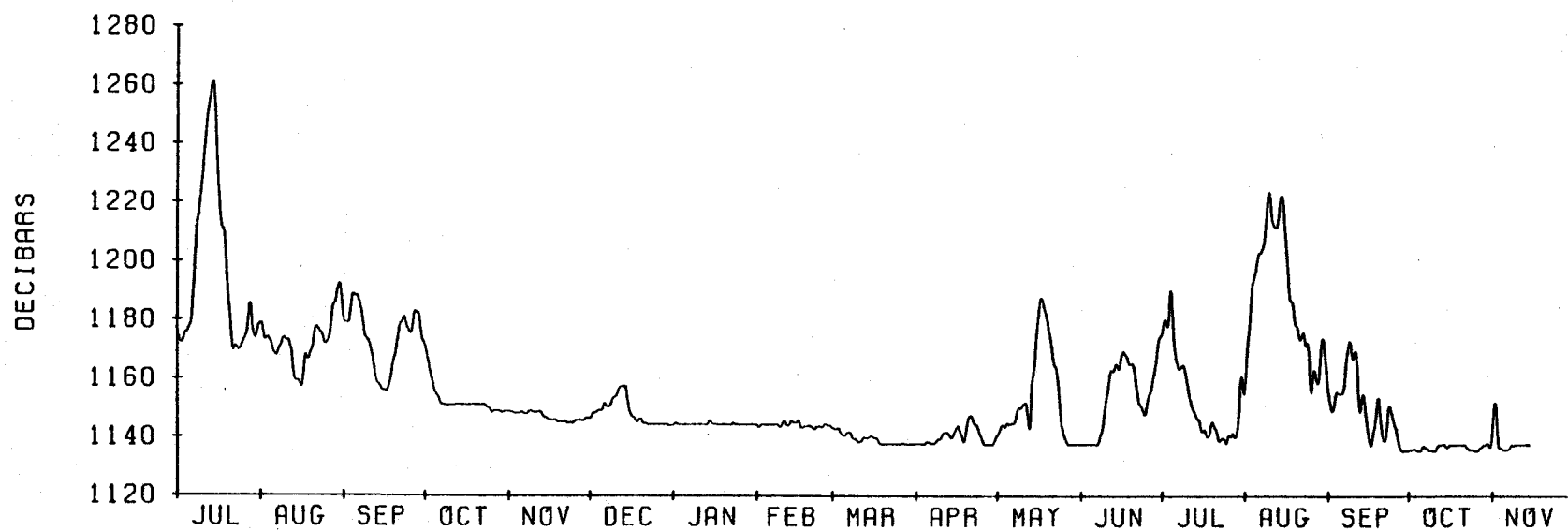
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LLP FILTERED TEMPERATURE



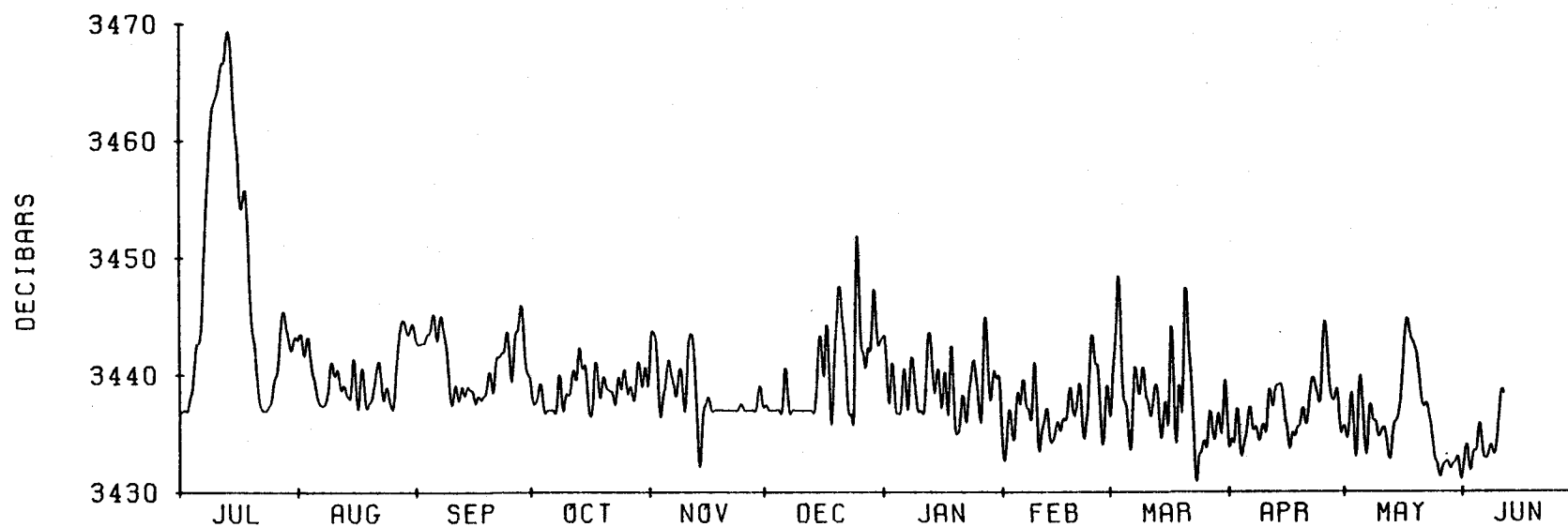
3400 METERS AT MOORING B
LLP FILTERED TEMPERATURE



420 METERS AT MOORING B.
LLP FILTERED PRESSURE

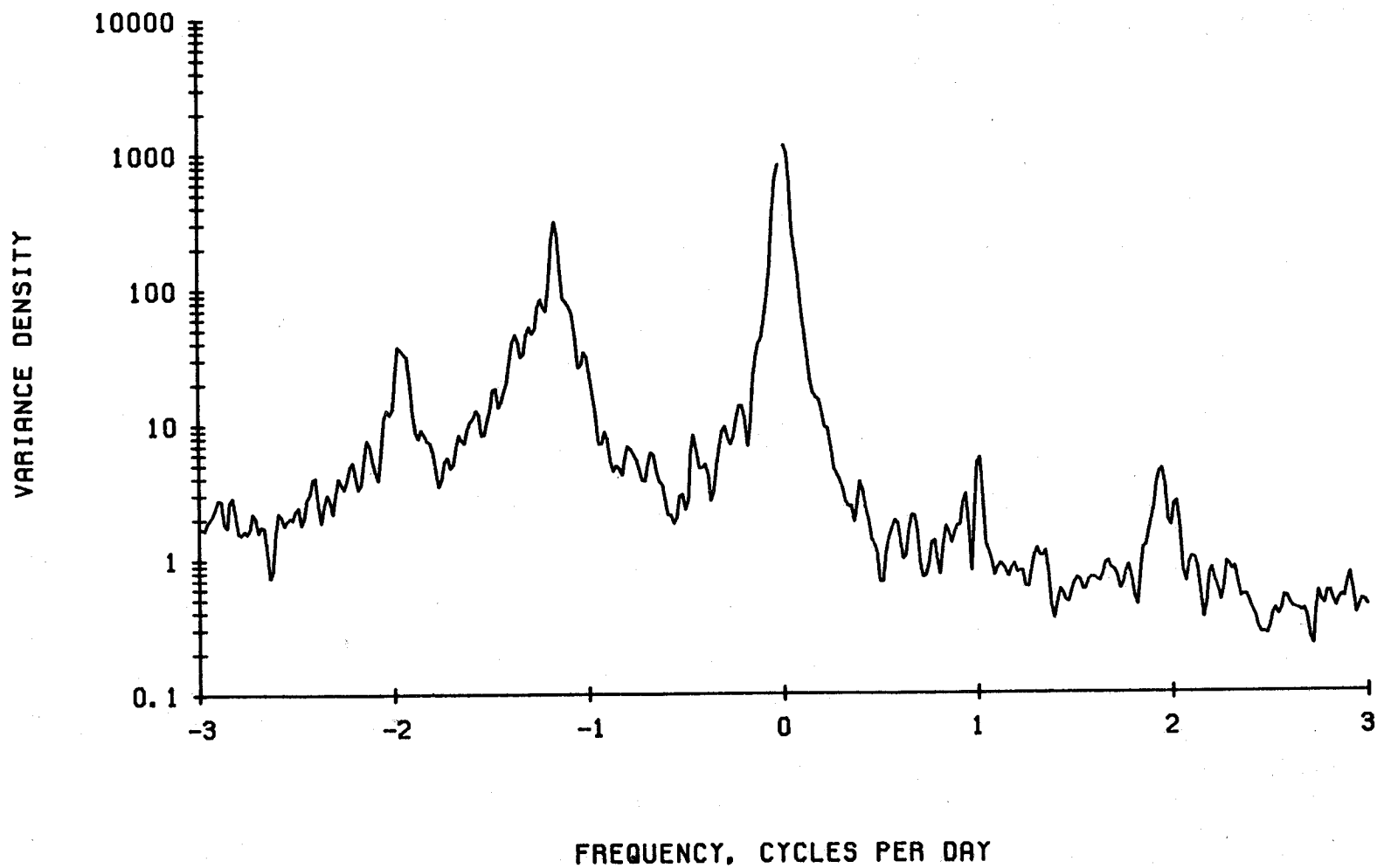


1100 METERS AT MOORING B.
LLP FILTERED PRESSURE



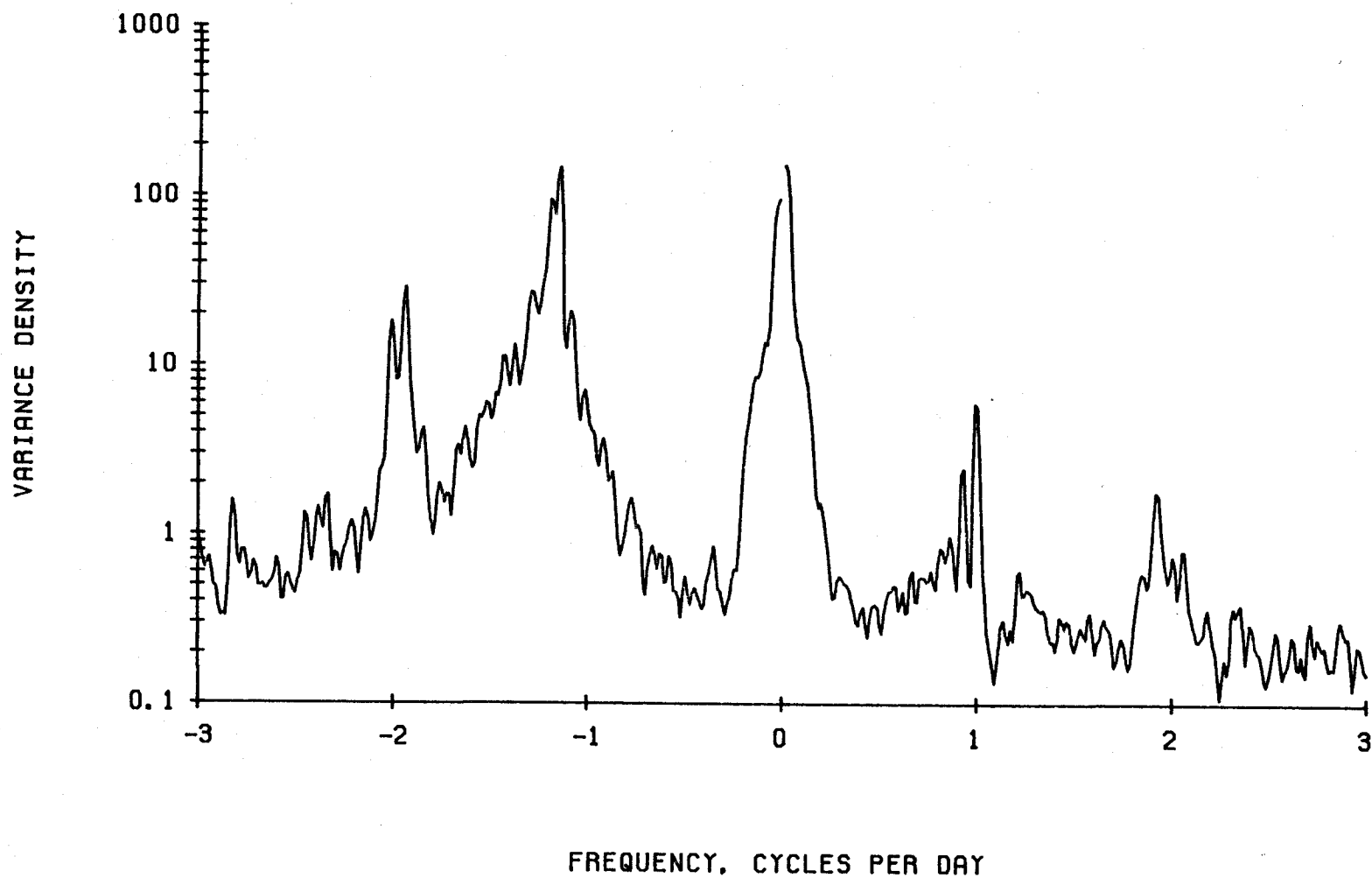
3400 METERS AT MOORING B.
LLP FILTERED PRESSURE

UNFILTERED CURRENT. 420 M AT EMPEROR MOORING B.

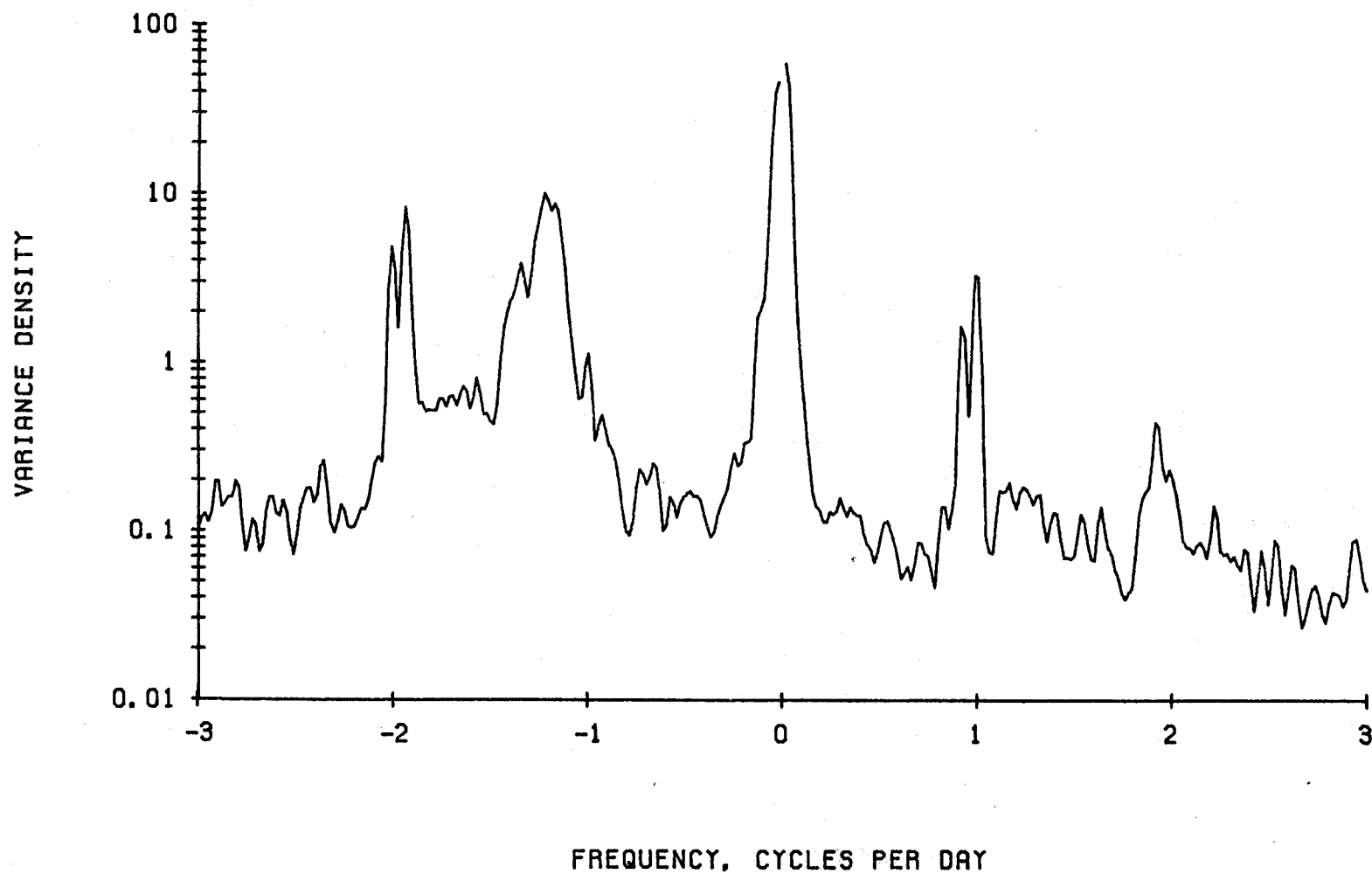


UNFILTERED CURRENT. 1100 M AT EMPEROR MOORING B.

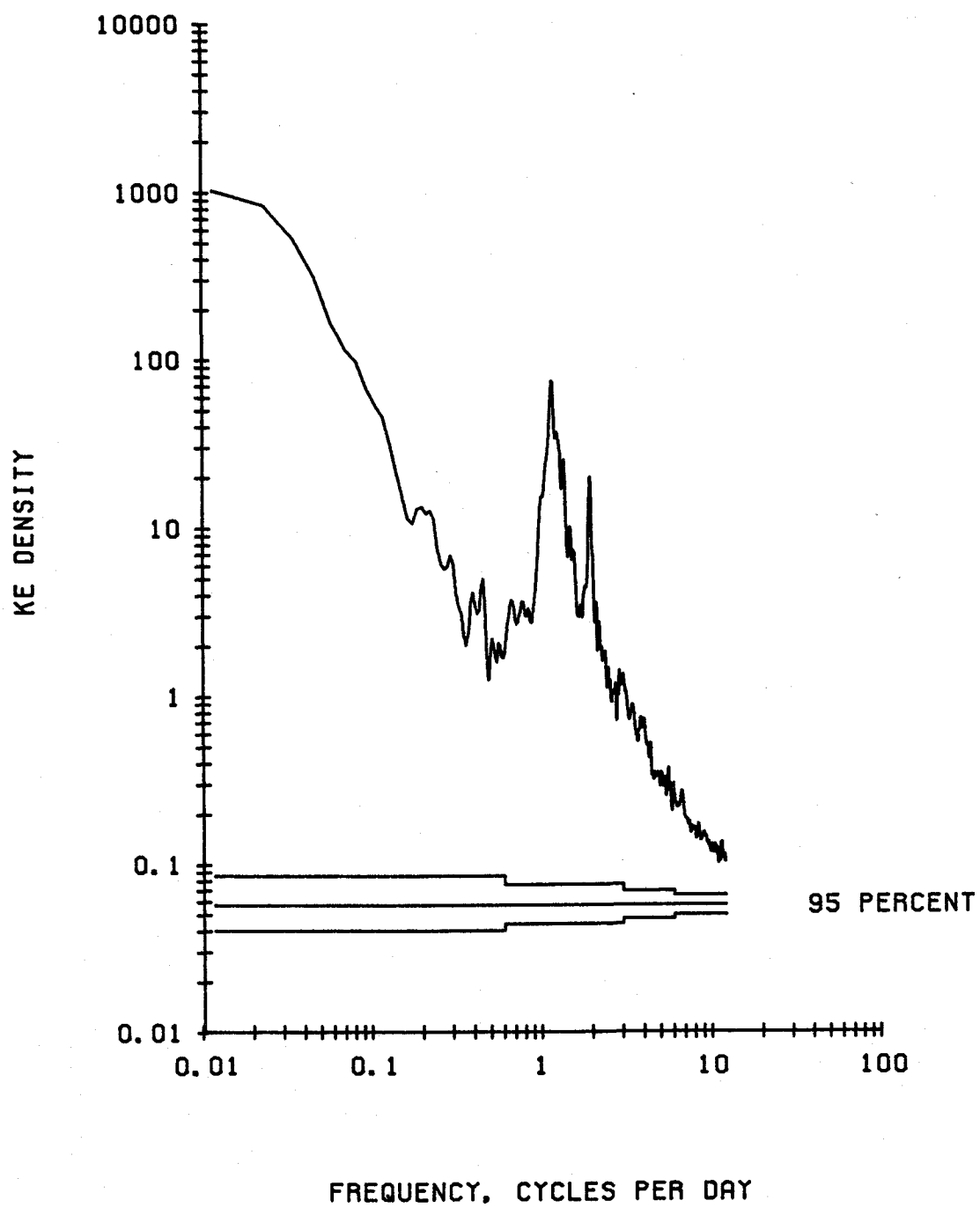
09



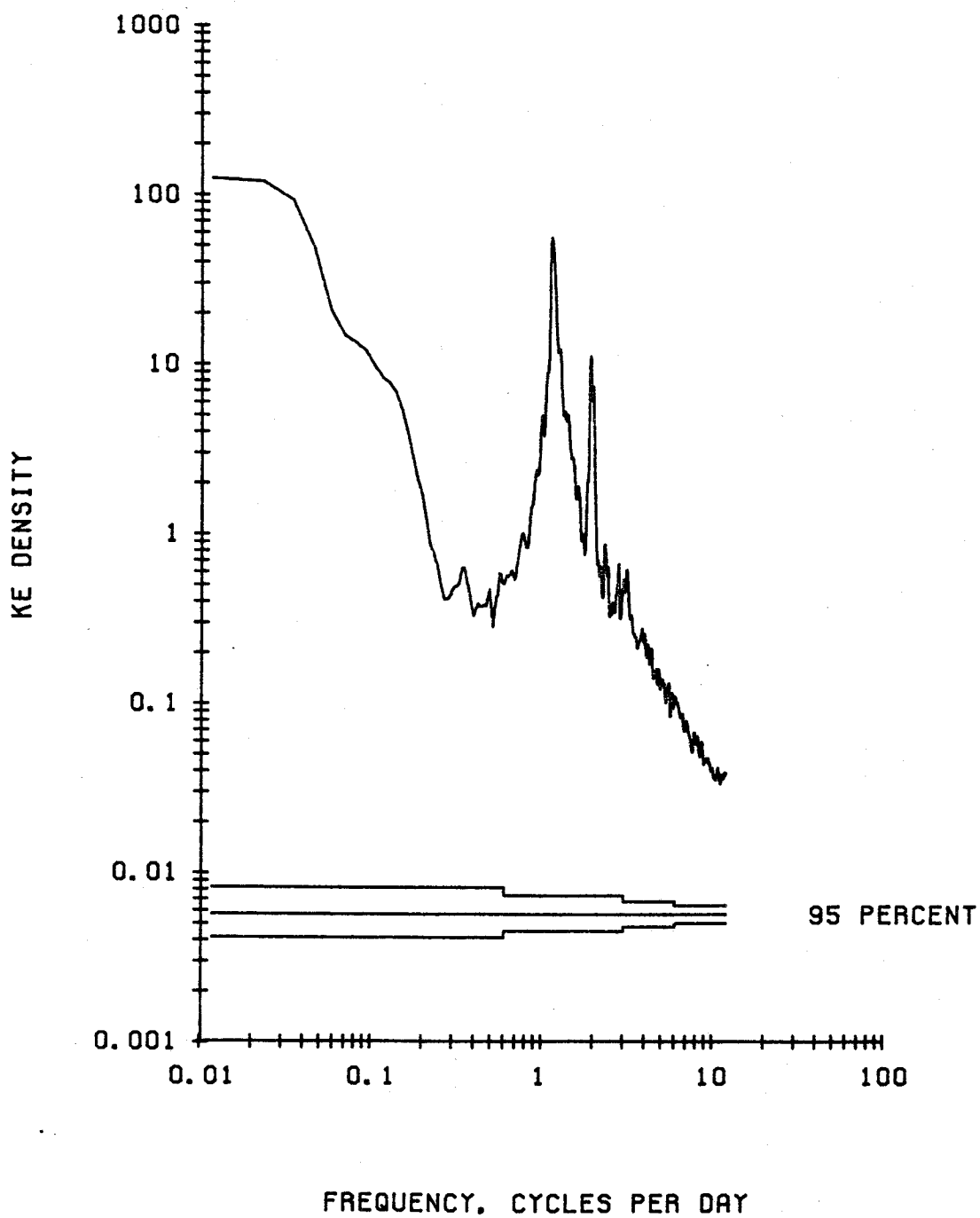
UNFILTERED CURRENT. 3400 M AT EMPEROR MOORING B.



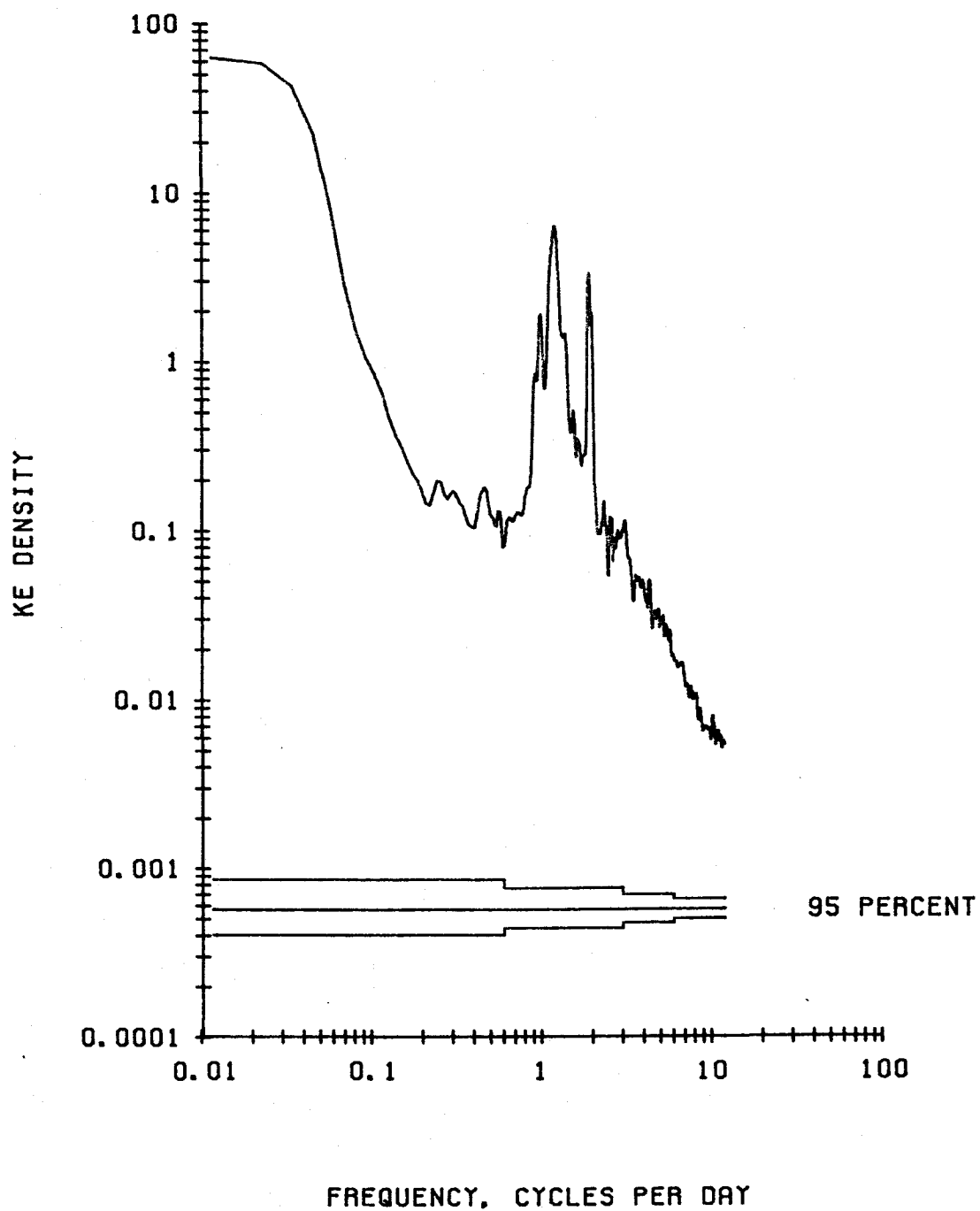
UNFILTERED CURRENT. 420 M AT EMPEROR MOORING B.



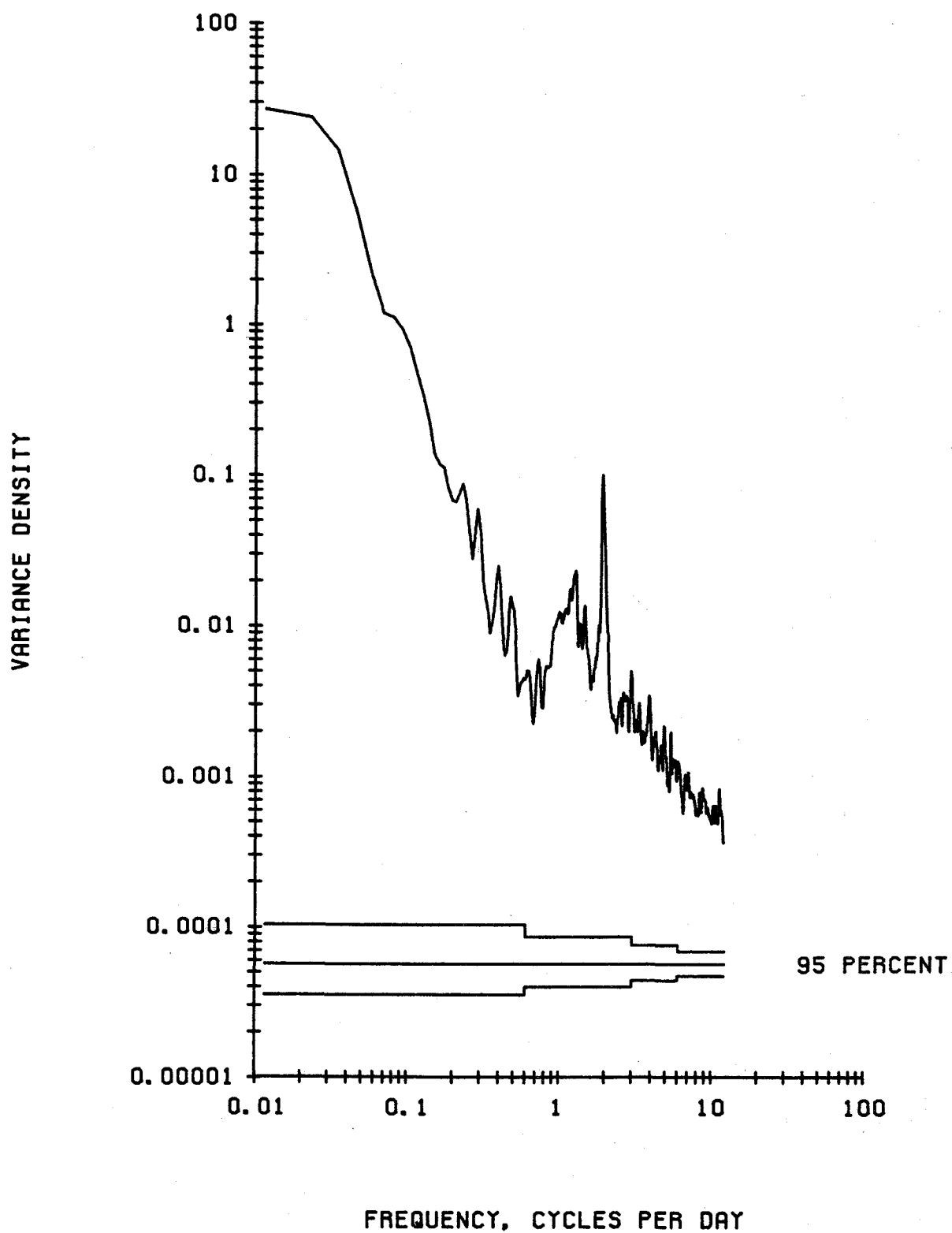
UNFILTERED CURRENT. 1100 M AT EMPEROR MOORING B.



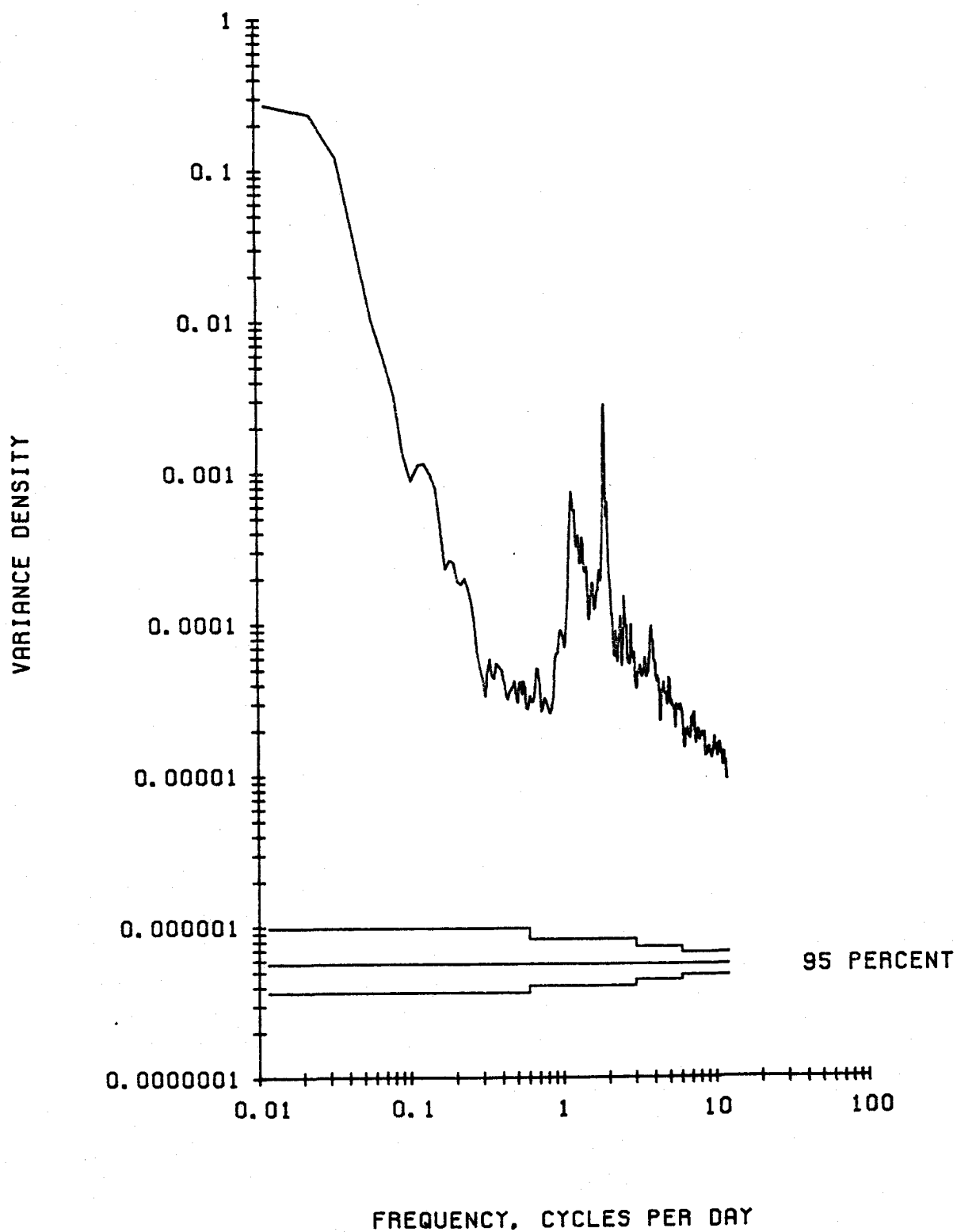
UNFILTERED CURRENT. 3400 M AT EMPEROR MOORING B.



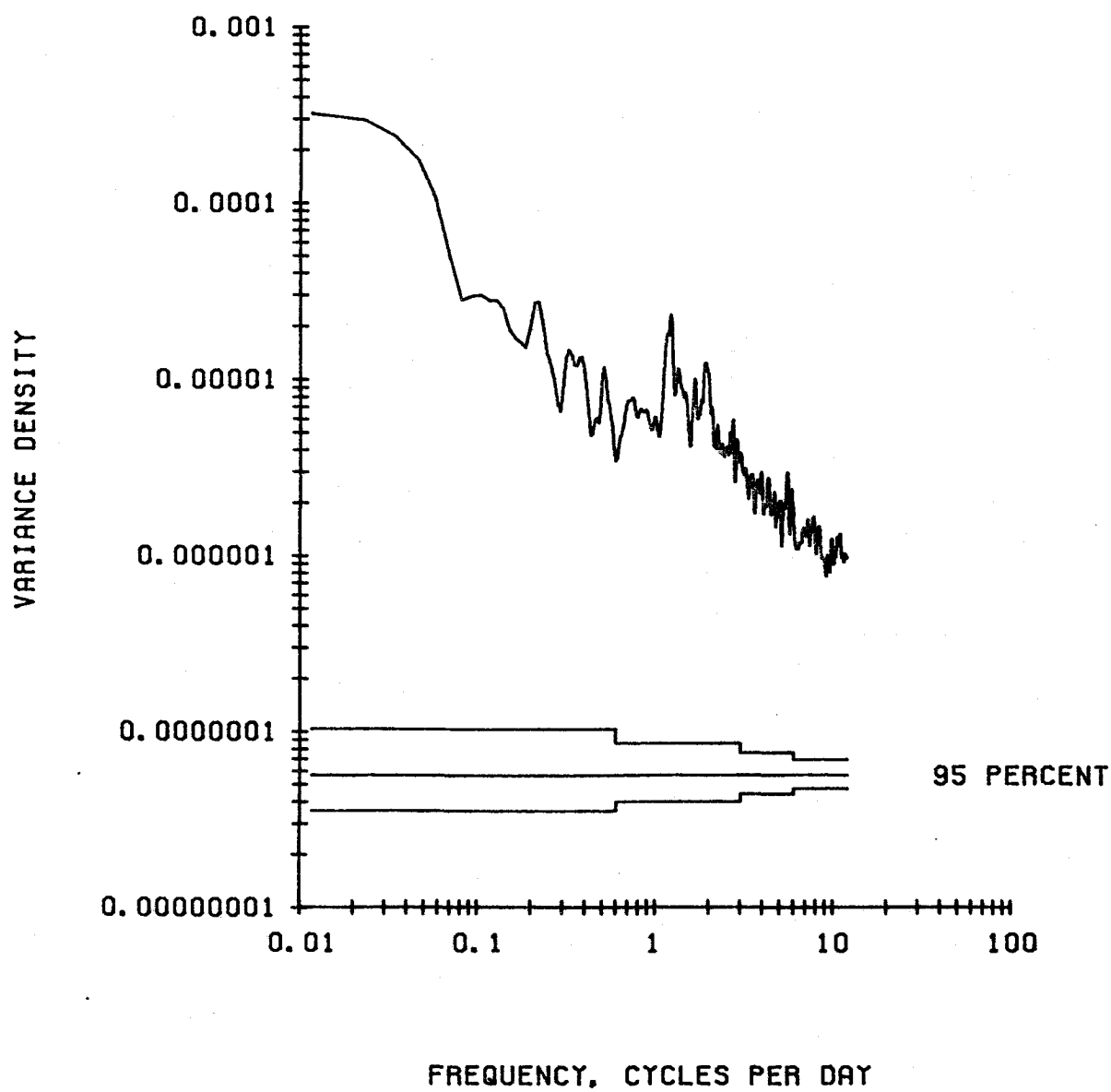
UNFILTERED TEMPERATURE. 420 M AT EMPEROR MOORING B.



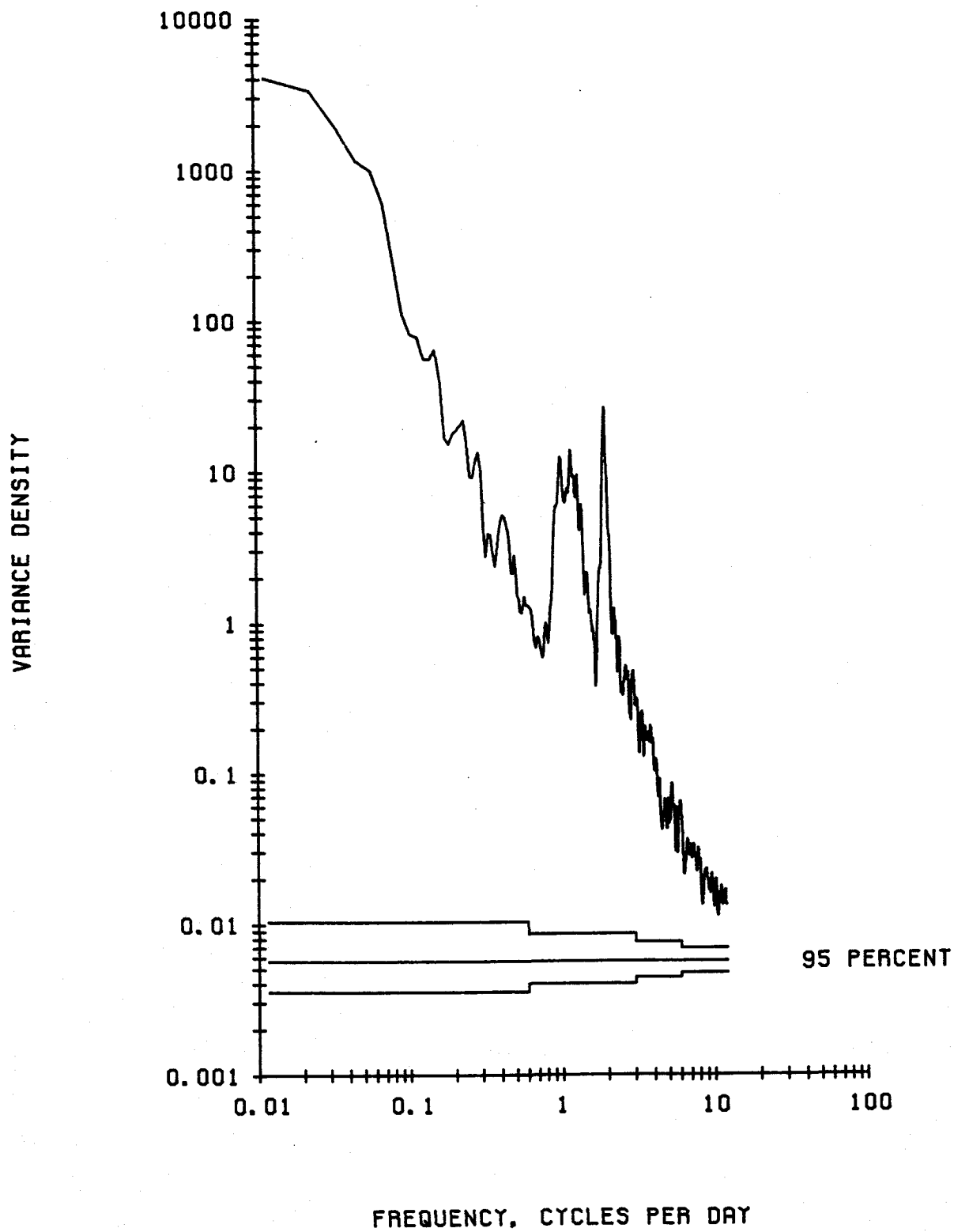
UNFILTERED TEMPERATURE. 1100 M AT EMPEROR MOORING B.



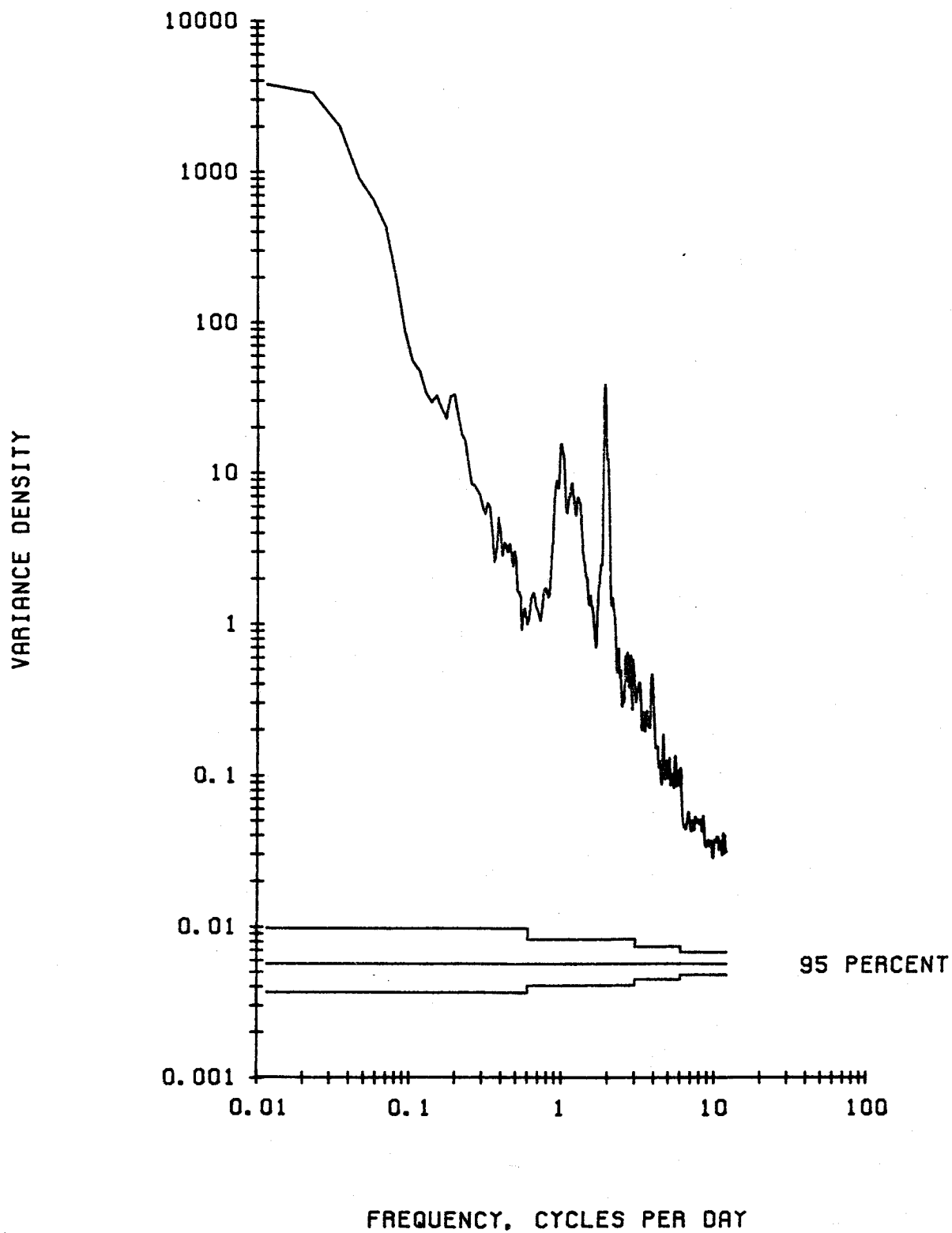
UNFILTERED TEMPERATURE. 3400 M AT EMPEROR MOORING B.



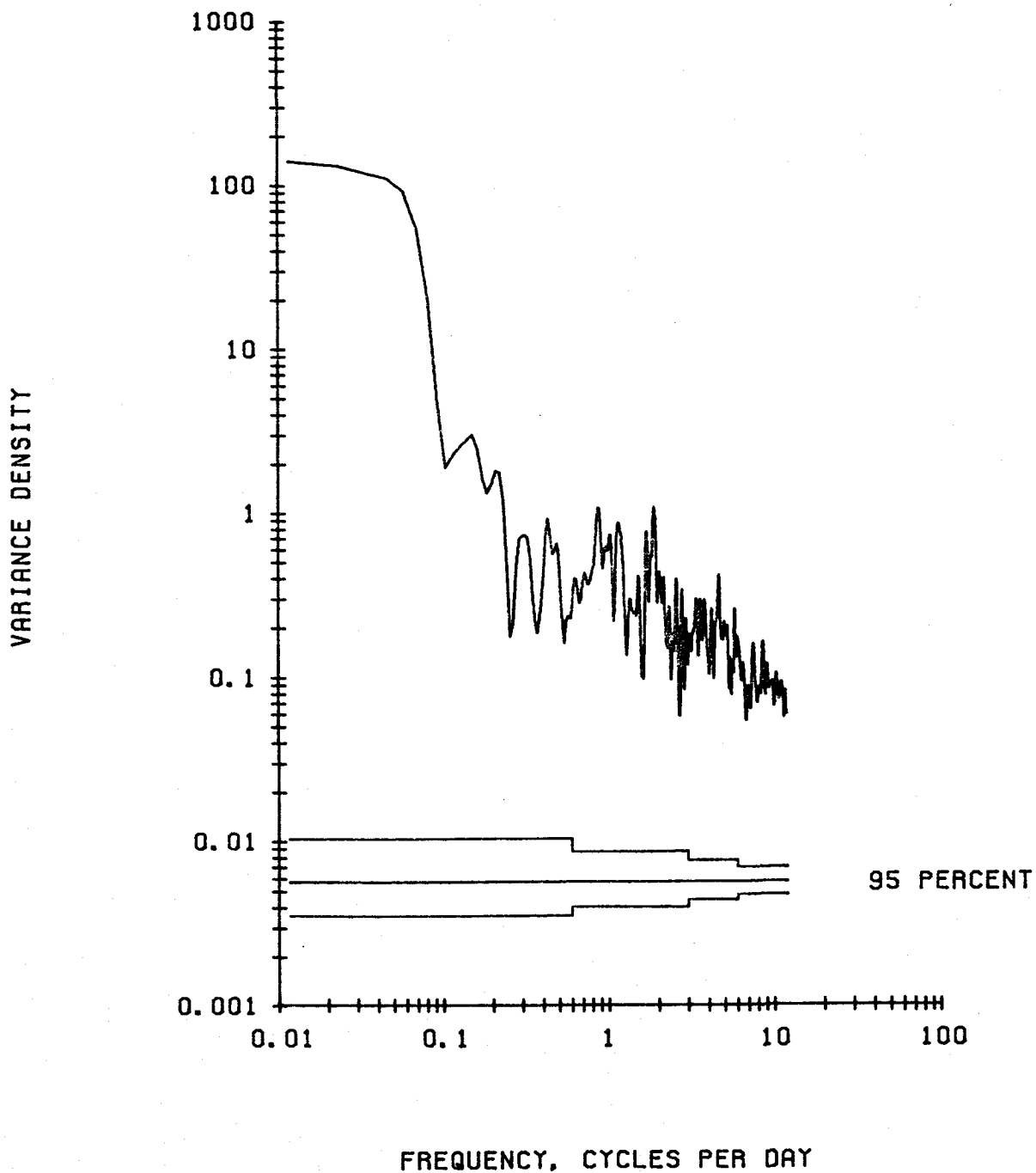
UNFILTERED PRESSURE. 420 M AT EMPEROR MOORING B.



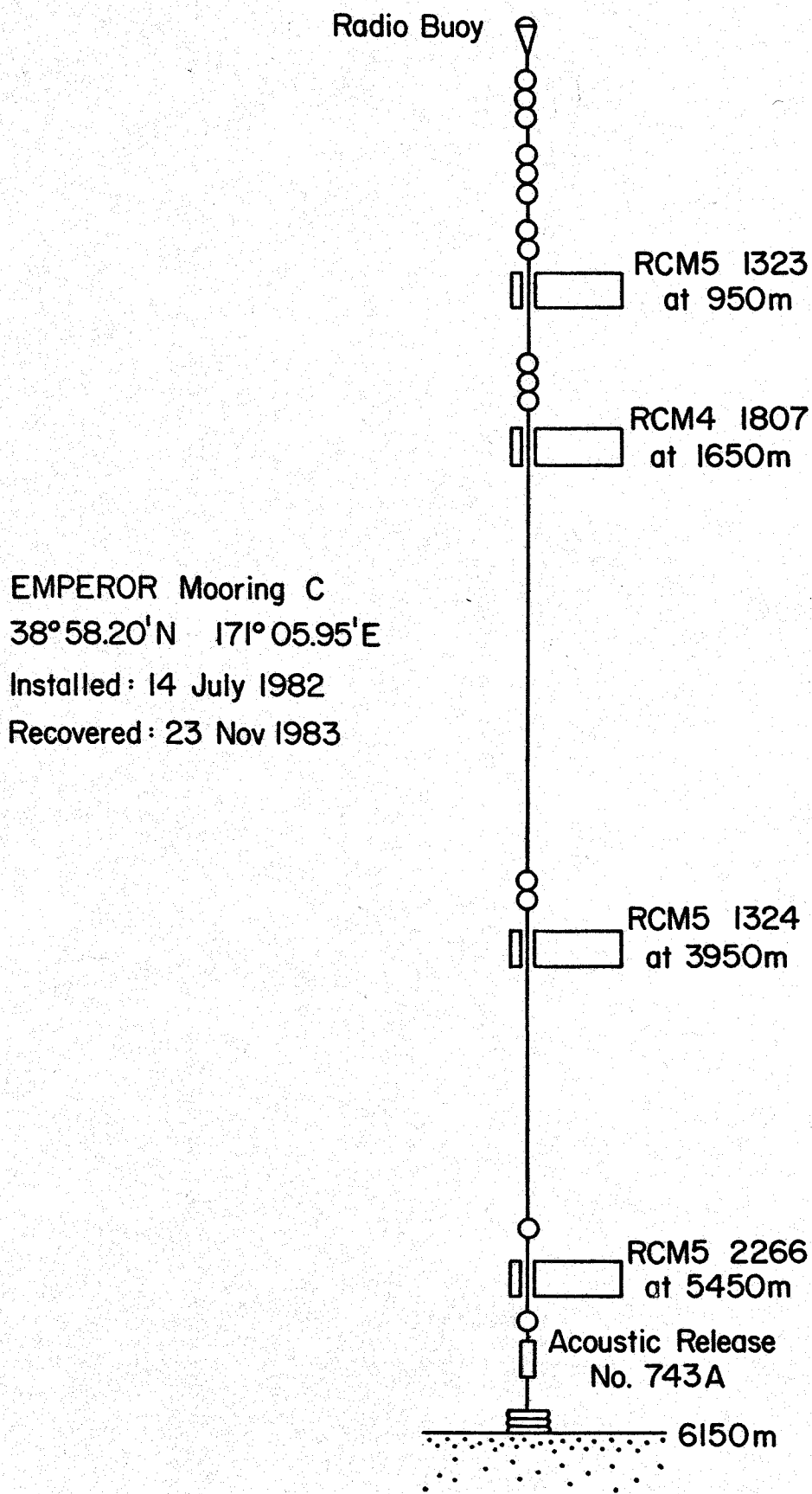
UNFILTERED PRESSURE. 1100 M AT EMPEROR MOORING B.



UNFILTERED PRESSURE. 3400 M AT EMPEROR MOORING B.



MOORING C.



EMPEROR MOORING C

Position: 38°58.20'N, 171°05.95'E
Depth of Water: 6150 m
Set at: 0636 UCT 14 JUL '82 by R/V T.G. THOMPSON
Retrieved at: 2213 UCT 23 NOV '83 by R/V T.G. THOMPSON
Data Interval: 0946 UCT 14 JUL '82 to 2102 UCT 23 NOV '83

Instrumentation

<u>Depth</u>	<u>Serial No./Tape No.</u>
950 m	RCM5 1323/23
1650 m	RCM4 1807/3
3950 m	RCM5 1324/9
5450 m	RCM5 2266/

Instrument 1323 recorded speed, direction, temperature, and pressure until 2346 UCT 5 AUG '83 when the battery apparently failed.

Instrument 1807 recorded speed, direction, temperature, and pressure until the instrument was recovered. The instrument appears to have been running about one hour slow when recovered.

Instrument 1324 recorded speed, direction, temperature, and pressure. Direction was recorded until line 6549 (0601 13 APR '83). Speed was recorded until line 6744 (1501 22 APR '83). Temperature and pressure were recorded until line 7094 2301 5 MAY '83.

Instrument 2266 flooded. No data was recovered.

EMPEROR MOORING C

950 METERS

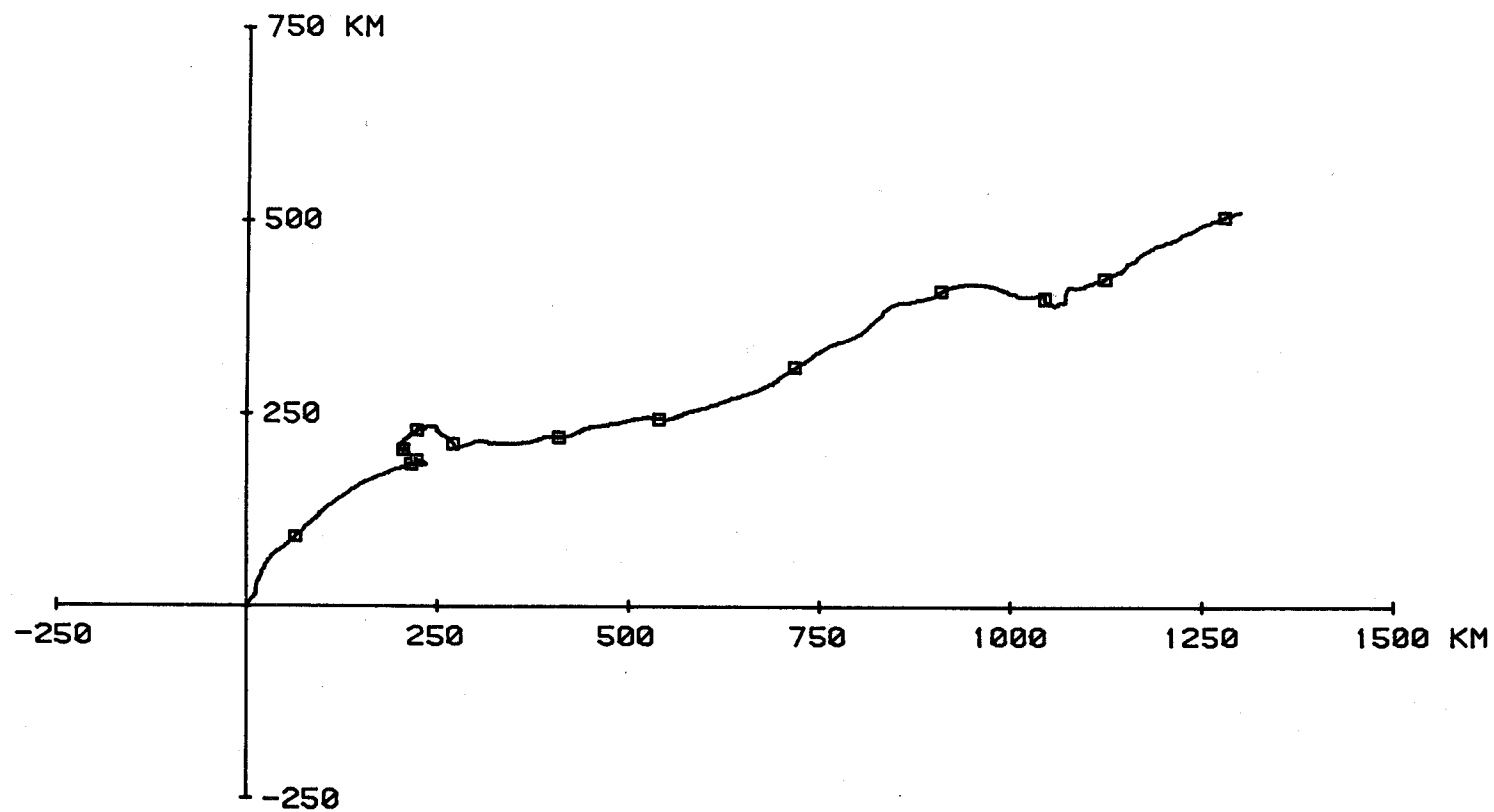
	MIN	MEAN	MAX	SD	N
S(cm/sec)	0.70	6.53	27.20	4.58	9303
u(cm/sec)	-13.00	3.88	26.60	5.21	9303
v(cm/sec)	-15.00	1.53	19.90	4.38	9303
T(°C)	2.98	3.41	3.79	0.14	9303
P(decibars)	951.50	959.09	993.50	5.82	9303

1650 METERS

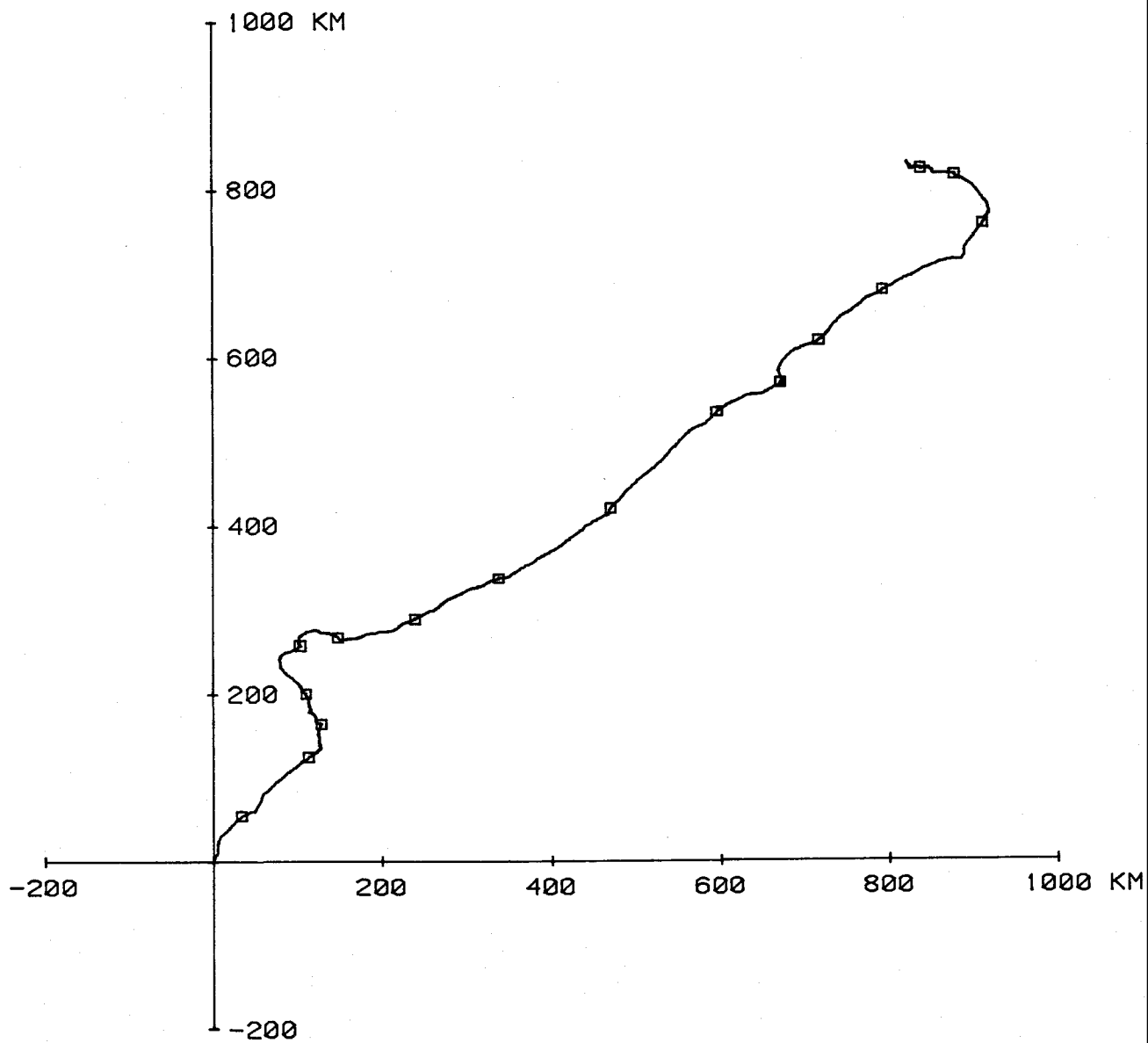
S(cm/sec)	0.80	5.75	21.20	2.96	11940
u(cm/sec)	-17.90	1.91	20.00	4.66	11940
v(cm/sec)	-12.50	1.94	16.40	3.52	11940
T(°C)	2.10	2.25	2.41	0.05	11940
P(decibars)	1658.20	1666.42	1698.70	5.88	11940

3950 METERS

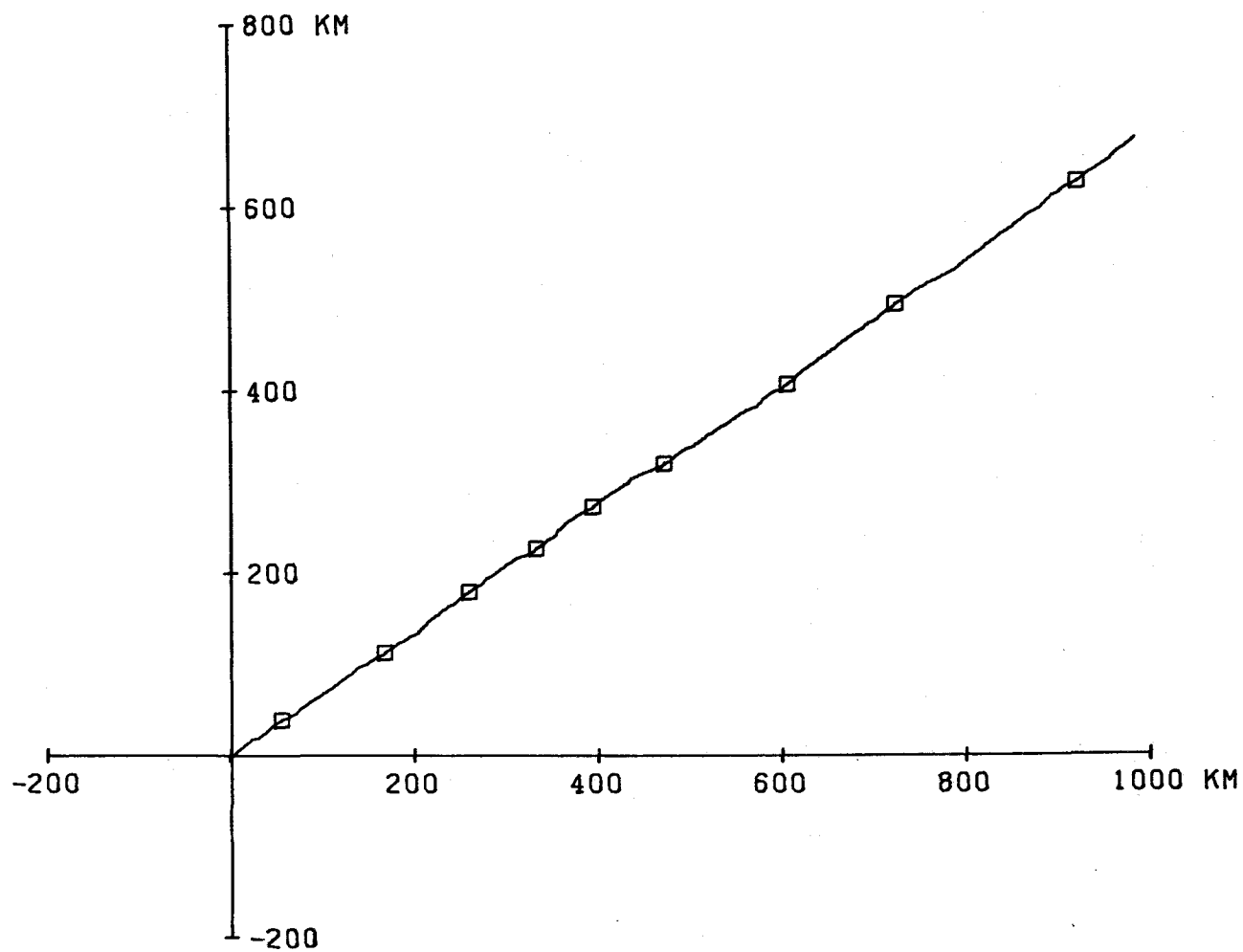
S(cm/sec)	0.70	5.62	17.30	2.99	6774
u(cm/sec)	-4.60	4.19	15.40	2.78	6549
v(cm/sec)	-5.10	2.85	11.60	2.34	6549
T(°C)	1.46	1.48	1.53	0.01	7094
P(decibars)	4008.00	4012.32	4032.00	3.10	7094



950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 5 AUG 83.

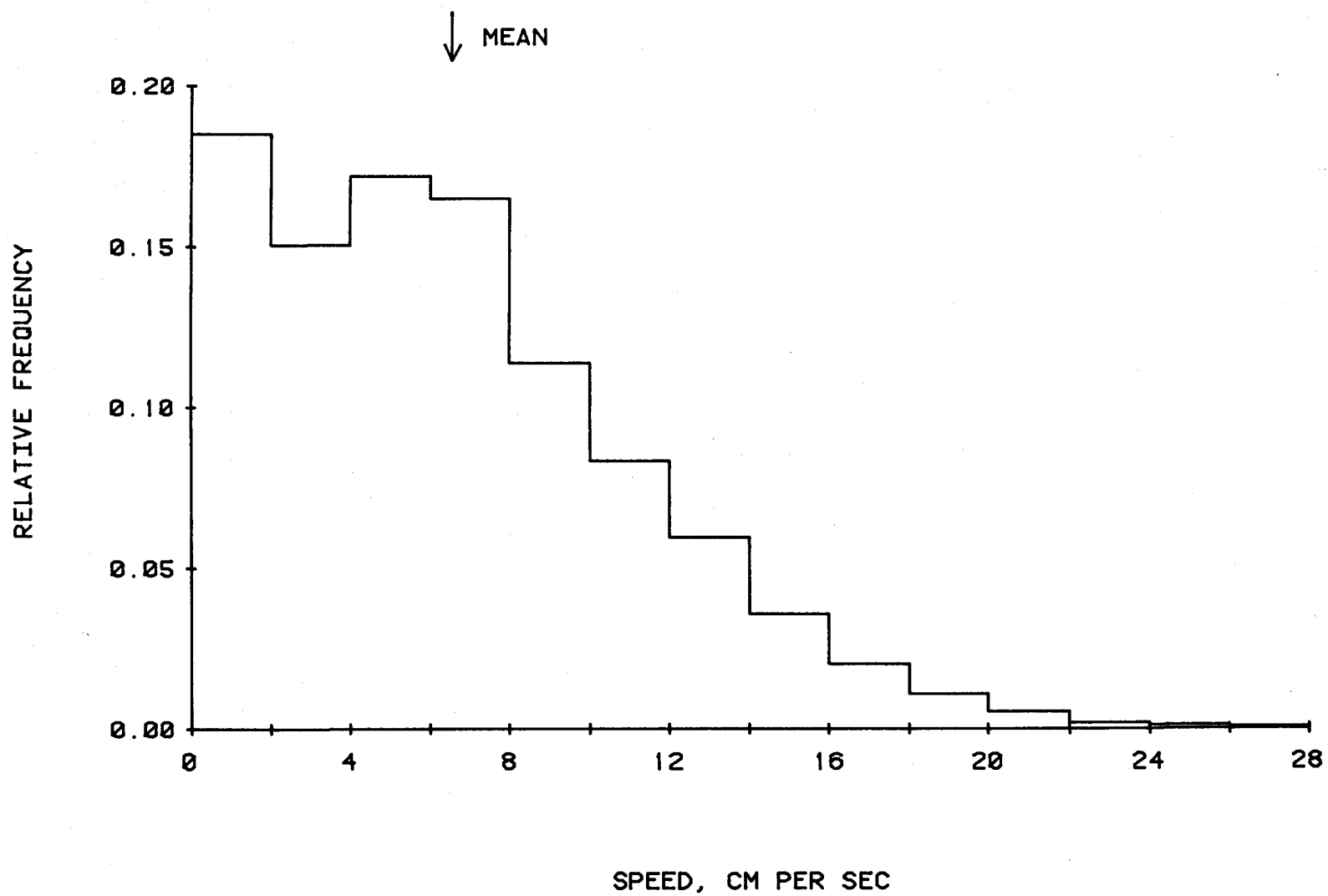


1650 METERS AT EMPEROR MOORING C. 14 JUL 82 - 23 NOV 83.

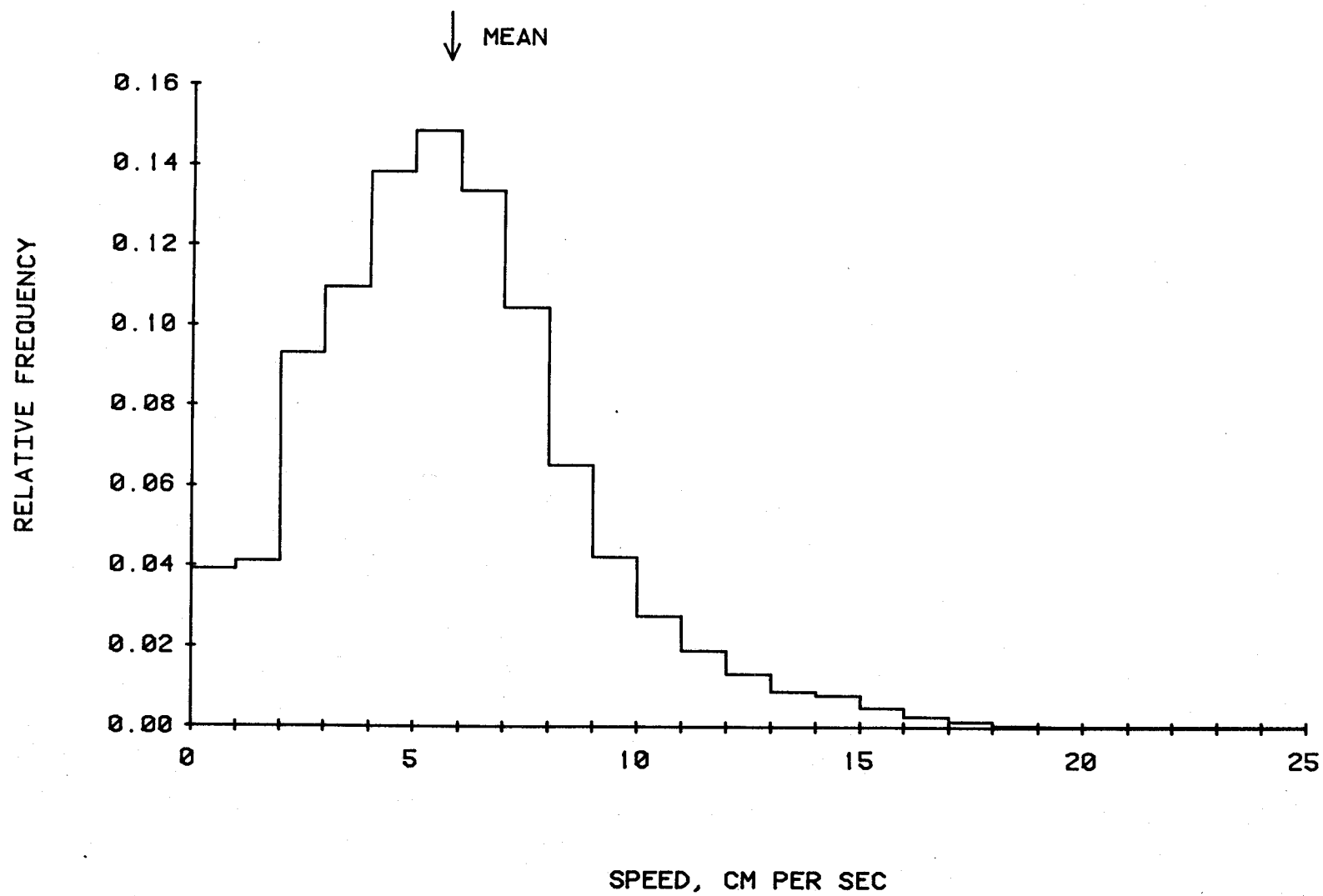


3950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 13 APR 83.

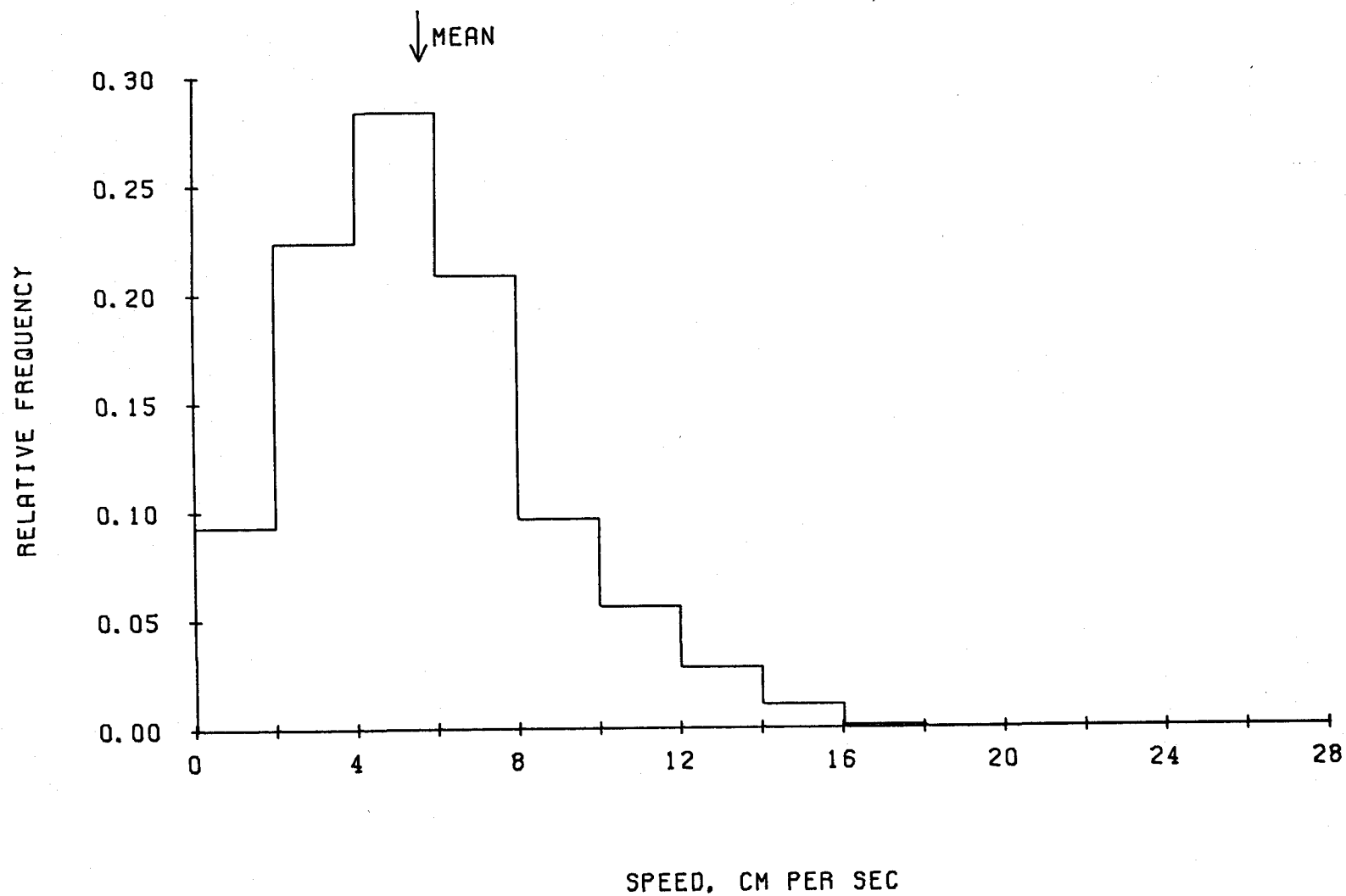
950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 5 AUG 83.



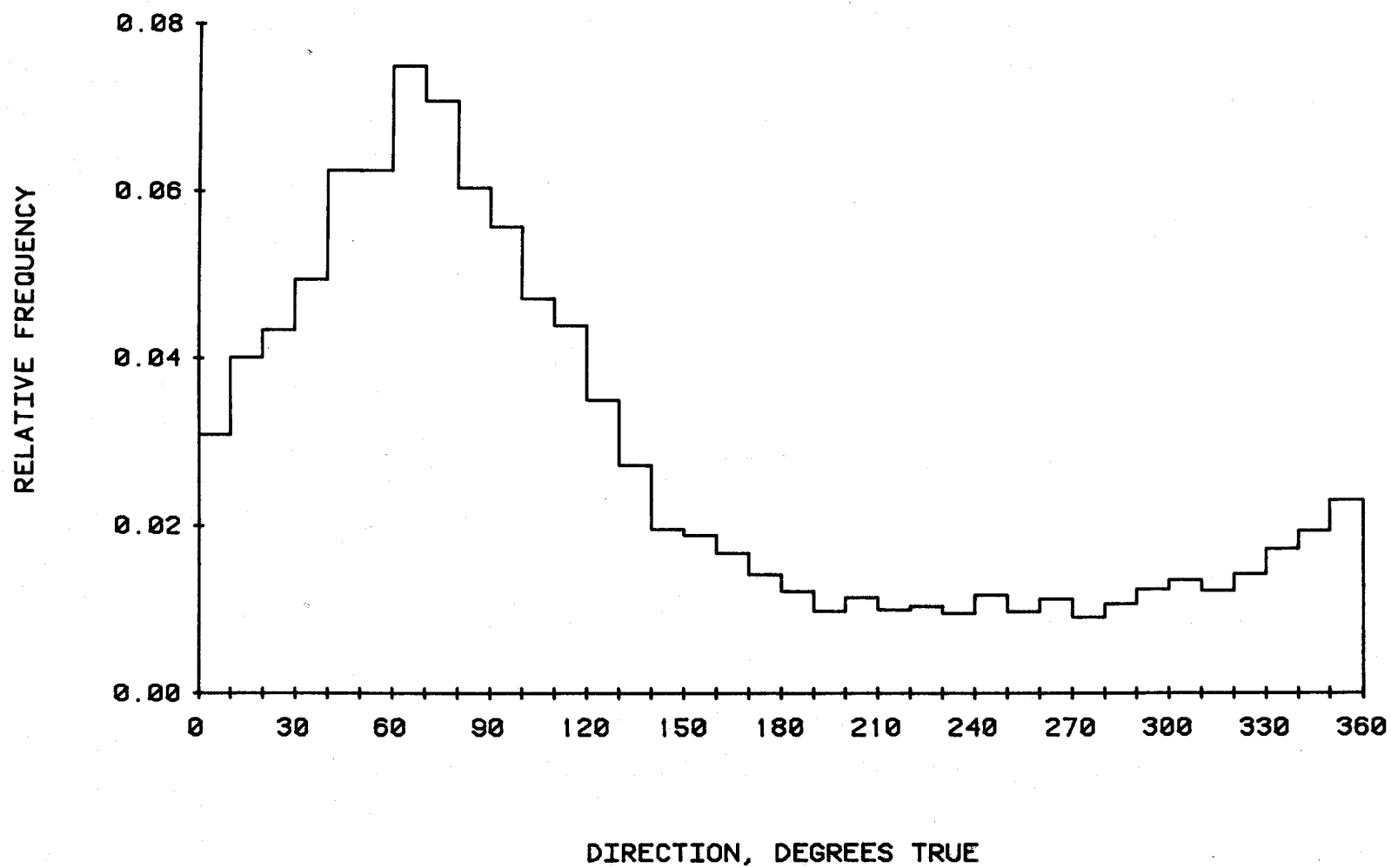
1650 METERS AT EMPEROR MOORING C. 14 JUL 82 - 23 NOV 83.



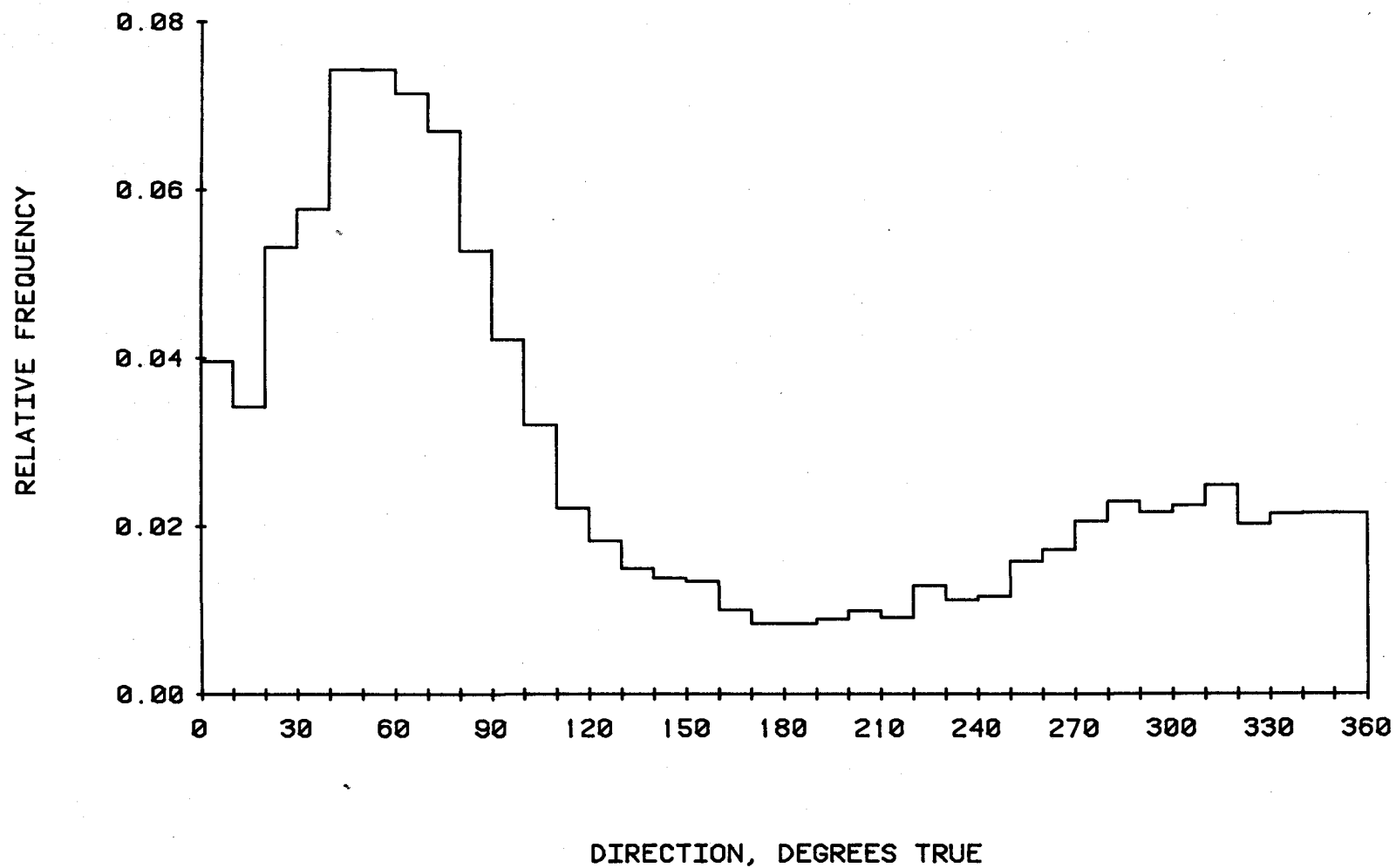
3950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 22 APR 83.



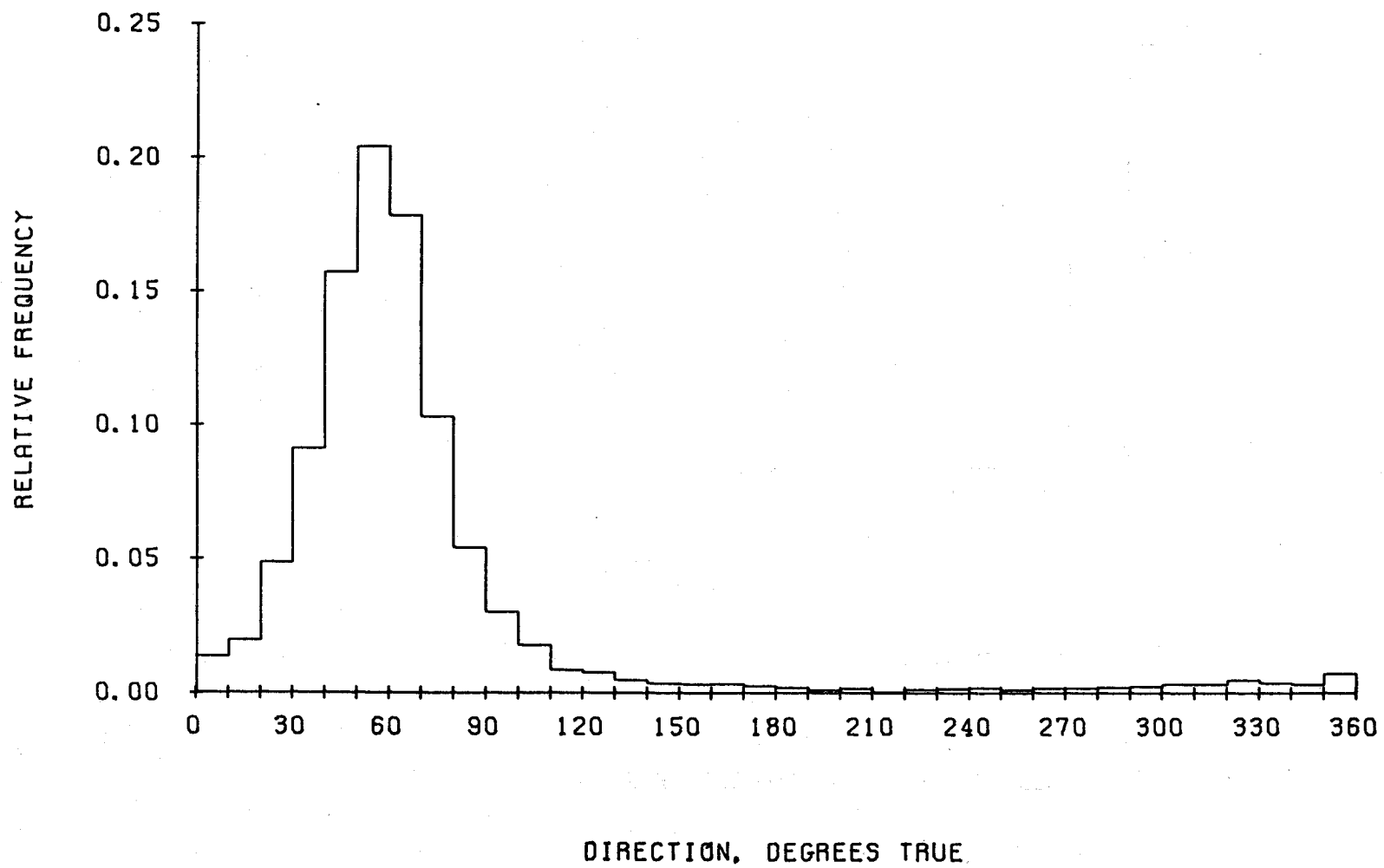
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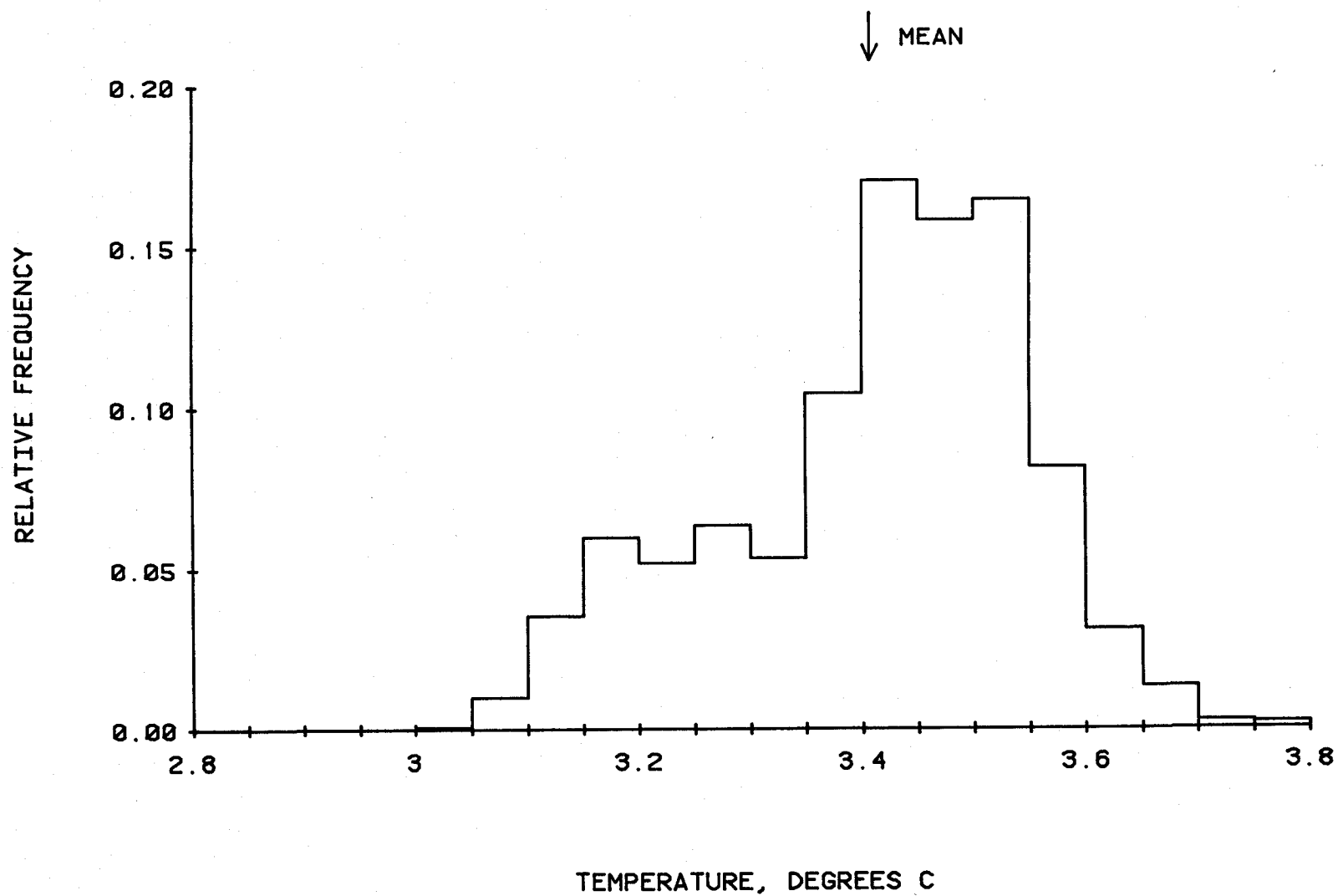
1650 METERS AT EMPEROR MOORING C. 14 JUL 82 - 23 NOV 83.



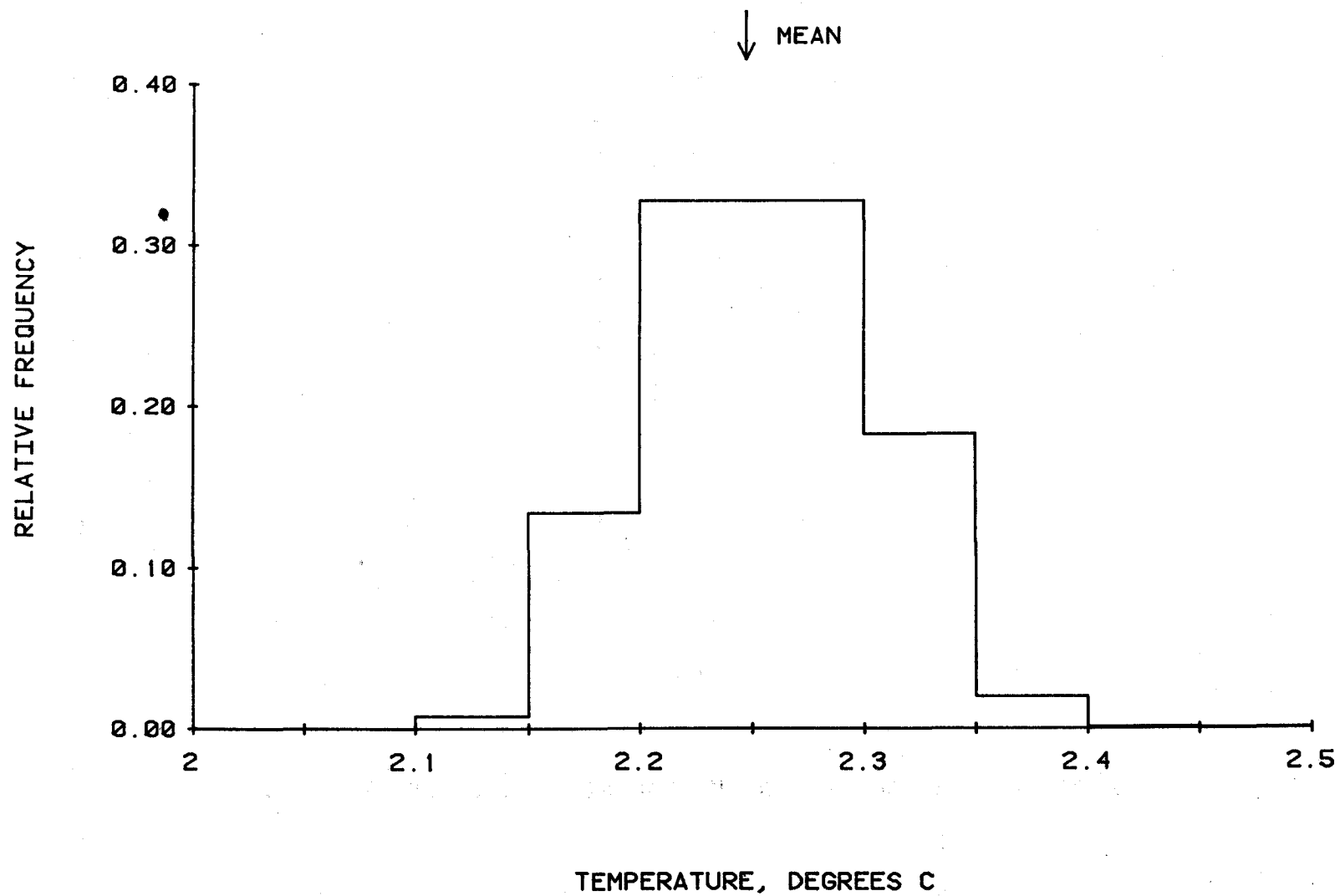
3950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 13 APR 83.



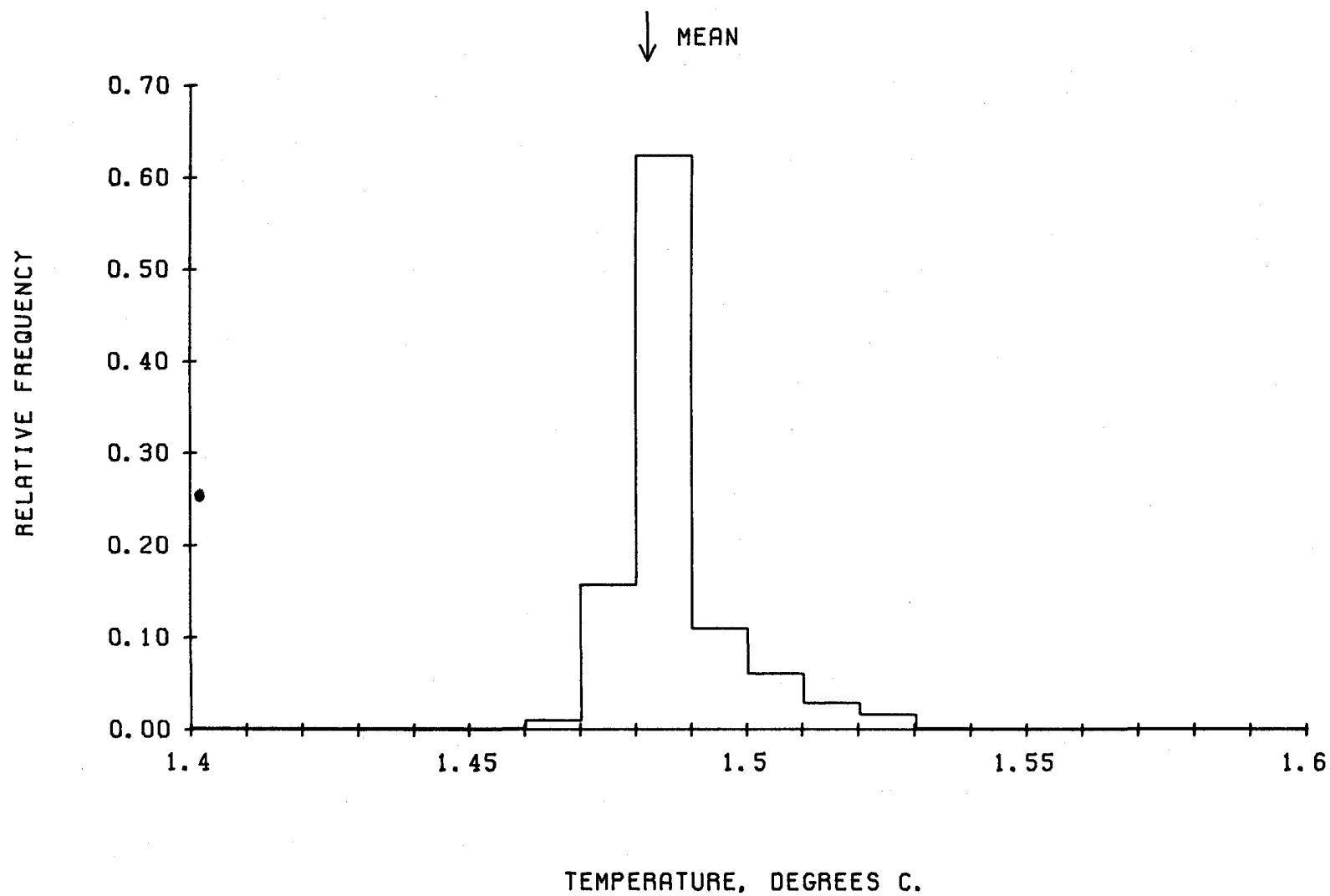
950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 5 AUG 83.



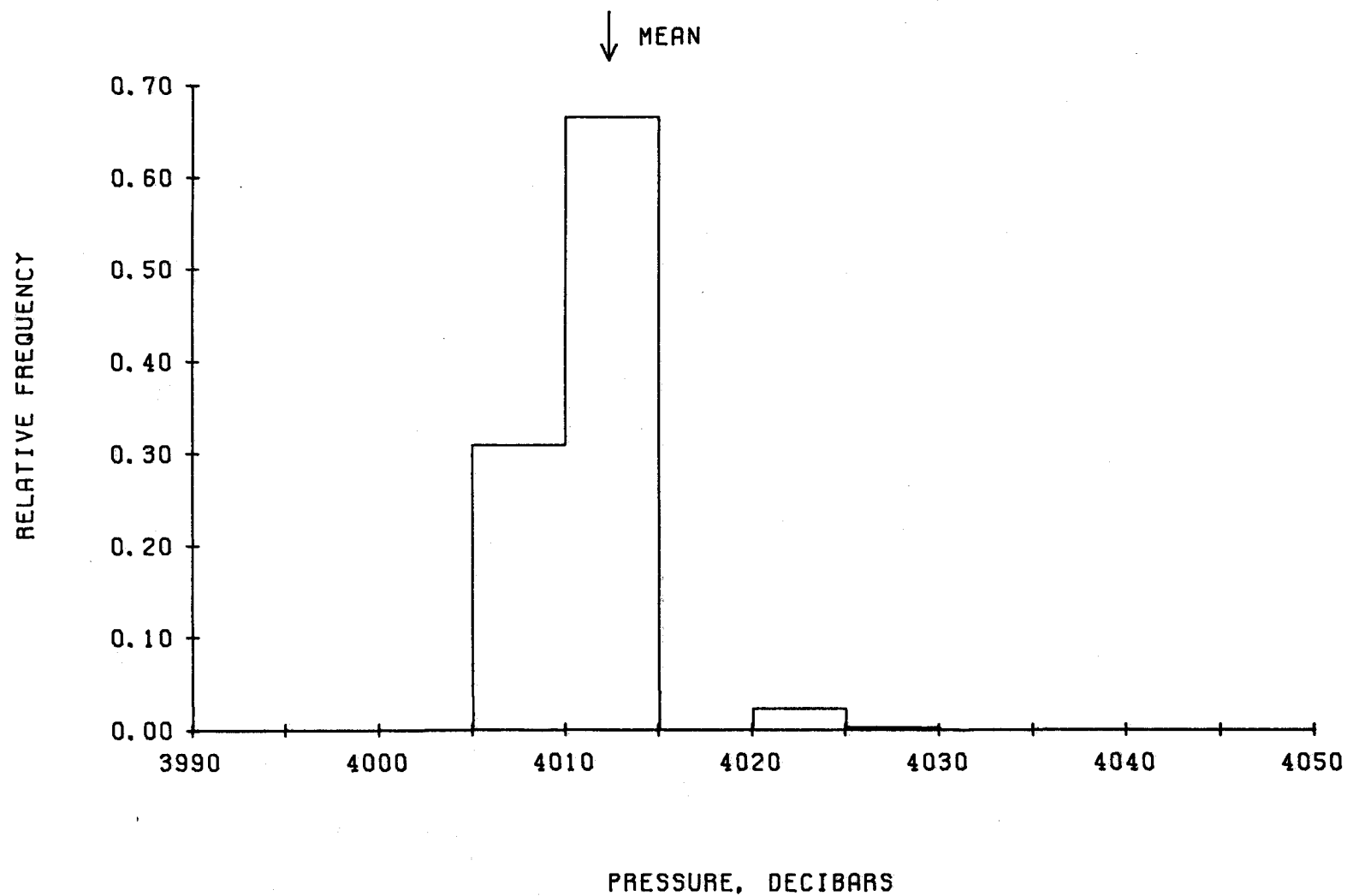
1650 METERS AT EMPEROR MOORING C. 14 JUL 82 - 23 NOV 83.



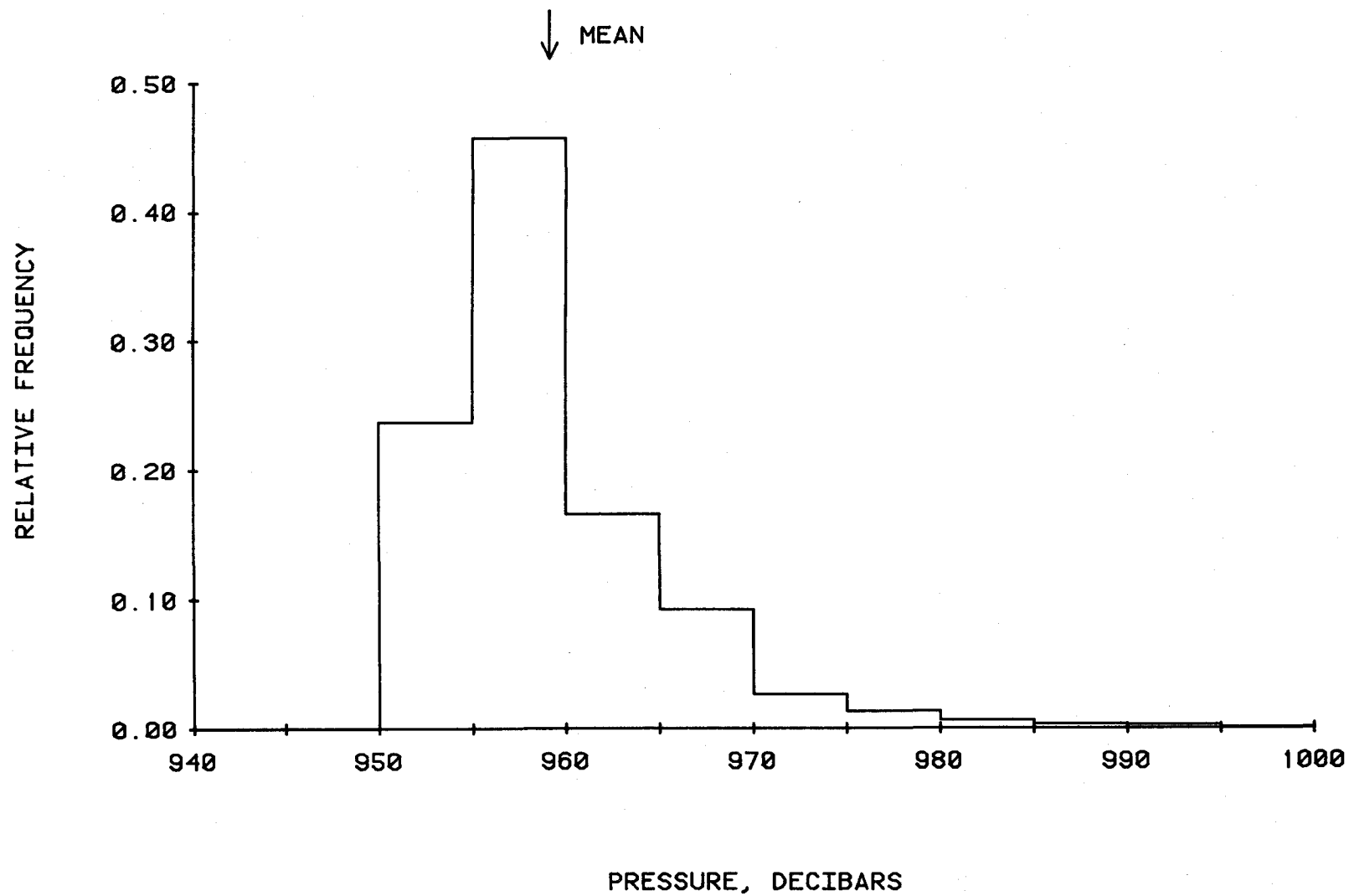
3950 METERS AT EMPEROR MOORING C. 14 JUL 81 - 5 MAY 83.



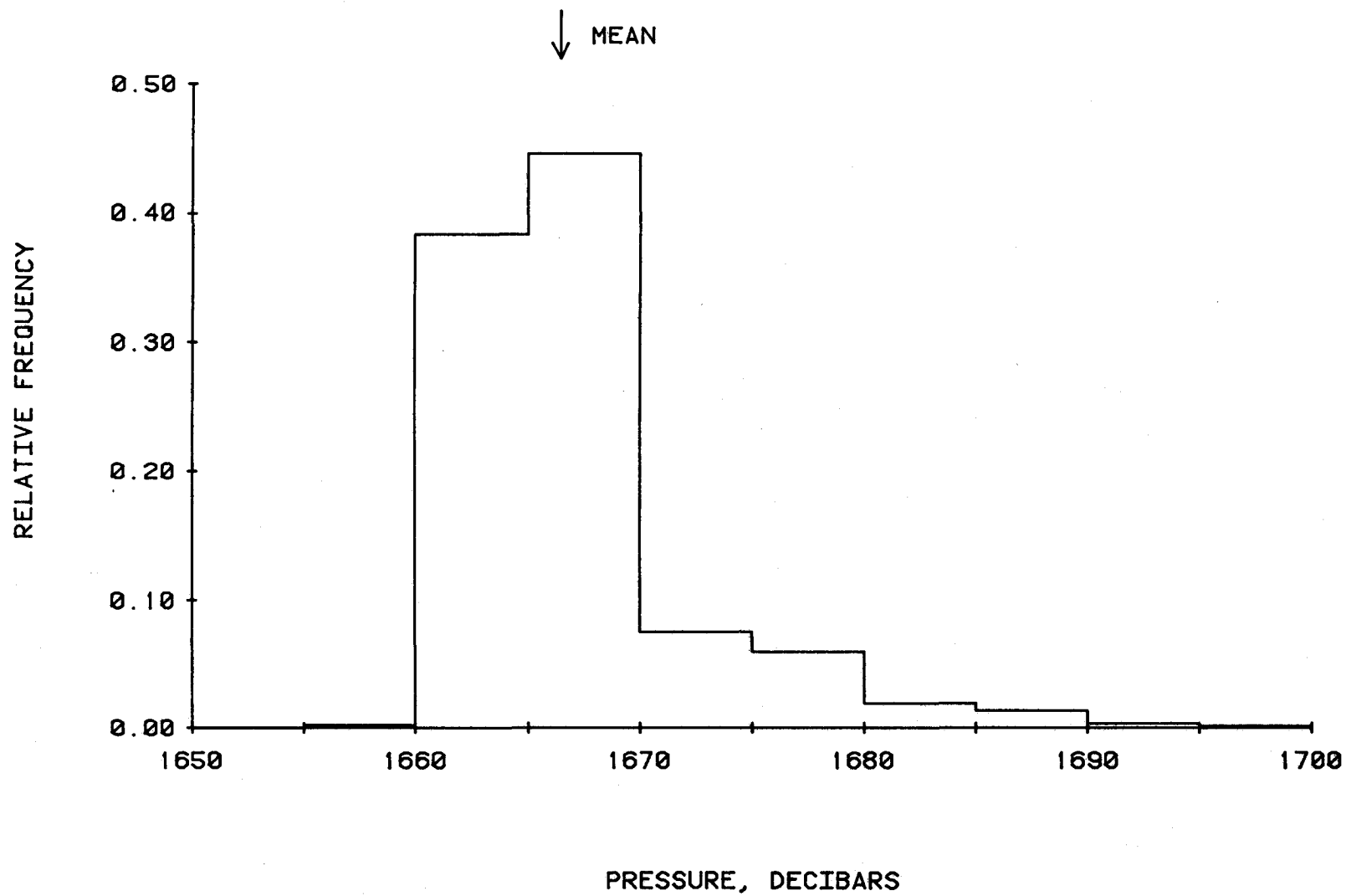
3950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 5 MAY 83.

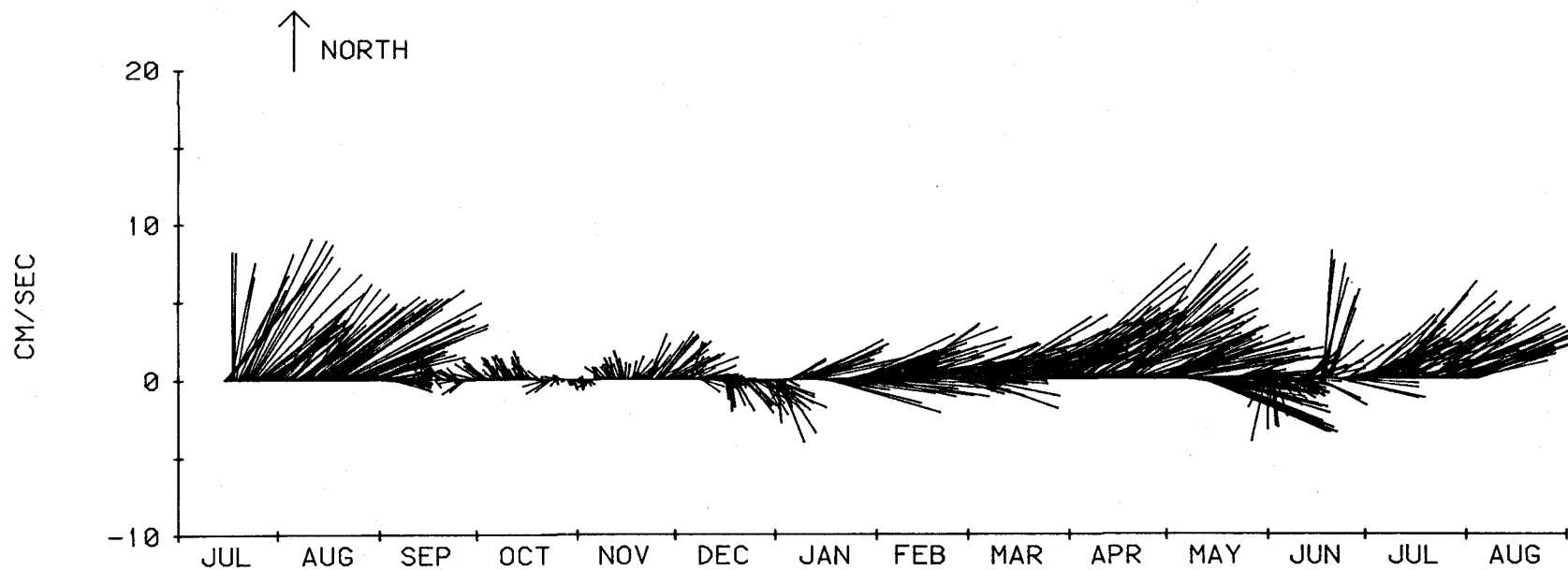


950 METERS AT EMPEROR MOORING C. 14 JUL 82 - 5 AUG 83.

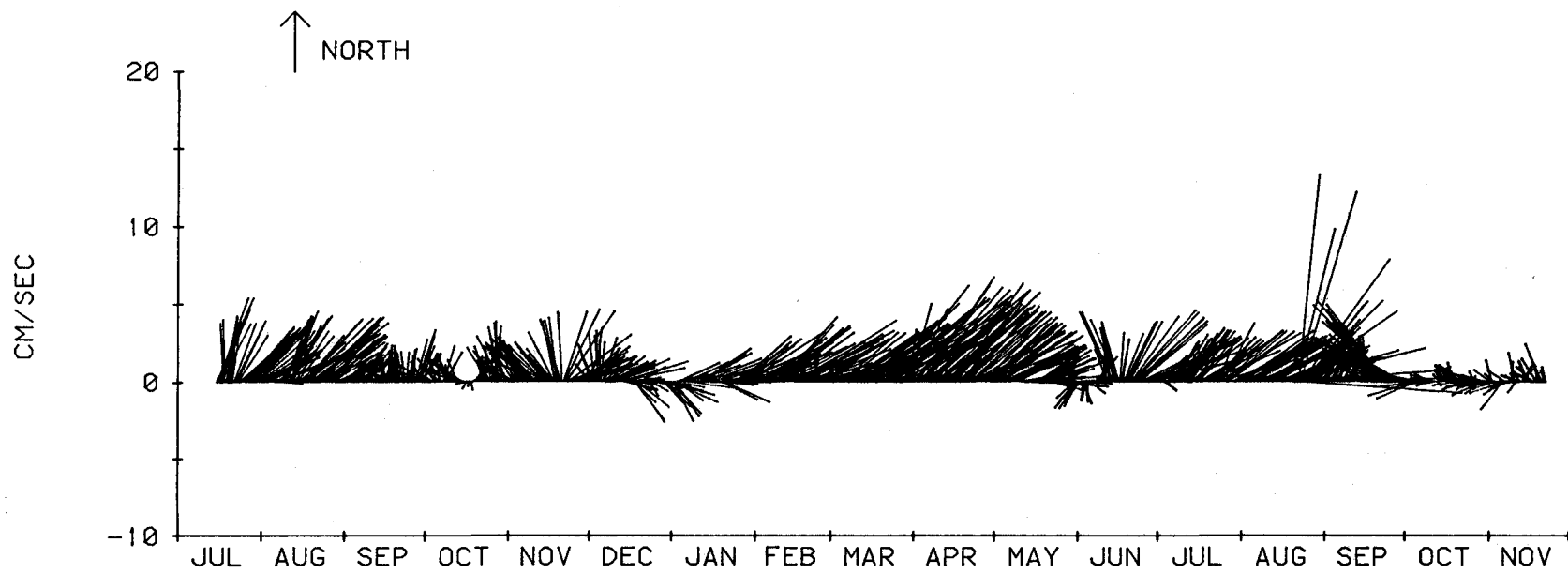


1650 METERS AT EMPEROR MOORING C. 14 JUL 82 - 23 NOV 83.

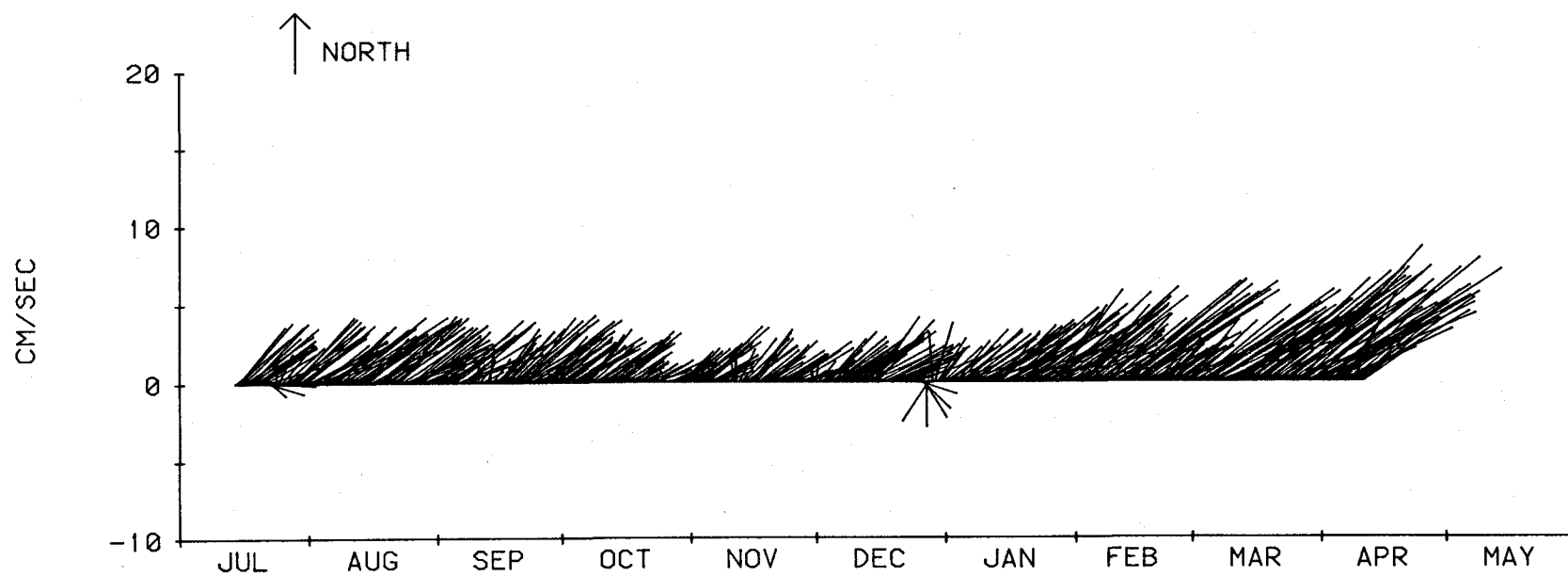




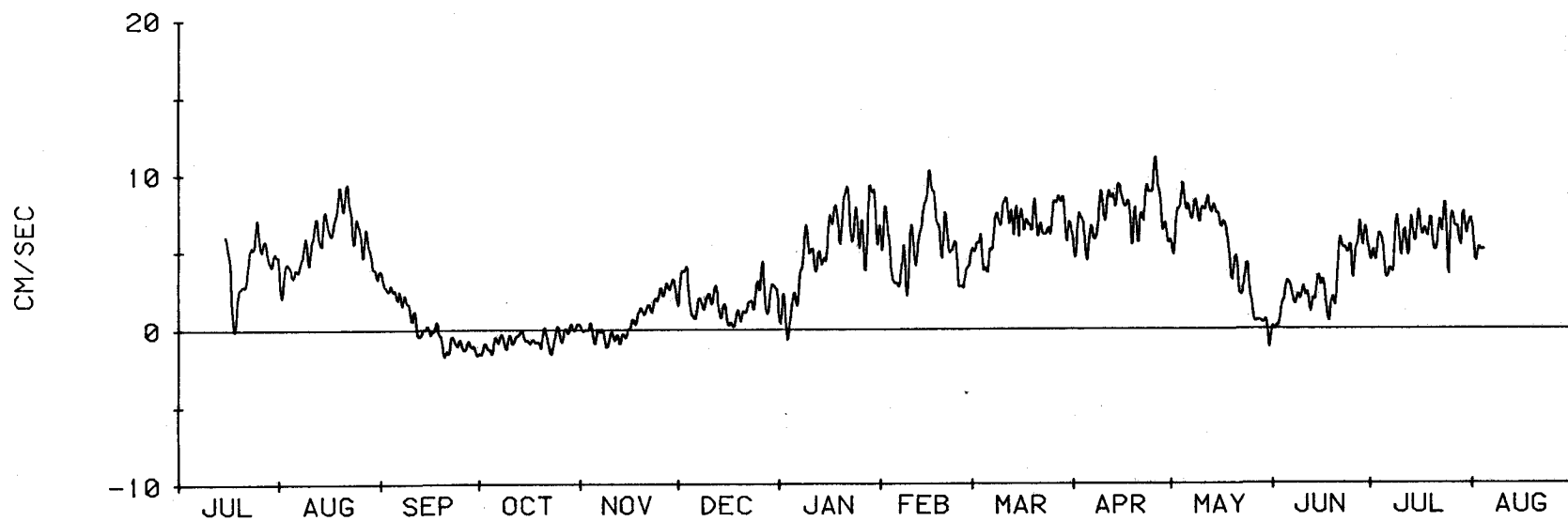
950 METERS AT MOORING C
LLP FILTERED CURRENT



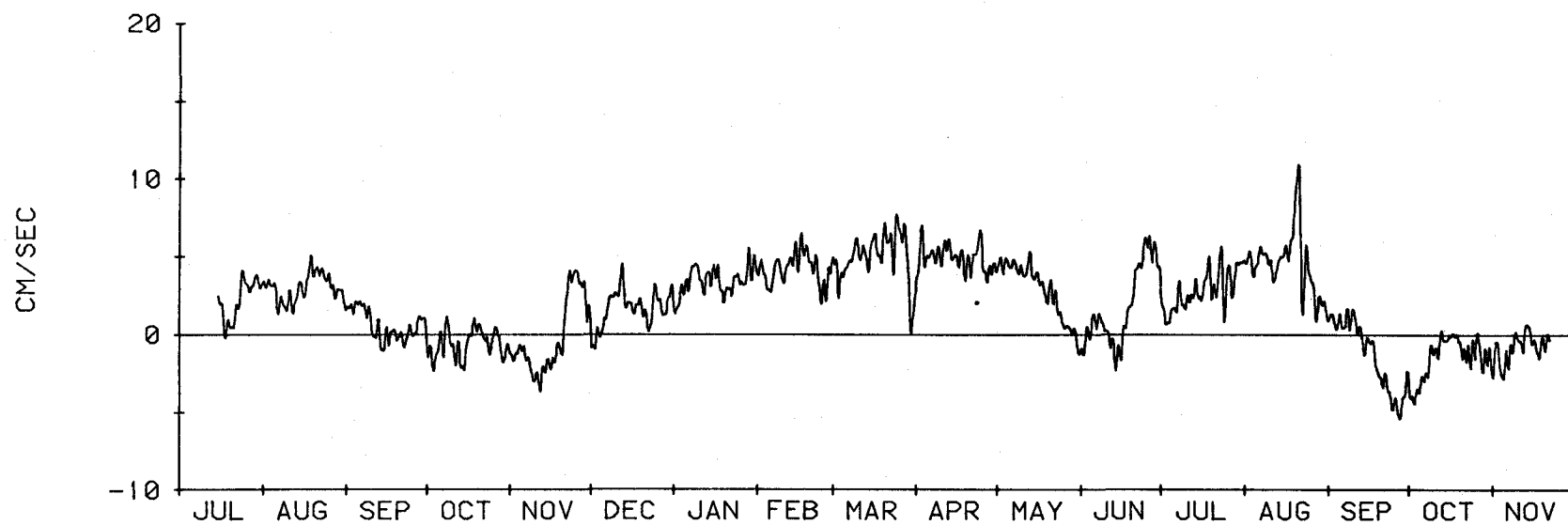
1650 METERS AT MOORING C
LLP FILTERED CURRENT



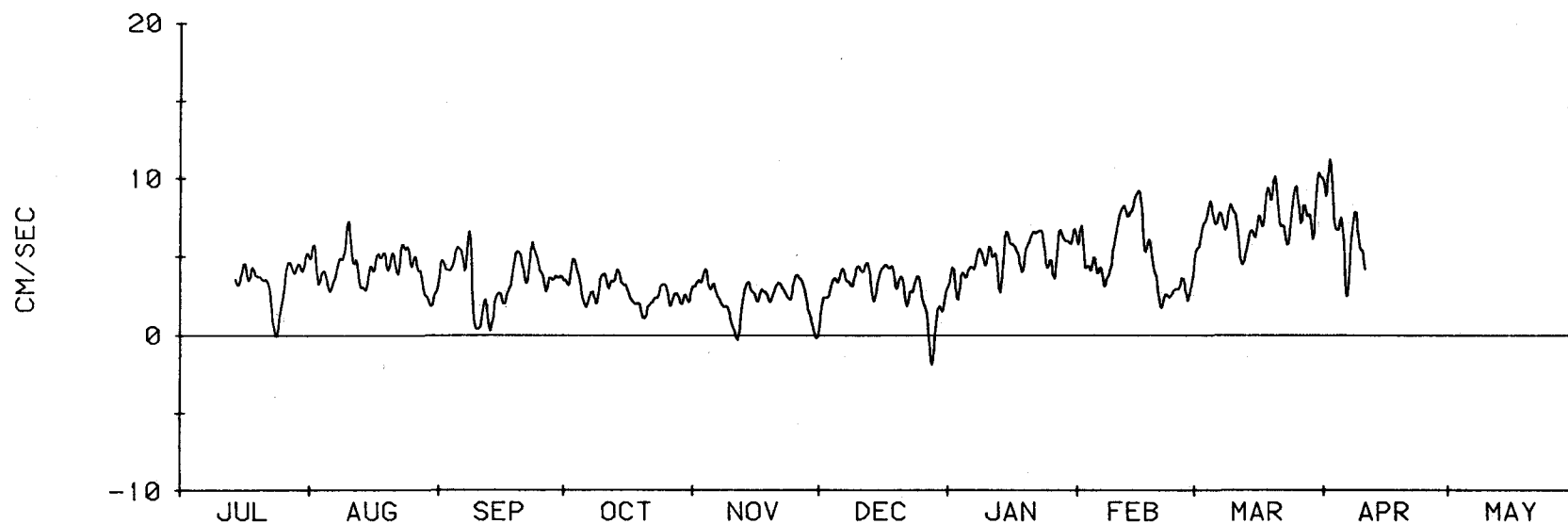
3950 METERS AT MOORING C
LLP FILTERED CURRENT



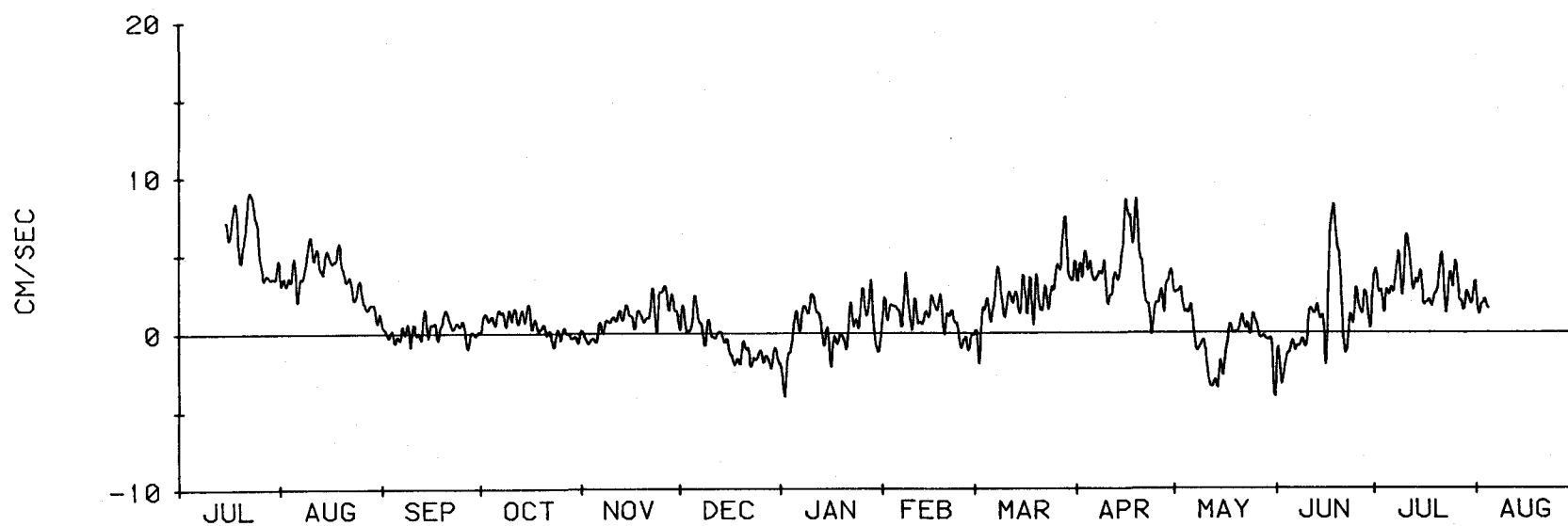
950 METERS AT MOORING C
LLP FILTERED U COMPONENT



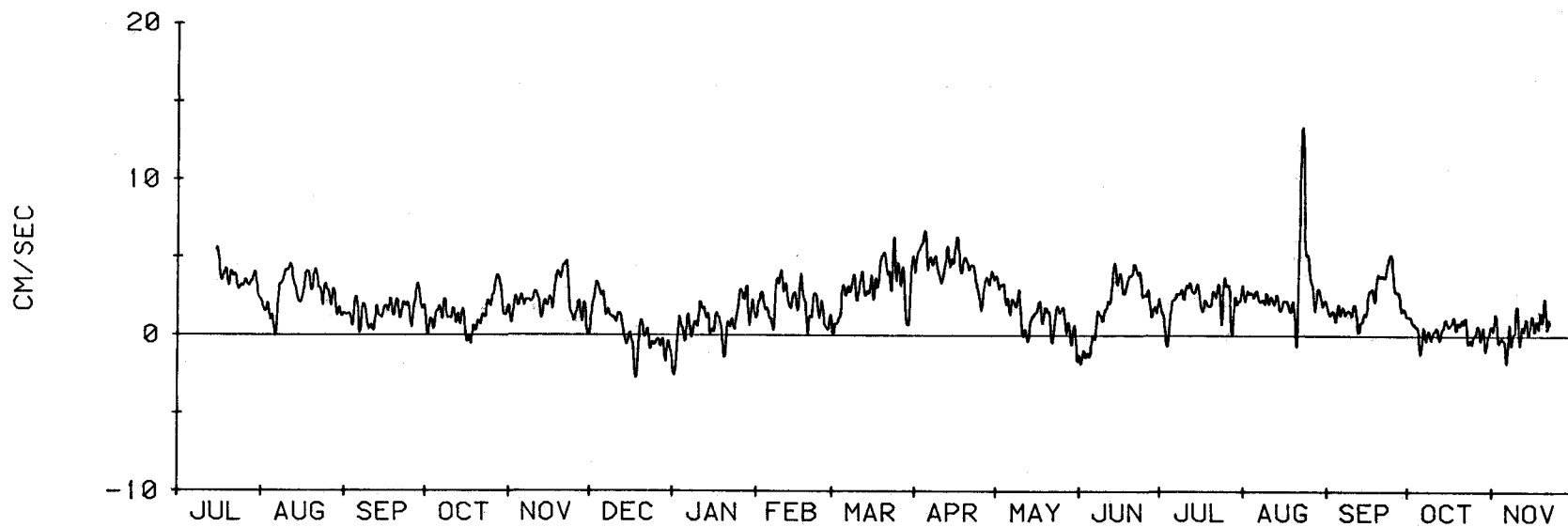
1650 METERS AT MOORING C
LLP FILTERED U COMPONENT



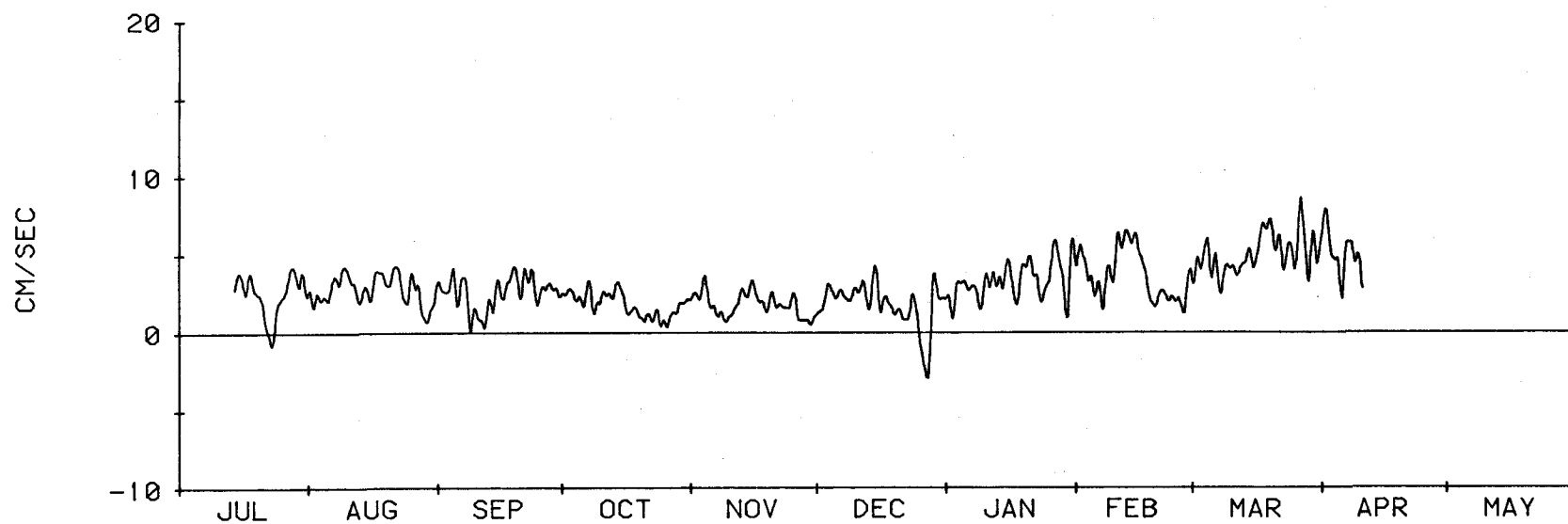
3950 METERS AT MOORING C
LLP FILTERED U COMPONENT



950 METERS AT MOORING C
LLP FILTERED V COMPONENT



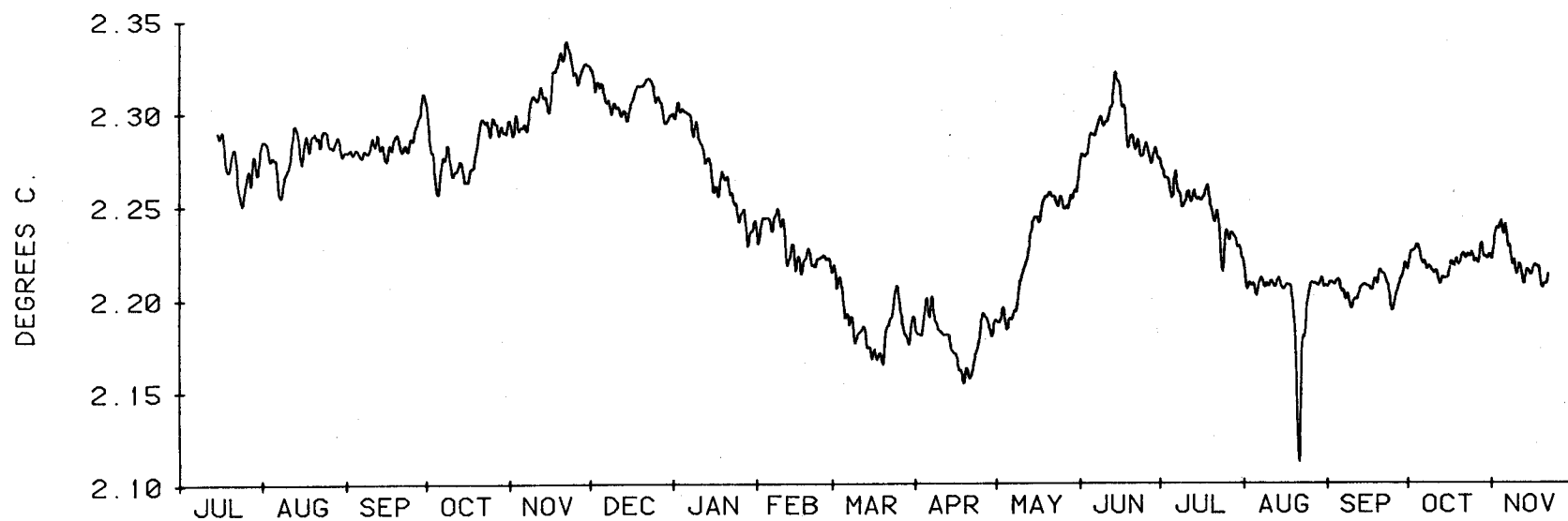
1650 METERS AT MOORING C
LLP FILTERED V COMPONENT



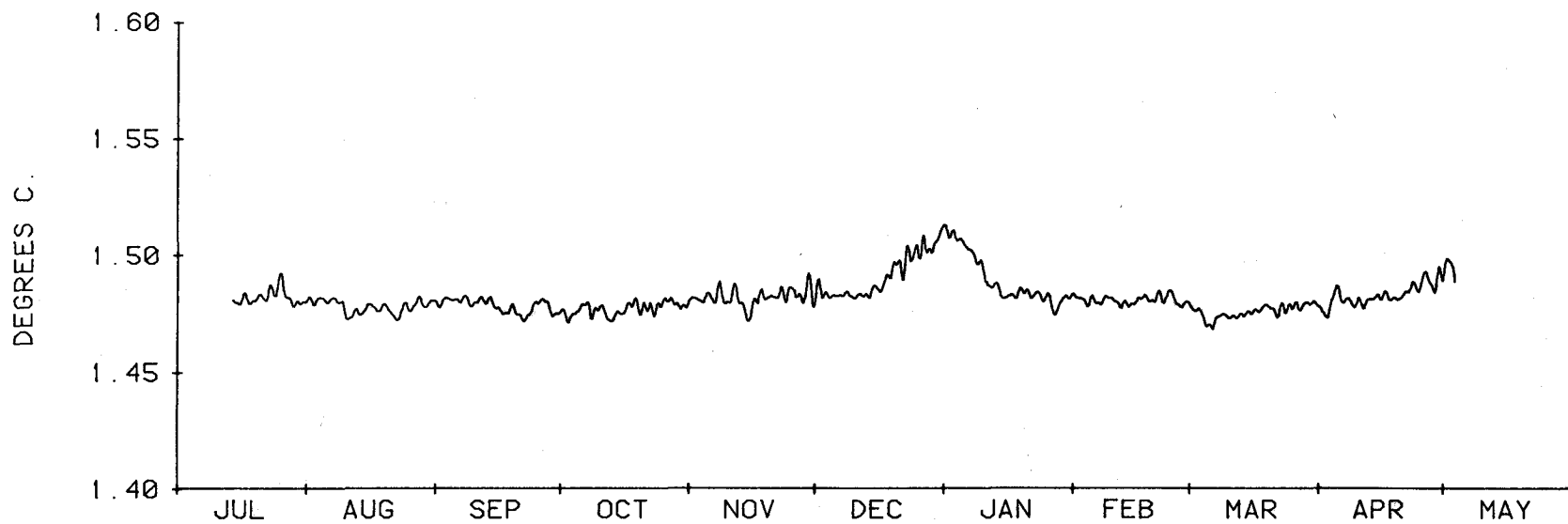
3950 METERS AT MOORING C
LLP FILTERED V COMPONENT



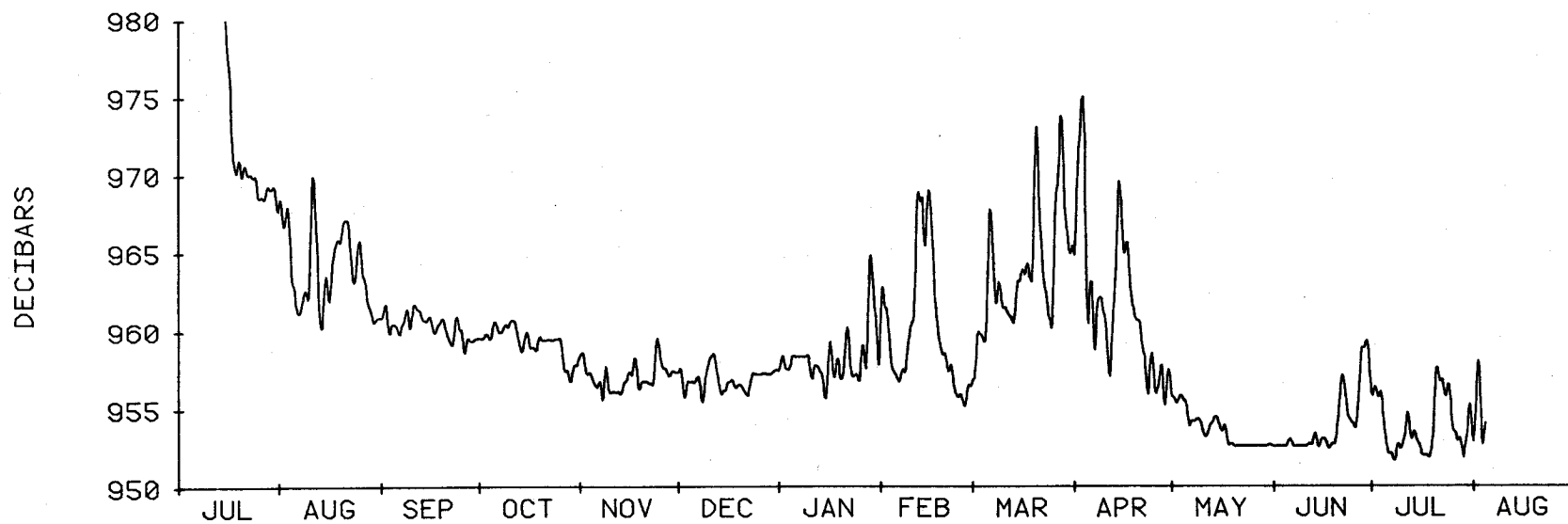
950 METERS AT MOORING C
LLP FILTERED TEMPERATURE



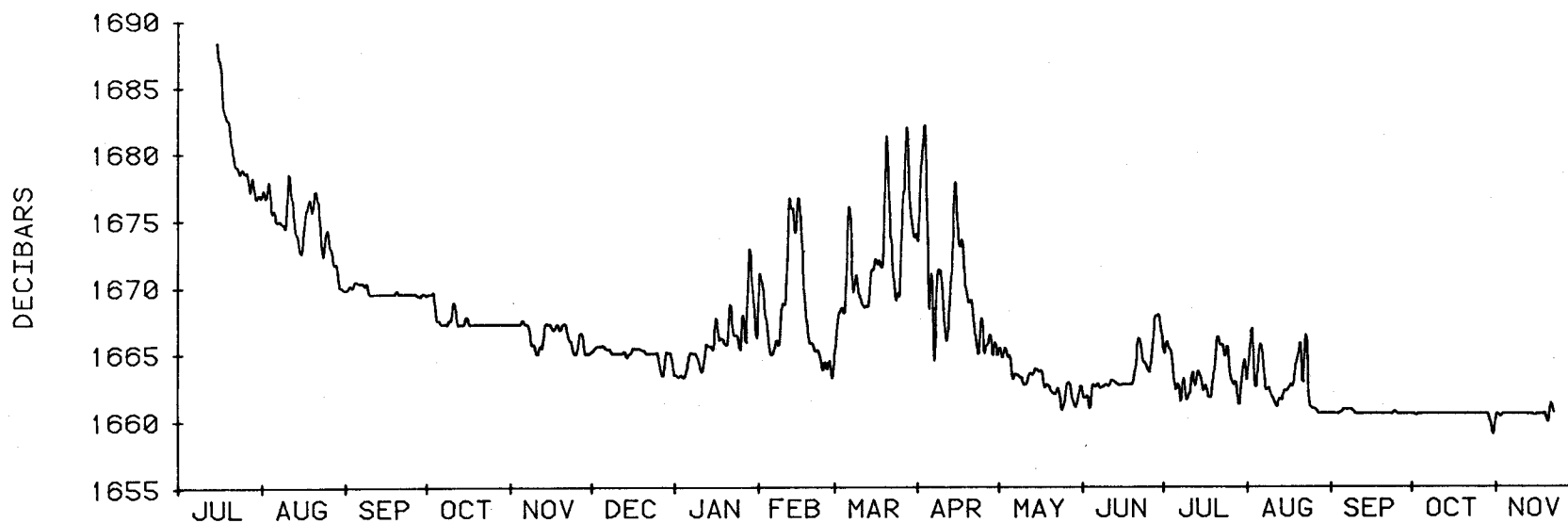
1650 METERS AT MOORING C
LLP FILTERED TEMPERATURE



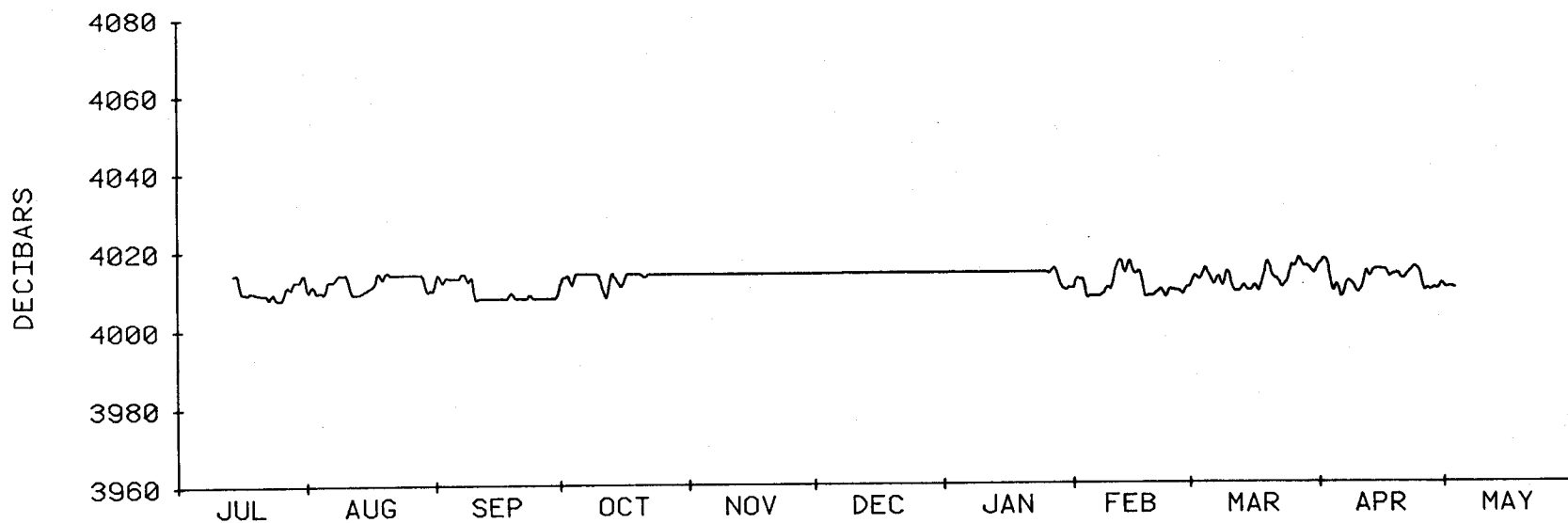
3950 METERS AT MOORING C
LLP FILTERED TEMPERATURE



950 METERS AT MOORING C
LLP FILTERED PRESSURE

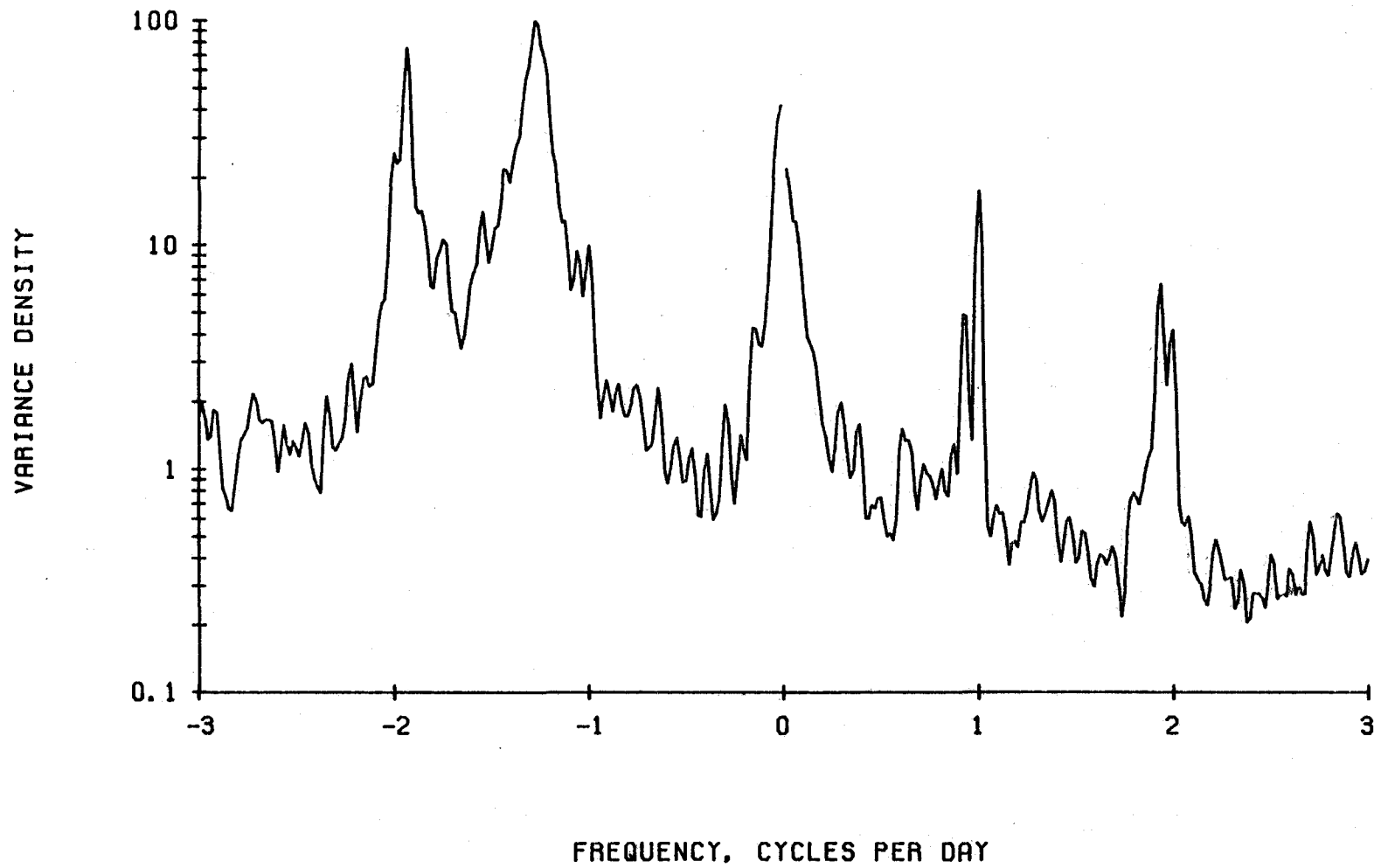


1650 METERS AT MOORING C
LLP FILTERED PRESSURE

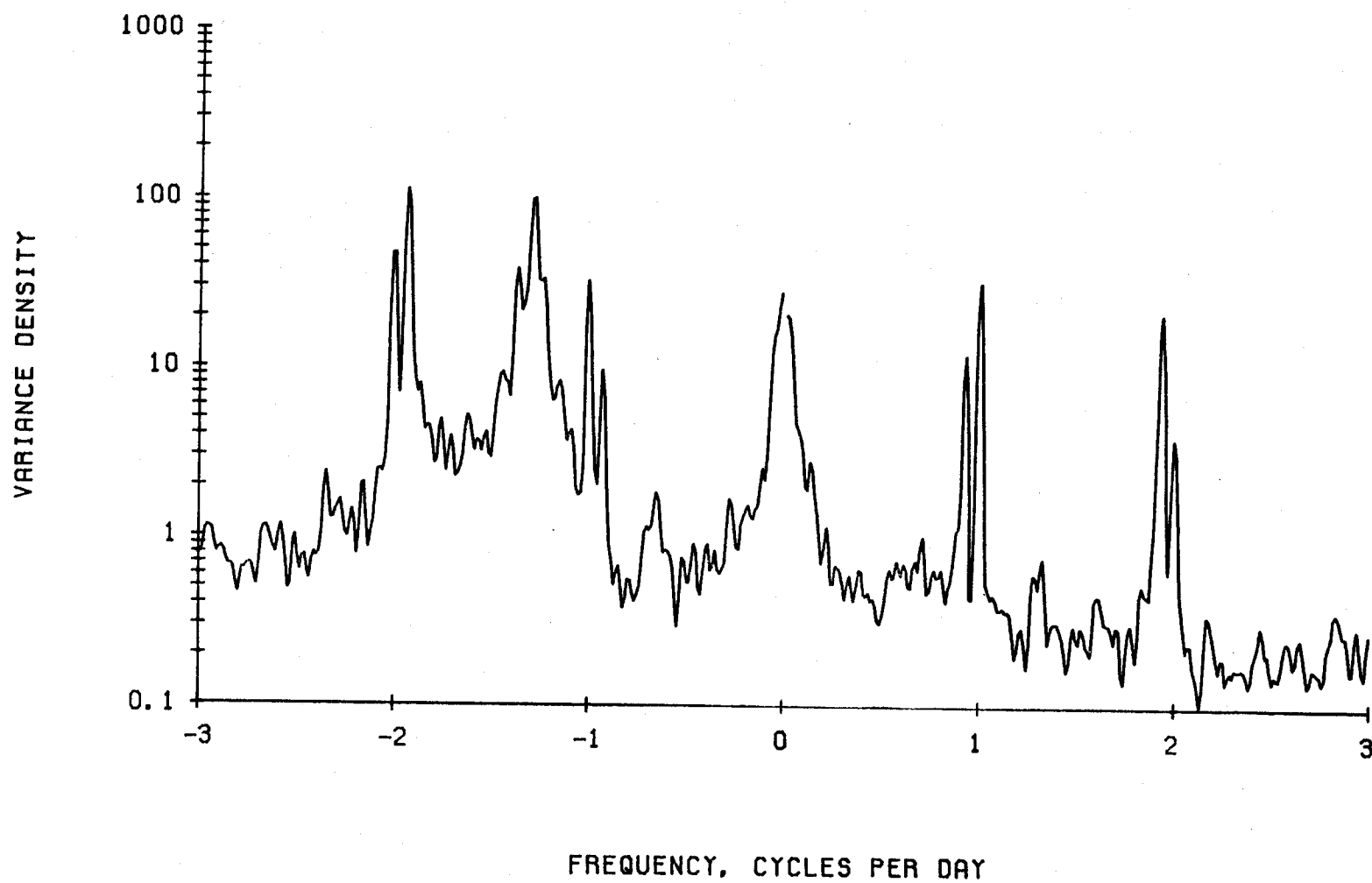


3950 METERS AT MOORING C
LLP FILTERED PRESSURE

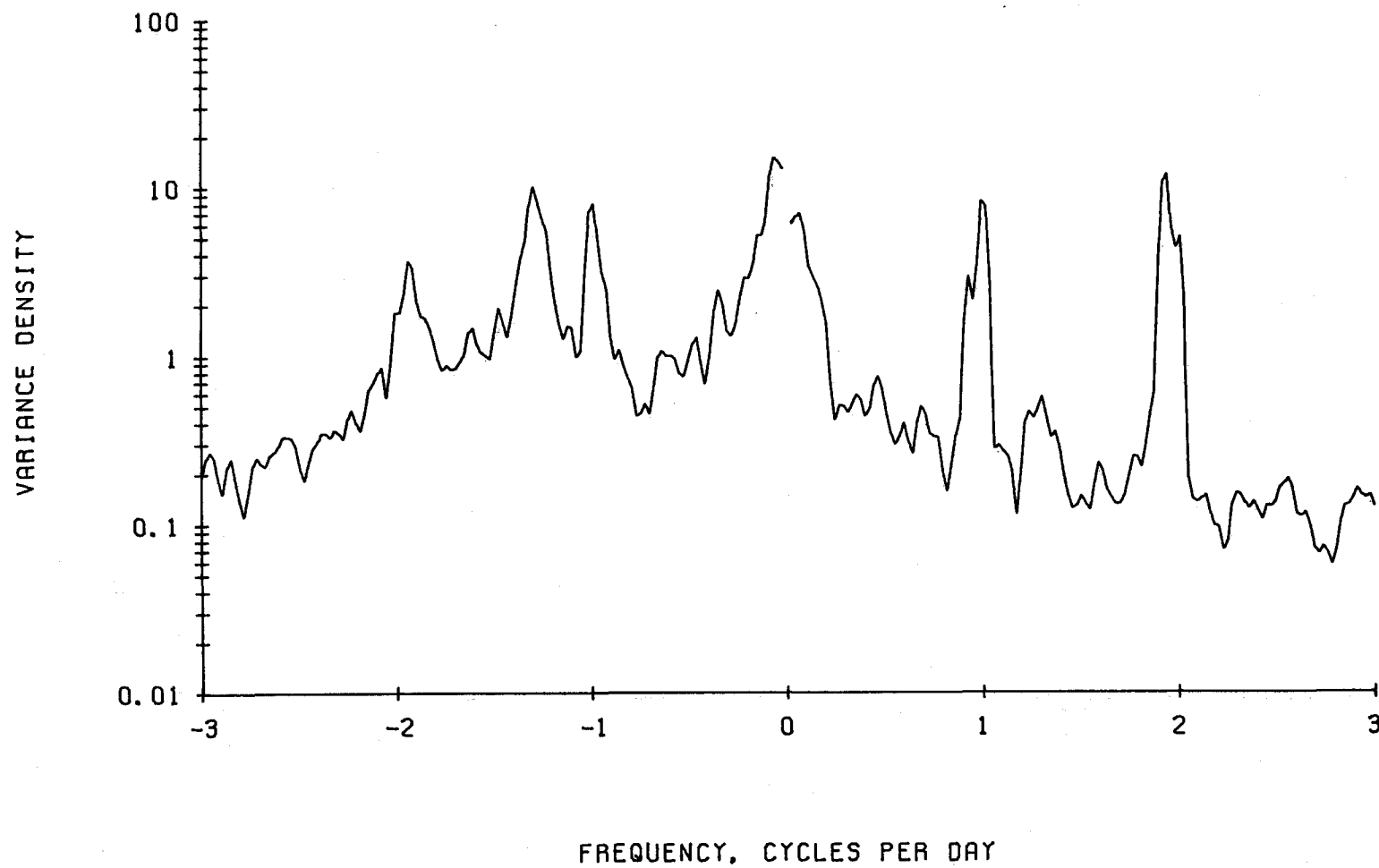
UNFILTERED CURRENT. 950 M AT EMPEROR MOORING C.



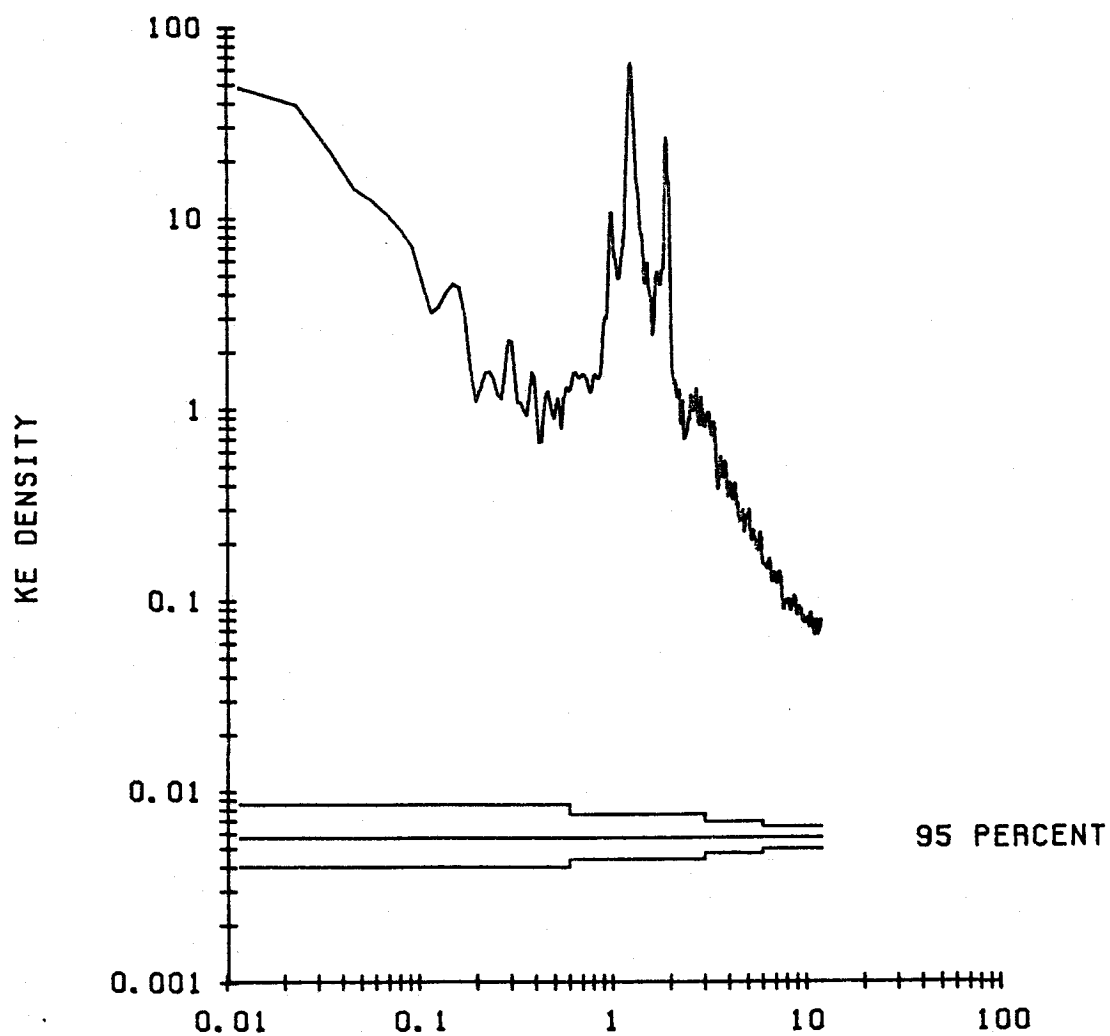
UNFILTERED CURRENT. 1650 M AT EMPEROR MOORING C.



UNFILTERED CURRENT. 3950 M AT EMPEROR MOORING C.

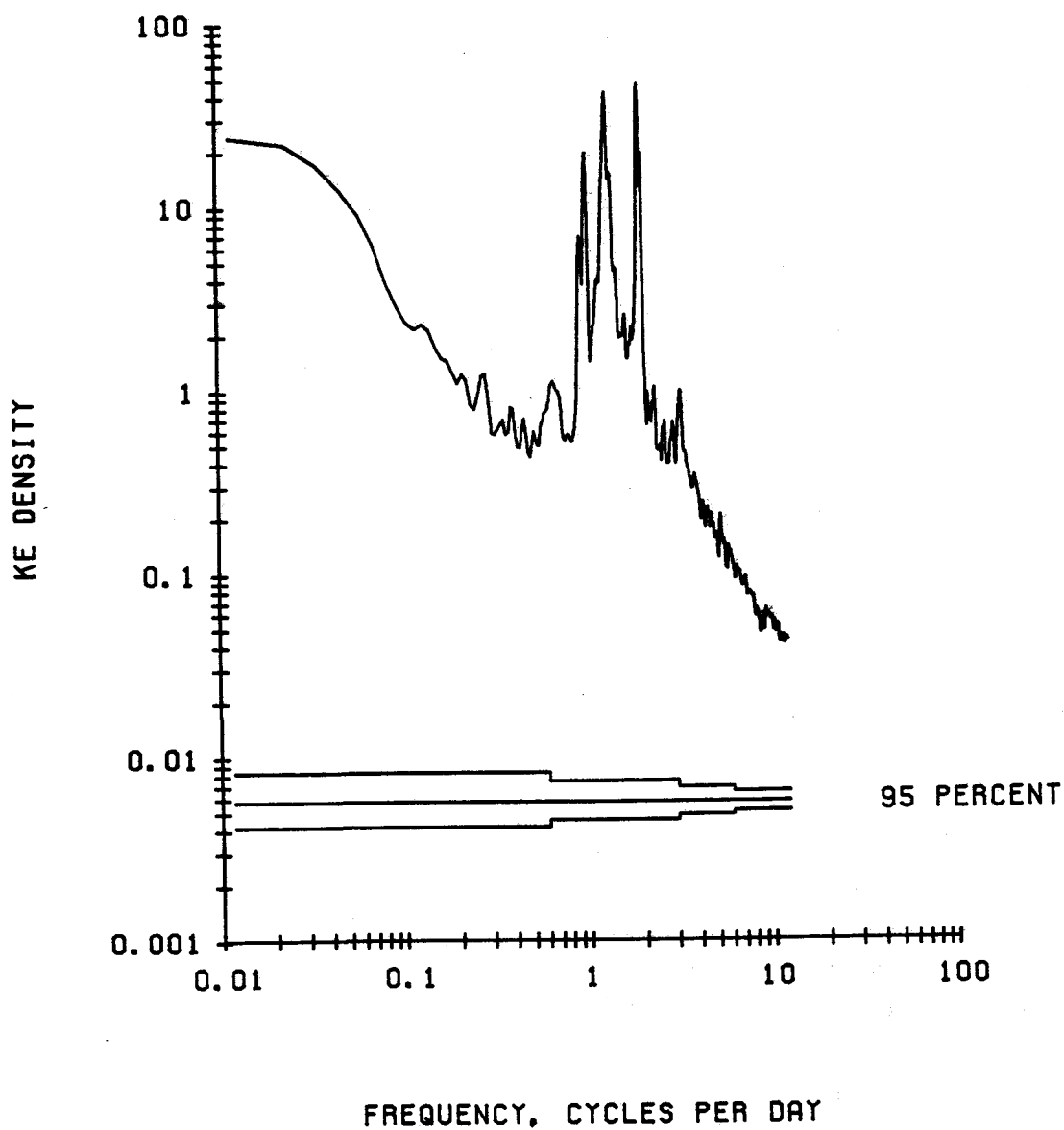


UNFILTERED CURRENT. 950 M AT EMPEROR MOORING C.

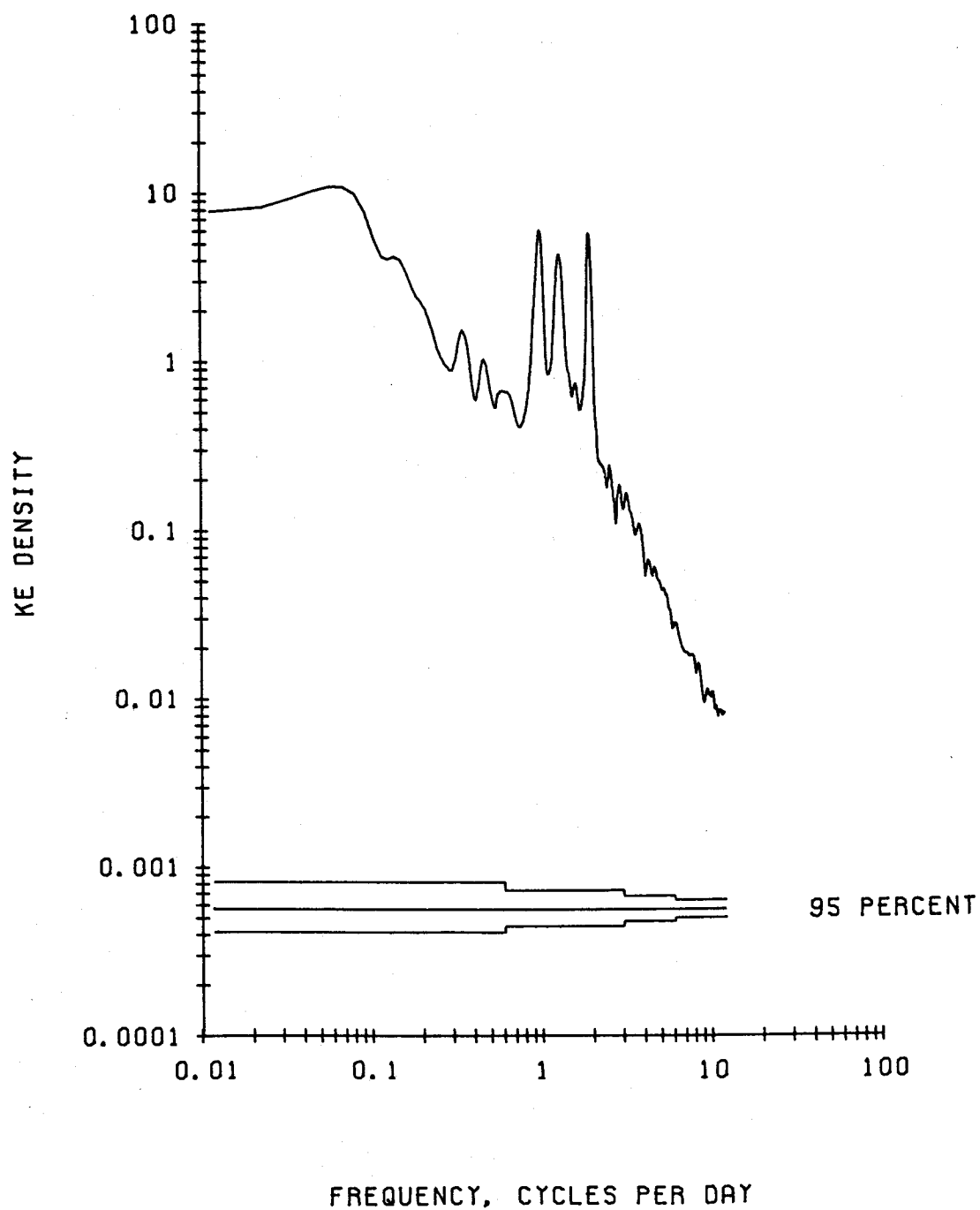


FREQUENCY, CYCLES PER DAY

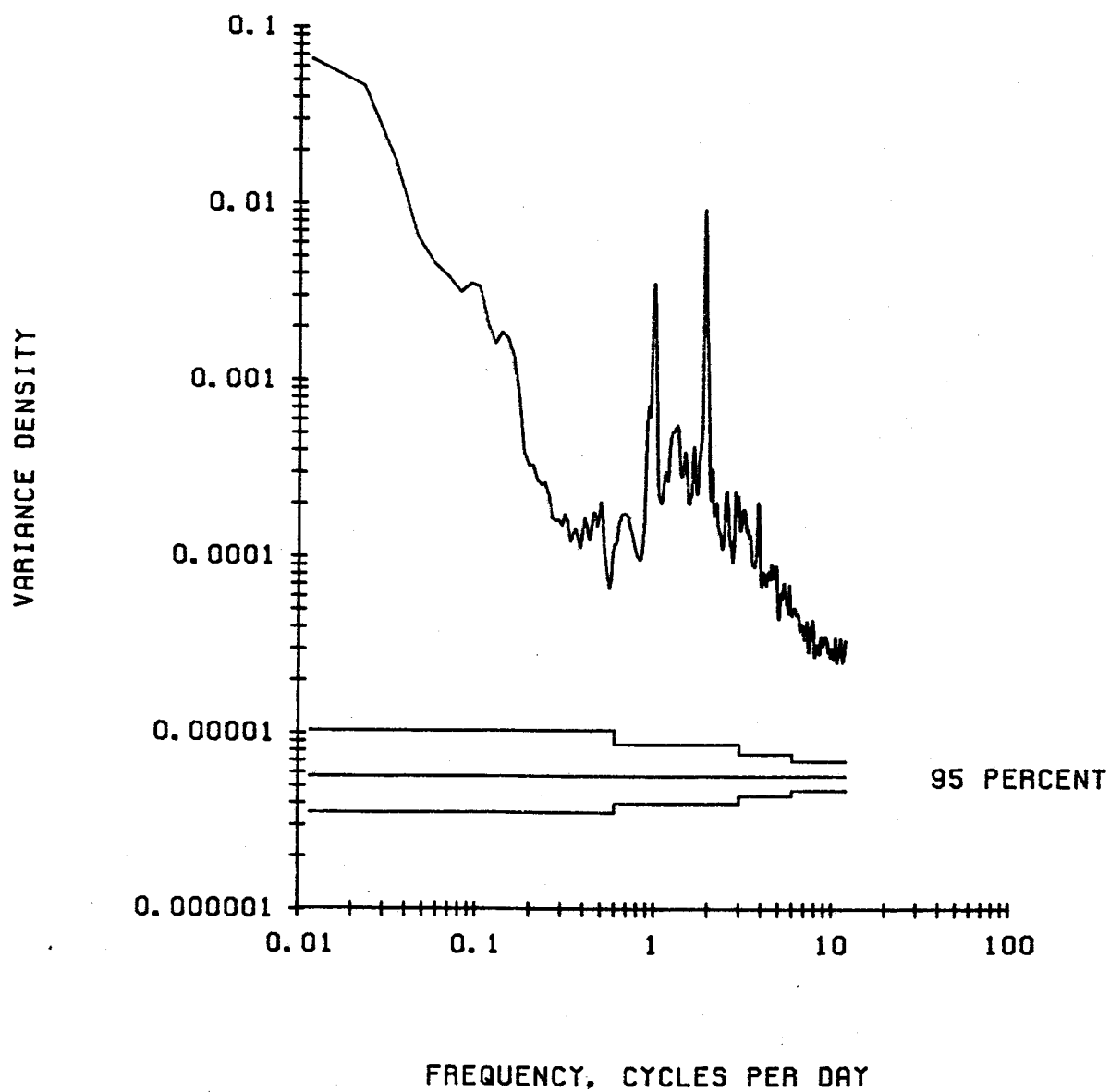
UNFILTERED CURRENT. 1650 M AT EMPEROR MOORING C.



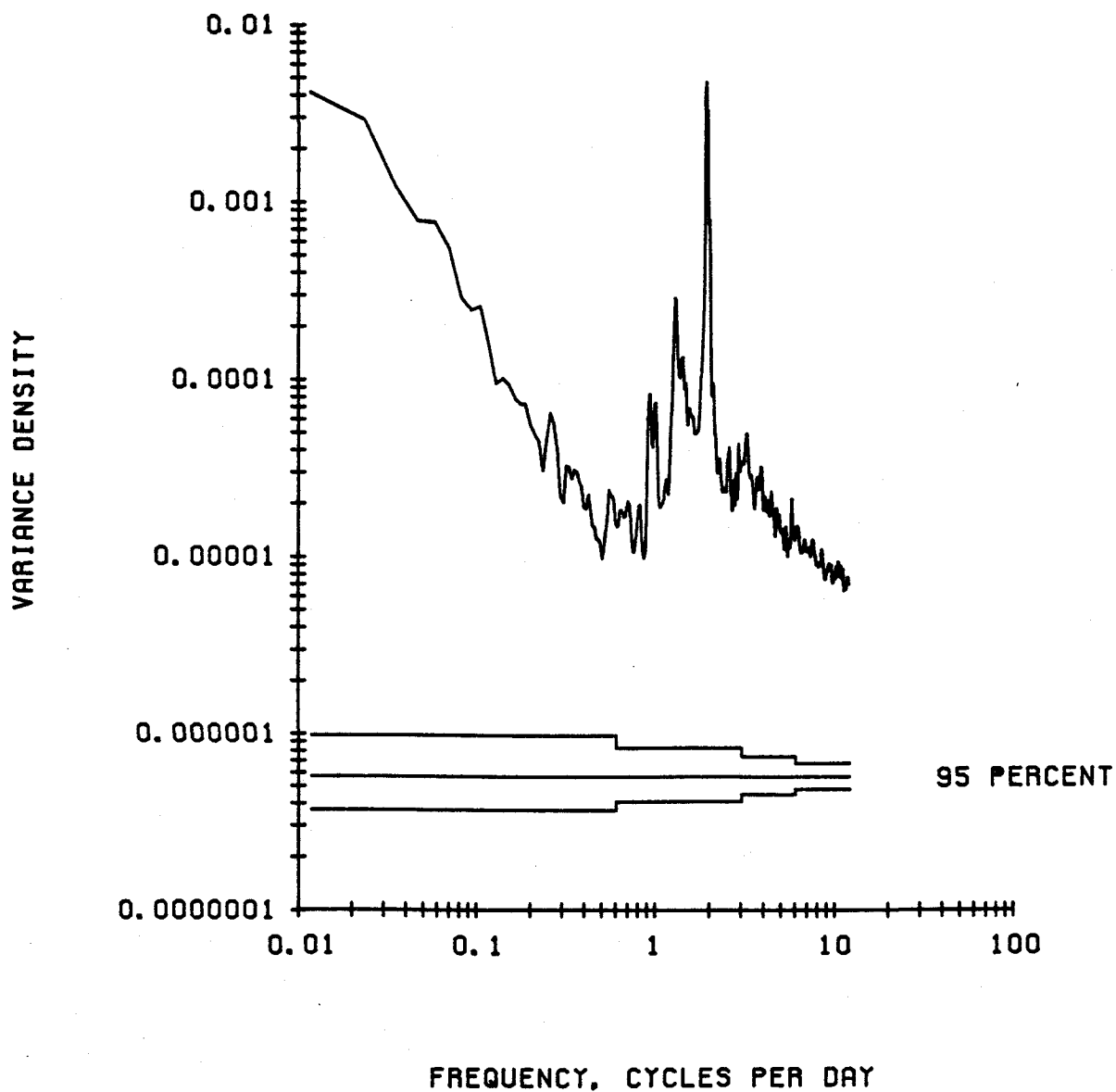
UNFILTERED CURRENT. 3950 M AT EMPEROR MOORING C.



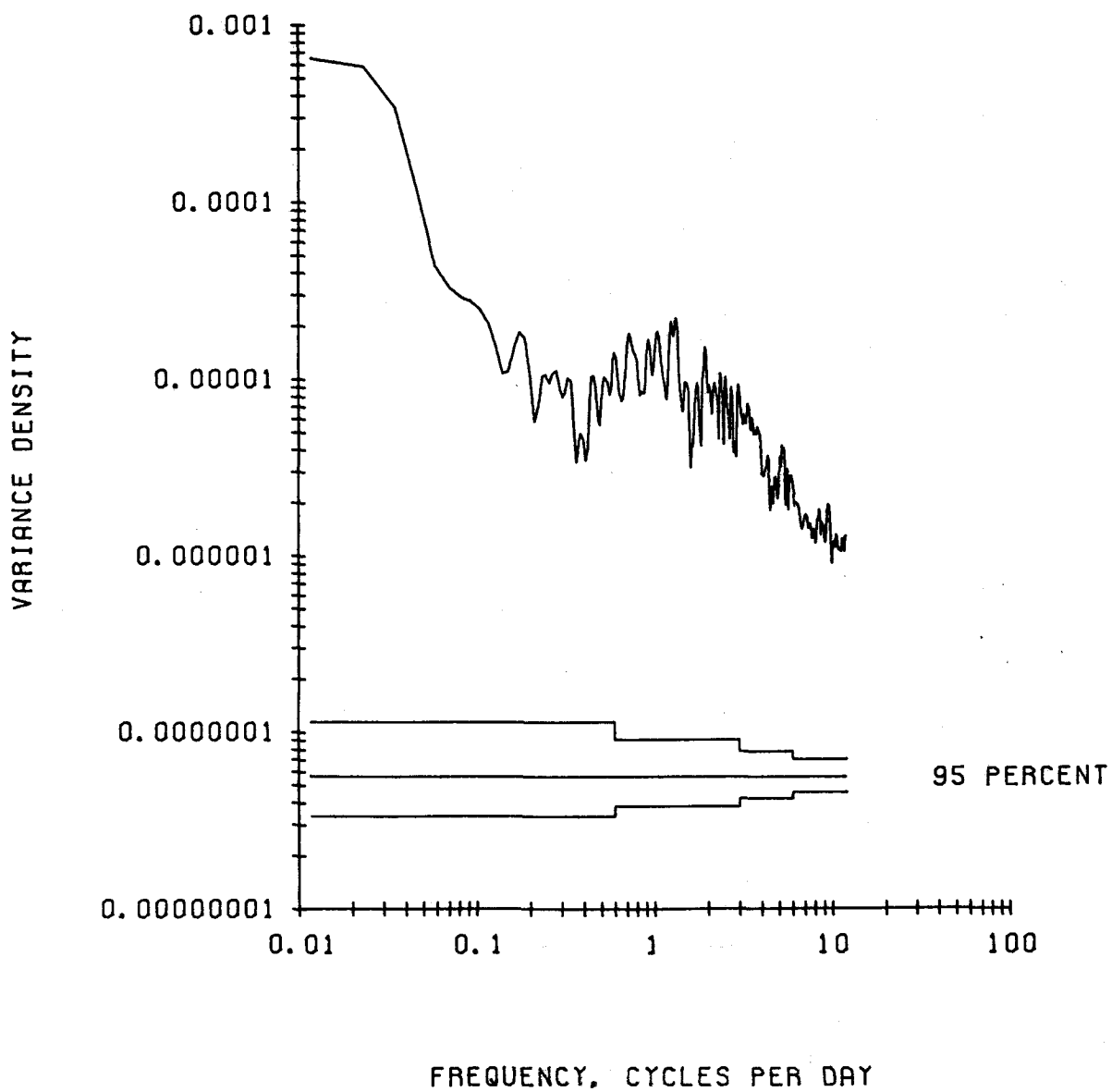
UNFILTERED TEMPERATURE. 950 M AT EMPEROR MOORING C.



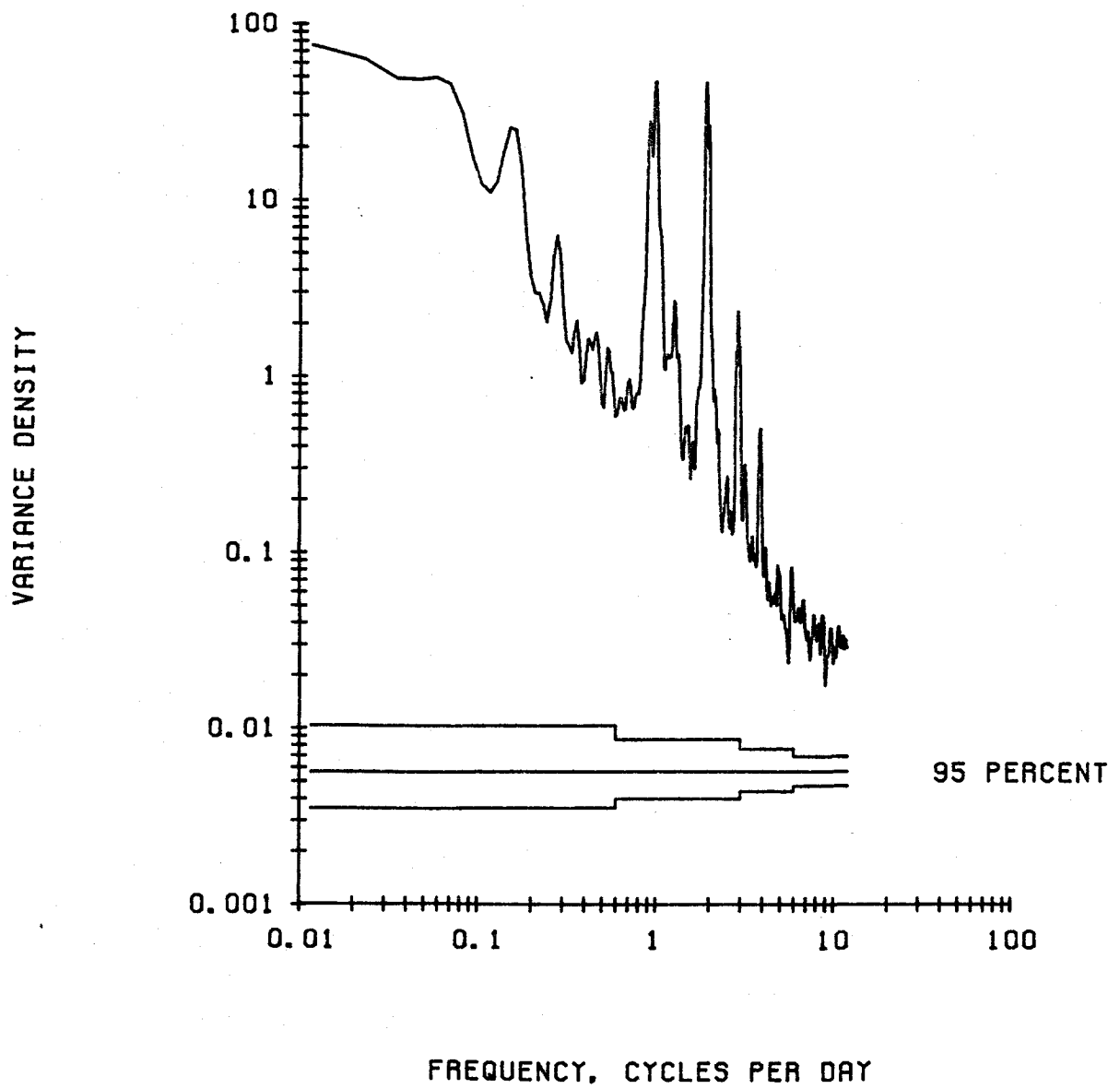
UNFILTERED TEMPERATURE. 1650 M AT EMPEROR MOORING C.



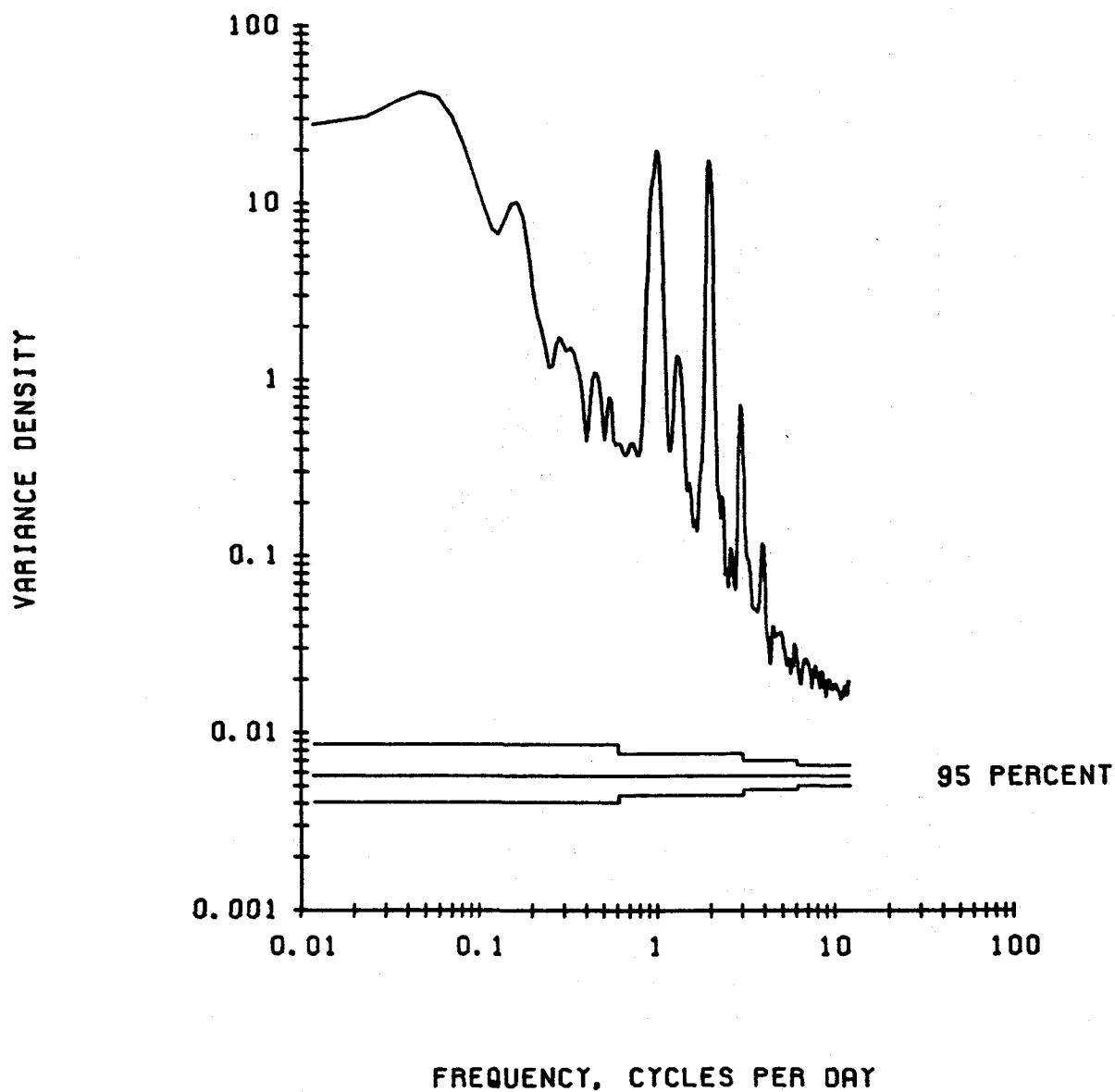
UNFILTERED TEMPERATURE. 3950 M AT EMPEROR MOORING C.



UNFILTERED PRESSURE. 950 M AT EMPEROR MOORING C.



UNFILTERED PRESSURE. 1650 M AT EMPEROR MOORING C.



UNFILTERED PRESSURE. 3950 M AT EMPEROR MOORING C.

