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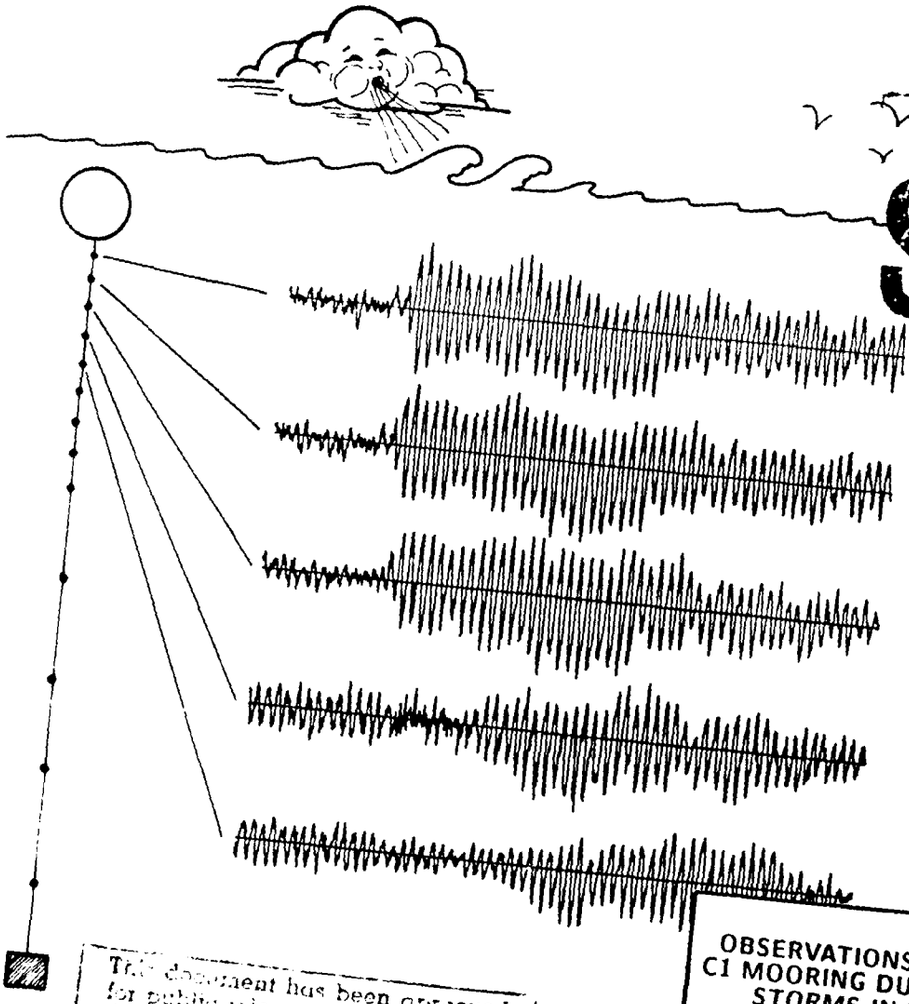

OBSERVATIONS FROM THE C1 MOORING DURING OCEAN STORMS IN THE N.E. PACIFIC OCEAN, AUGUST 1987–JUNE 1988

by

Murray D. Levine
Clayton A. Paulson
Steve R. Gard
Jay Simpkins
Vassilis Zervakis

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Data Report 151

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents observations from a single mooring of velocity, temperature, conductivity, and pressure, made as part of the Ocean Storms experiment, conducted in the N.E. Pacific Ocean (47° 25.4' N, 139° 17.8' W) from August 1987 to June 1988. The mooring contained a total of 14 current meters, 4 thermistor chains and 5 temperature-conductivity recorders. A sample of the data time series is displayed in two forms: unfiltered and low-pass filtered.

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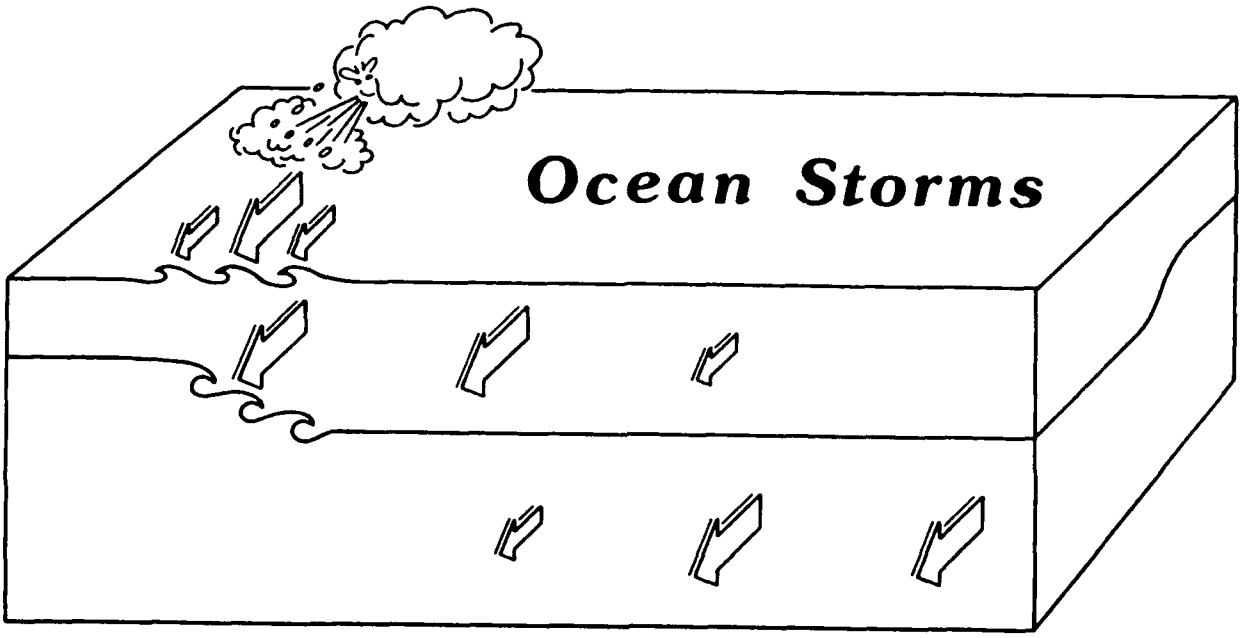
Ocean Storms

Observations from the C1 Mooring during OCEAN STORMS in the N.E. Pacific Ocean, August 1987–June 1988

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The cover illustration was kindly provided by Barbara Levine. We thank Melinda Stewart for typing, organizing and overseeing the printing of the report.

The support for this research by the Office of Naval Research through contract N00014-84-C-0218 and N00014-87-K-0009 is gratefully acknowledged.

TABLE OF CONTENTS

INTRODUCTION

This report presents moored observations of velocity, temperature, conductivity and pressure, made as part of the Ocean Storms experiment, conducted in the N.E. Pacific Ocean from August 1987 to June 1988.

The main objective of Ocean Storms is to study the three-dimensional response of the upper ocean to severe storms. To meet this objective, a variety of observations were made from sensors on moorings, drifters and aircraft. The aim was to measure simultaneously the horizontal variability of the atmospheric forcing and the oceanic response. The observations reported here represent one component that will be used in a comprehensive analysis of the entire Ocean Storms data set.

The specific goals of this project are:

- To investigate the generation of near-inertial waves by wind forcing,
- To investigate the thermal response in the seasonal thermocline to surface forcing,
- To investigate the response of deep currents to fluctuations of wind stress curl,
- To determine if there is any response to storms of internal waves in the main thermocline,
- To resolve the temporal variability and vertical structure of the internal tide, and
- To resolve the mesoscale variability.

INSTRUMENTATION

Description

A single mooring was deployed in the N.E. Pacific Ocean at site C1 (47° 25.4′ N, 139° 17.8′ W) as part of the Ocean Storms moored array (Figure 1). The site is located about 1100 km west of the Washington coast with a water depth of 4225 m. The mooring was deployed from the R/V Melville on 20 August 1987; recovery was made from the same ship 10 months later on 25 June 1988.

The mooring contained a total of 14 current meters, 4 thermistor chains and 5 temperature-conductivity recorders (Figure 2). The shallowest mooring element was a steel sphere at 57 m; a subsurface design was selected to reduce contamination of current meter observations due to mooring motion. Three types of current meters were used: 7 VMCMs that use dual propellers (manufactured by EG&G), 5 RCM-5s that use a Savonius rotor and vane (manufactured by Aanderaa), and 2 S-4s that measure the electric field (manufactured by InterOcean). The VMCMs and RCM-5s also recorded temperature. The 4 thermistor chains (manufactured by Aanderaa) consisted of 11 thermistors distributed evenly over the length of the chain. The 5 Seacat temperature-conductivity recorders (manufactured by Seabird Electronics) measured temperature and conductivity time series at a single point; the upper two instruments also contained a Digiquartz pressure sensor (manufactured by Paroscientific, Inc.). The pressure records were used to determine sensor depths and to monitor mooring motion. Also, an upward-looking acoustic sensor (WOTAN), to measure surface wind speed, was attached to the mooring for Bill Large. Two acoustic releases (manufactured by EG&G) were used at the bottom to release the anchor for recovery.

Also included in this report are data from one additional Aanderaa thermistor chain that was attached to the surface mooring deployed by Scripps Institution of Oceanography at site W (47° 28.04′ N, 139° 59.23′ W), located about 50 km to the west of C1. The 11 thermistors were distributed from 9 to 105 m below the surface.

Technical details about the instruments, including sampling intervals and serial numbers, are presented in Tables 1 to 4. The data recovery was nearly 90%. Figure 3 is a time line showing the period of successful operation for each instrument.

Calibration

VMCM Temperature. The VMCMs were modified to record over a temperature range from 4 to 15°. All instruments were calibrated before deployment and

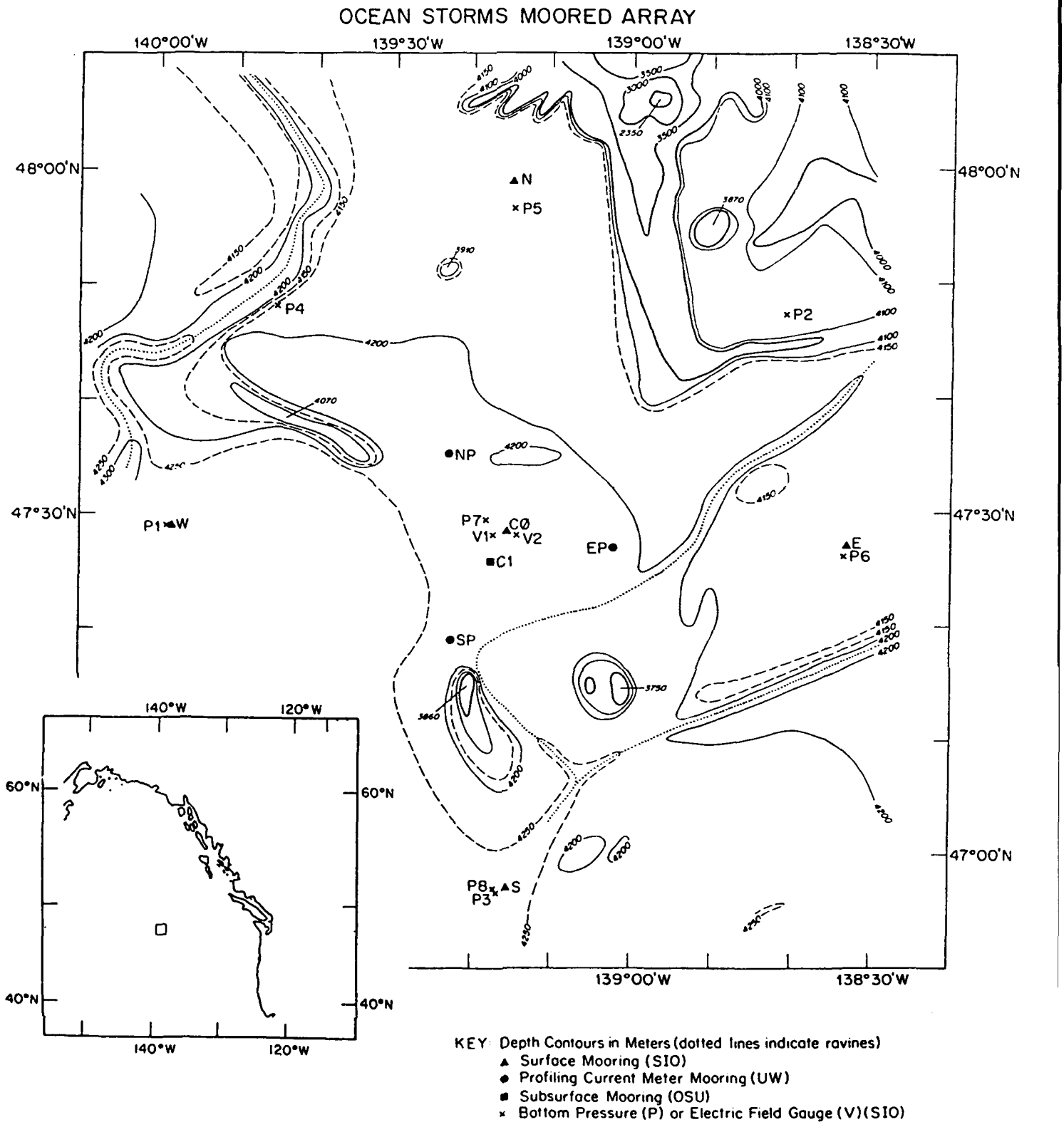


Figure 1. Chart showing location of all moorings deployed during Ocean Storms (courtesy of C. Eriksen).

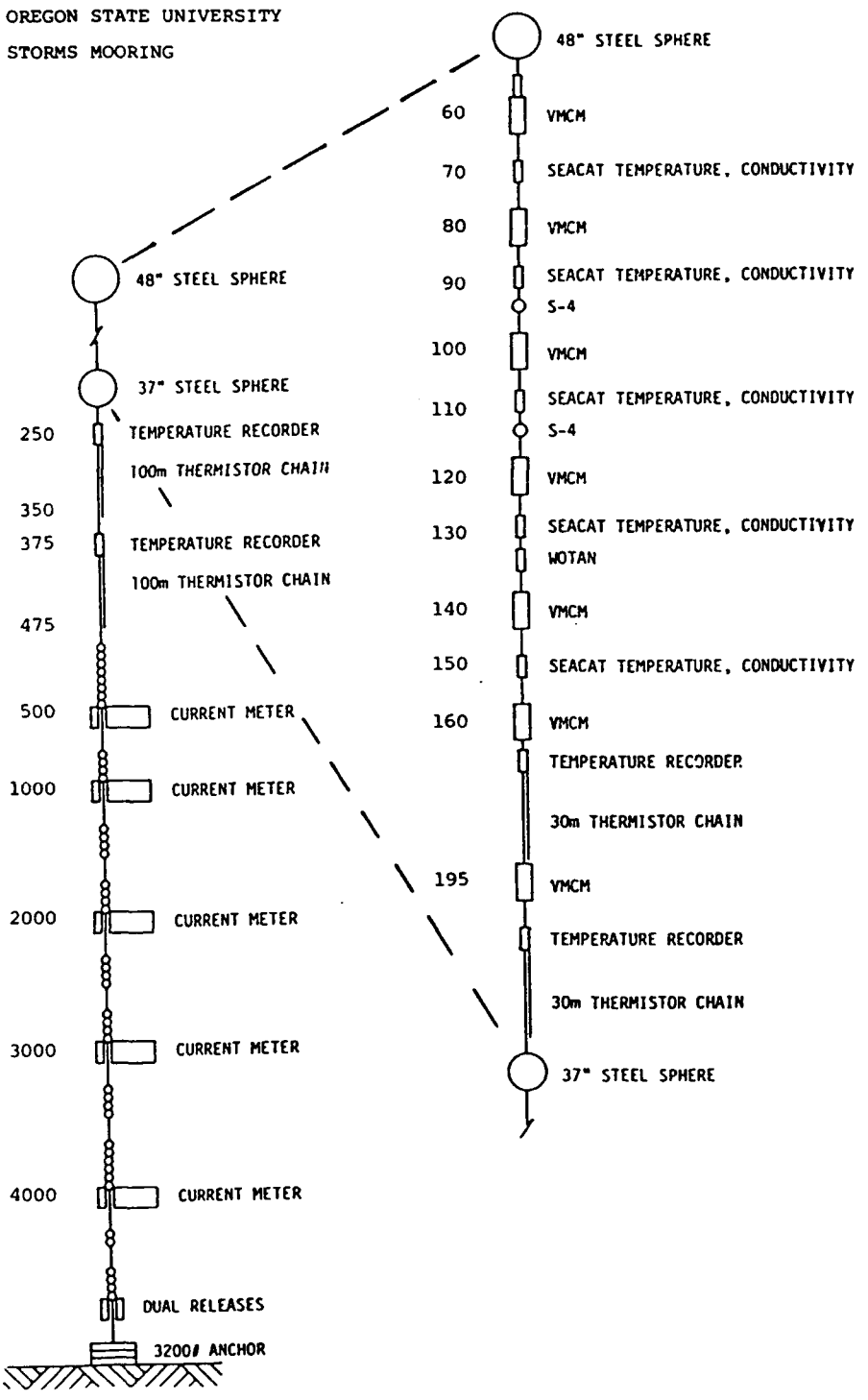


Figure 2. Schematic diagram of the mooring deployed at site C1.

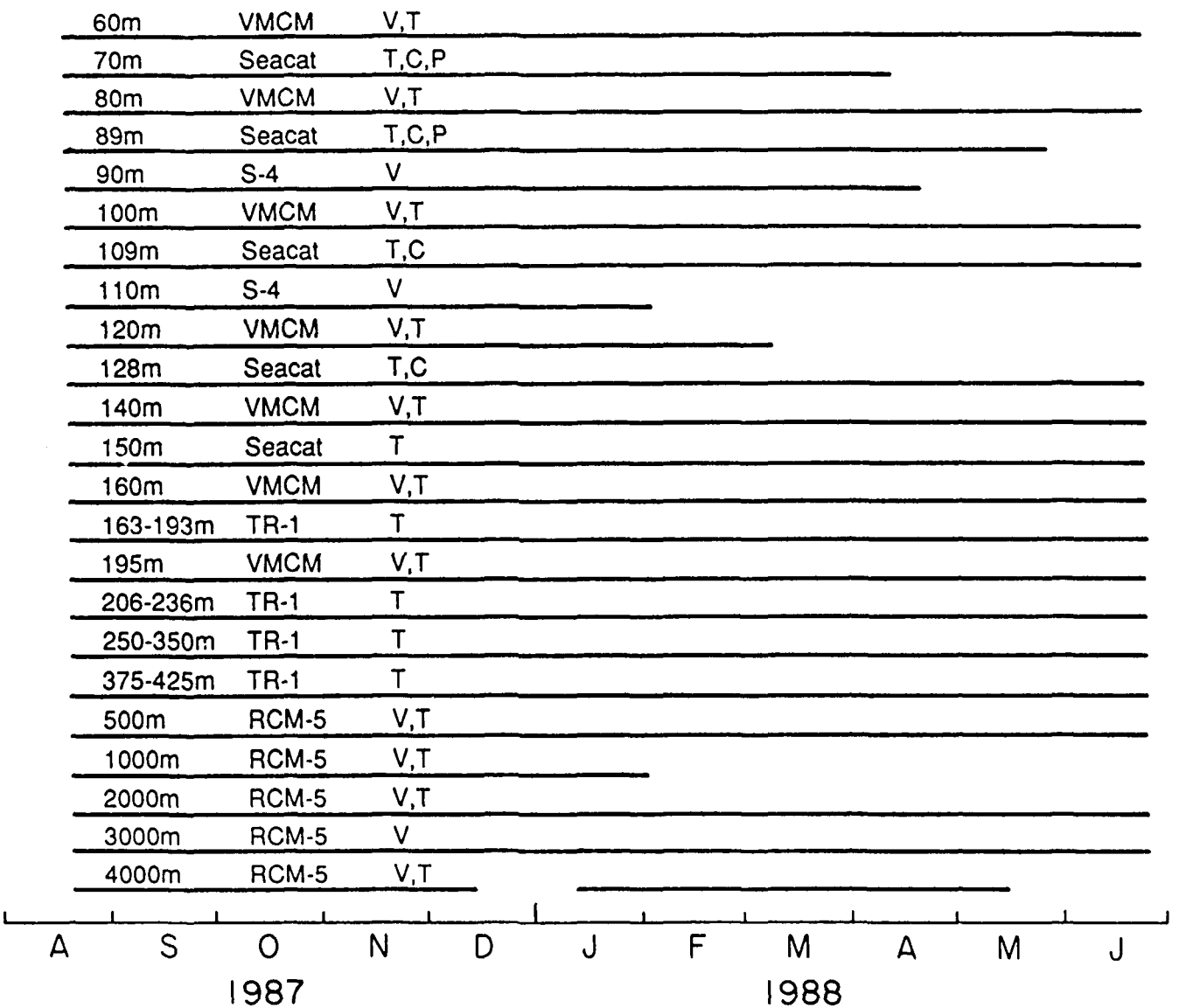


Figure 3. Time interval that velocity (V), temperature (T), conductivity (C) and pressure (P) were recorded from VMCMs (current meters manufactured by EG&G), TCM-5s (current meters manufactured by Aanderaa), S-4s (current meters manufactured by Inter Ocean), Seacats (temperature-conductivity recorders manufactured by Seabird), TR-1 (thermistor chains manufactured by Aanderaa).

Depth, m	Serial No./ Tape No.	Temperature Range	Sampling Interval	Temperature Calibration Differences,* units: 10^{-3} °C 6°C	10°C	Compass Calibration, Range of deviation from true, degrees (Pre-Storms/Post-Storms)
60	203504/3	4 - 15°	15 min.	-10	-6	-2.6 to 8.8 / -0.4 to 7.7
80	401205/5	4 - 15°	15 min.	- 5	-2	0.2 to 6.3 / -1.0 to 5.5
100	203203/3	4 - 15°	15 min.	- 4	-2	-5.4 to 0.7 / -3.0 to 1.5
120	203304/3	4 - 15°	15 min.	- 7	-3	-5.2 to 1.8 / -4.0 to 4.9
140	202803/3	4 - 15°	15 min.	3	5	-0.5 to 9.0 / -0.2 to 10.2
160	401105/5	4 - 15°	15 min.	- 4	-2	-1.0 to 3.4 / -2.6 to 3.4
195	401004/4	4 - 15°	15 min.	- 5	-1	-1.0 to 2.1 / -1.3 to 2.1

*Differences between post-Storms and pre-Storms calibrations.

Table 1. Technical information about EG&G VMCMs (Vector Measuring Current Meters) deployed during Ocean Storms.

Depth, m	Serial No./ Tape No.	Temperature Range Configuration		Pressure Sensor Range, psi	Sampling Interval, hours
		Channel 2	Channel 4		
500	6974/15	–2.6 to 5.6° (Arctic Range)	3.1 to 5.1° ($R_h = 4546\Omega$) ($R_l = 4964\Omega$)	0–1500	1
1000	5883/18	–2.6 to 5.6° (Arctic Range)	2.0 to 3.0° ($R_h = 4987\Omega$) ($R_l = 5213\Omega$)	0–3000	1
2000	5884/8	0 to 20° (Std. low range)	1.5 to 2.5° ($R_h = 5097\Omega$) ($R_l = 5329\Omega$)	0–5000	1
3000	1241/46	0 to 20° (Std. low range)	1.1 to 2.1° ($R_h = 5186\Omega$) ($R_l = 5423\Omega$)	0–5000	1
4000	1236/53	0 to 20° (Std. low range)	1.1 to 2.1° ($R_h = 5186\Omega$) ($R_l = 5423\Omega$)	0–8000	1

Table 2. Technical information about Aanderaa RCM-5 current meters deployed during Ocean Storms.

Depth, m	Serial No.	Pressure Sensor* Serial No.	Battery Type	Sampling Interval	Temperature Calibration Differences,** Units= $\times 10^{-3}$ °C Mean	Std. Dev.
70	161415–50	21449	Electrochem Lithium "D", 4 ea.	6 min before 3/5/88 12 min after 3/5/88	2.8	1.3
89	161415–51	21432	Electrochem Lithium "D", 4 ea.	6 min before 3/5/88 12 min after 3/5/88	1.8	1.0
109	161415–40	N/A	Duracell "D" 6 ea.	6 min before 3/5/88 12 min after 3/5/88	2.5	1.6
128	161415–41	N/A	Duracell "D" 6 ea.	6 min before 3/5/88 12 min after 3/5/88	2.3	1.2
150	161415–43	N/A	Duracell "D" 6 ea.	6 min before 3/5/88 12 min after 3/5/88		

* Parascientific Digiquartz, Model 8600, 0–600 meters.

** Differences between post-Storms and factory calibrations.

Table 3. Technical information about Seabird Seacat temperature-conductivity recorders deployed during Ocean Storms.

Depth of shallowest–deepest thermistor, *m*	Serial No./ Tape No. of TR Recorder	Chain No./ Encoder No./ Electronic Board No.	Recorder Configuration		Bridge Resistors, WR1/WR4, ohms	Sampling Interval, Hours
			Range, °C	Resolution, °C		
9–105†	768/11	1083/9751/731*	-2.5 to 21.5°	0.024°	2000/3825	3
163–193	269/21	687/4222/1061**	2.5 to 10.5°	0.078°	9536/4284	2
206–236	265/31	1479/4223/1058**	2.5 to 9.0°	0.063°	12177/4419	2
250–350	8/22	1480/ 711/1057**	3.0 to 7.4°	0.043°	18372/4532	2
375–475	268/22	1084/6522/54*	2.9 to 9.0°	0.060°	12877/4386	2

* Model No. 2167

** Model No. 2167BS

† On Scripps West Mooring

Table 4. Technical information about Aanderaa thermistor chains deployed during Ocean Storms.

after recovery at OSU. Over the temperature range of interest, the difference between the post- and pre-Storms calibrations were typically less than 0.005°C; the two instruments at 60 and 100 m showed slightly higher differences (see Table 1). The data were converted using the pre-Storms calibrations.

VMCM Velocity. Compass calibrations were performed before and after deployment at OSU. Differences between pre- and post-Storms calibrations were small (Table 1). When rotated, the maximum deviation of the compass from the true value was found to be 10°—for some instruments it was less than 5° (Table 1).

RCM-5 Temperature. The RCM-5s recorded temperature from a single thermistor in both channels 2 and 4. The temperature resolution in channel 4 was increased from the factory value by replacing resistors in the bridge network. The temperature range of channel 4 was selected for each instrument based on historical data (see Table 2). Pre-Storms calibrations were performed at OSU and used to convert the data. Temperature at 3000 m (#1241) failed due to a broken wire.

RCM-5 Velocity. Compass calibrations were performed before and after deployment at OSU on instruments #6974, #5883 and #5884; differences of less than 1 degree were observed. Instruments #1241 and #1236 were calibrated only before deployment. On #1236 at 4000 m the speed sensor went bad for a continuous 29-day period in December-January. The sensor apparently recovered, however, some caution is advised as the cause of this behavior is unknown. All channels were bad on #1236 from mid-May till the end.

Seacat Temperature. These instruments were new at the time of the deployment; therefore, factory calibrations were used to convert the data. A post-Storms calibration was performed at OSU. Temperature differences between factory and post-Storms calibrations were between .0018 and .0028°C (see Table 3).

Seacat Conductivity. These instruments were new at the time of the deployment; therefore, factory calibrations were used to convert the data. A post-Storms intercomparison was performed and indicated that all the sensors were within 0.002 Siemen/m of each other. This was not a full calibration as the bath was not referenced to an absolute standard conductivity. The conductivity cell at 150 m (#161415-43) failed early in the deployment.

Thermistor Chains. The thermistor chain and recorder attached to the Scripps' mooring at site W (recorder #768, chain #1083) was configured to record over the standard range of –2.5 to 21.5°C, yielding a least count resolution of 0.024°.

The four chains attached to the mooring at C1 were modified to record at increased resolution by replacing resistors in the bridge circuit (see Table 4). Two

problems were encountered in the instruments when the temperature ranges were narrowed: an increase in digitization noise due to self heating of the thermistors and occasional "jumps" in temperature. The self-heating problem has been studied previously and has been reduced as much as possible by using a modified electronic board (model no. 2167BS) supplied by Aanderaa that reduces the amount of time the thermistor is powered. The amount of noise introduced by self-heating is different for each thermistor. This noise does not appear to be significant in the plots shown here. The second problem of occasional "jumps" is more troublesome. These shifts appeared a few time in recorders #265 and #268 during long-term tests. They were so infrequent that they could not be predicted. It does not appear that such shifts affect the plots. However, the possibility that "jumps" have occurred needs to be considered if a more detailed analysis of these series is attempted.

Calibrations were performed for all chains at OSU both before deployment and after recovery. A comparison of the two calibrations is described below.

Recorder No./Chain No.

#269/#689 Over the range of 6 to 7°C the difference between post- and pre-Storms calibration was between −.025 and −.035°C for all thermistors. Post-Storms calibrations were used.

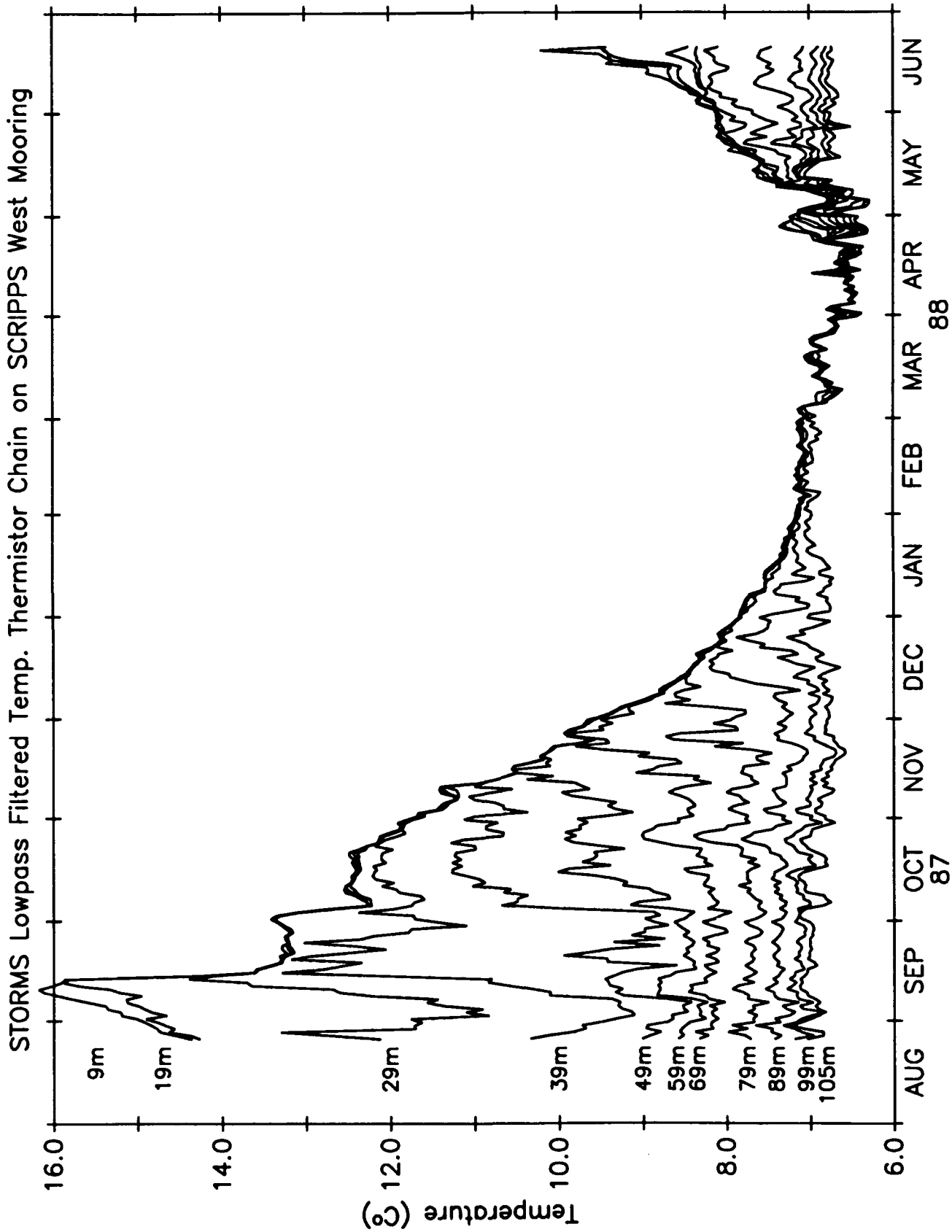
#265/#1479 Over the range of 5.5 to 7°C the difference between post- and pre-Storms calibrations was nearly −.035°C for thermistors #1 to 10 and about −.05°for thermistor #11. Pre-Storms calibrations were used.

#8/#1480 Over the range of 4.5 to 6.5°C the difference between post- and pre-Storms calibrations was between −.02 and −.03°C for all thermistors except #5 and #10 which had differences of −.05 and −.04 respectively. Pre-Storms calibrations were used.

#268/#1084 Over the range of 4.5 to 6.5°C the difference between post- and pre-Storms calibrations increased systematically for thermistors further from the recorder. Differences between −.01 and −.03°C were found for thermistors #1 to 5, and differences of −.04 to −.05 for thermistors #6 to 11. Differences in calibration in thermistors #6 to 11 were large relative to the temperature range and therefore were not plotted. Post-Storms calibrations were used.

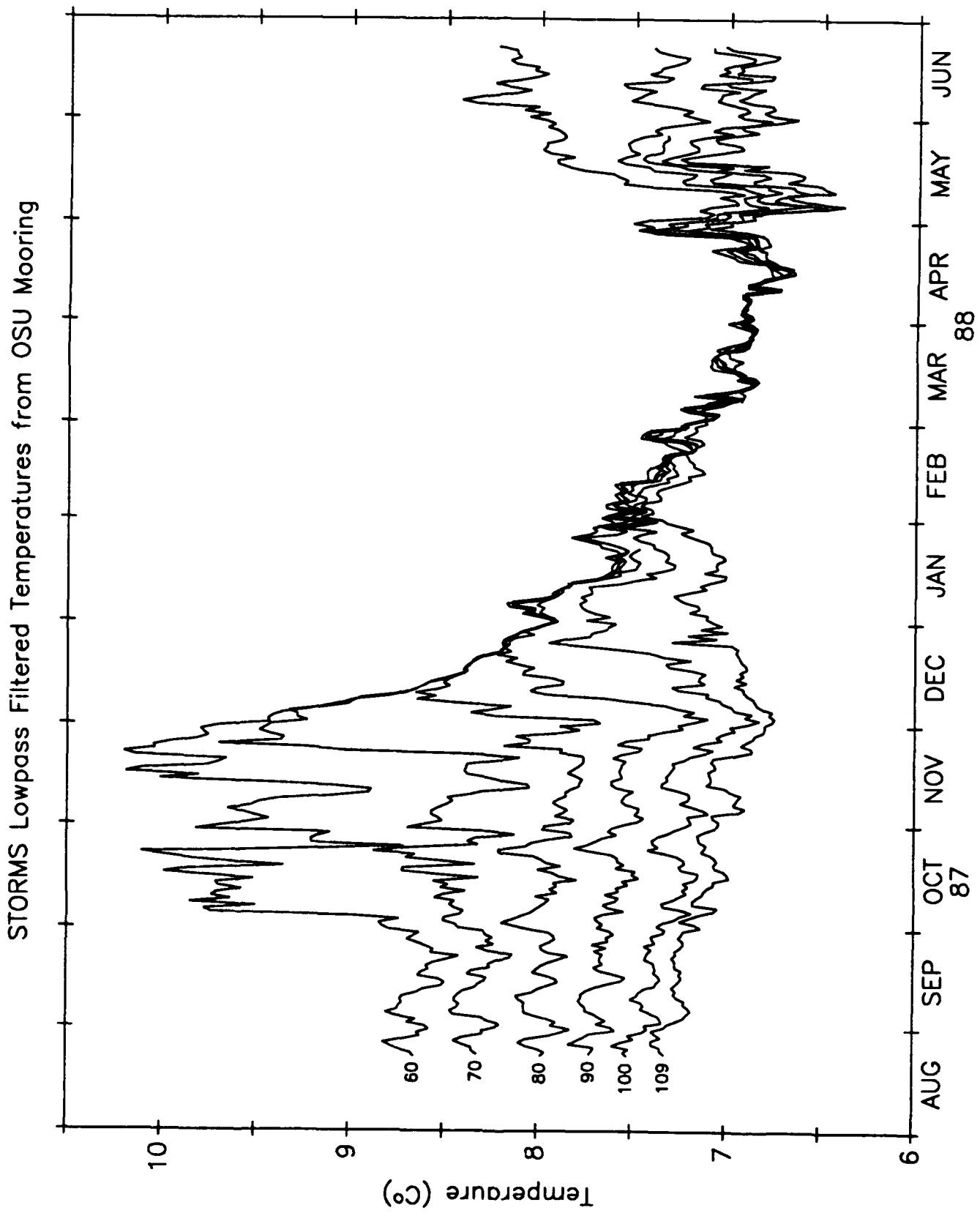
TIME SERIES OF TEMPERATURE: LOW-PASS FILTERED

Observations are from thermistor chain on Scripps' mooring at site W. Data are low-pass filtered (40 hour half-power) and decimated to daily values.


STORMS Lowpass Filtered Temp. Thermistor Chain on SCRIPPS West Mooring
Temperature (C°)
16.0
14.0
12.0
10.0
8.0
6.0
9m
19m
29m
39m
49m
59m
69m
79m
89m
99m
105m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

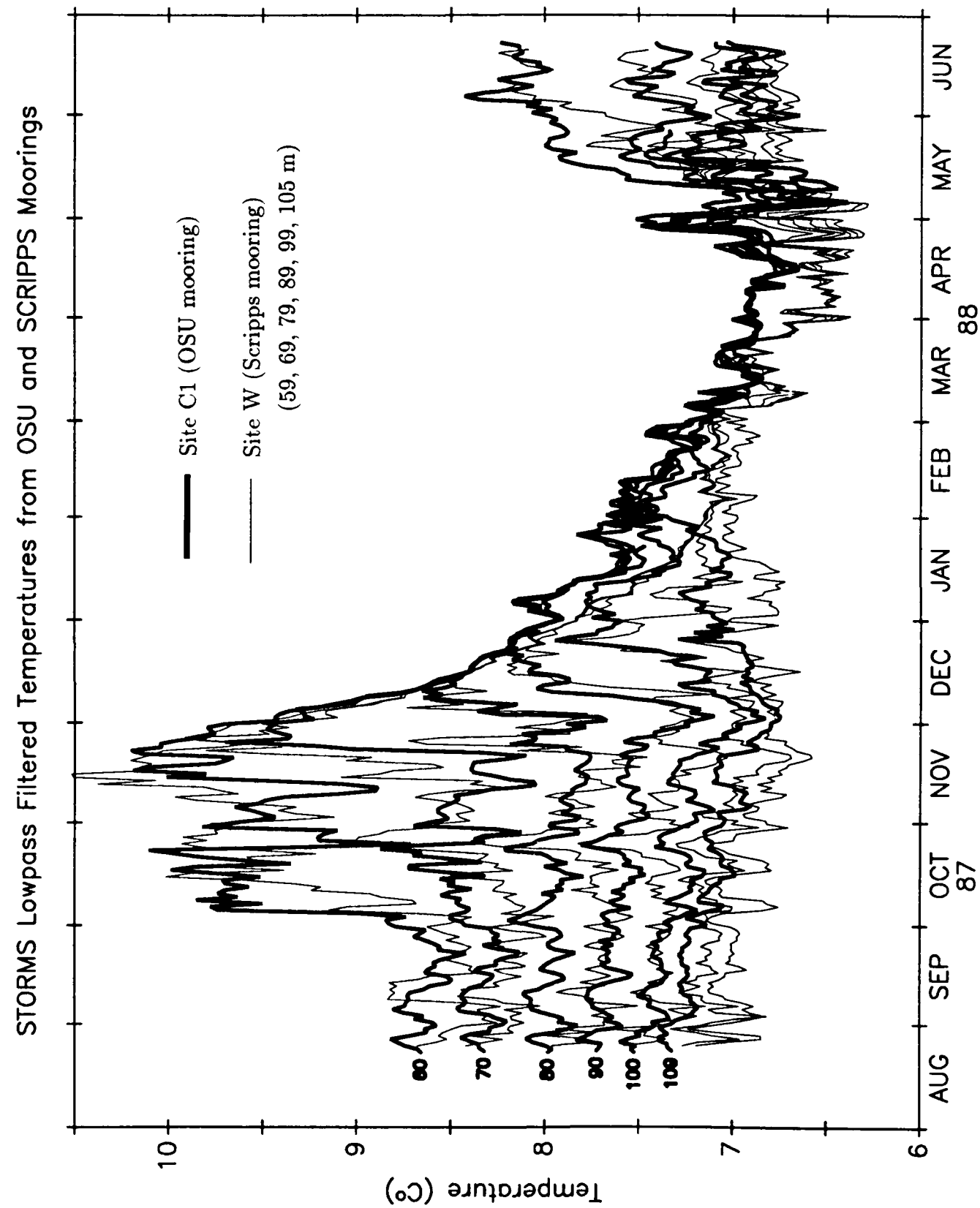
TIME SERIES OF TEMPERATURE: LOW-PASS FILTERED

Observations are from VMCMs at 60, 80, and 100 m and from Seacats at 89 and 109 m. Data are low-pass filtered (40 hour half-power) and decimated to daily values.


STORMS Lowpass Filtered Temperatures from OSU Mooring
Temperature (C°)
10
9
8
7
6
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
88
MAY
JUN
60
70
80
90
100
109

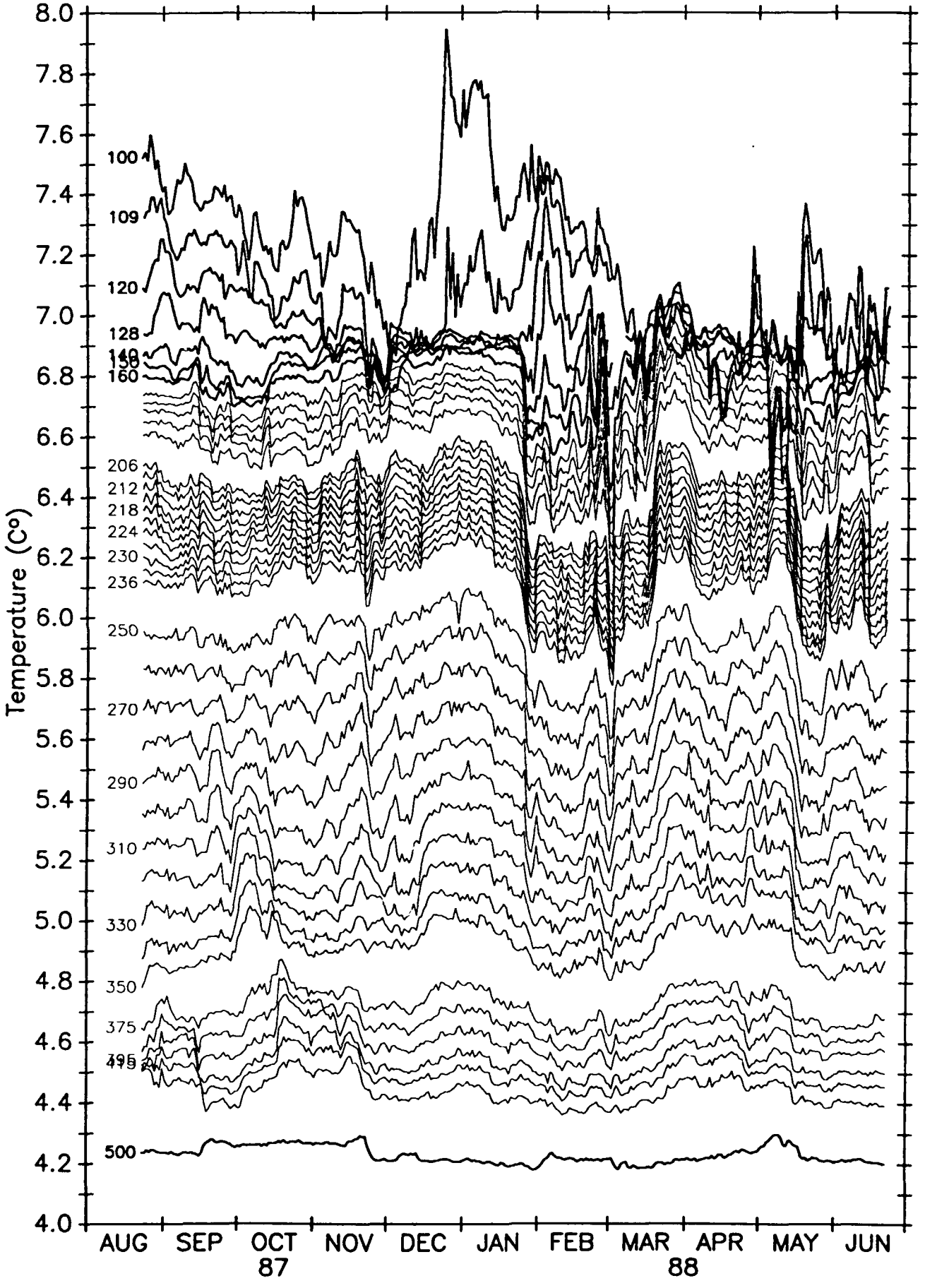
TIME SERIES OF TEMPERATURE: LOW-PASS FILTERED

This plot compares temperature measured at site W and C1 over the depth range from 60 to 109 m. Observations from site W are from the thermistor chain on the Scripps' mooring; observations from site C1 are from VMCMs at 60, 80, and 100 m, and from Seacats at 89 and 109 m. Data are low-pass filtered (40 hour half-power) and decimated to daily values.


STORMS Lowpass Filtered Temperatures from OSU and SCRIPPS Moorings
Site C1 (OSU mooring)
Site W (Scripps mooring)
(59, 69, 79, 89, 99, 105 m)
Temperature (C°)
10
9
8
7
6
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
88
60
70
80
90
100
100

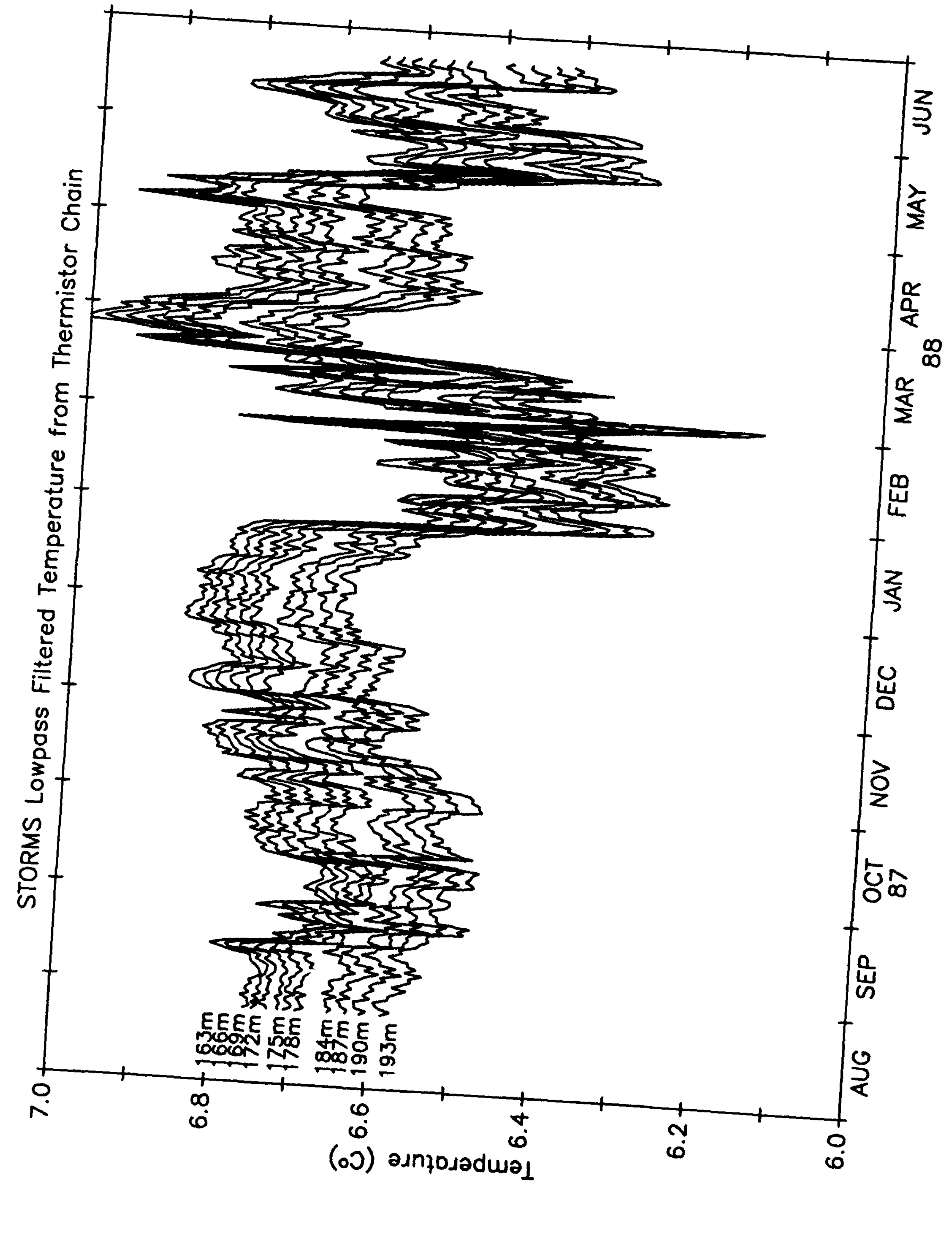
TIME SERIES OF TEMPERATURE: LOW-PASS FILTERED

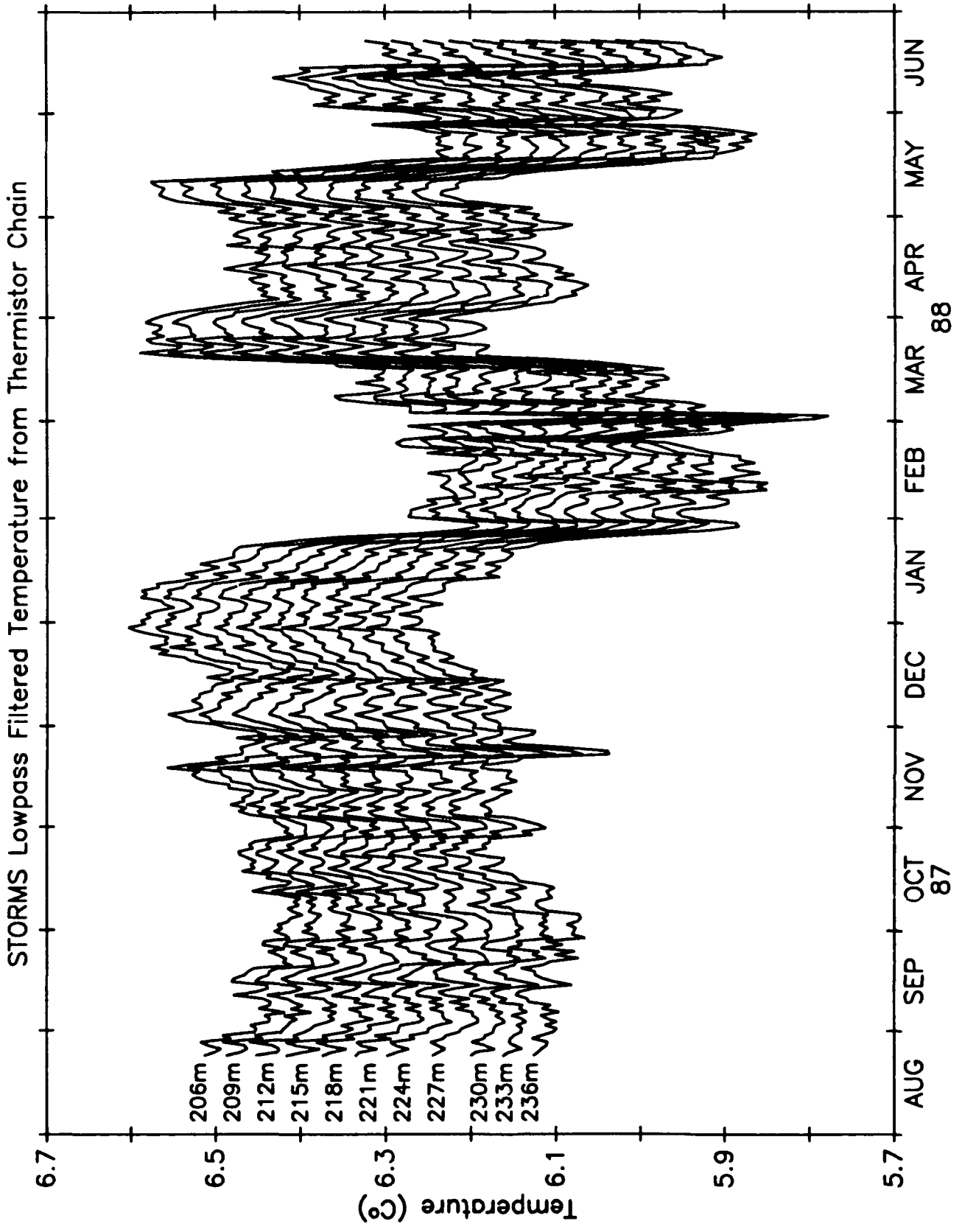
Observations from 100 to 500 m from VMCMs at 100, 120, 140 and 160 m; from Seacats at 109, 128 and 150 m; from thermistor chains spanning 163–193 m, 206–236 m, 250–350 m, and 375–425 m; and from an RCM-5 at 500 m. Data are low-pass filtered (40 hour half-power) and decimated to daily values.

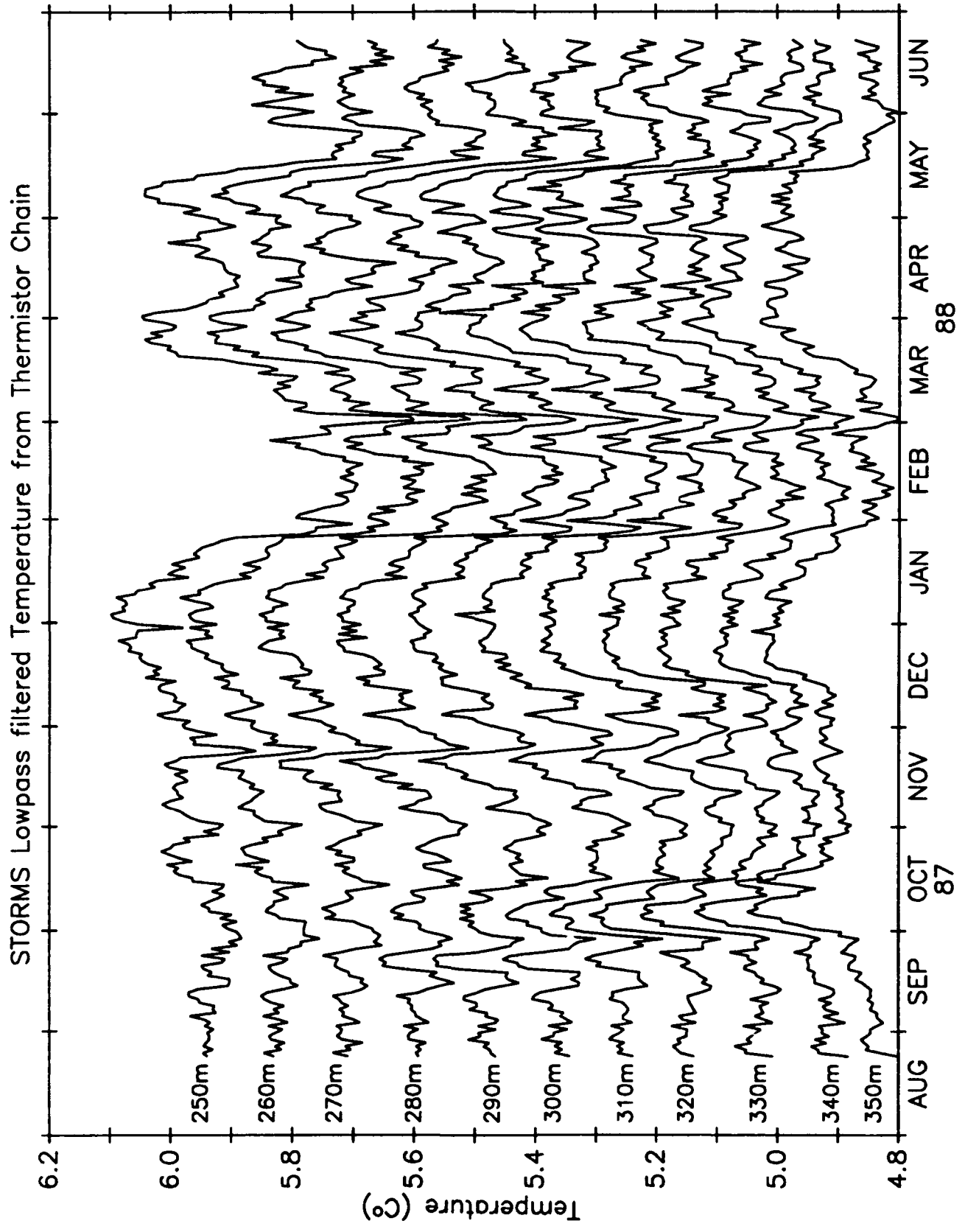

STORMS Lowpass Filtered Temperatures
Temperature (C°)
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
100
109
120
128
140
150
160
206
212
218
224
230
236
250
270
290
310
330
350
375
495
500
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

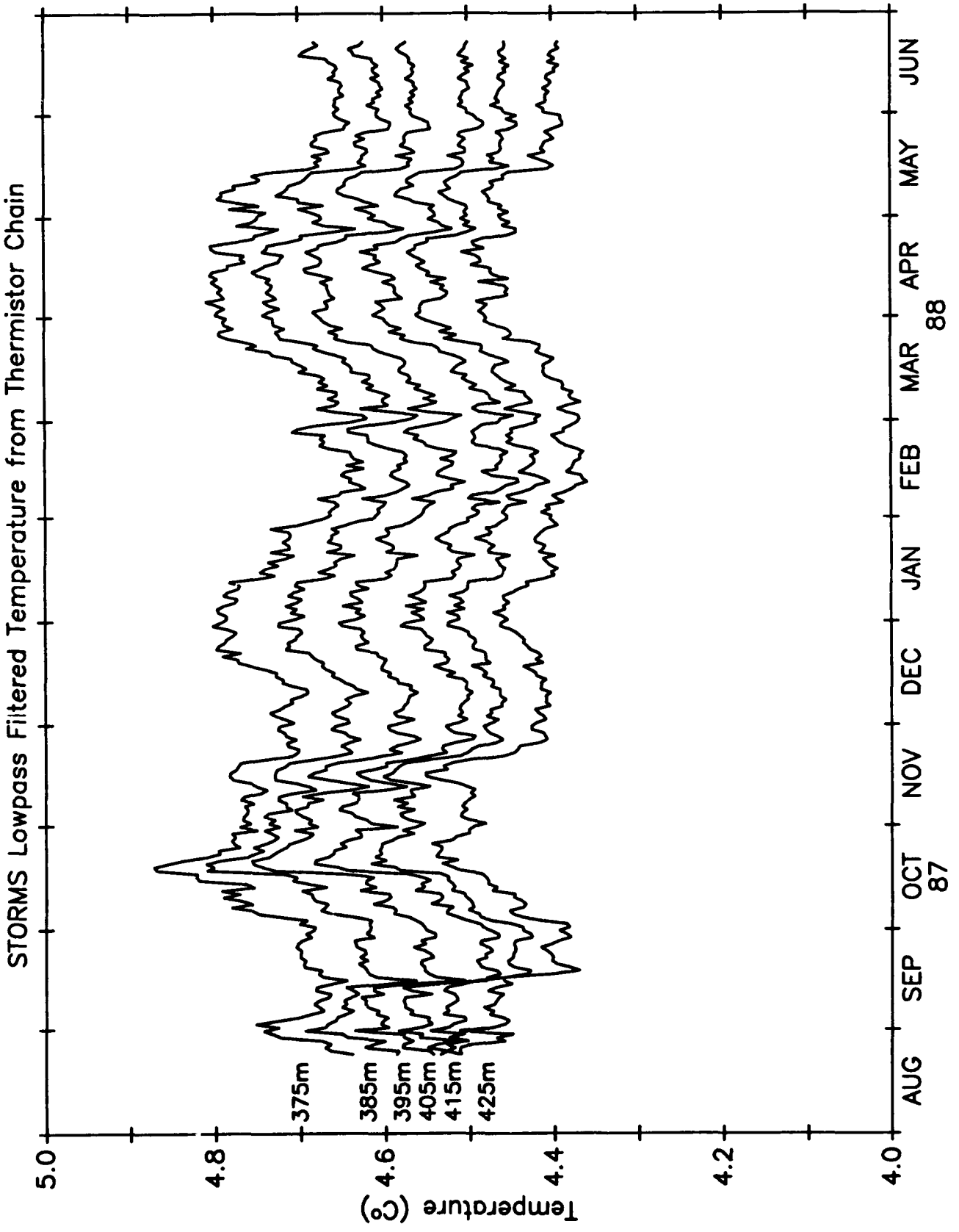
TIME SERIES OF TEMPERATURE: LOW-PASS FILTERED

The following four plots are observations from thermistor chains spanning depths 163–193 m, 206–236 m, 250–350 m, and 375–425 m. Data are low-pass filtered (40 hour half-power) and decimated to daily values.


STORMS Lowpass Filtered Temperature from Thermistor Chain
Temperature (C°)
7.0
6.8
6.6
6.4
6.2
6.0
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
88
MAY
JUN
163m
166m
169m
172m
175m
178m
184m
187m
190m
193m

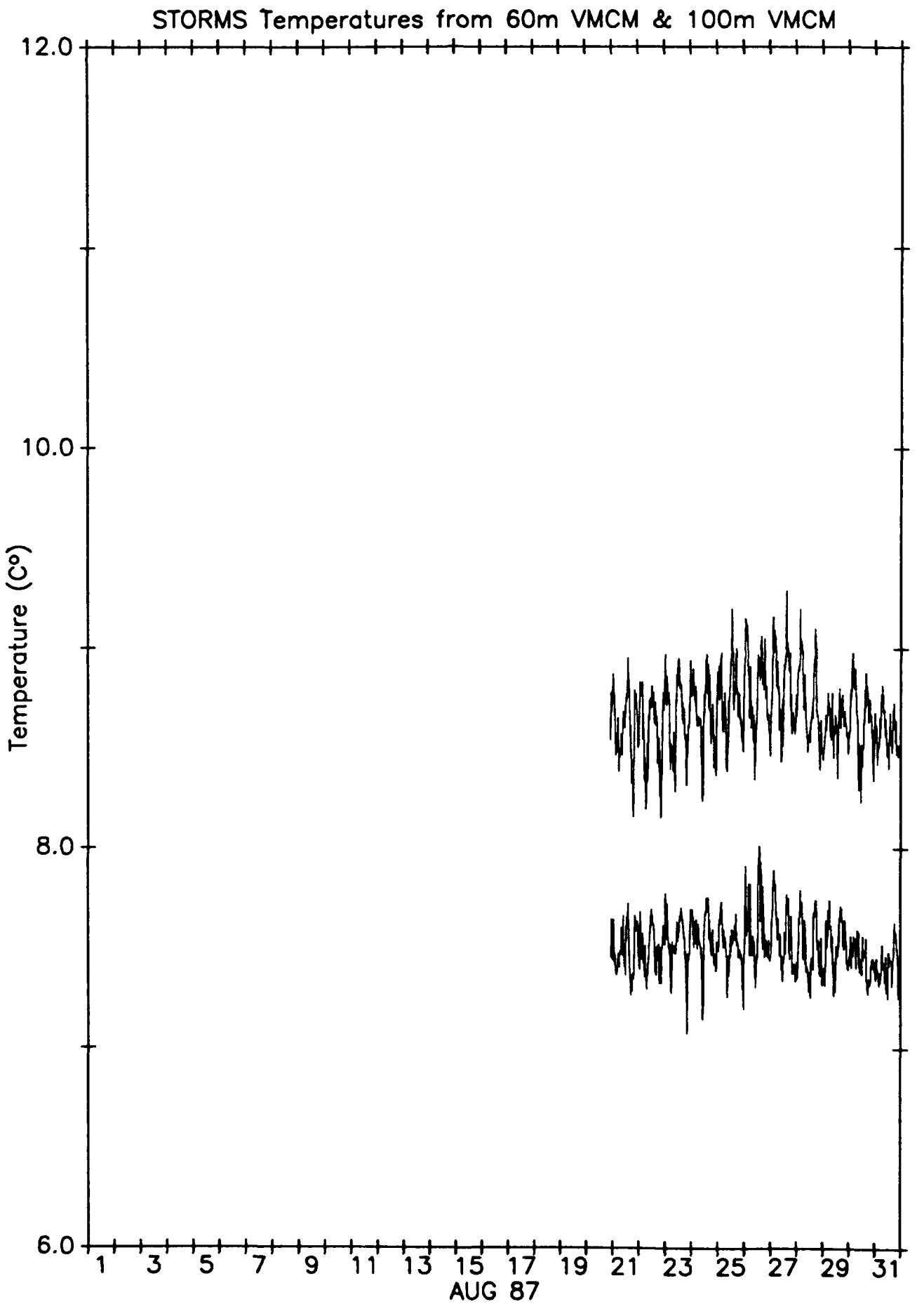

STORMS Lowpass Filtered Temperature from Thermistor Chain
Temperature (C°)
6.7
6.5
6.3
6.1
5.9
5.7
206m
209m
212m
215m
218m
221m
224m
227m
230m
233m
236m
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
88
MAY
JUN

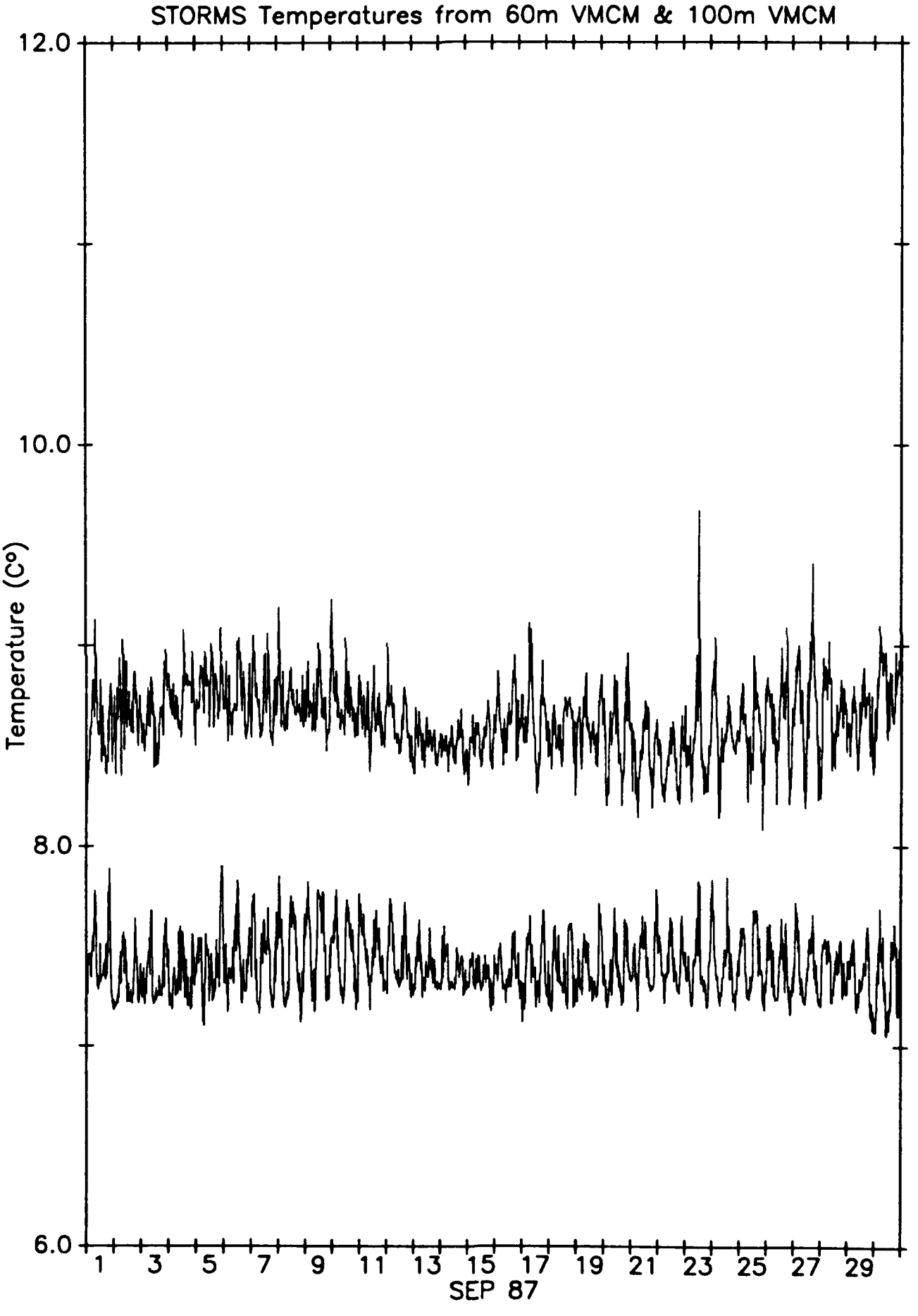

STORMS Lowpass filtered Temperature from Thermistor Chain
Temperature (C°)
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
250m
260m
270m
280m
290m
300m
310m
320m
330m
340m
350m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

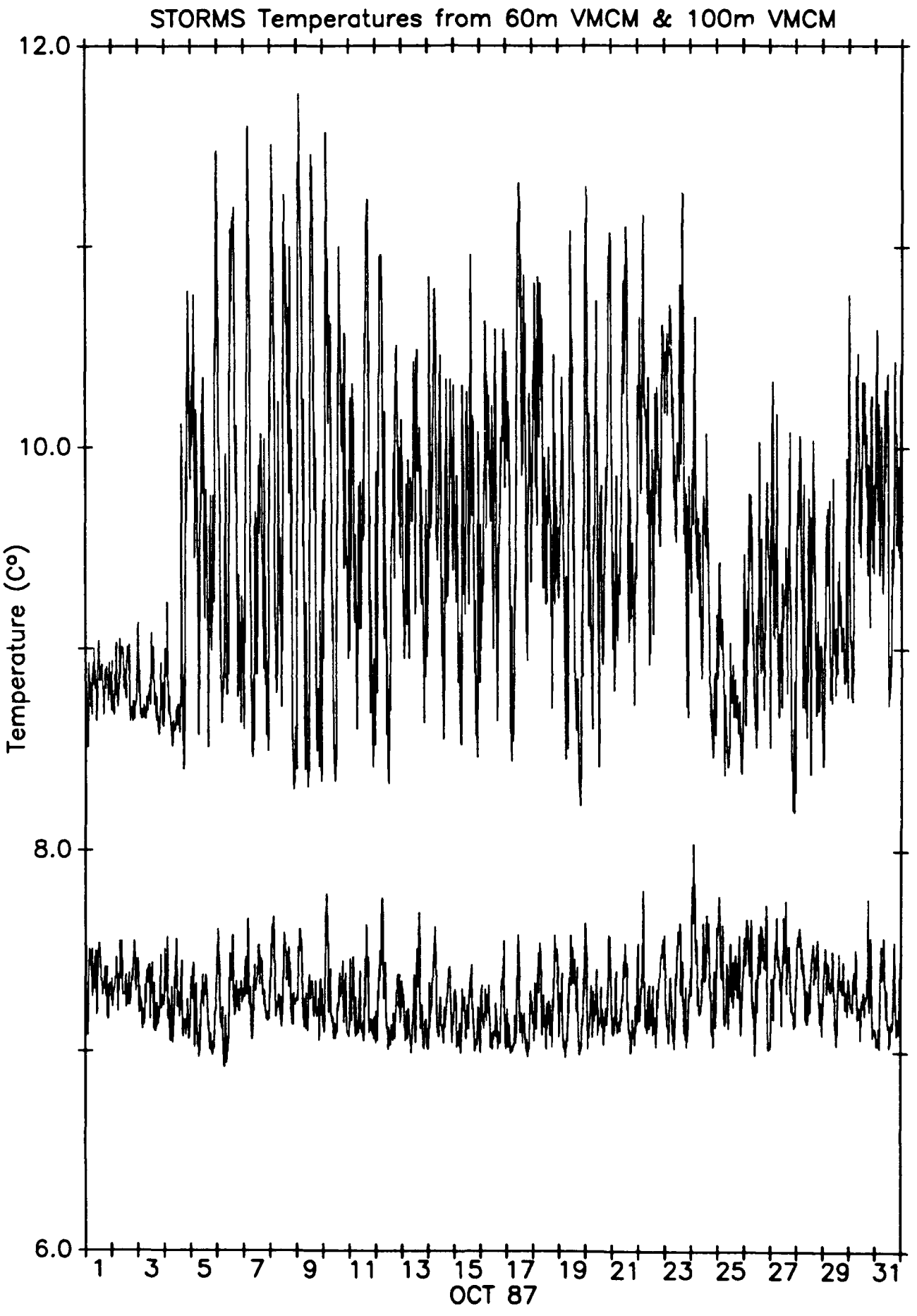

STORMS Lowpass Filtered Temperature from Thermistor Chain
Temperature (C°)
5.0
4.8
4.6
4.4
4.2
4.0
375m
385m
395m
405m
415m
425m
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
88
MAY
JUN

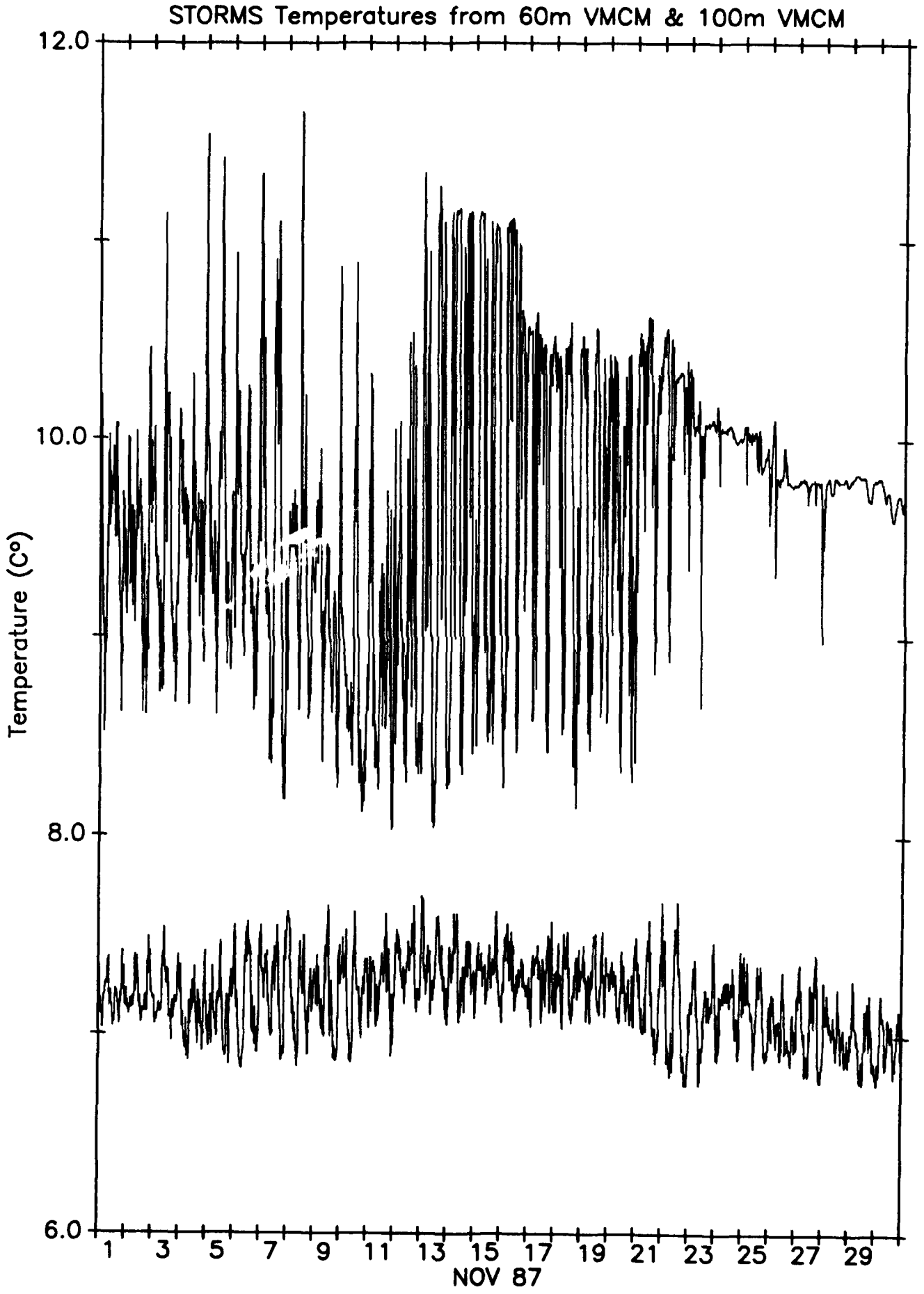
TIME SERIES OF TEMPERATURE: UNFILTERED

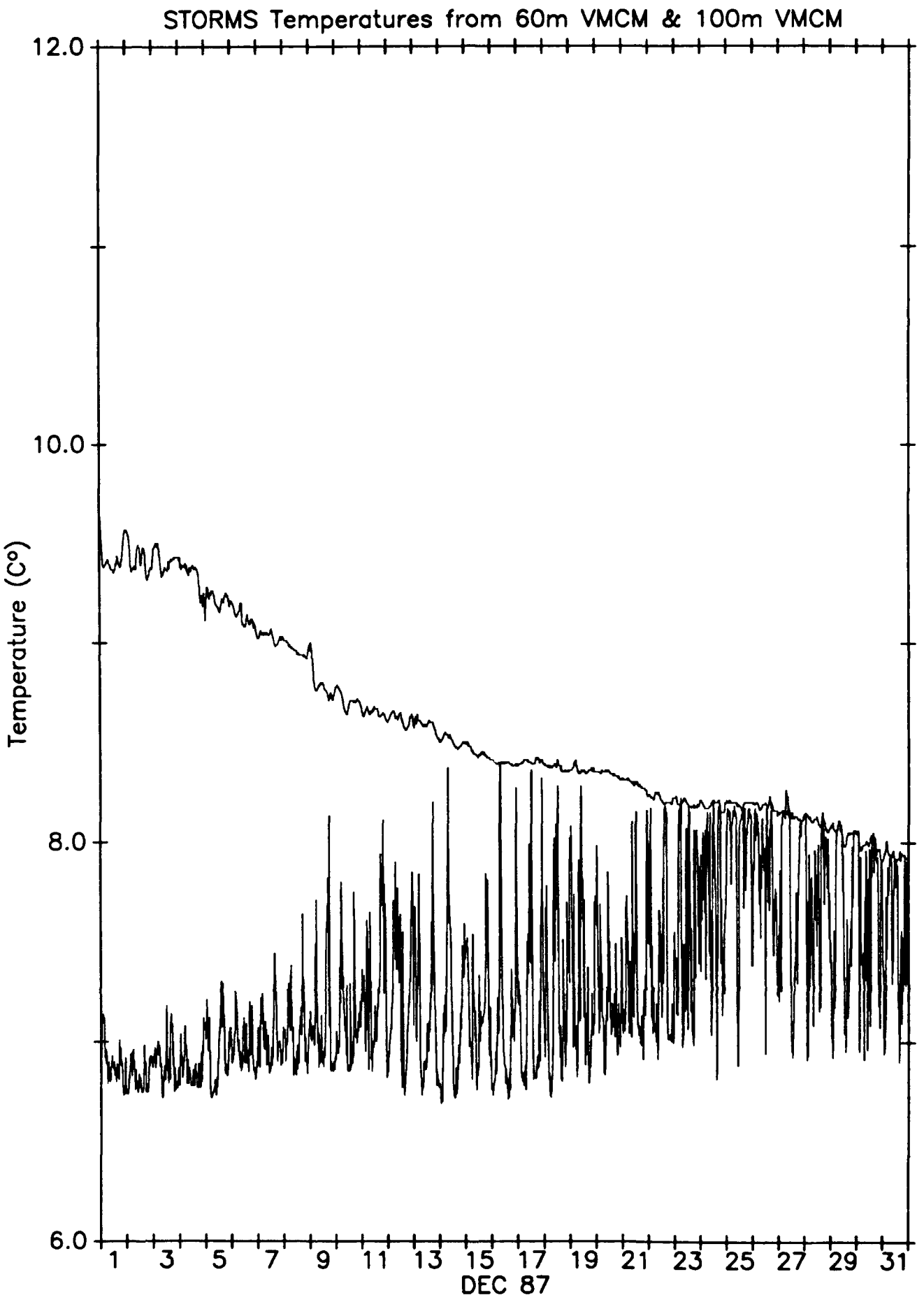
On the following 11 pages are observations from VMCMs at 60 and 100 m. One month is plotted per page; sampling interval is 15 minutes.

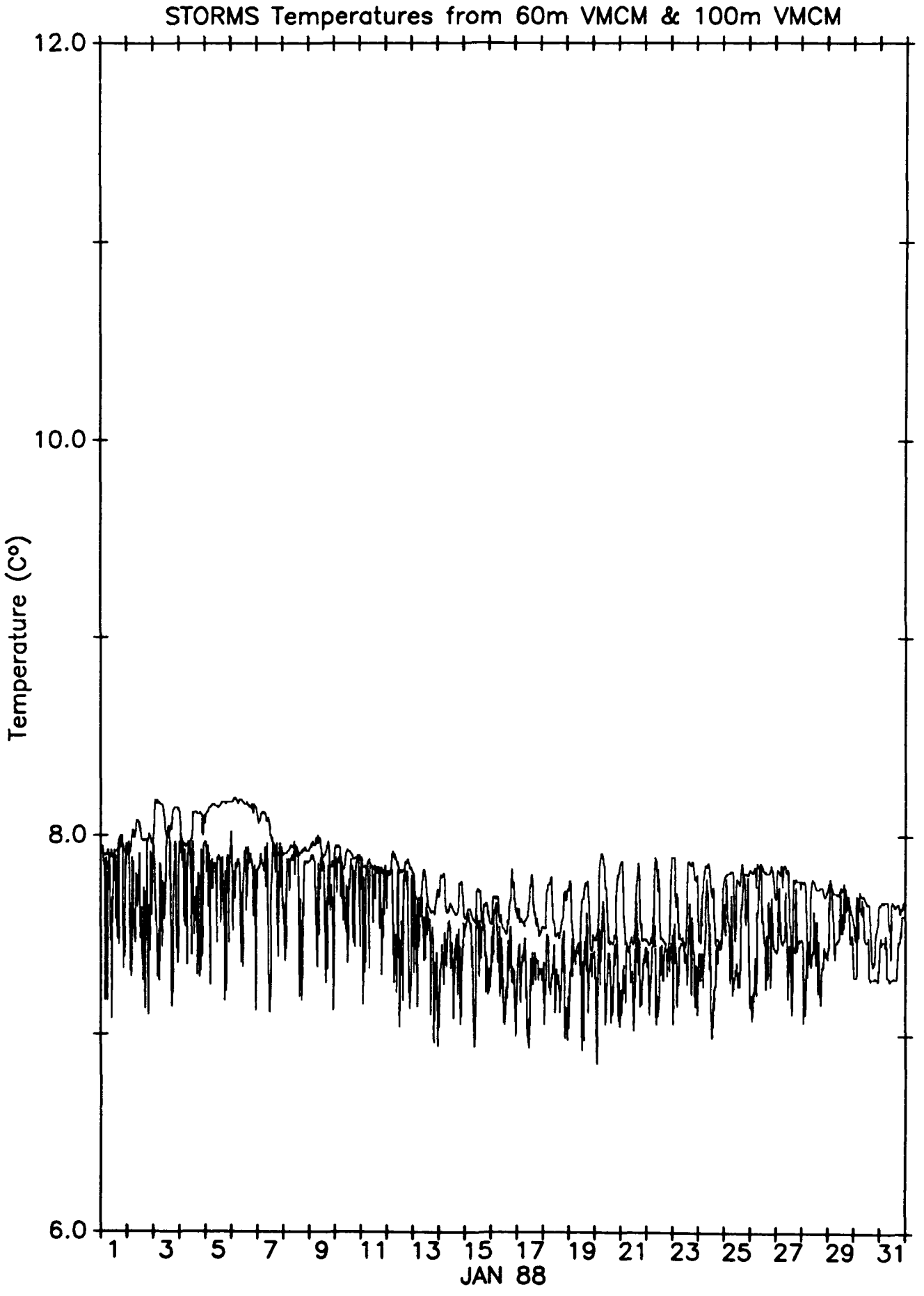

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87

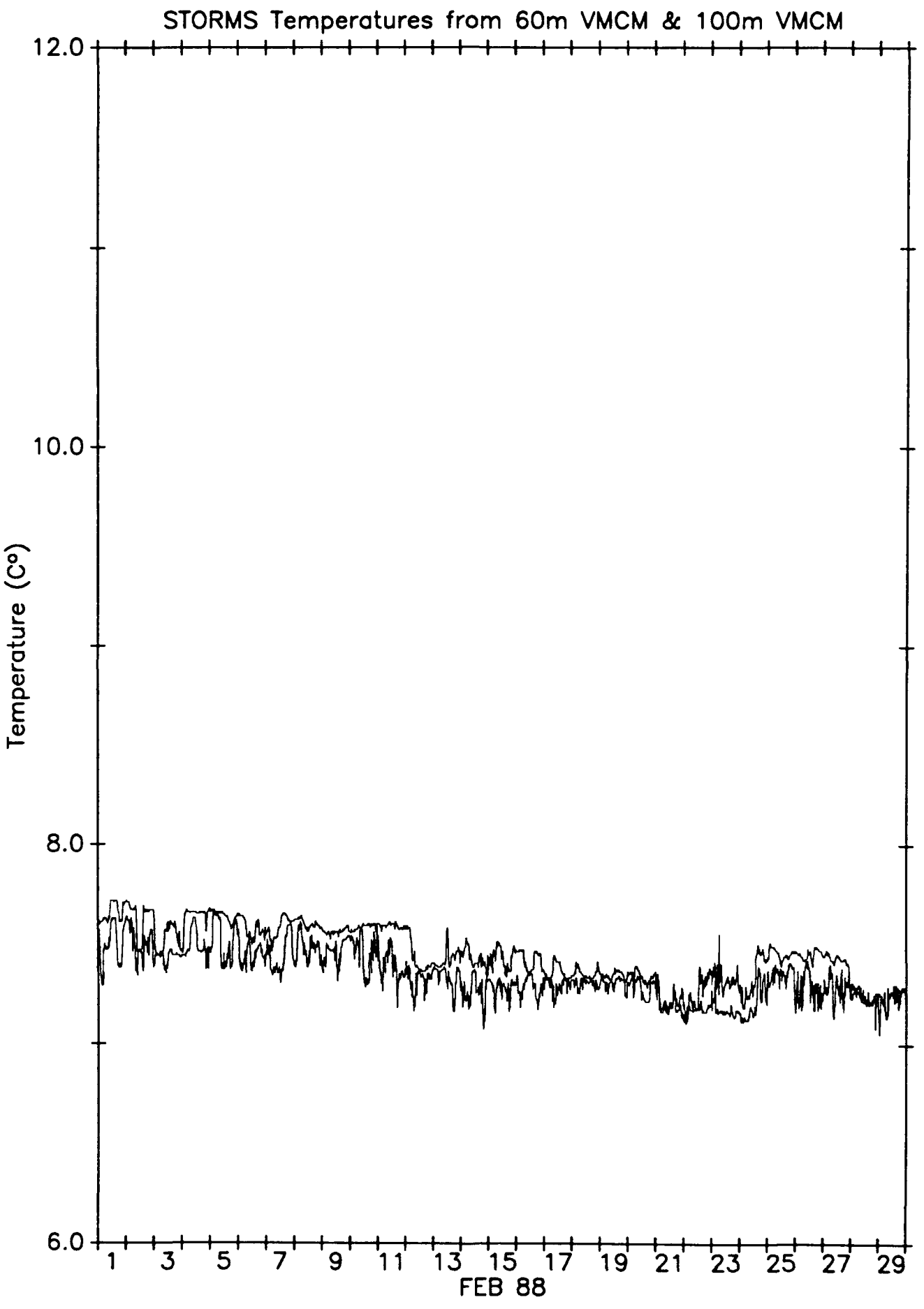

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
SEP 87

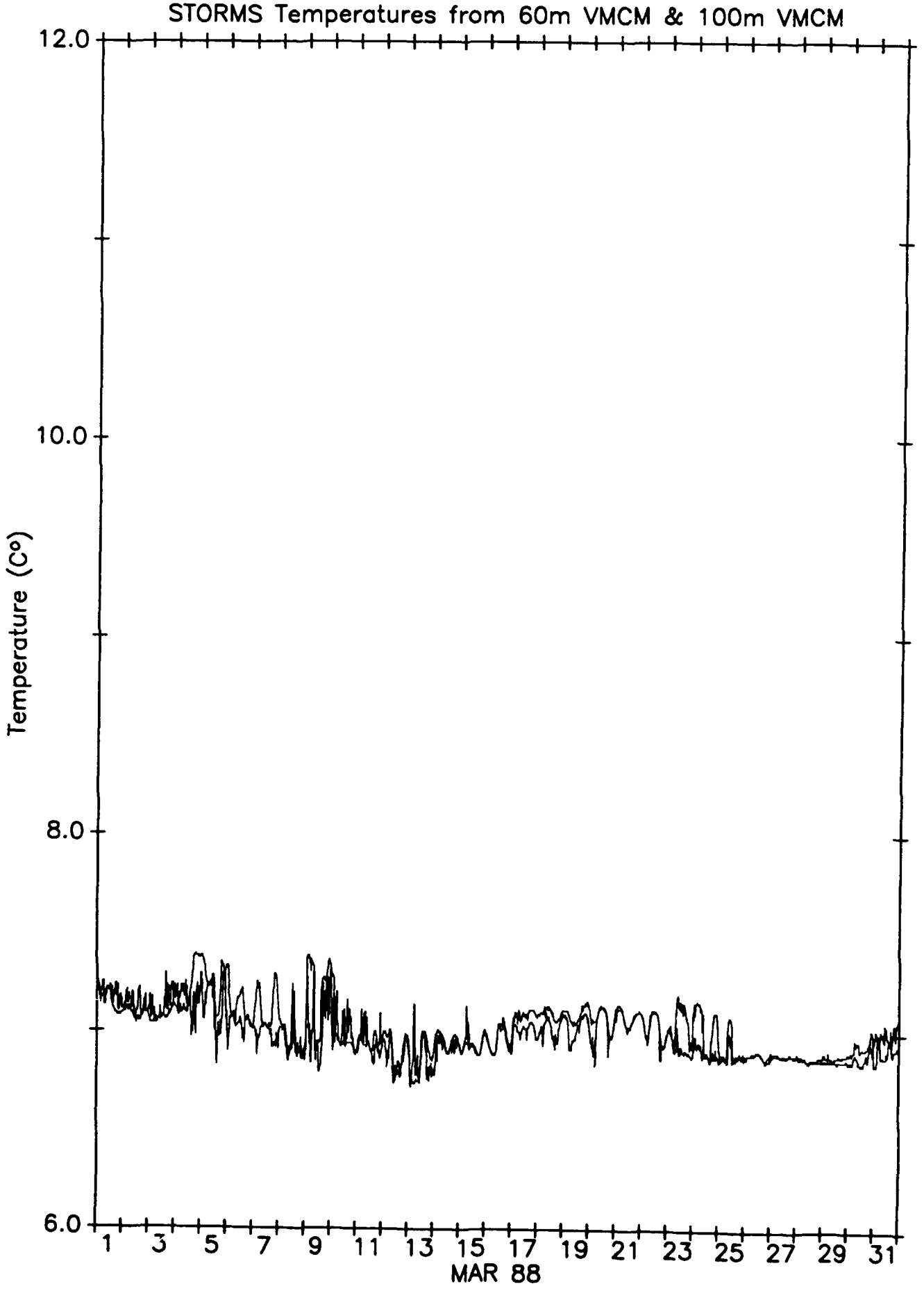

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87

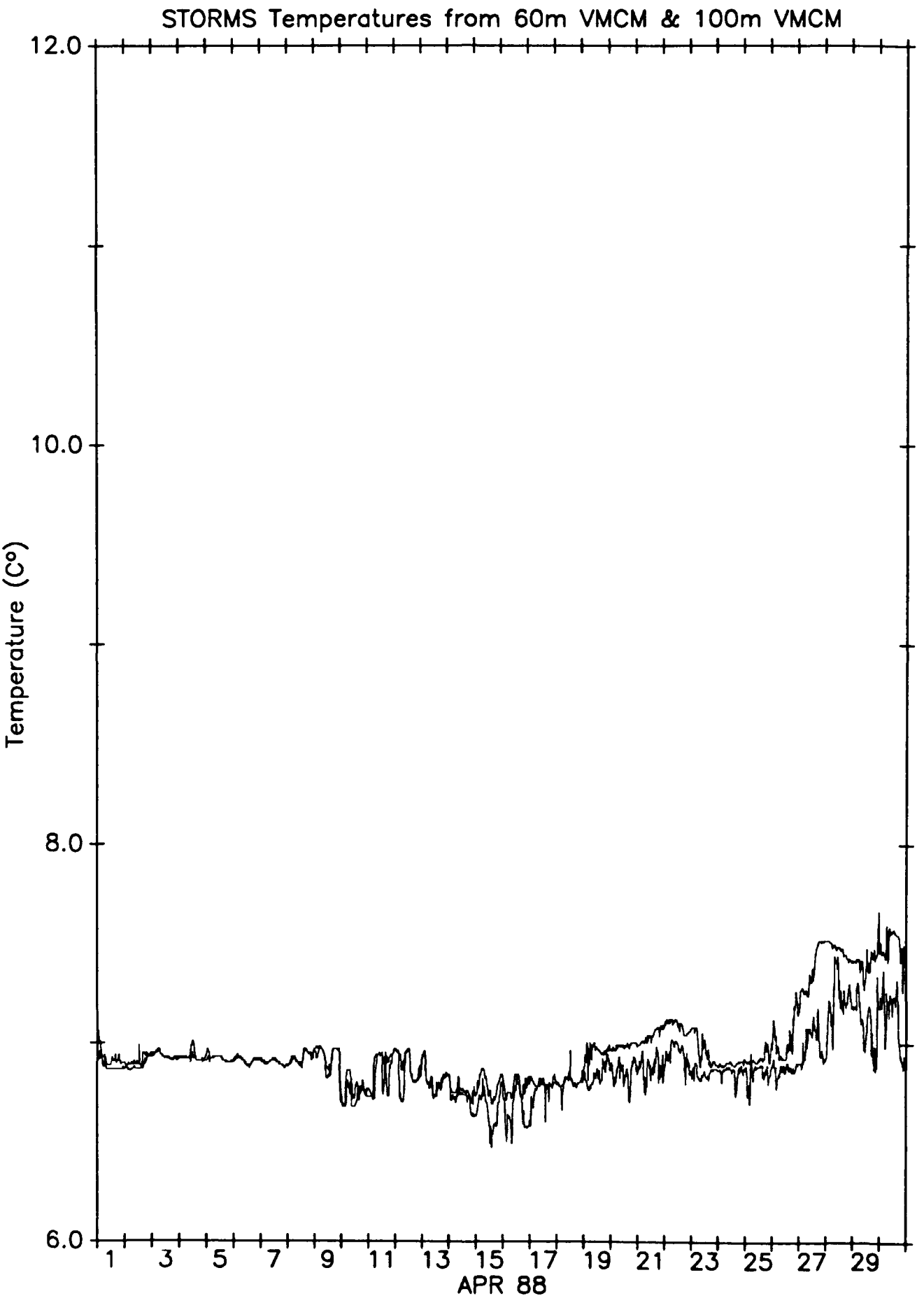

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
NOV 87

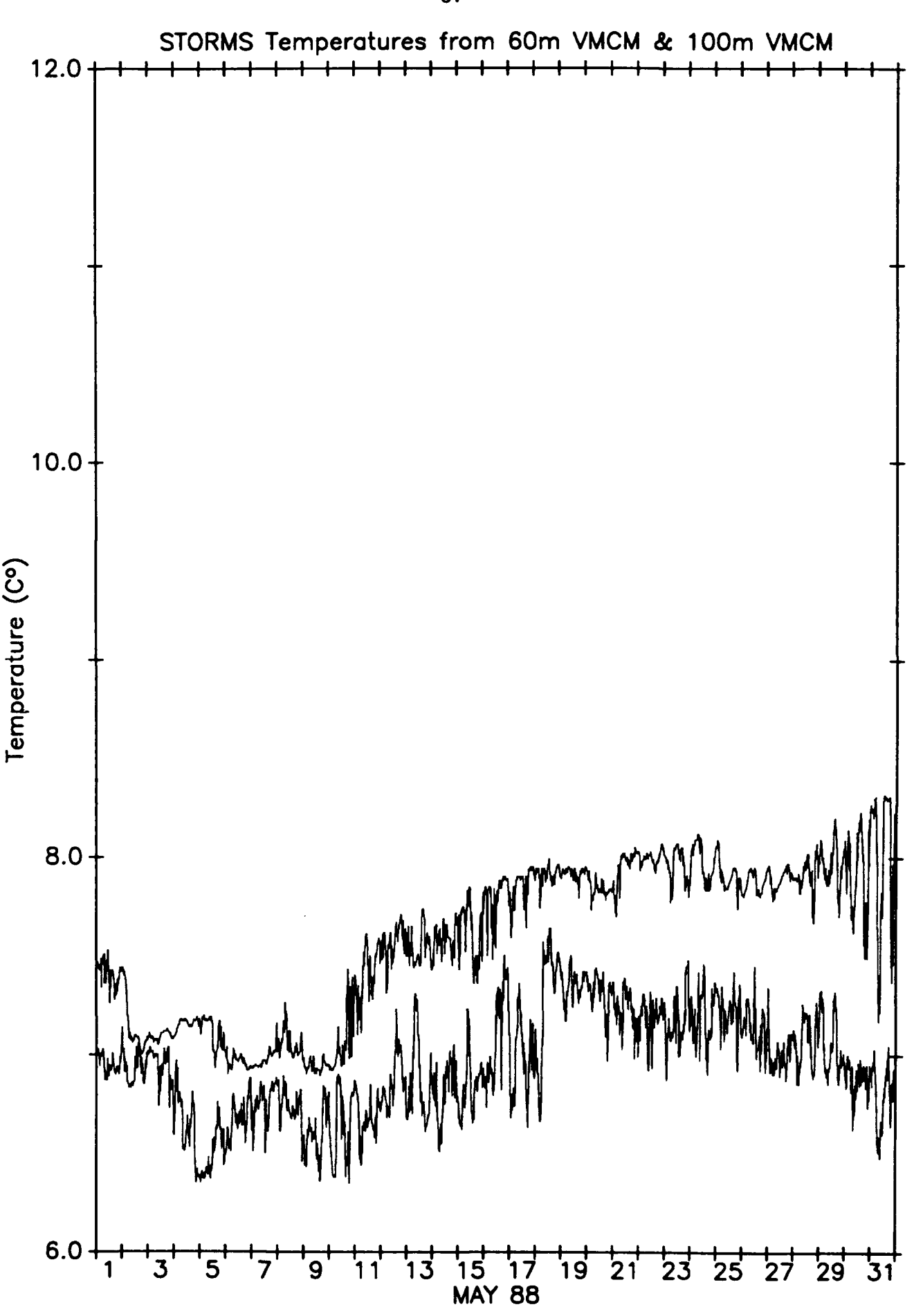

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
DEC 87

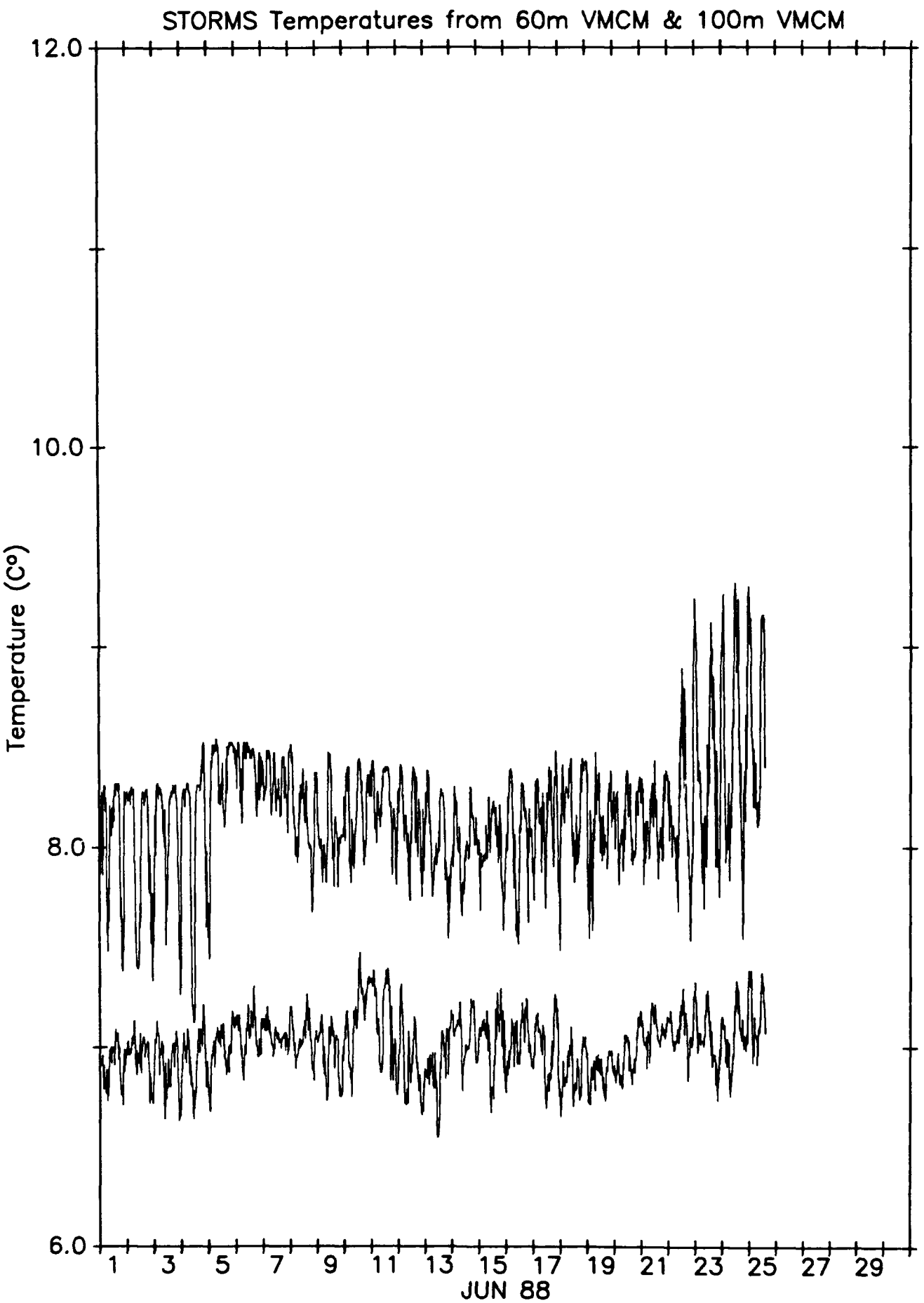

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
JAN 88


STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
FEB 88


STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
MAR 88

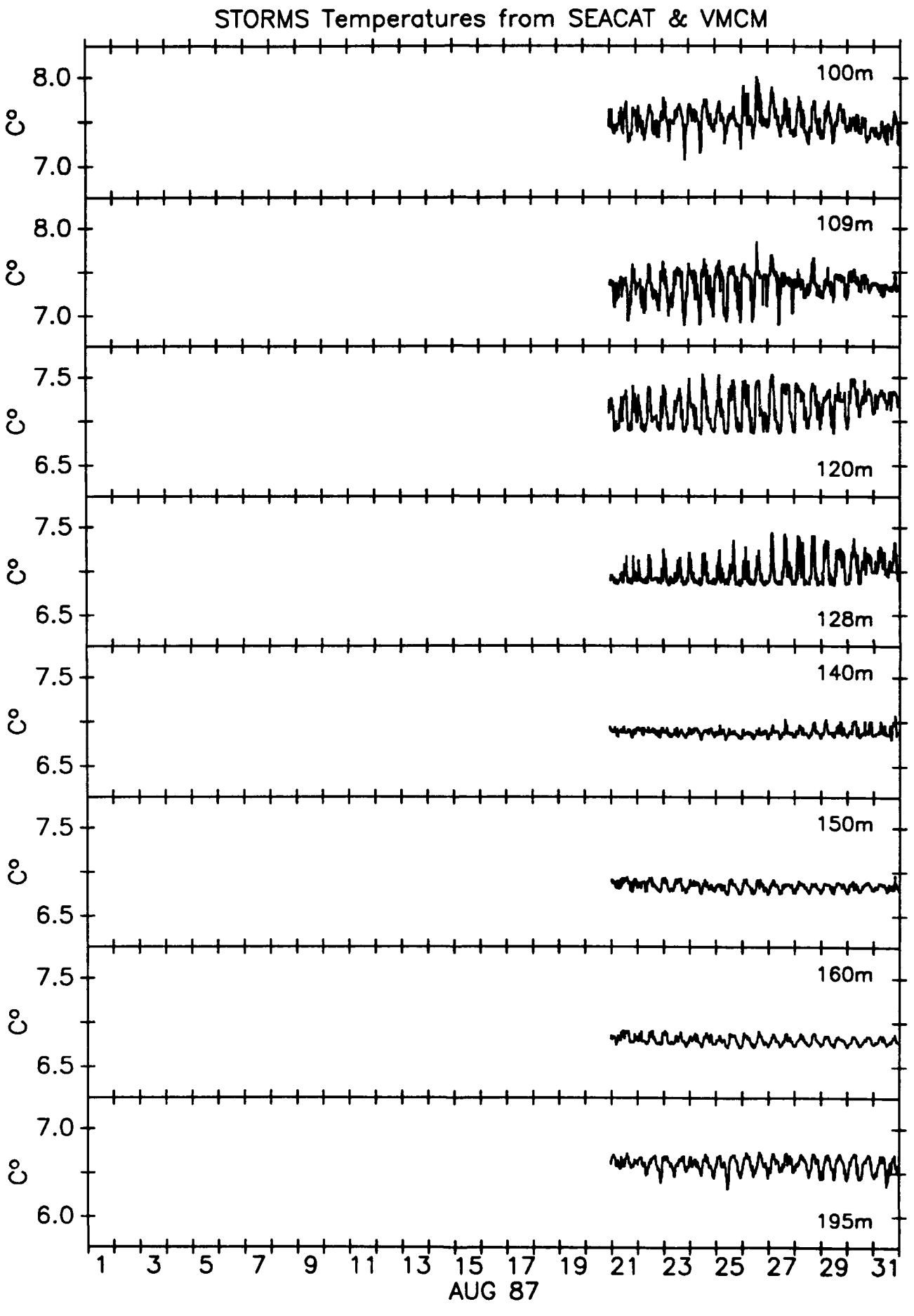

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
APR 88

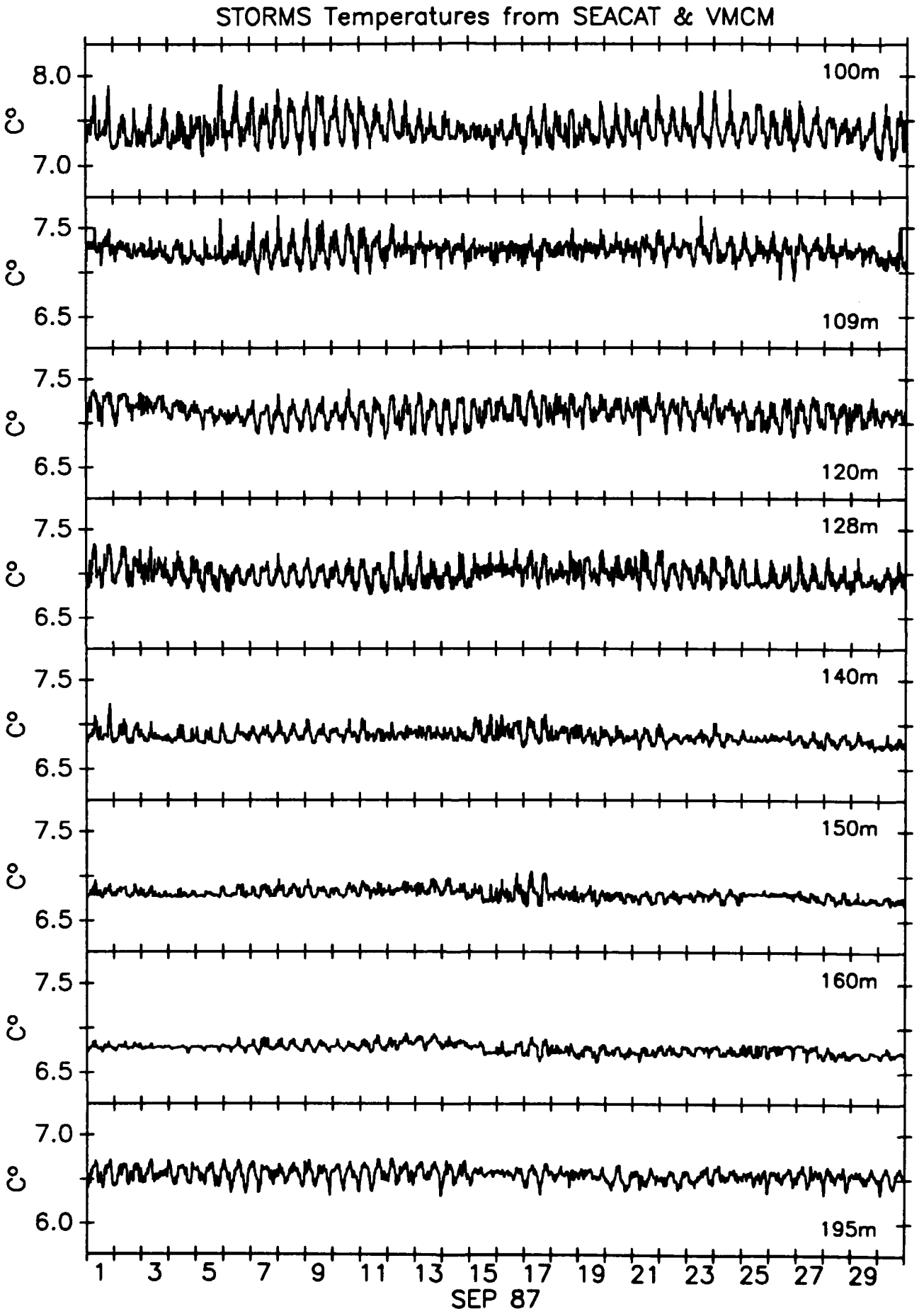

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88

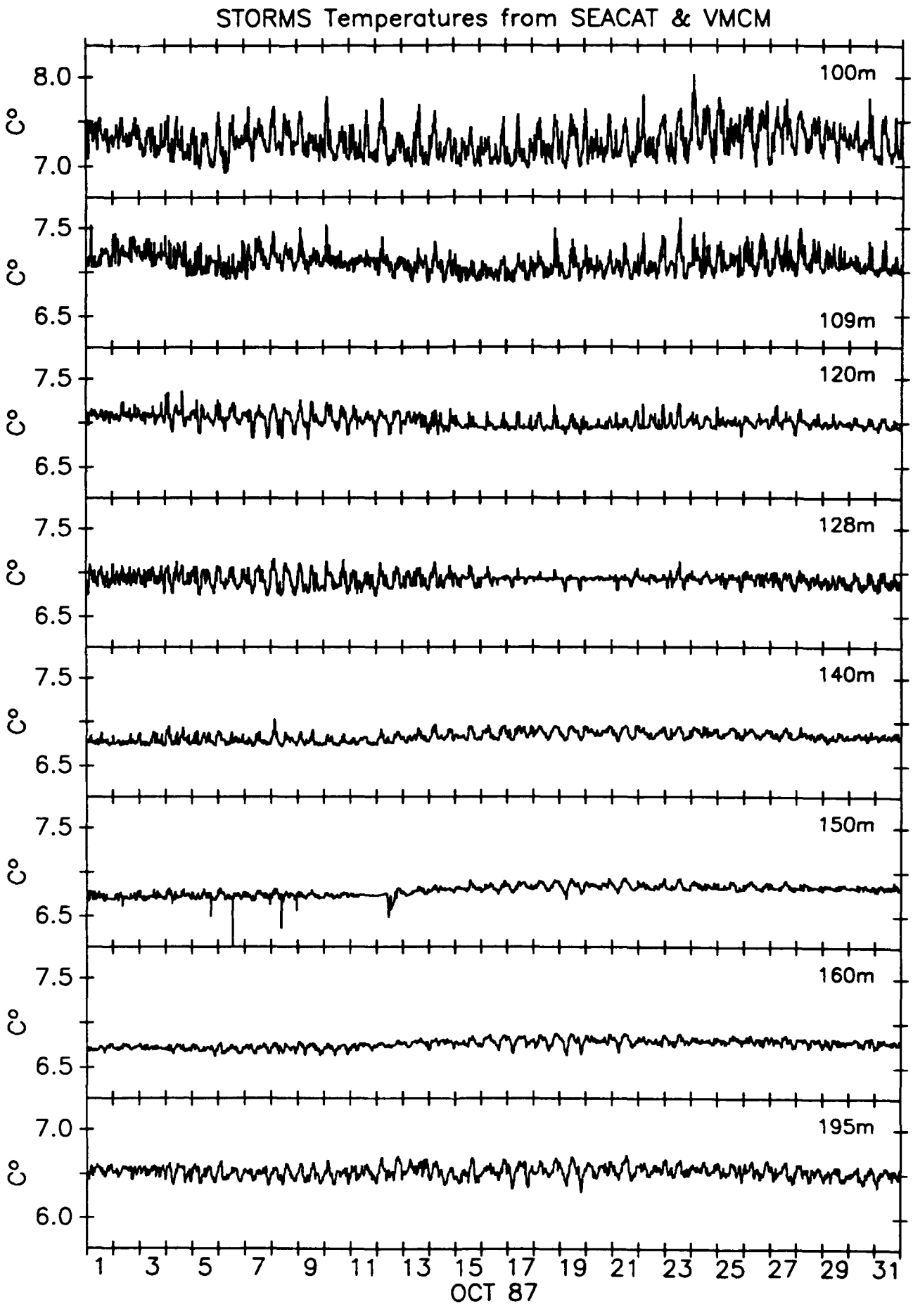

STORMS Temperatures from 60m VMCM & 100m VMCM
12.0
10.0
8.0
6.0
Temperature (C°)
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
JUN 88

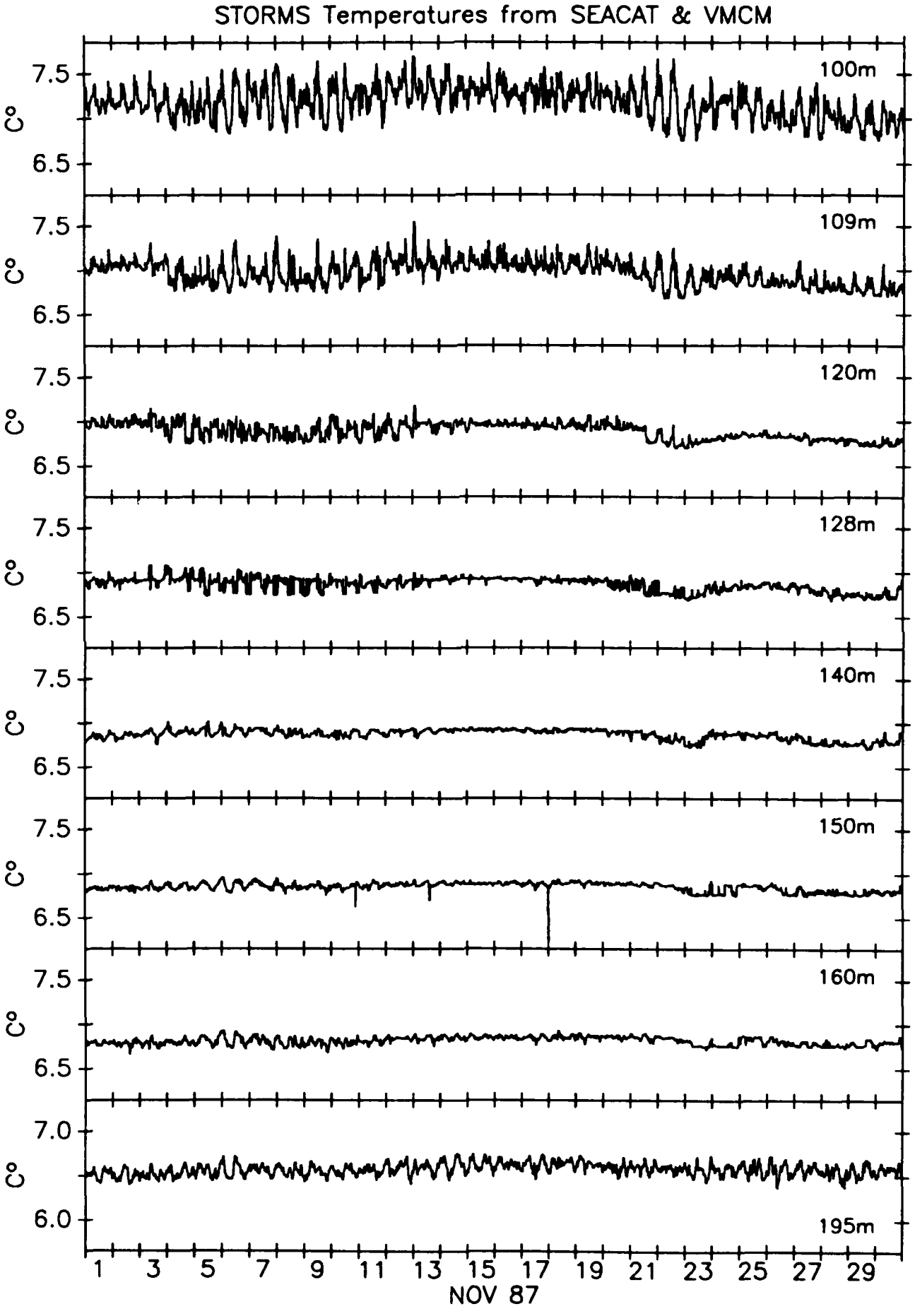
TIME SERIES OF TEMPERATURE: UNFILTERED

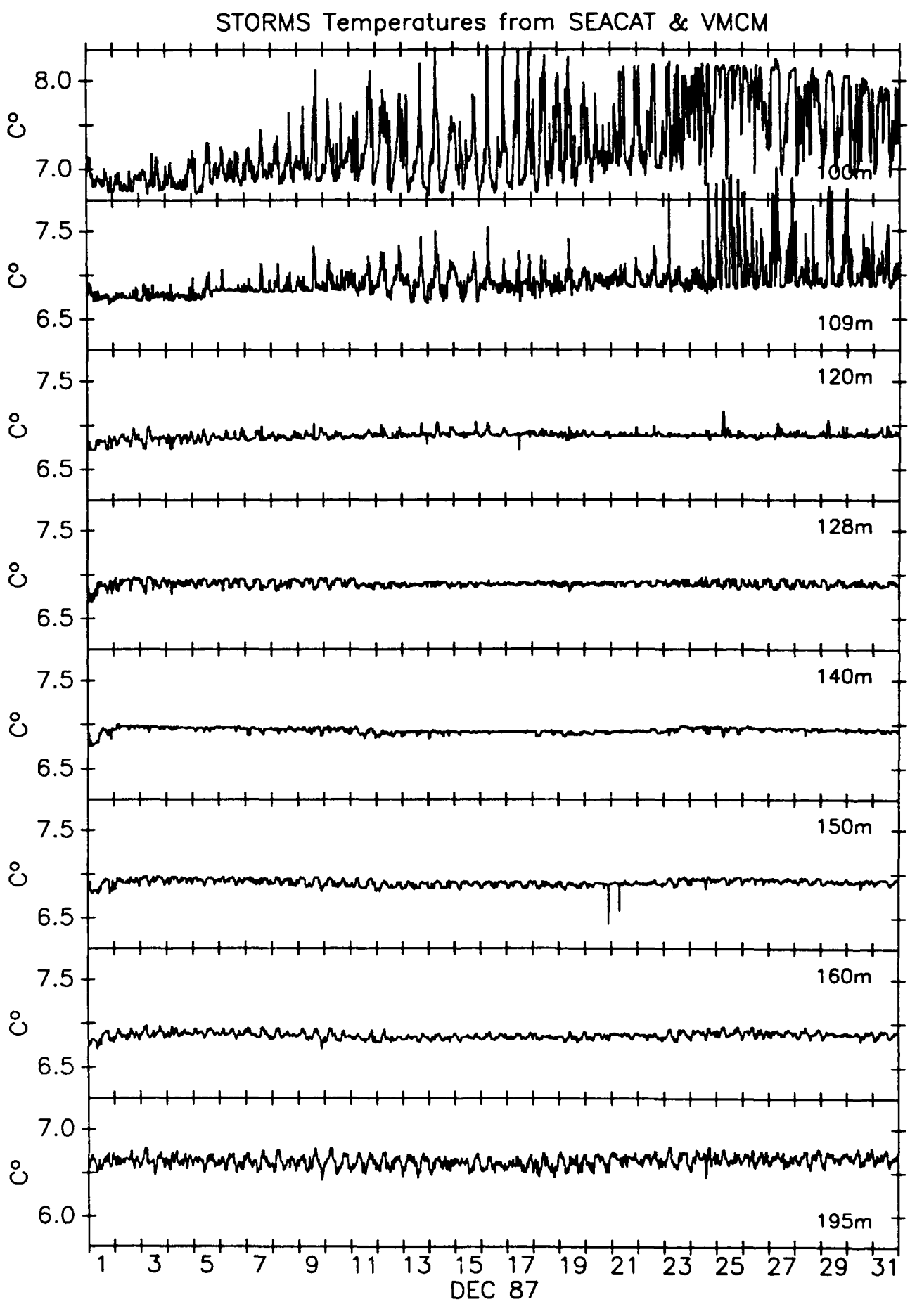
On the following 11 pages are observations from 100 to 195 m from VMCMs at 100, 120, 140, 160 and 195 m and from Seacats at 109, 128 and 150 m. One month is plotted per page. Sampling interval for VMCMs is 15 minutes and for the Seacats is 6 minutes before 3/4/88 and 12 minutes after.

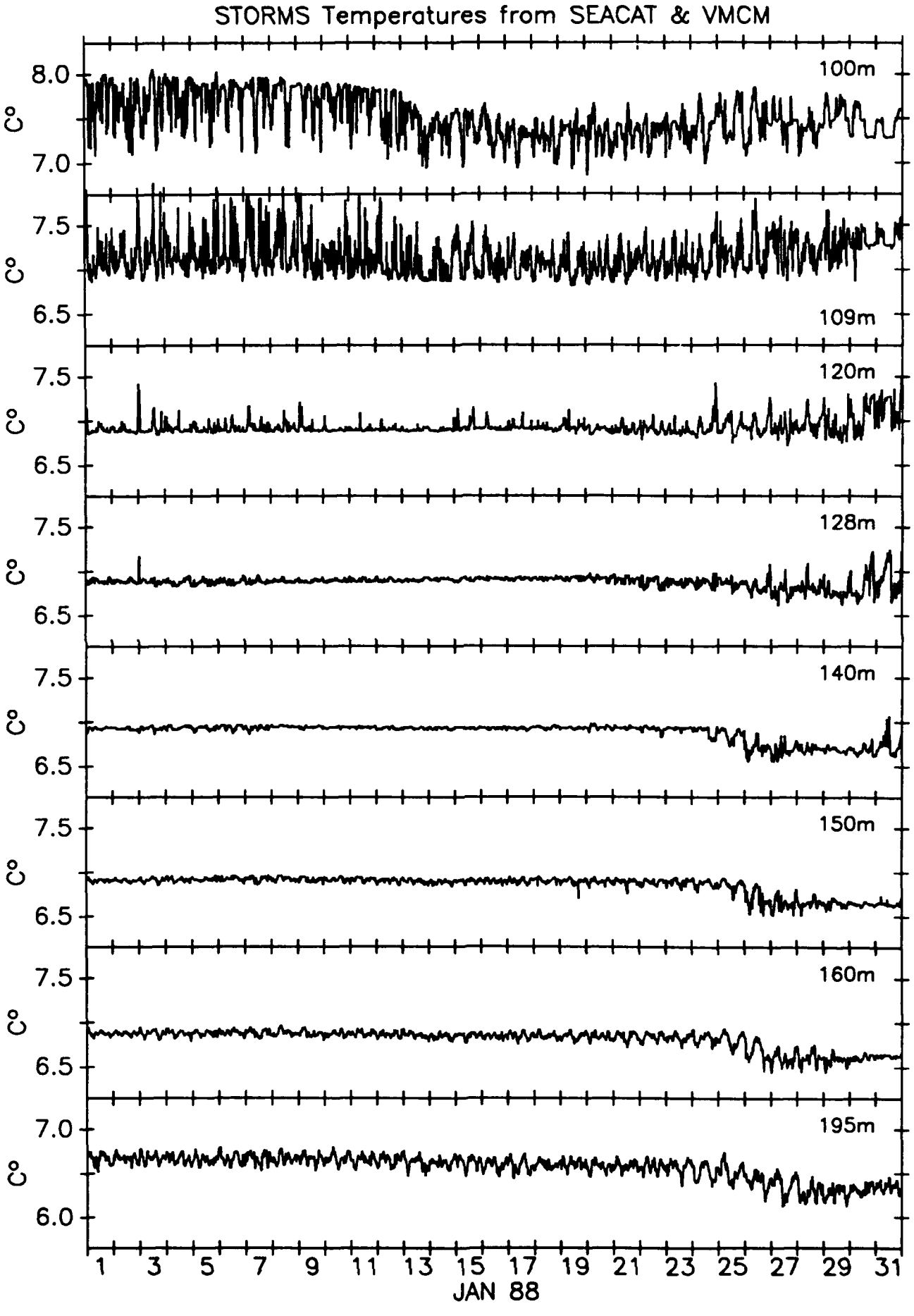

STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
8.0
7.0
7.5
6.5
6.0
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87

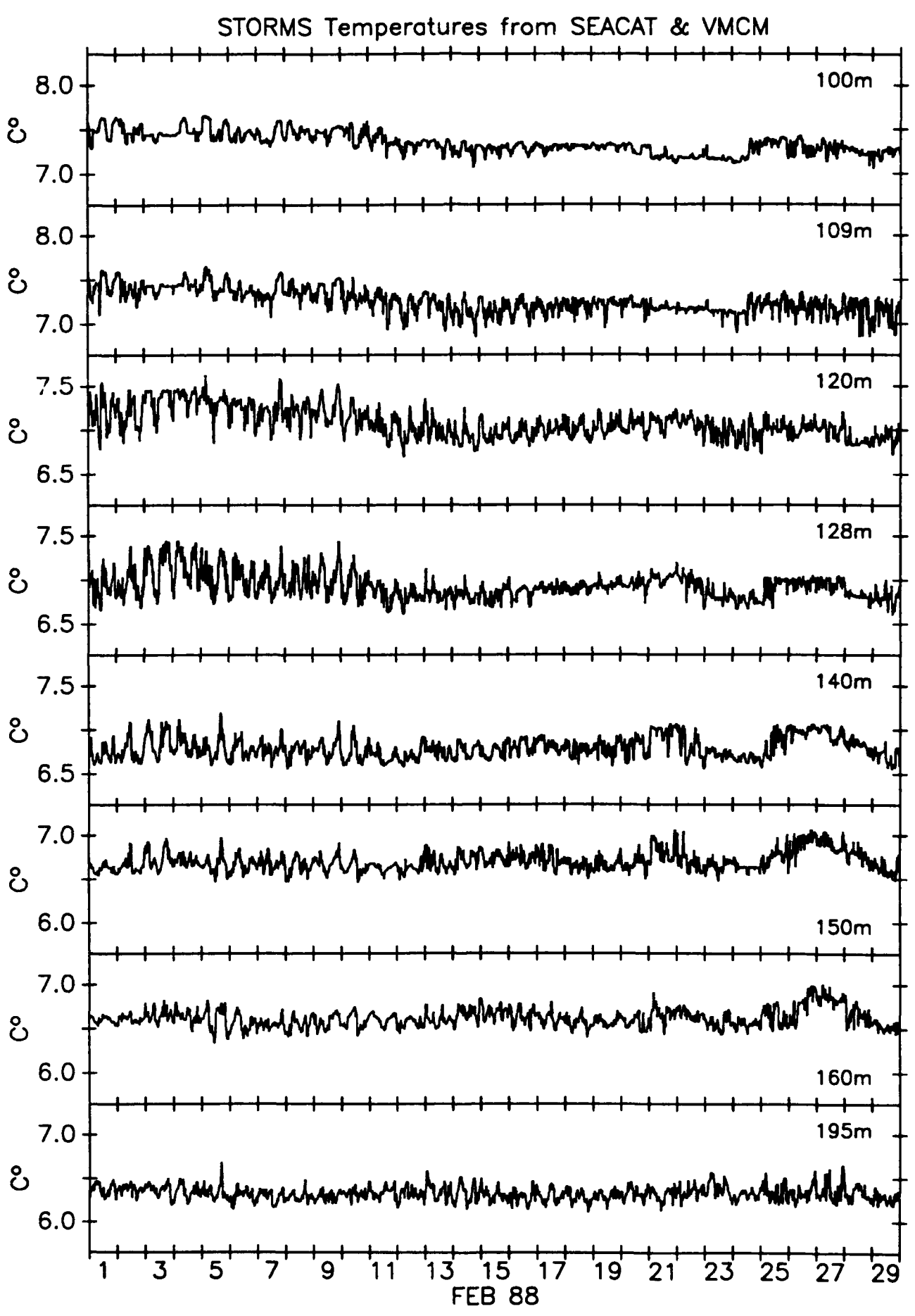

STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
C°
8.0
7.0
7.5
6.5
6.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
SEP 87

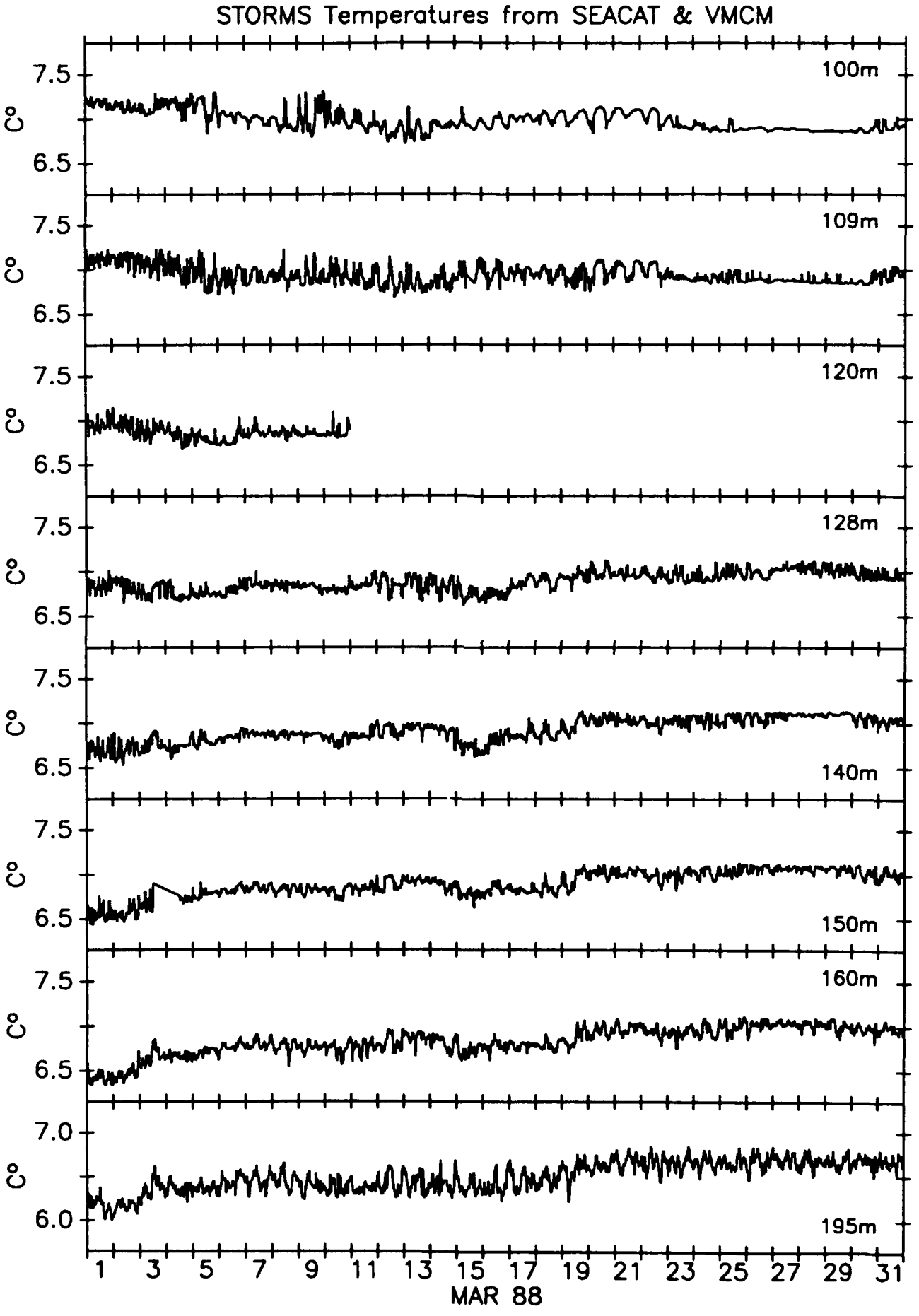

STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
C°
8.0
7.0
7.5
6.5
6.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87

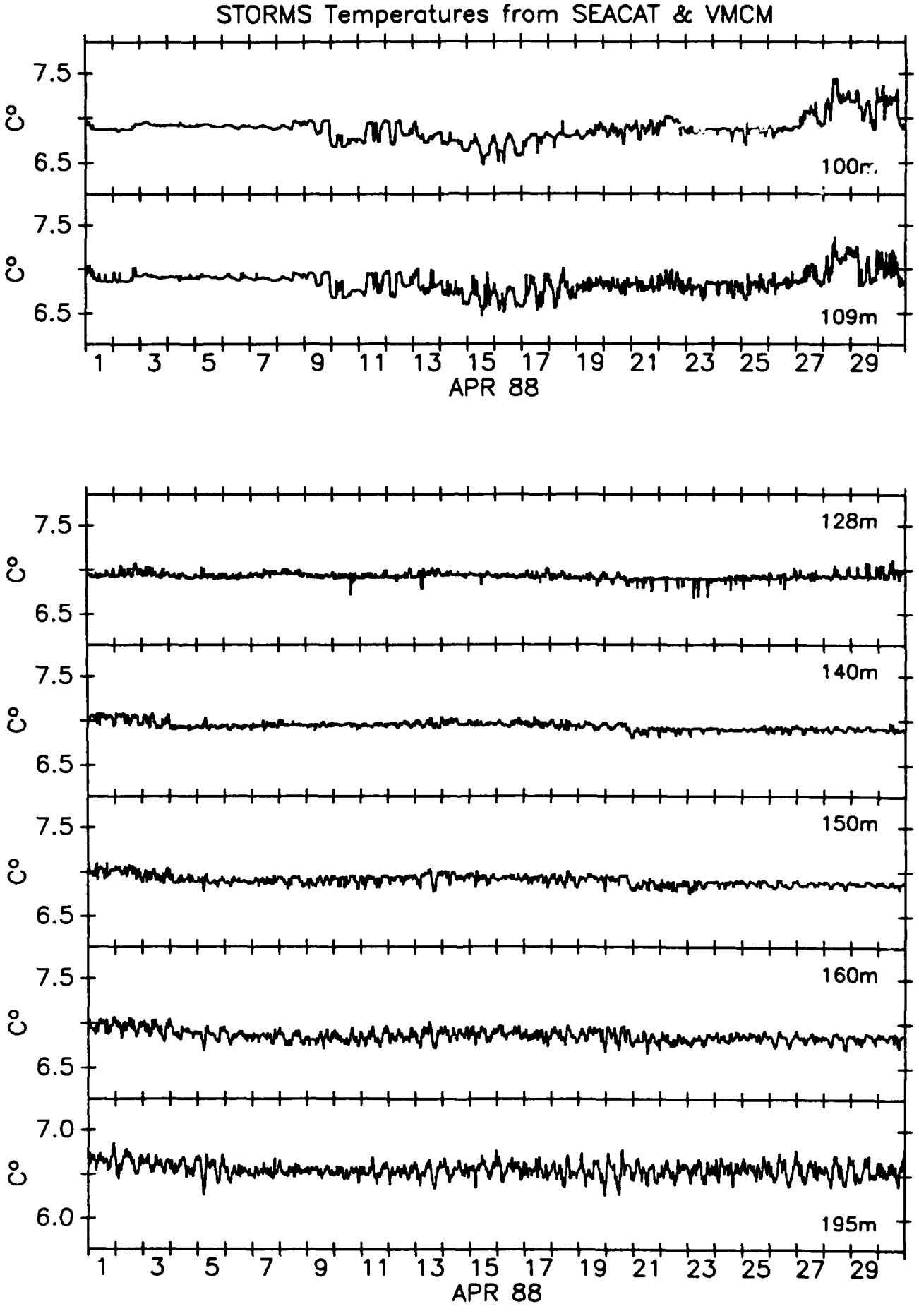

STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
C°
7.5
6.5
7.0
6.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
NOV 87

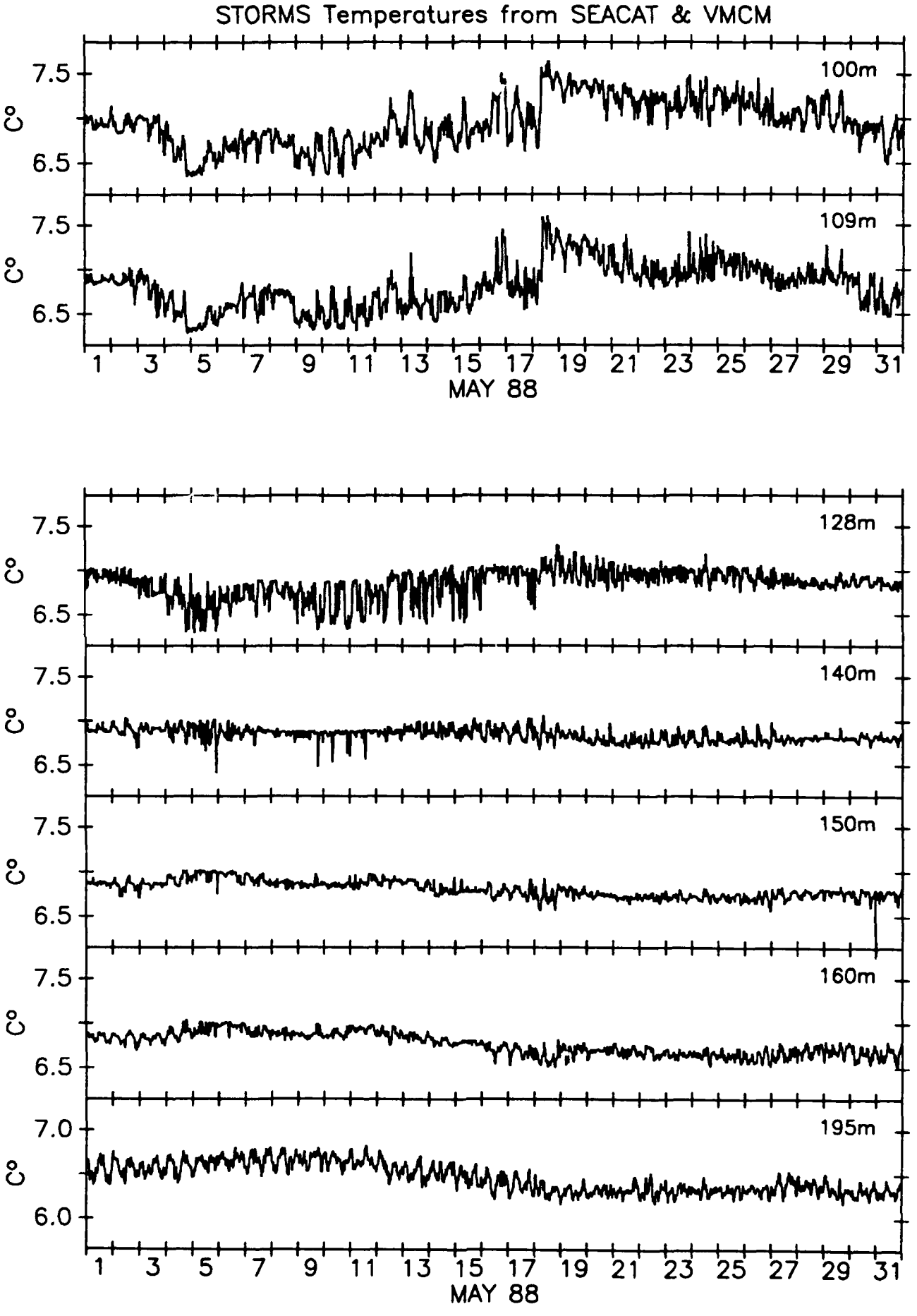

STORMS Temperatures from SEACAT & VMCM
8.0
7.0
C°
100m
7.5
6.5
C°
109m
7.5
C°
120m
6.5
7.5
C°
128m
6.5
7.5
C°
140m
6.5
7.5
C°
150m
6.5
7.5
C°
160m
6.5
7.0
C°
6.0
195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
DEC 87

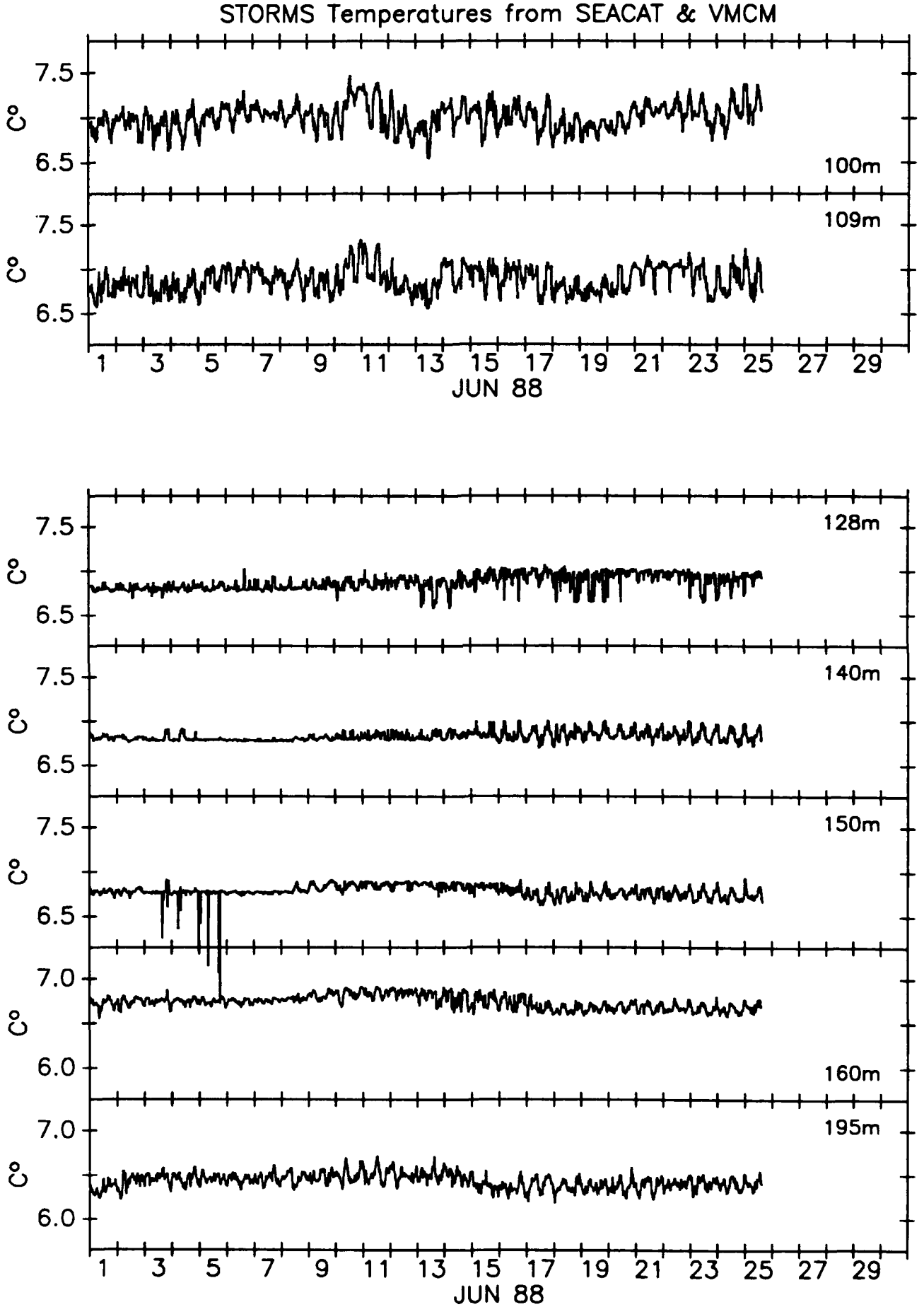

STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
C°
8.0
7.0
7.5
6.5
6.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
JAN 88


STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
8.0
7.0
7.5
6.5
6.0
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
FEB 88


STORMS Temperatures from SEACAT & VMCM
100m
109m
120m
128m
140m
150m
160m
195m
C°
7.5
6.5
7.0
6.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAR 88

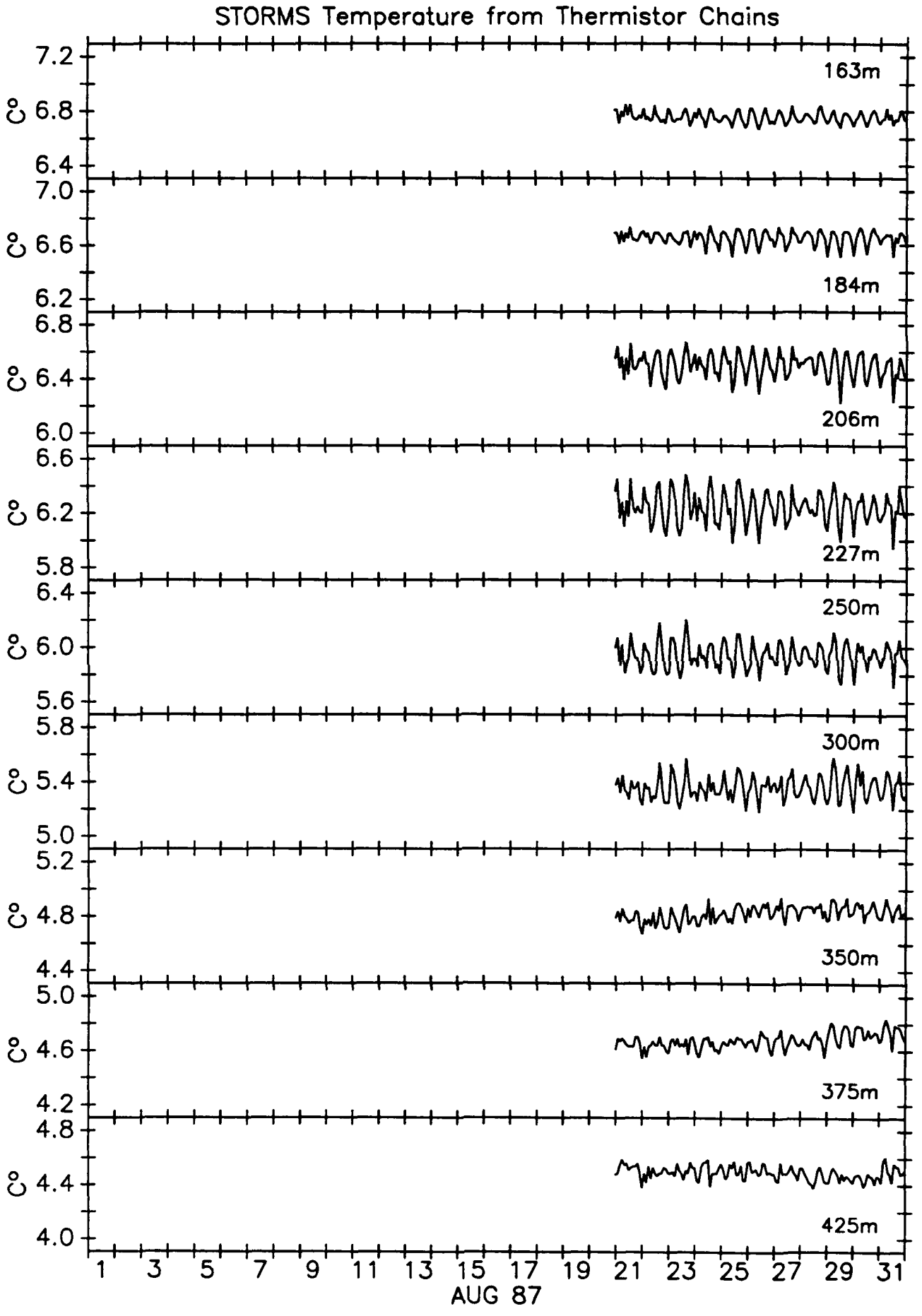

STORMS Temperatures from SEACAT & VMCM
7.5
6.5
°C
100m
7.5
6.5
°C
109m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
APR 88
7.5
6.5
°C
128m
7.5
6.5
°C
140m
7.5
6.5
°C
150m
7.5
6.5
°C
160m
7.0
6.0
°C
195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
APR 88

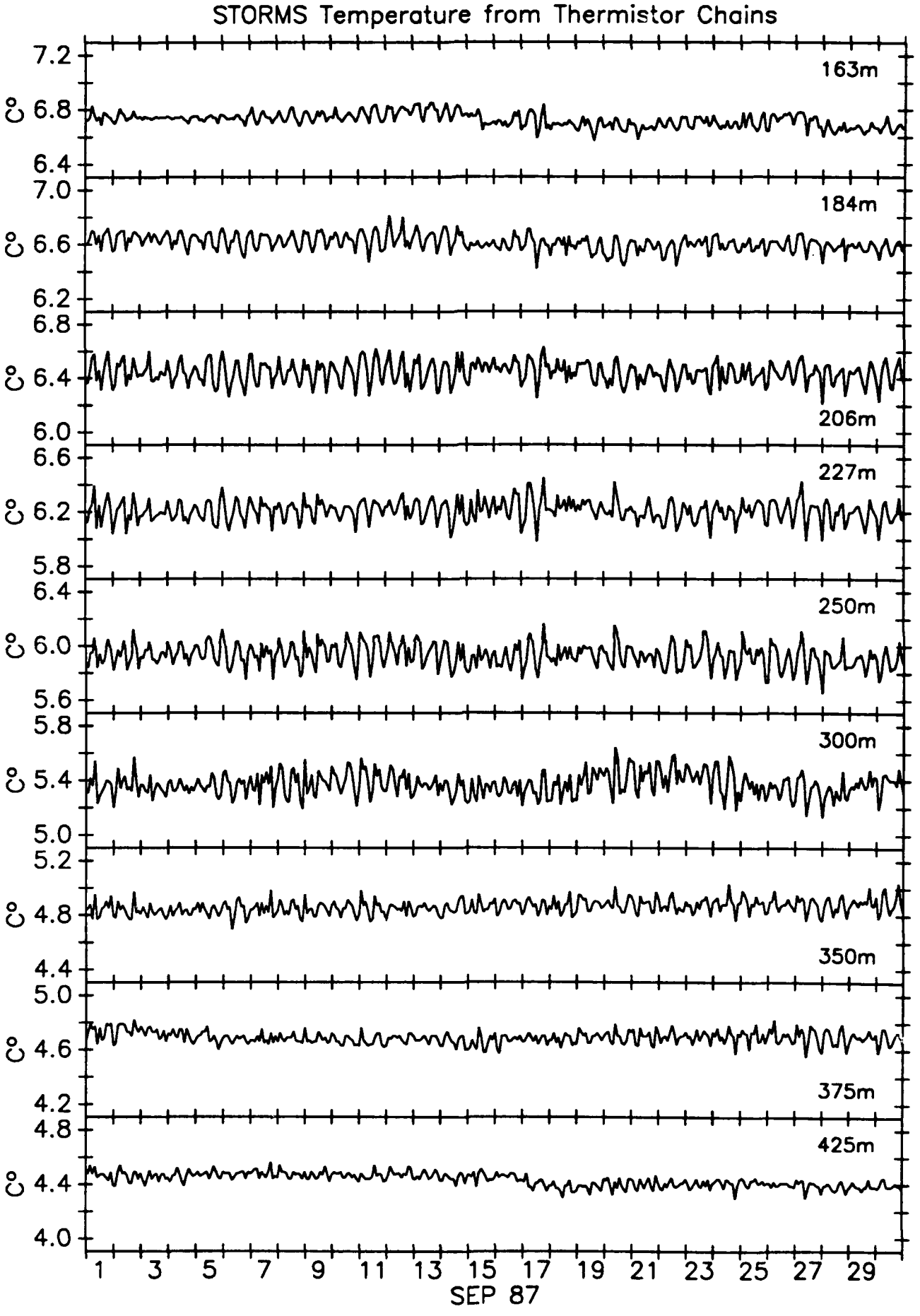

STORMS Temperatures from SEACAT & VMCM
100m
109m
128m
140m
150m
160m
195m
C°
7.5
6.5
7.0
6.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88

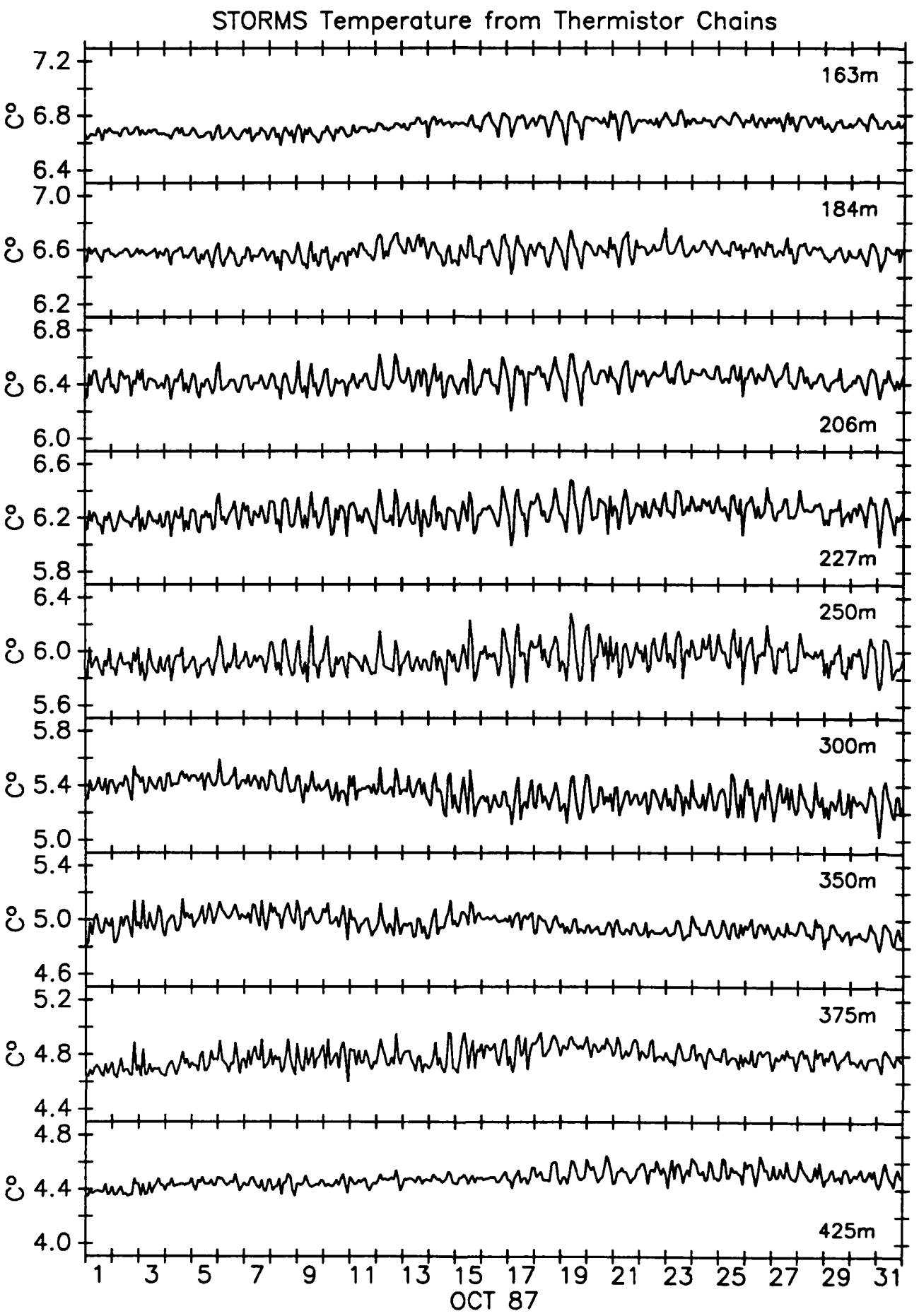

STORMS Temperatures from SEACAT & VMCM
7.5
6.5
C°
100m
109m
128m
140m
150m
7.0
6.0
160m
195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
JUN 88

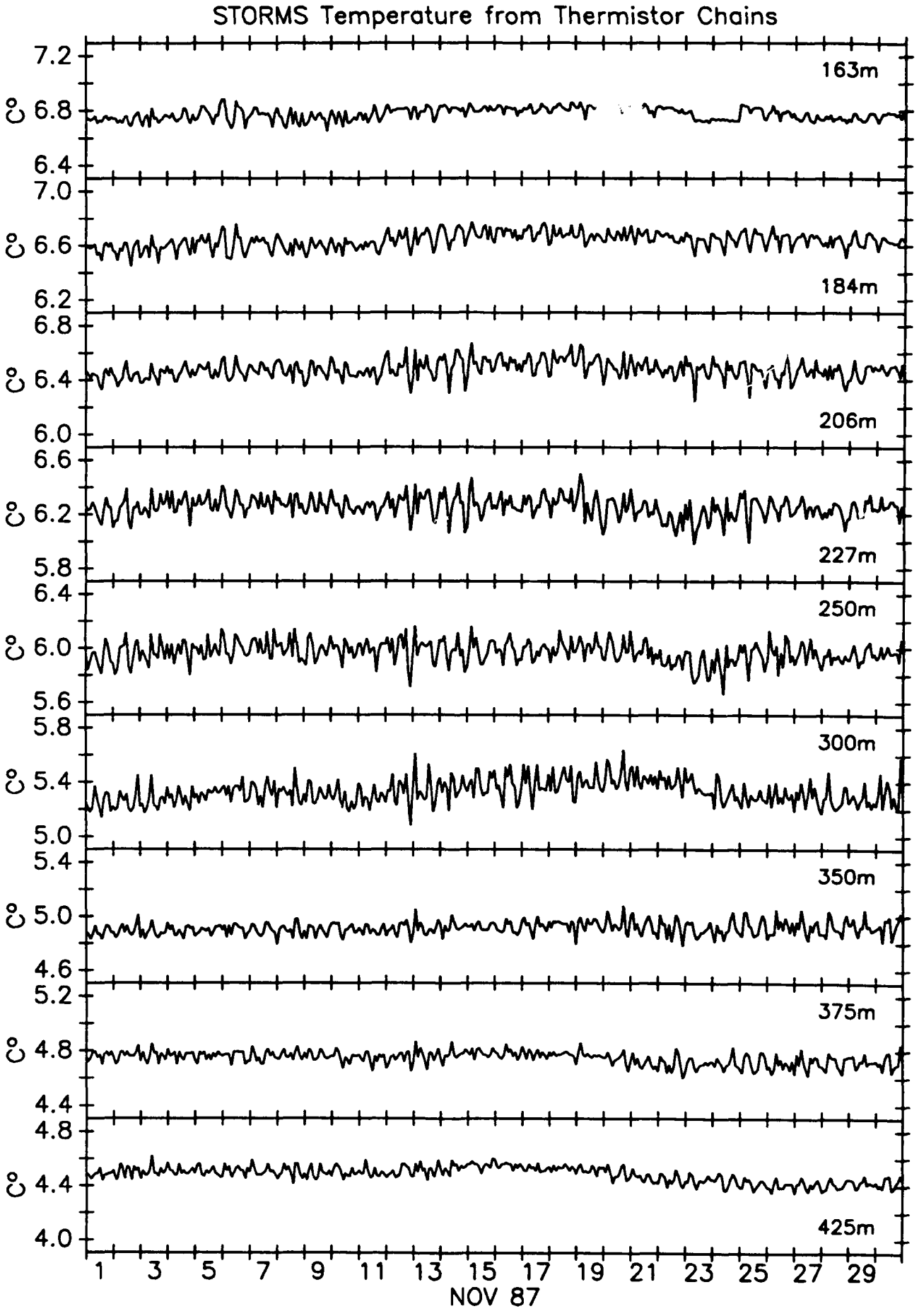
TIME SERIES OF TEMPERATURE: UNFILTERED

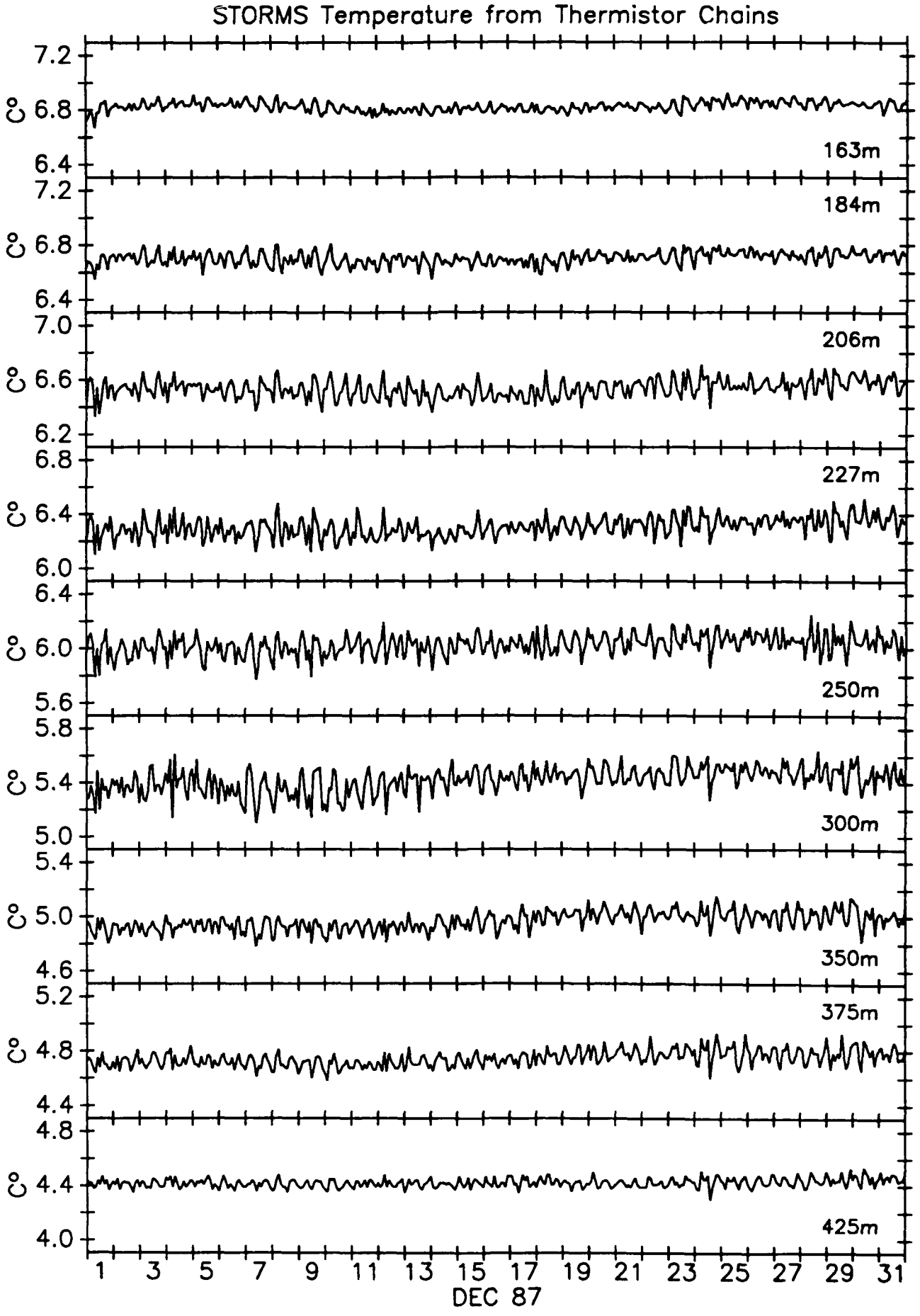
On the following 11 pages are observations from 163 to 425 m from selected thermistors on four thermistor chains. One month is plotted per page. Sampling interval is 2 hours.

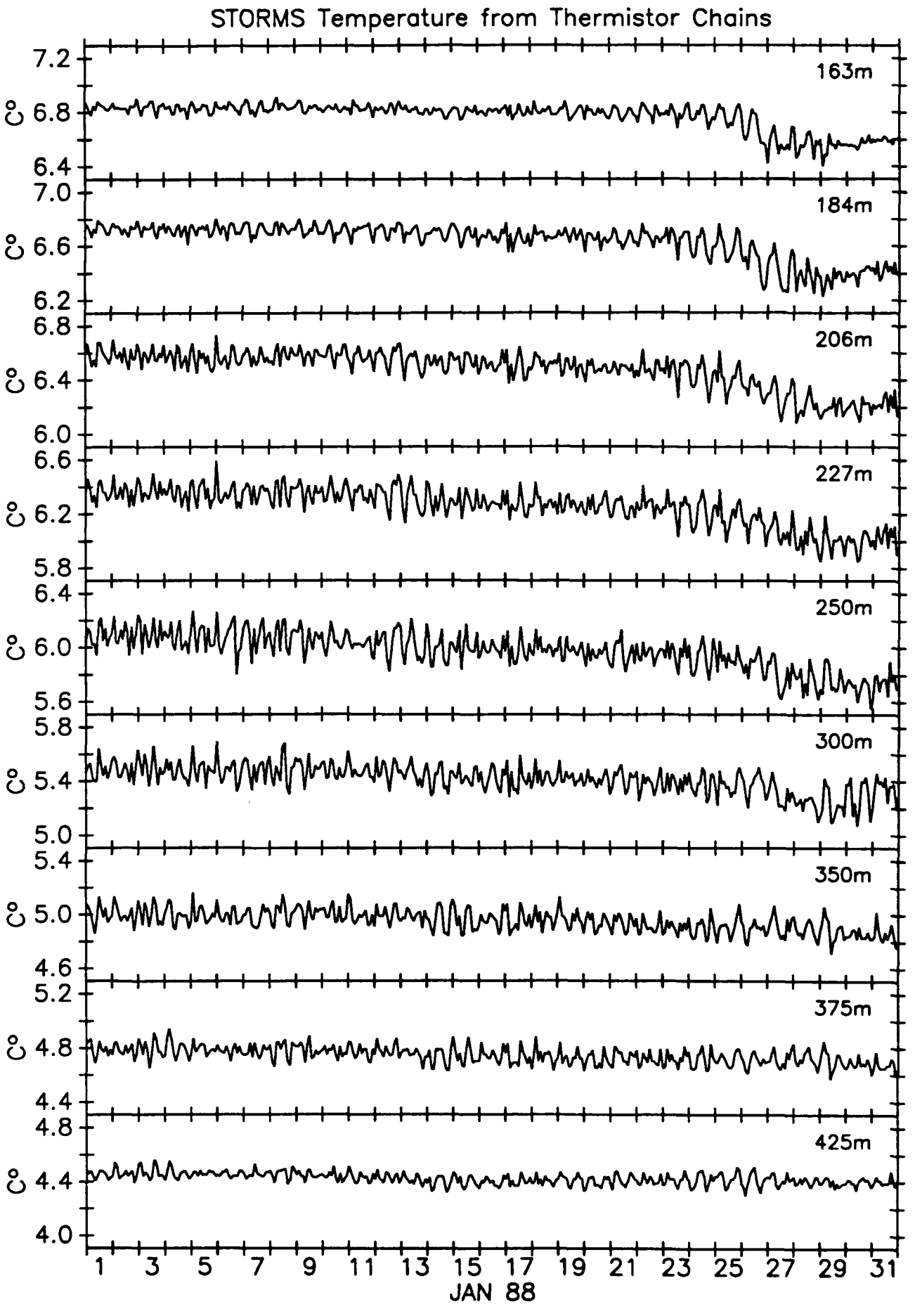

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.6
6.2
5.8
6.4
6.0
5.6
5.8
5.4
5.0
5.2
4.8
4.4
5.0
4.6
4.2
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87

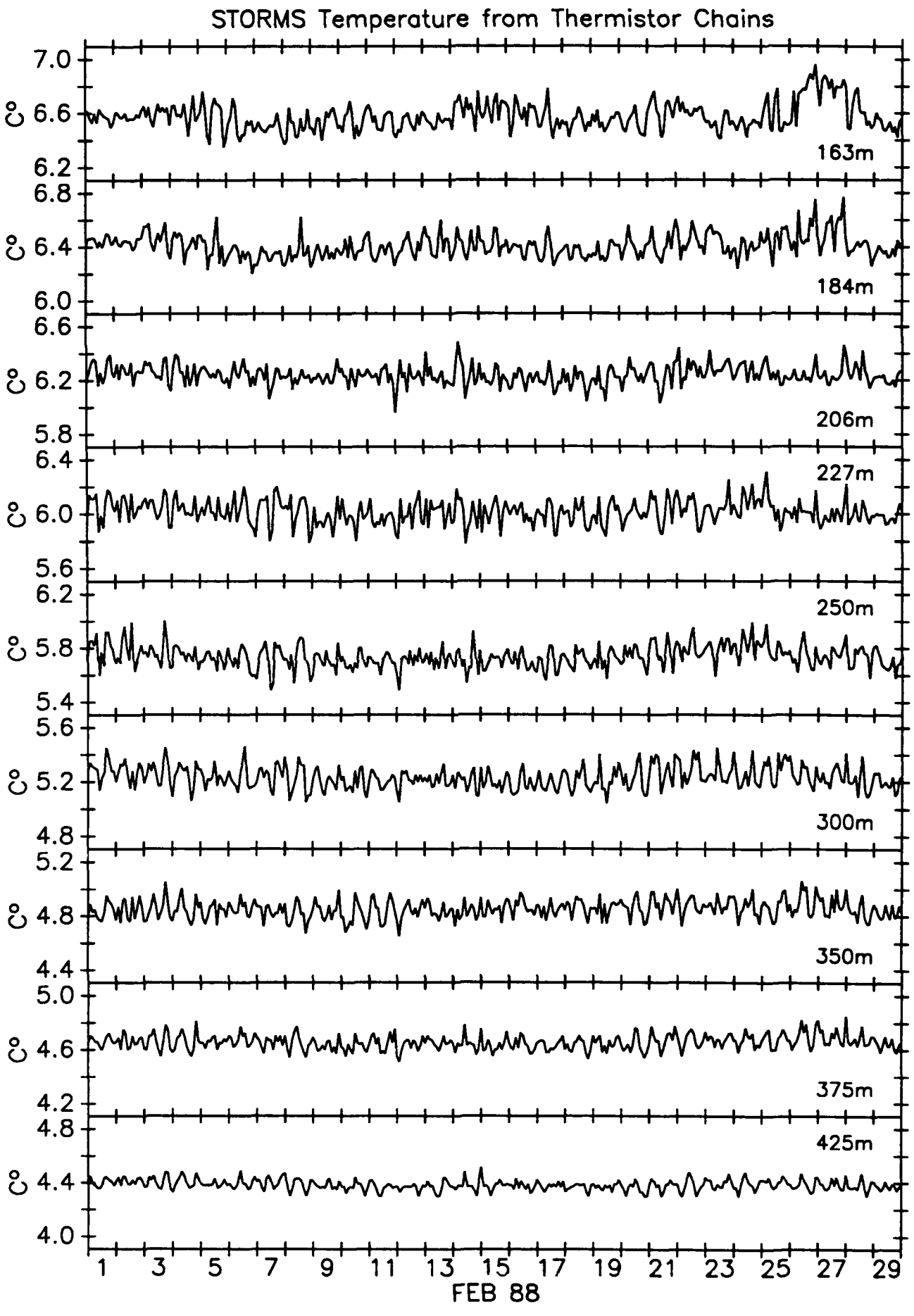

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.6
6.2
5.8
6.4
6.0
5.6
5.8
5.4
5.0
5.2
4.8
4.4
5.0
4.6
4.2
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
SEP 87

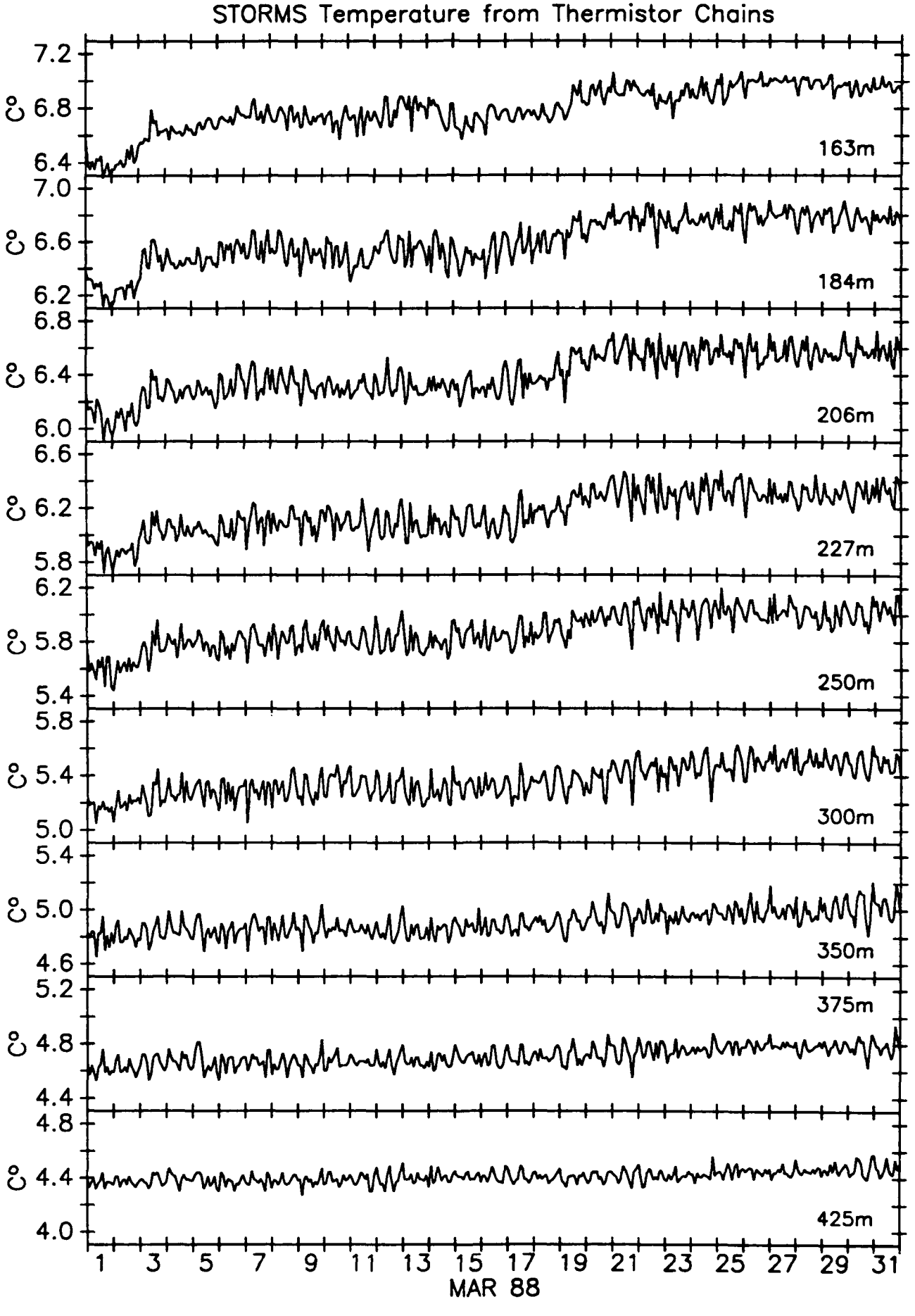

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.6
6.2
5.8
6.4
6.0
5.6
5.8
5.4
5.0
5.4
5.0
4.6
5.2
4.8
4.4
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87

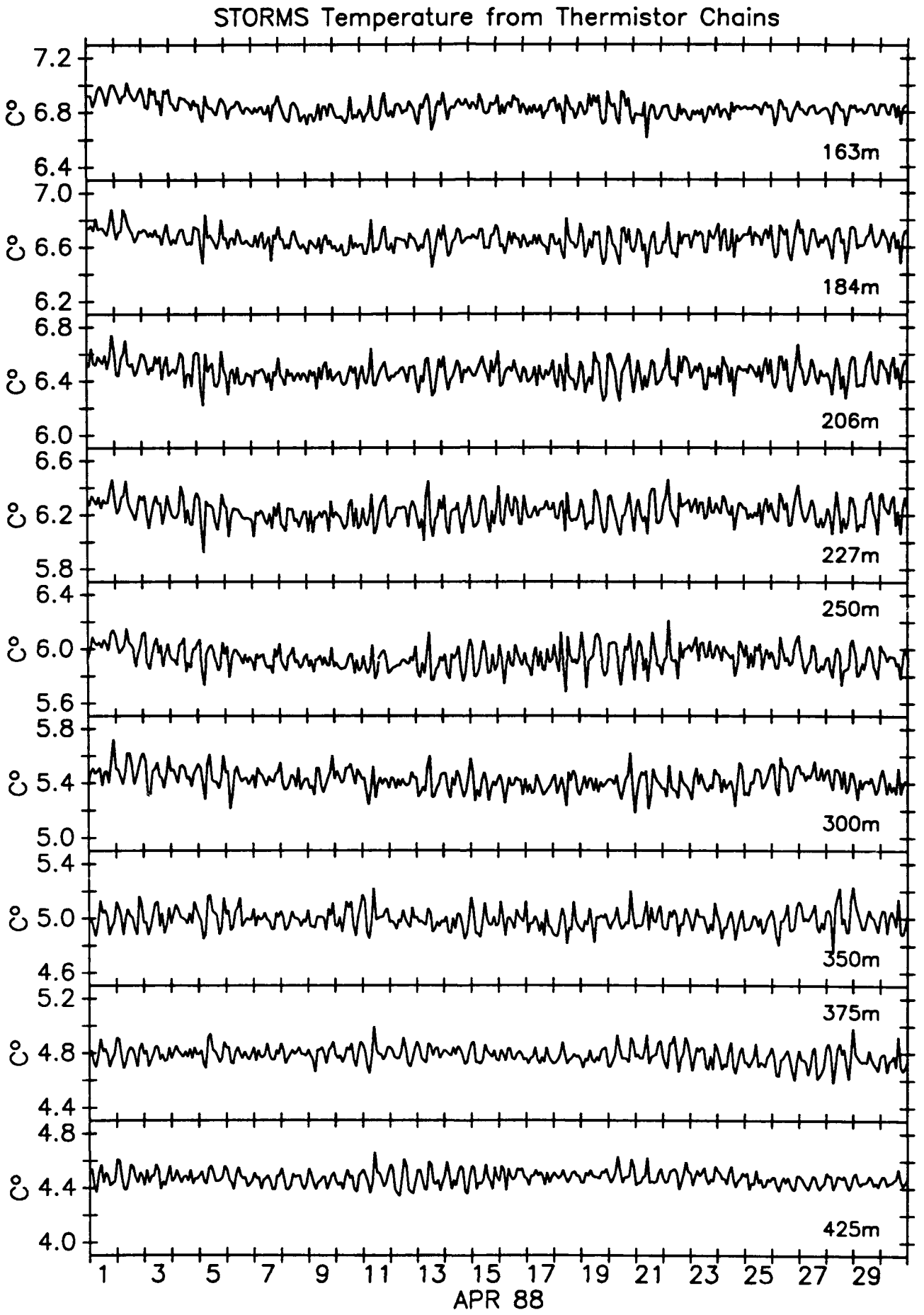

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.6
6.2
5.8
6.4
6.0
5.6
5.8
5.4
5.0
5.4
5.0
4.6
5.2
4.8
4.4
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
NOV 87

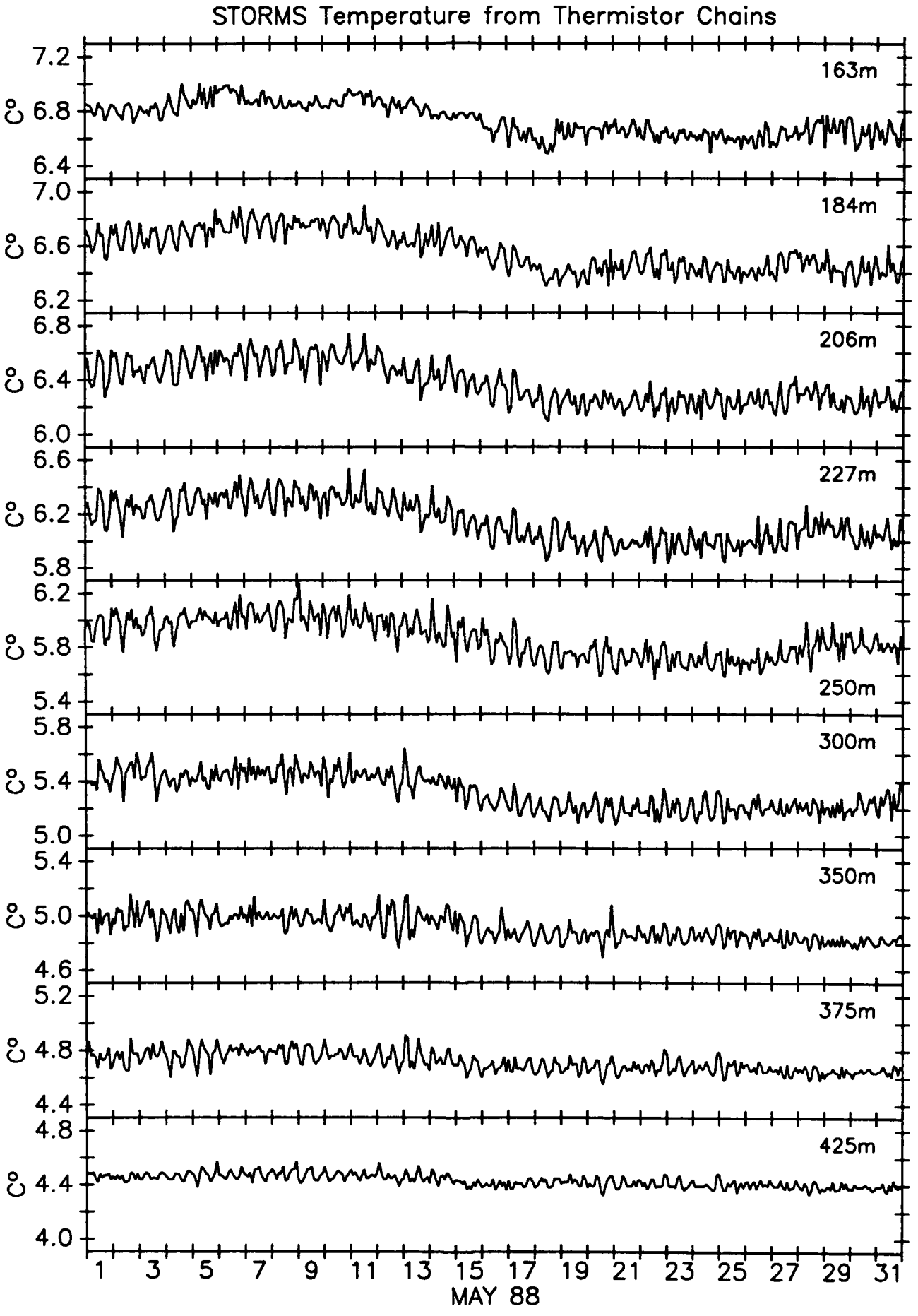

STORMS Temperature from Thermistor Chains
7.2
6.8
6.4
°C
163m
7.2
6.8
6.4
°C
184m
7.0
6.6
6.2
°C
206m
6.8
6.4
6.0
°C
227m
6.4
6.0
5.6
°C
250m
5.8
5.4
5.0
°C
300m
5.4
5.0
4.6
°C
350m
5.2
4.8
4.4
°C
375m
4.8
4.4
4.0
°C
425m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
DEC 87

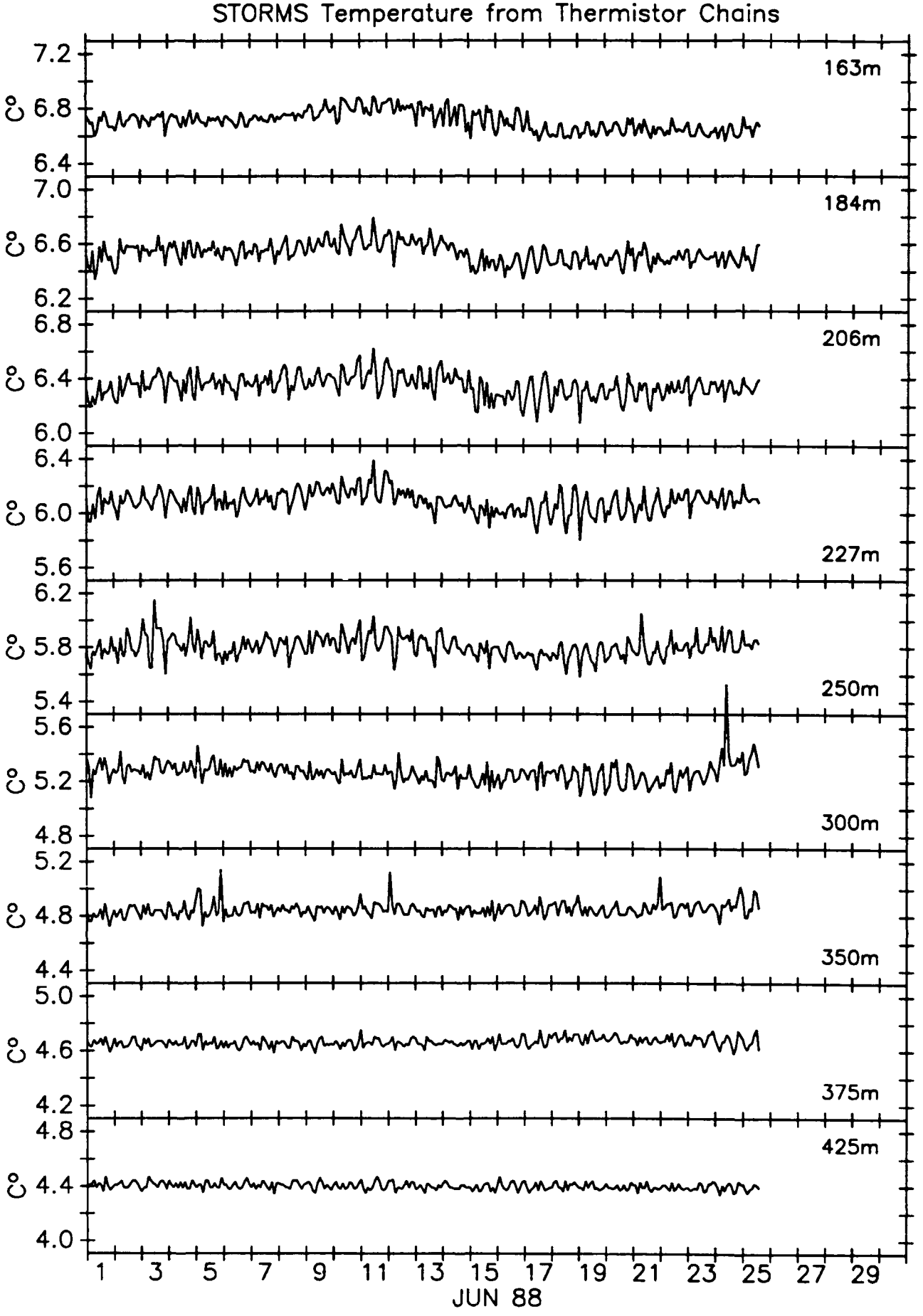

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.6
6.2
5.8
6.4
6.0
5.6
5.8
5.4
5.0
5.4
5.0
4.6
5.2
4.8
4.4
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
JAN 88


STORMS Temperature from Thermistor Chains
7.0
6.6
6.2
°C
163m
6.8
6.4
6.0
°C
184m
6.6
6.2
5.8
°C
206m
6.4
6.0
5.6
°C
227m
6.2
5.8
5.4
°C
250m
5.6
5.2
4.8
°C
300m
5.2
4.8
4.4
°C
350m
5.0
4.6
4.2
°C
375m
4.8
4.4
4.0
°C
425m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
FEB 88


STORMS Temperature from Thermistor Chains
7.2
6.8
6.4
°C
163m
7.0
6.6
6.2
°C
184m
6.8
6.4
6.0
°C
206m
6.6
6.2
5.8
°C
227m
6.2
5.8
5.4
°C
250m
5.8
5.4
5.0
°C
300m
5.4
5.0
4.6
°C
350m
5.2
4.8
4.4
°C
375m
4.8
4.4
4.0
°C
425m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAR 88

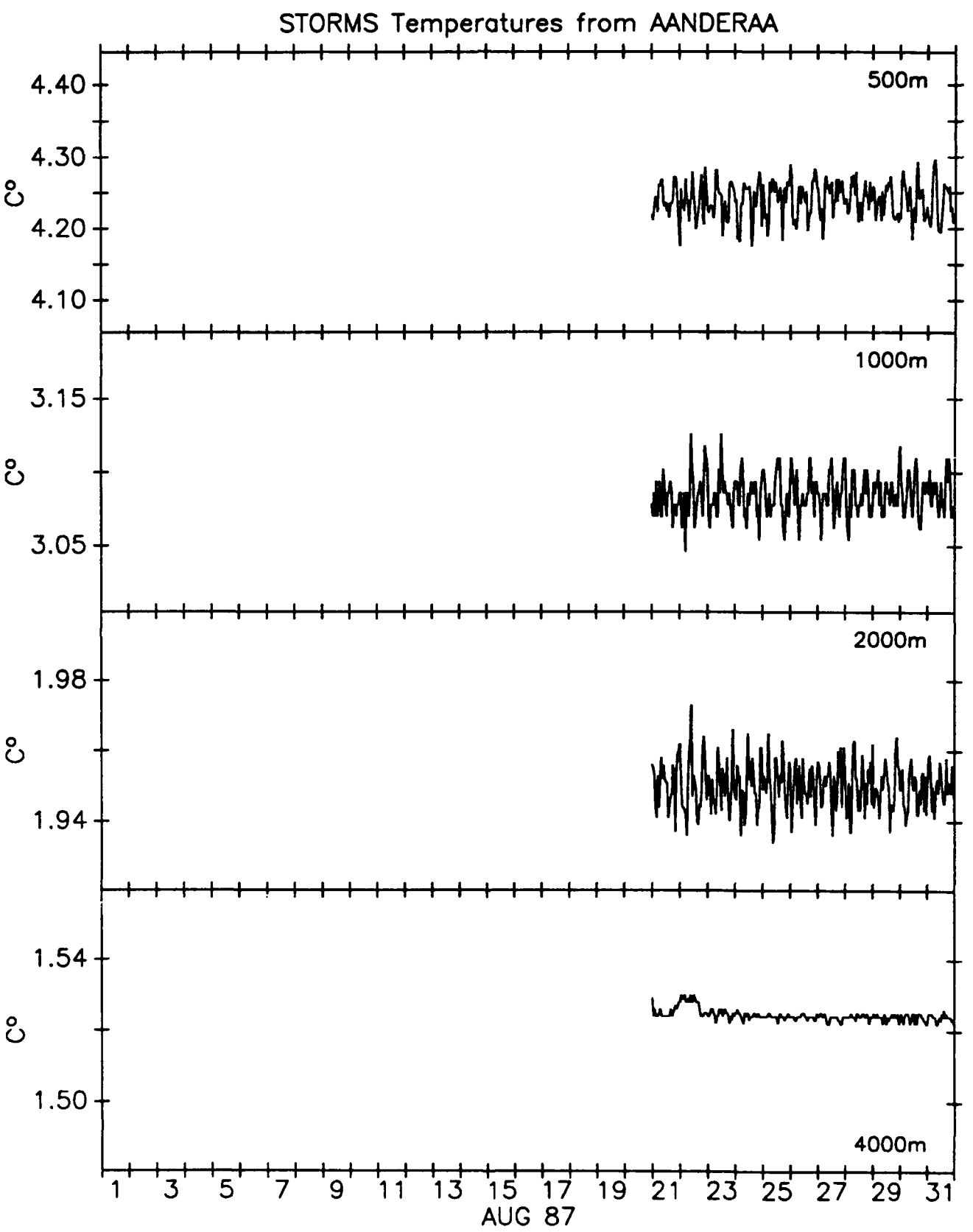

STORMS Temperature from Thermistor Chains
7.2
6.8
6.4
°C
163m
7.0
6.6
6.2
°C
184m
6.8
6.4
6.0
°C
206m
6.6
6.2
5.8
°C
227m
6.4
6.0
5.6
°C
250m
5.8
5.4
5.0
°C
300m
5.4
5.0
4.6
°C
350m
5.2
4.8
4.4
°C
375m
4.8
4.4
4.0
°C
425m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
APR 88

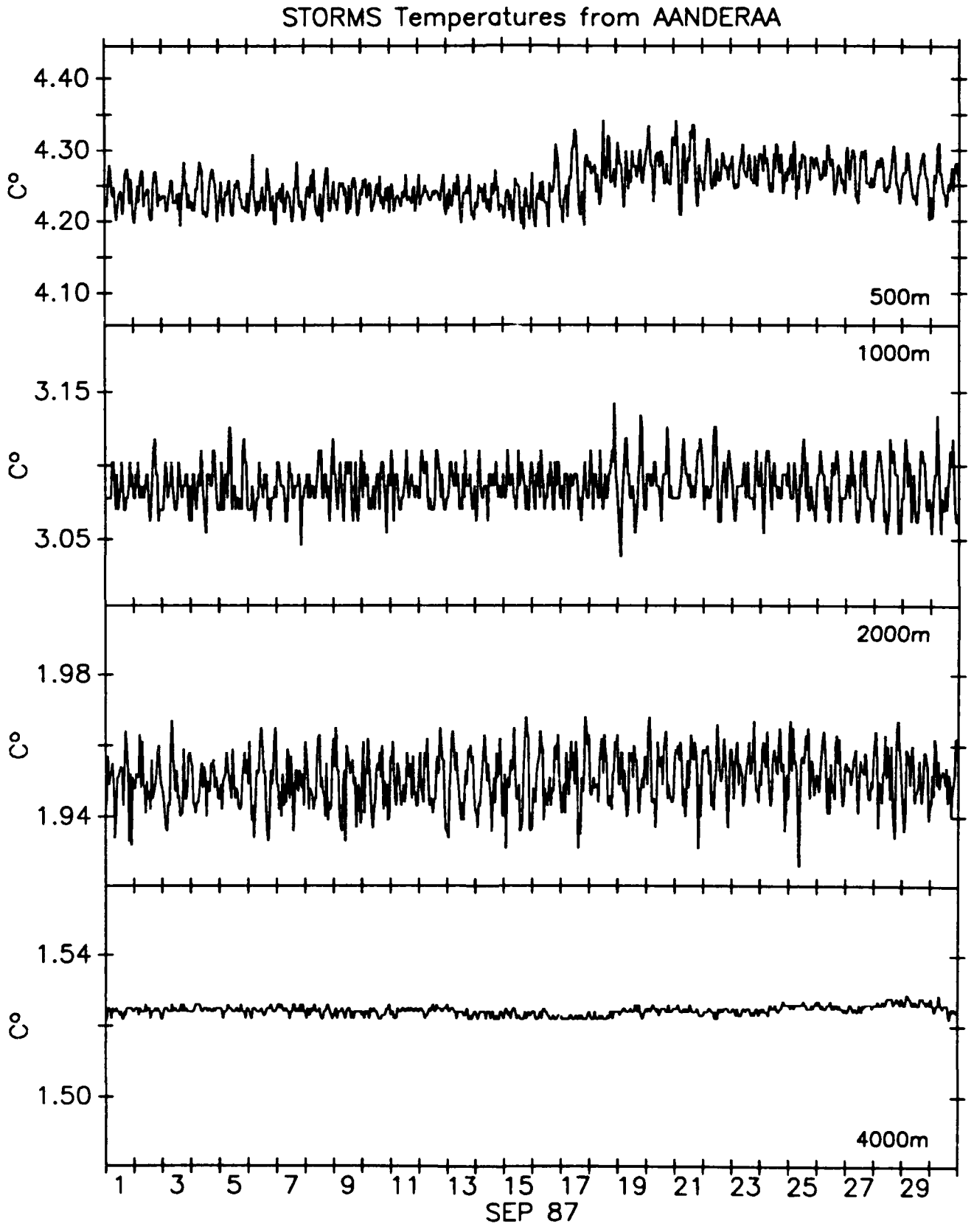

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.6
6.2
5.8
6.2
5.8
5.4
5.8
5.4
5.0
5.4
5.0
4.6
5.2
4.8
4.4
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88

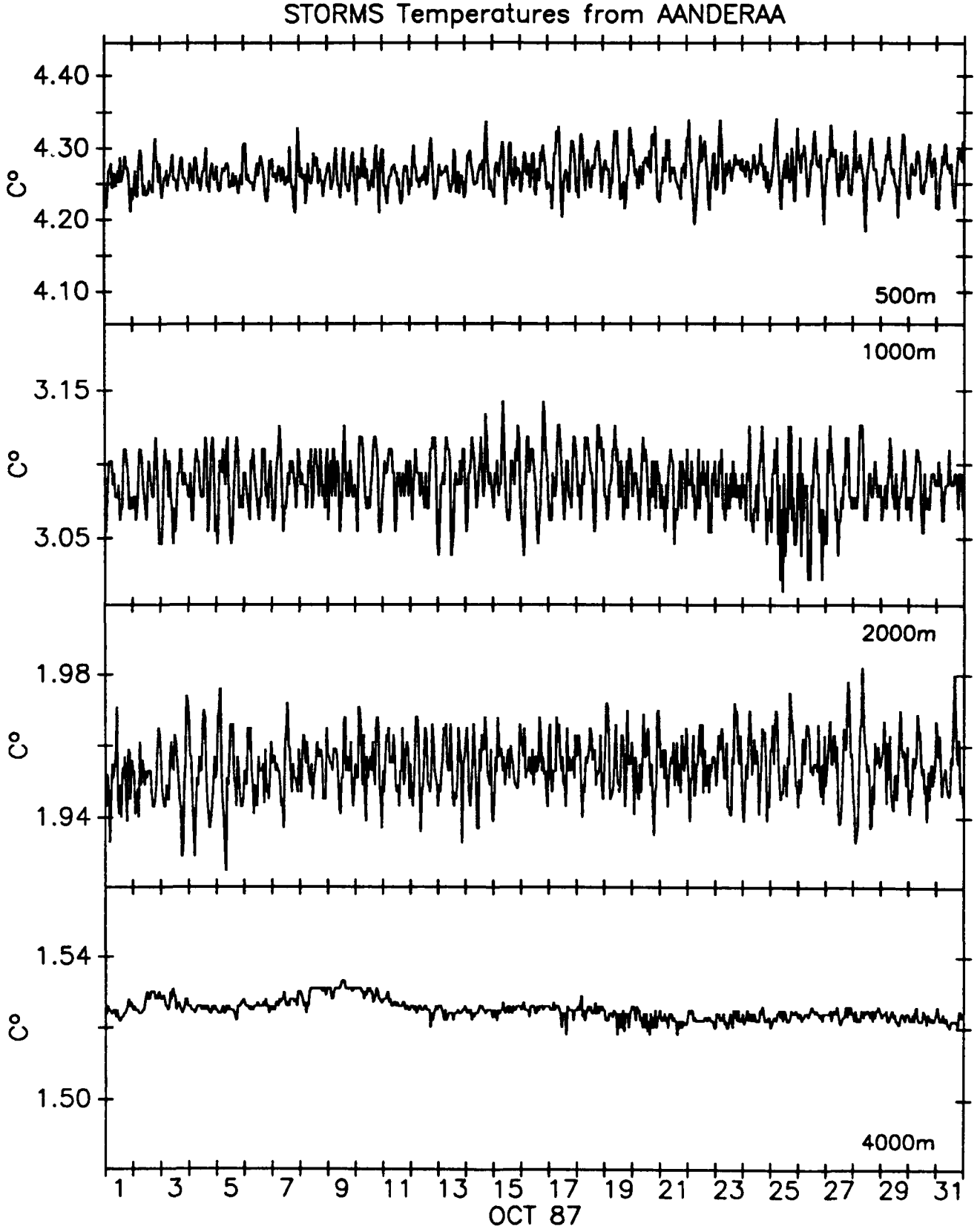

STORMS Temperature from Thermistor Chains
163m
184m
206m
227m
250m
300m
350m
375m
425m
°C
7.2
6.8
6.4
7.0
6.6
6.2
6.8
6.4
6.0
6.4
6.0
5.6
6.2
5.8
5.4
5.6
5.2
4.8
5.2
4.8
4.4
5.0
4.6
4.2
4.8
4.4
4.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
JUN 88

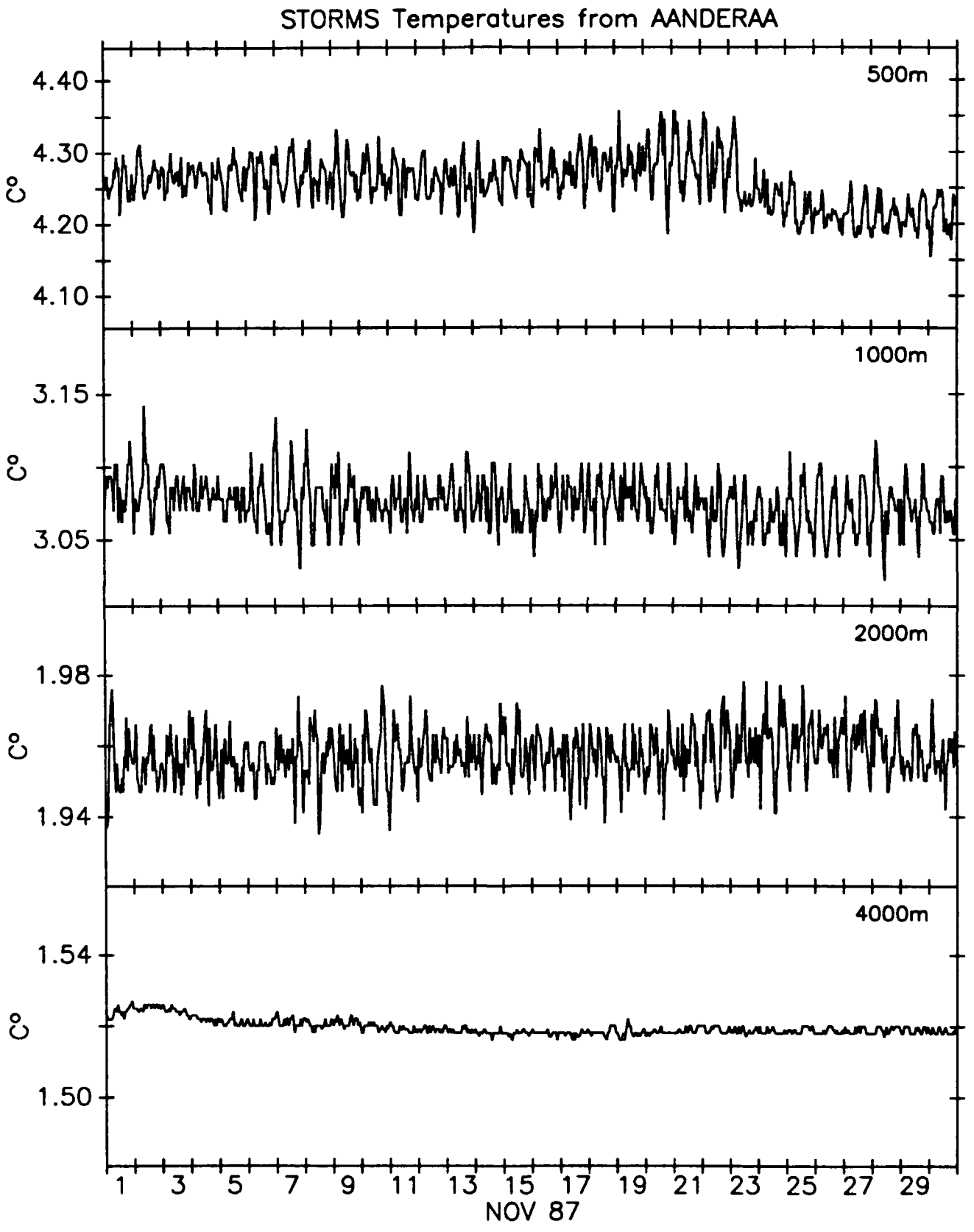
TIME SERIES OF TEMPERATURE: UNFILTERED

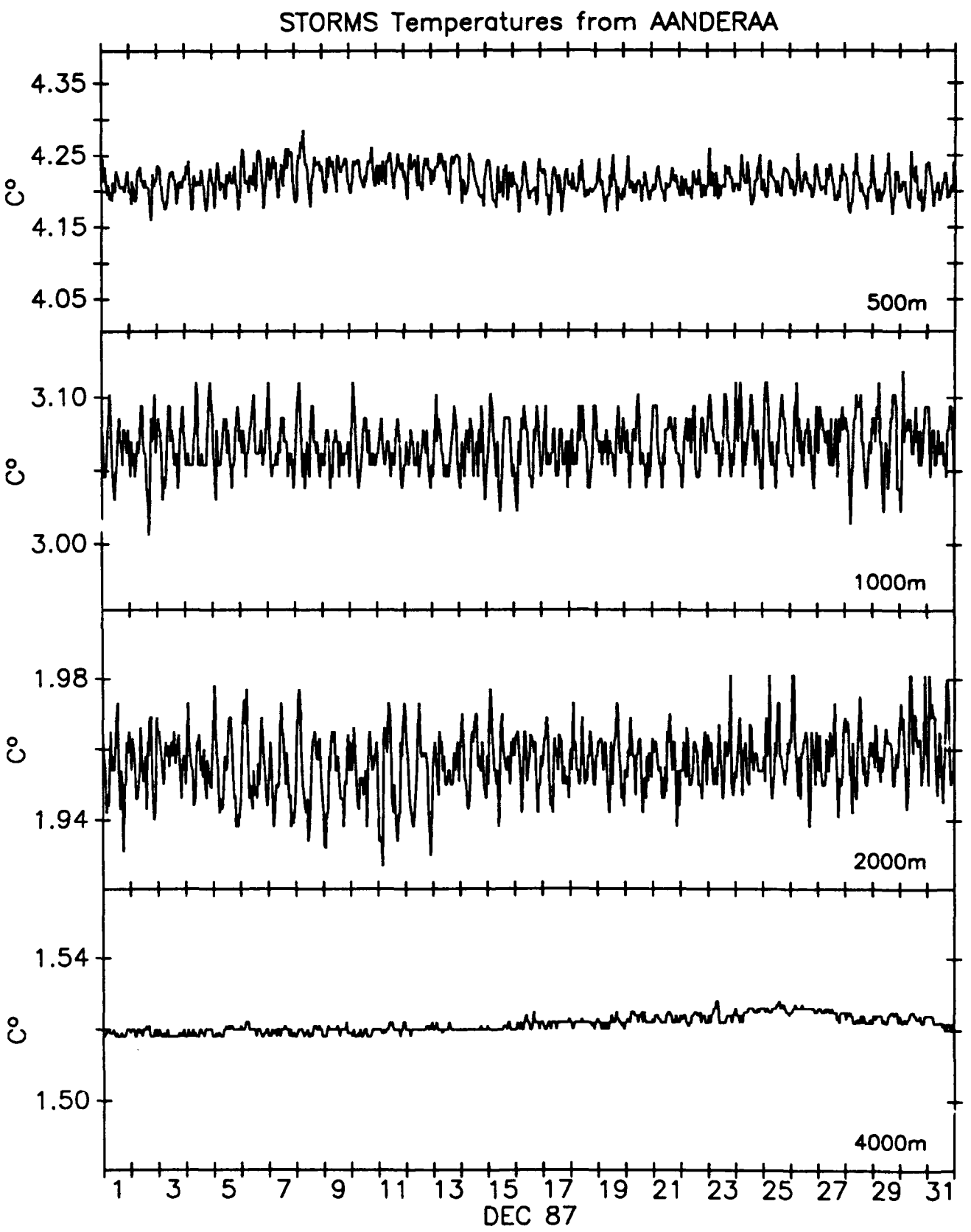
On the following 11 pages are observations from RCM-5s at 500, 1000, 2000, and 4000 m. One month is plotted per page; sampling interval is 1 hour.

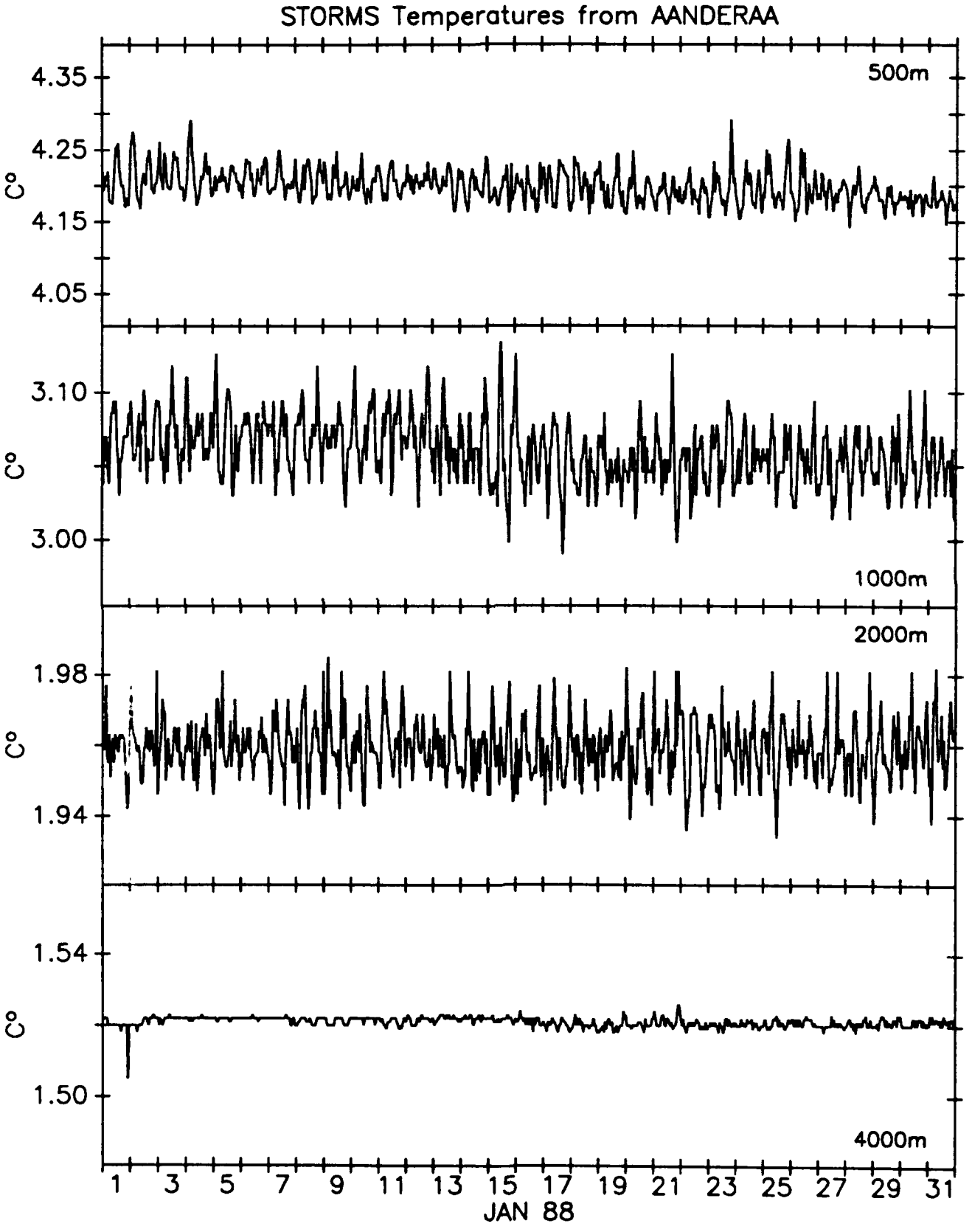

STORMS Temperatures from AANDERAA
500m
4.40
4.30
4.20
4.10
C°
1000m
3.15
3.05
C°
2000m
1.98
1.94
C°
1.54
1.50
C°
4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87

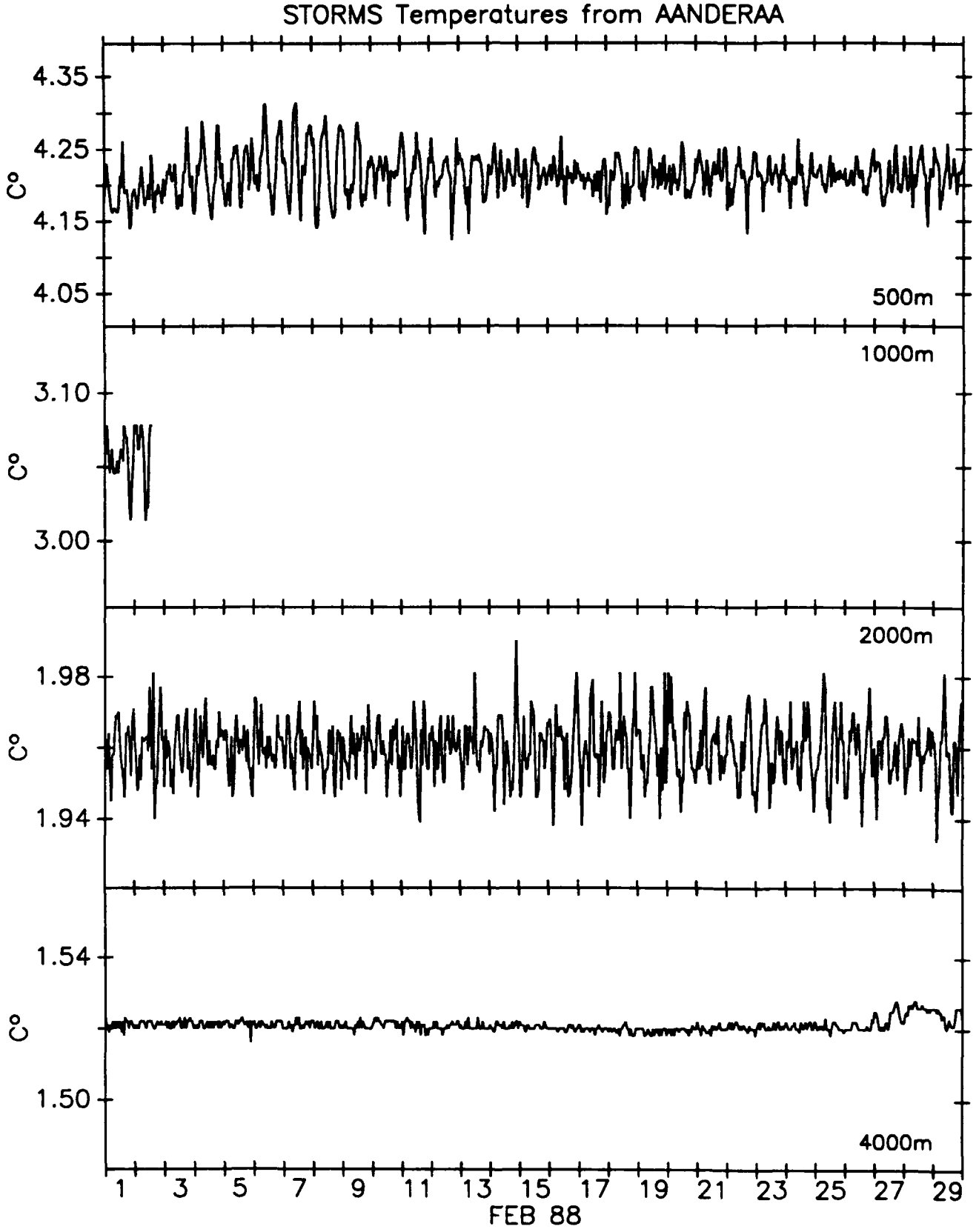

STORMS Temperatures from AANDERAA
4.40
4.30
4.20
4.10
C°
500m
1000m
3.15
3.05
C°
2000m
1.98
1.94
C°
1.54
1.50
C°
4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
SEP 87

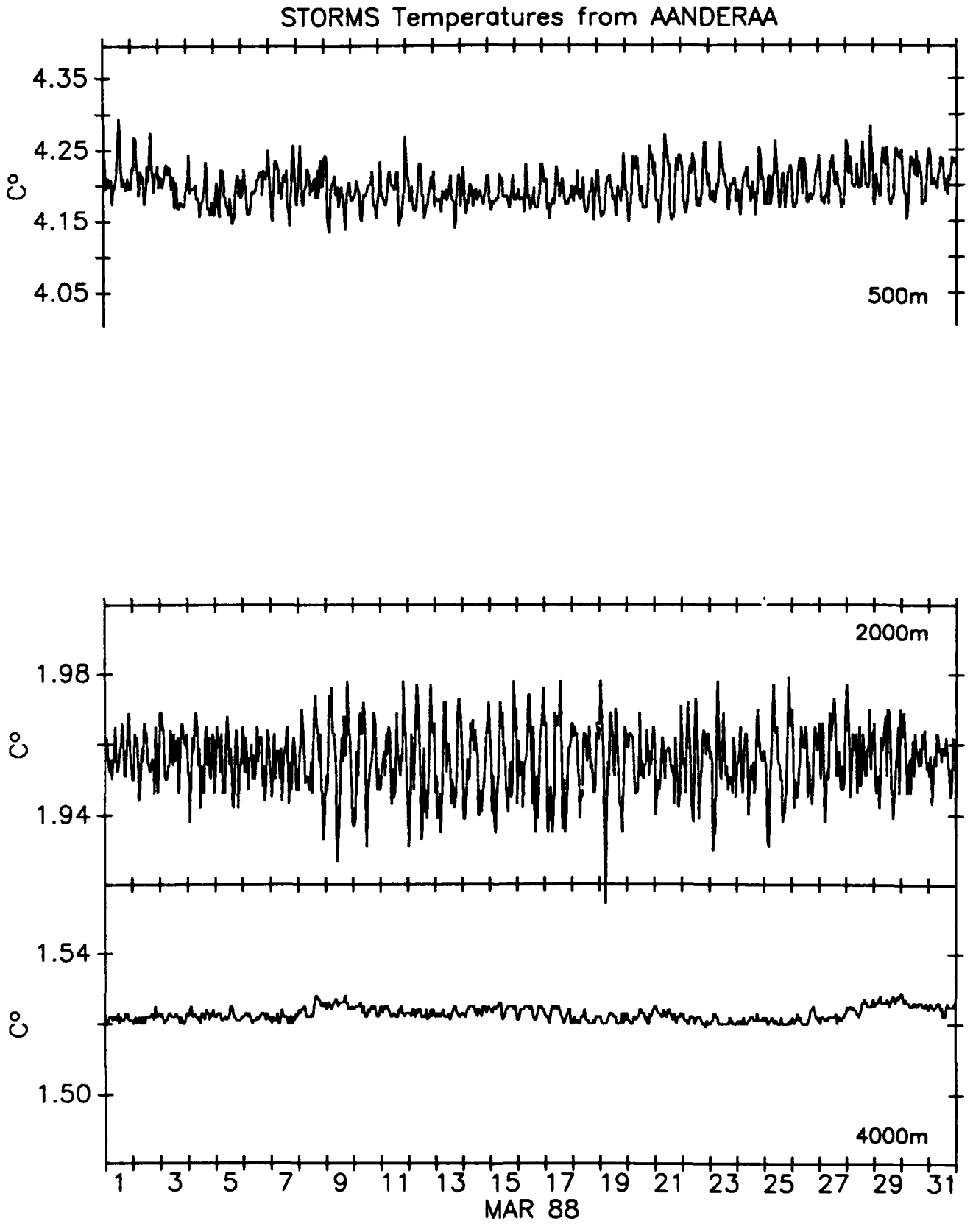

STORMS Temperatures from AANDERAA
4.40
4.30
4.20
4.10
C°
500m
1000m
3.15
3.05
C°
2000m
1.98
1.94
C°
1.54
1.50
C°
4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87

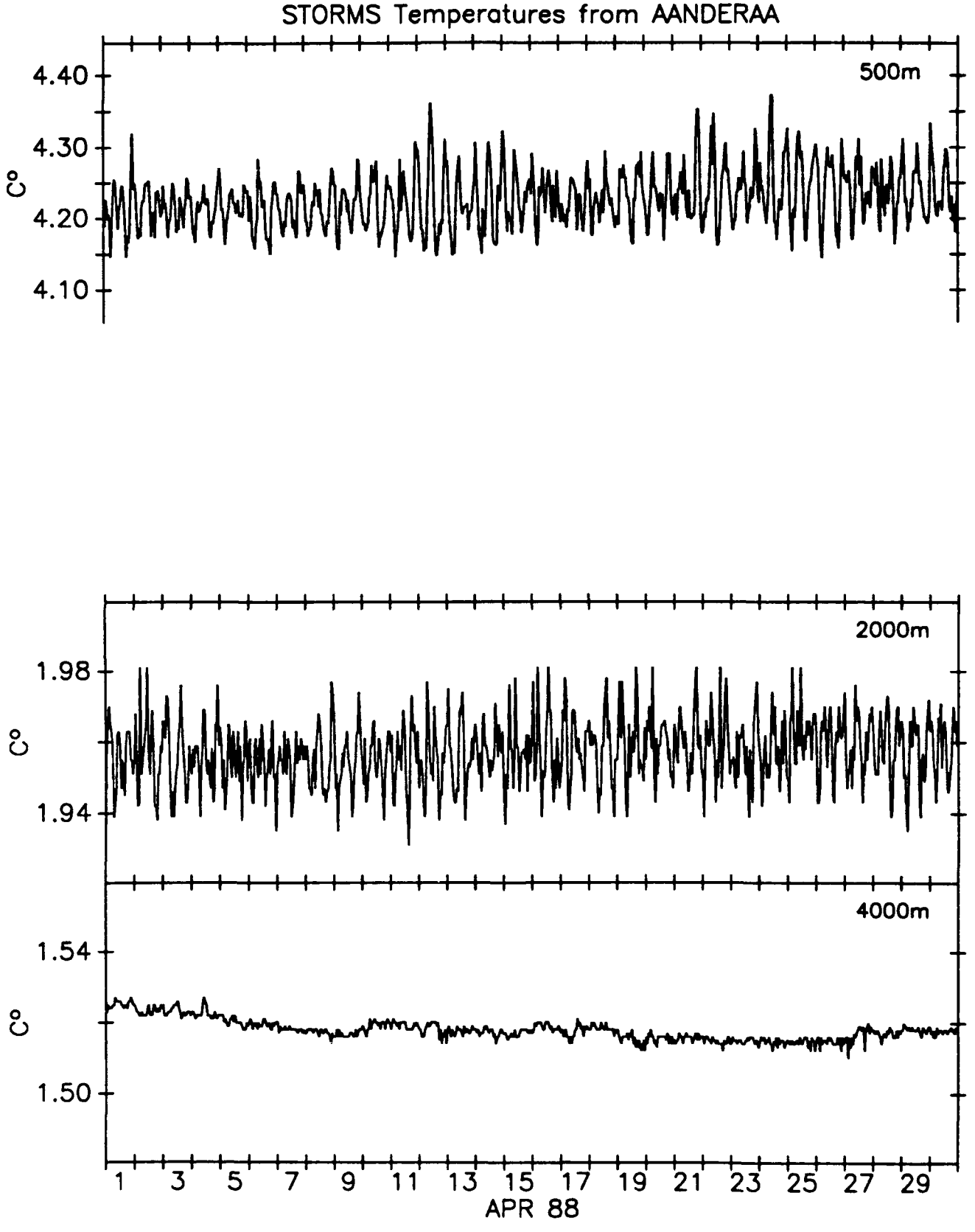

STORMS Temperatures from AANDERAA
500m
4.40
4.30
4.20
4.10
C°
1000m
3.15
3.05
C°
2000m
1.98
1.94
C°
4000m
1.54
1.50
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
NOV 87

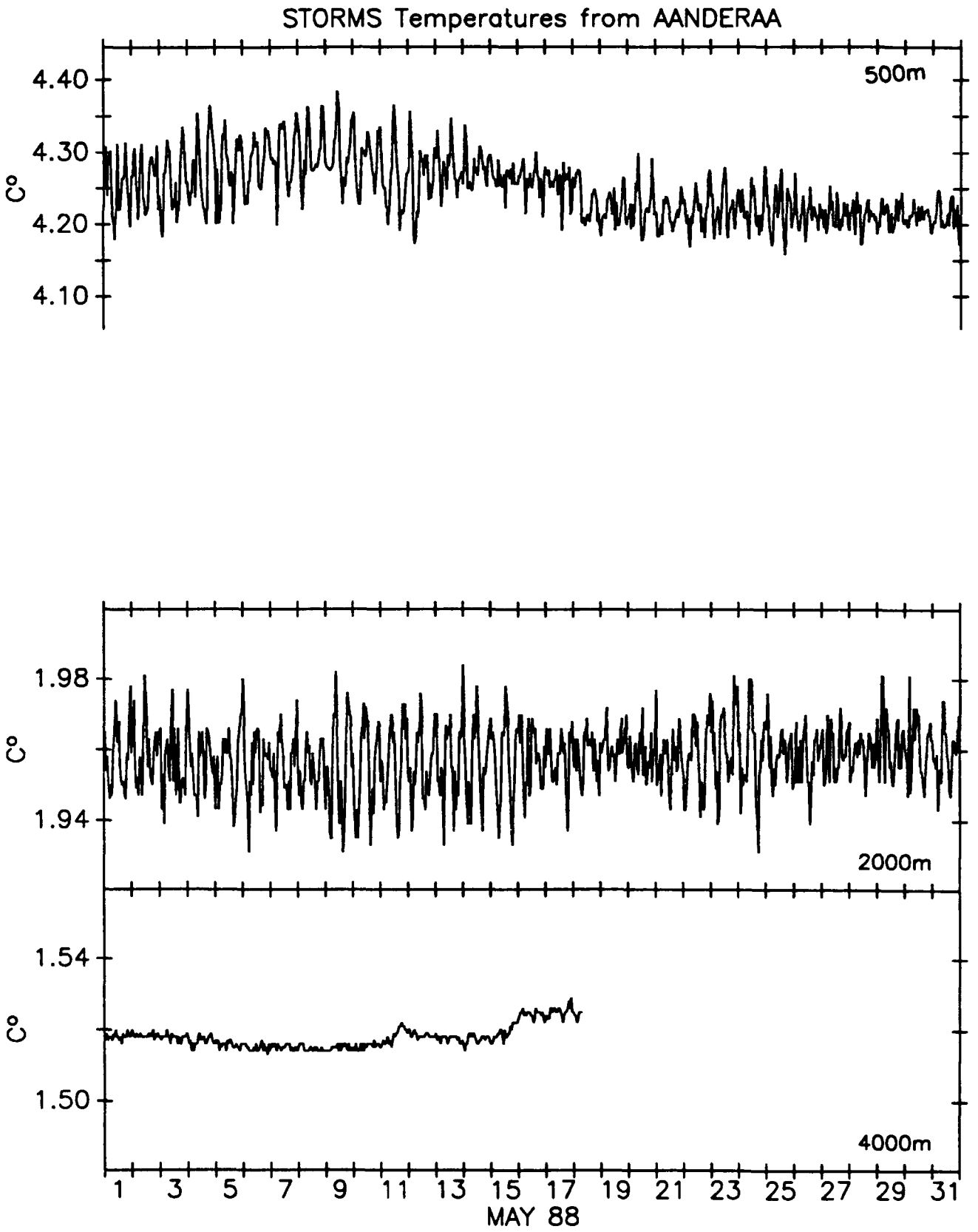

STORMS Temperatures from AANDERAA
4.35
4.25
4.15
4.05
C°
500m
3.10
3.00
C°
1000m
1.98
1.94
C°
2000m
1.54
1.50
C°
4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
DEC 87

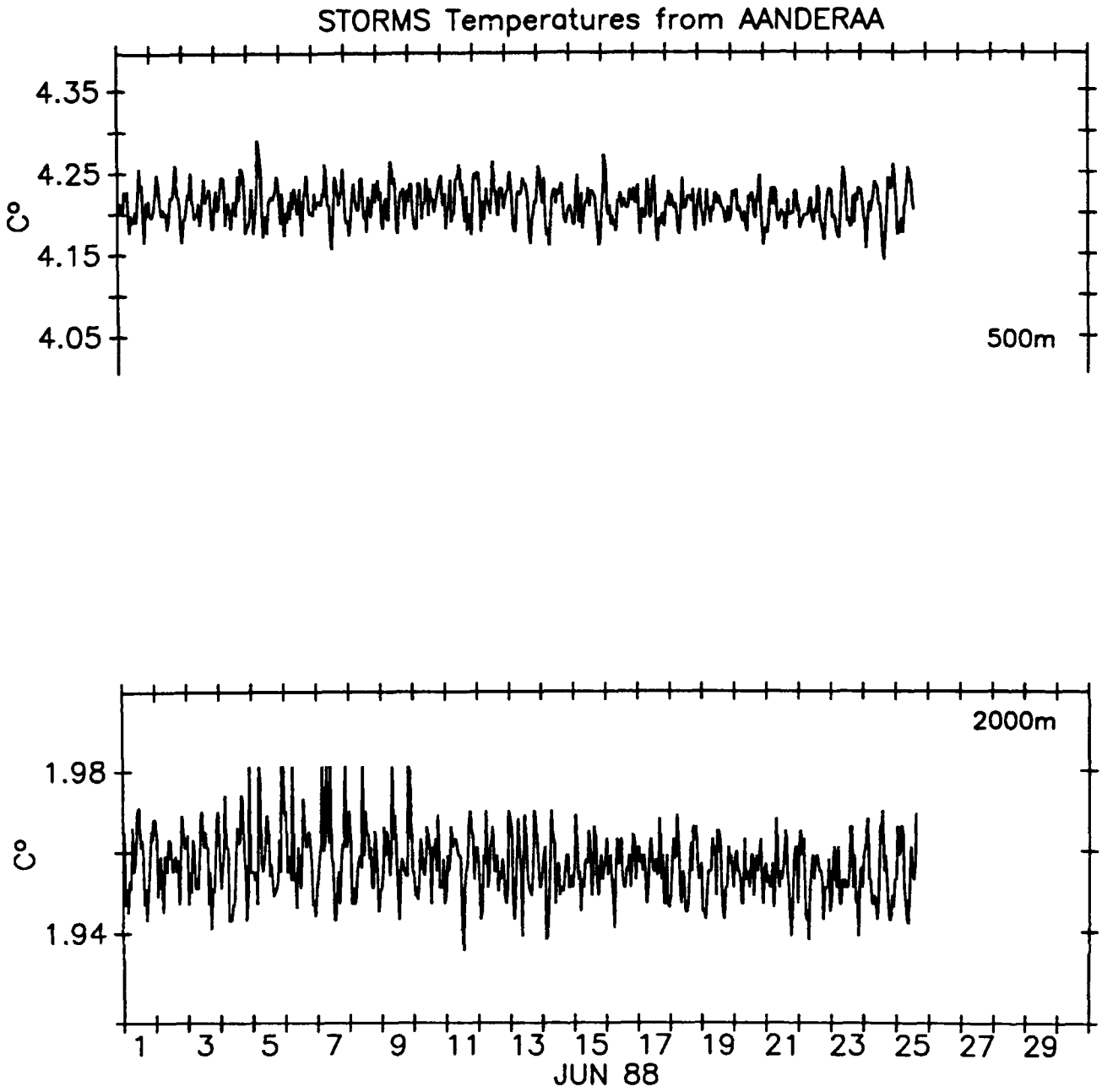

STORMS Temperatures from AANDERAA
500m
4.35
4.25
4.15
4.05
C°
1000m
3.10
3.00
C°
2000m
1.98
1.94
C°
4000m
1.54
1.50
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
JAN 88


STORMS Temperatures from AANDERAA
4.35
4.25
4.15
4.05
C°
500m
1000m
3.10
3.00
C°
2000m
1.98
1.94
C°
1.54
1.50
C°
4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
FEB 88


STORMS Temperatures from AANDERAA
4.35
4.25
4.15
4.05
C°
500m
2000m
1.98
1.94
1.54
1.50
C°
C°
4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAR 88

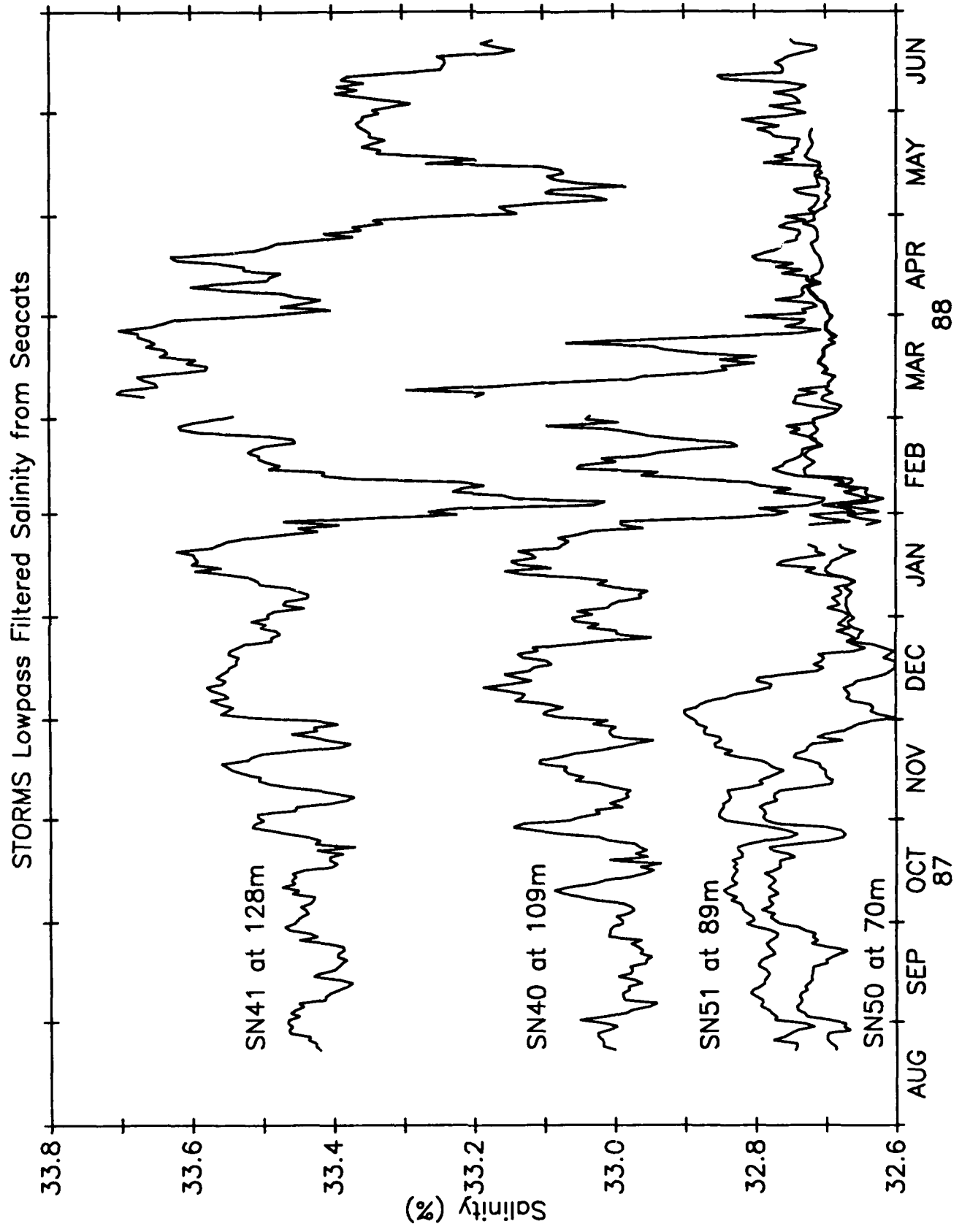

STORMS Temperatures from AANDERAA
500m
4.40
4.30
4.20
4.10
C°
2000m
1.98
1.94
4000m
1.54
1.50
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
APR 88


STORMS Temperatures from AANDERAA
500m
4.40
4.30
4.20
4.10
C°
2000m
1.98
1.94
4000m
1.54
1.50
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88


STORMS Temperatures from AANDERAA
4.35
4.25
4.15
4.05
C°
500m
2000m
1.98
1.94
C°
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
JUN 88

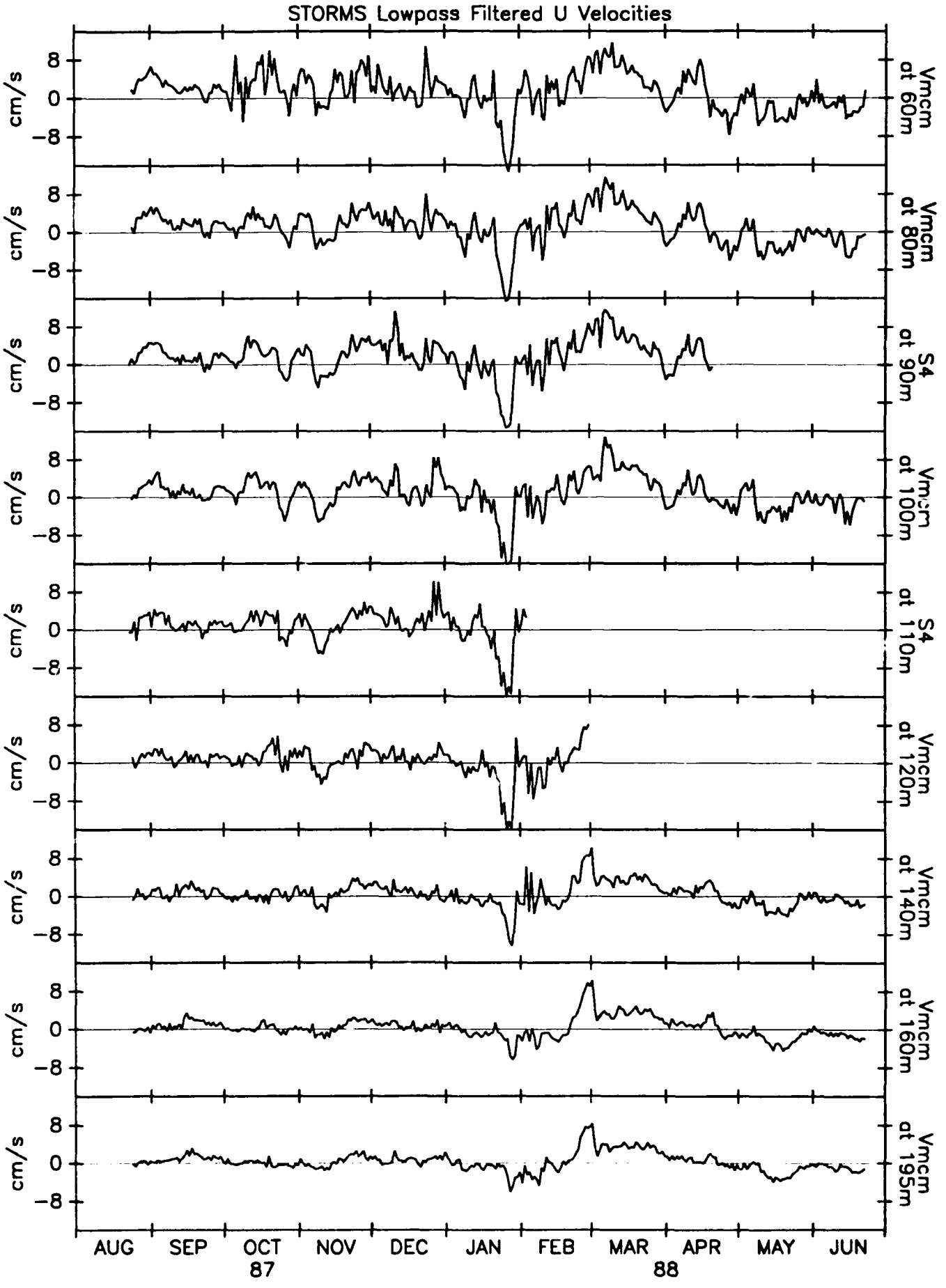
TIME SERIES OF SALINITY: LOW-PASS FILTERED

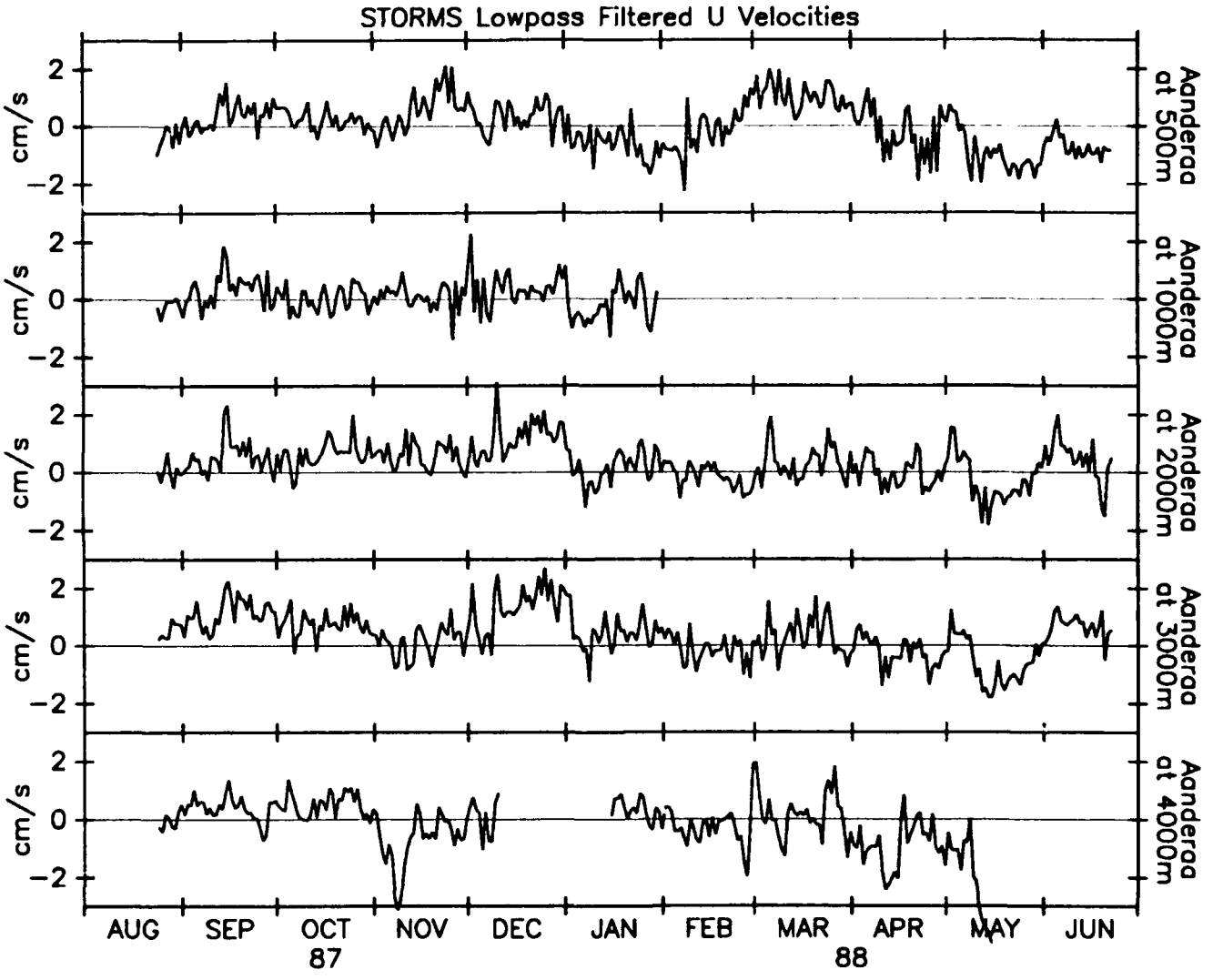
Observations of salinity calculated from temperature and conductivity measured by Seacats at 70, 89, 109 and 128 m. Data are low-pass filtered (40 hour half-power) and decimated to daily values.

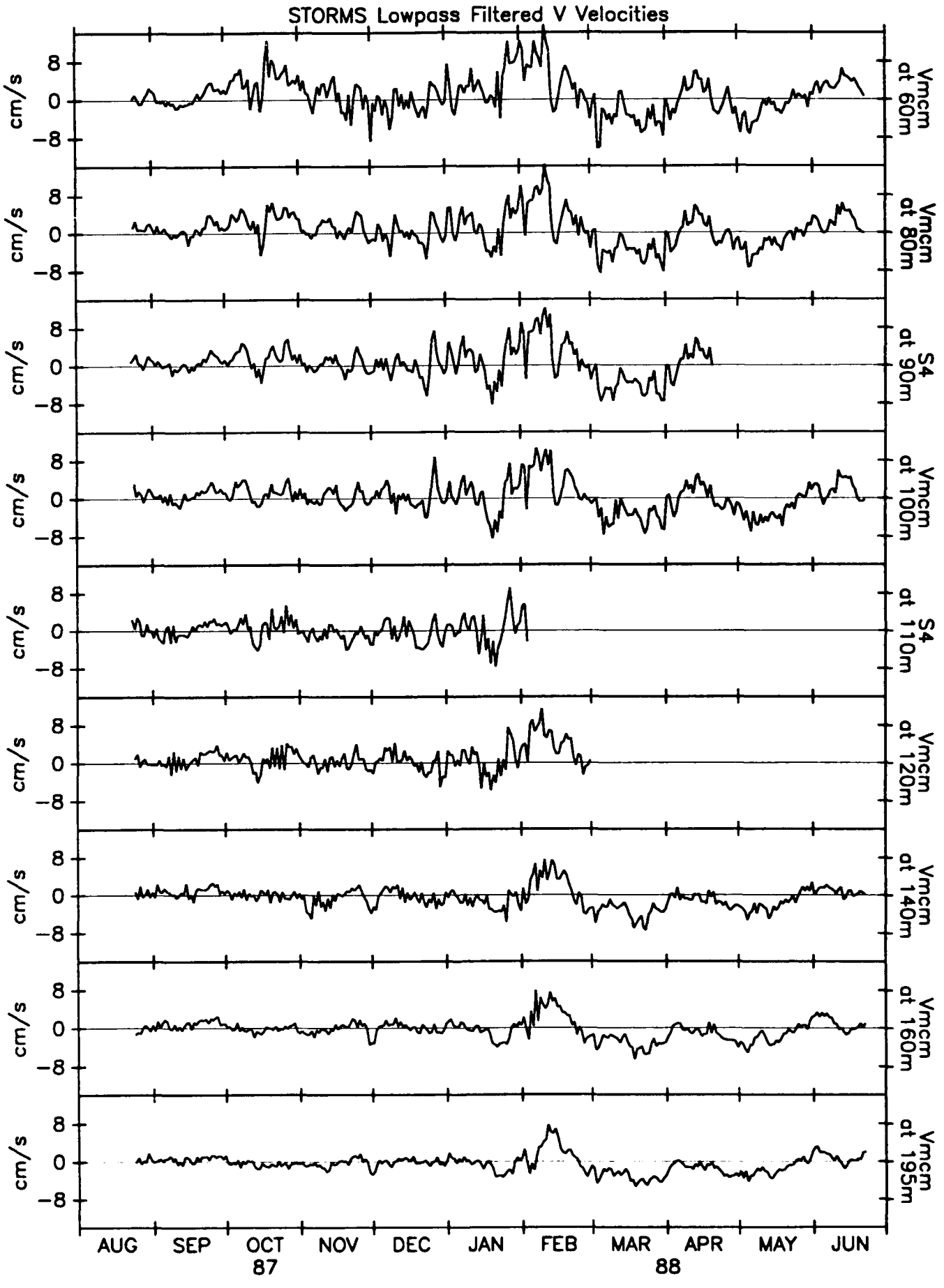

STORMS Lowpass Filtered Salinity from Seacats
Salinity (%)
33.8
33.6
33.4
33.2
33.0
32.8
32.6
SN41 at 128m
SN40 at 109m
SN51 at 89m
SN50 at 70m
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
88

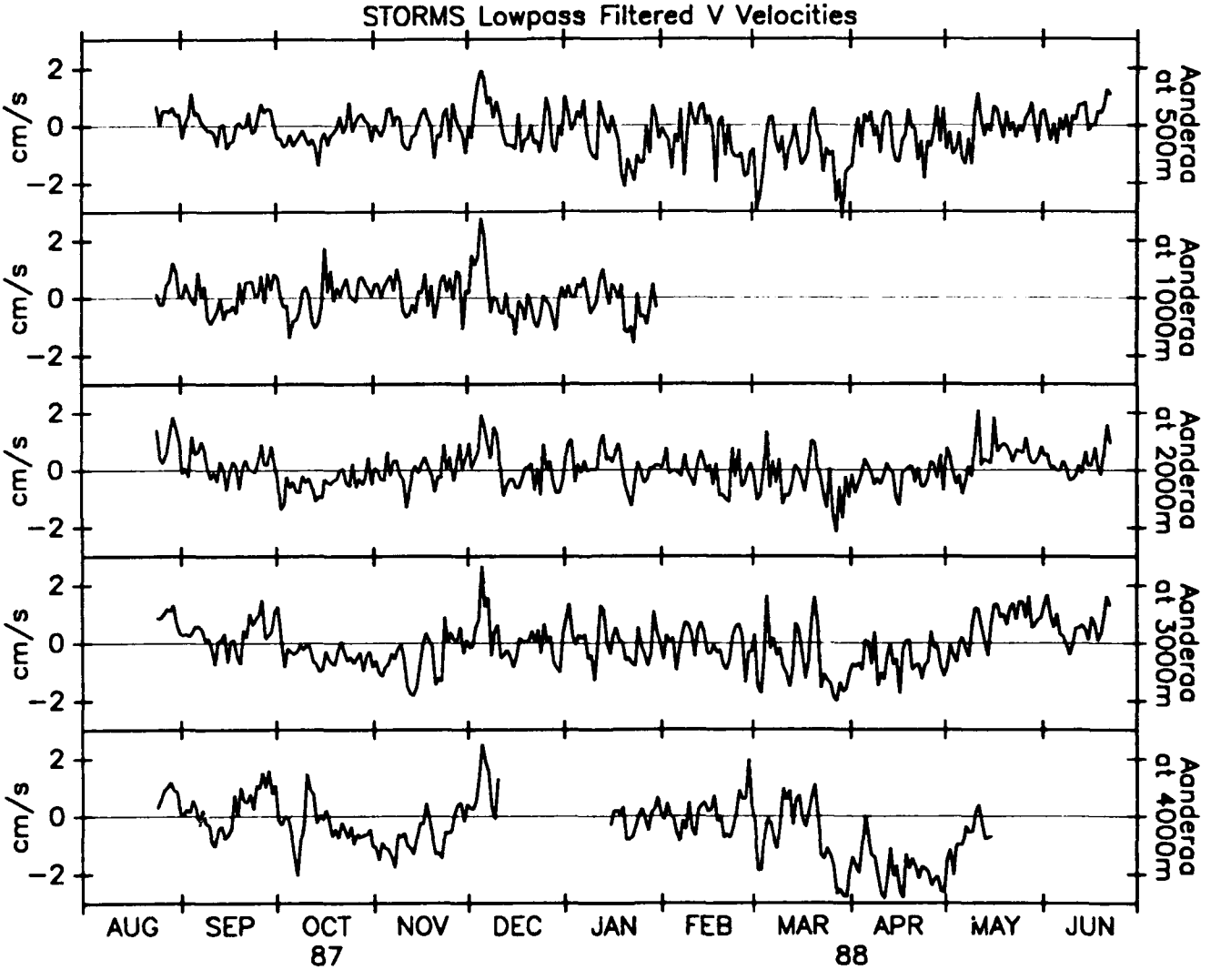
TIME SERIES OF VELOCITY: LOW-PASS FILTERED

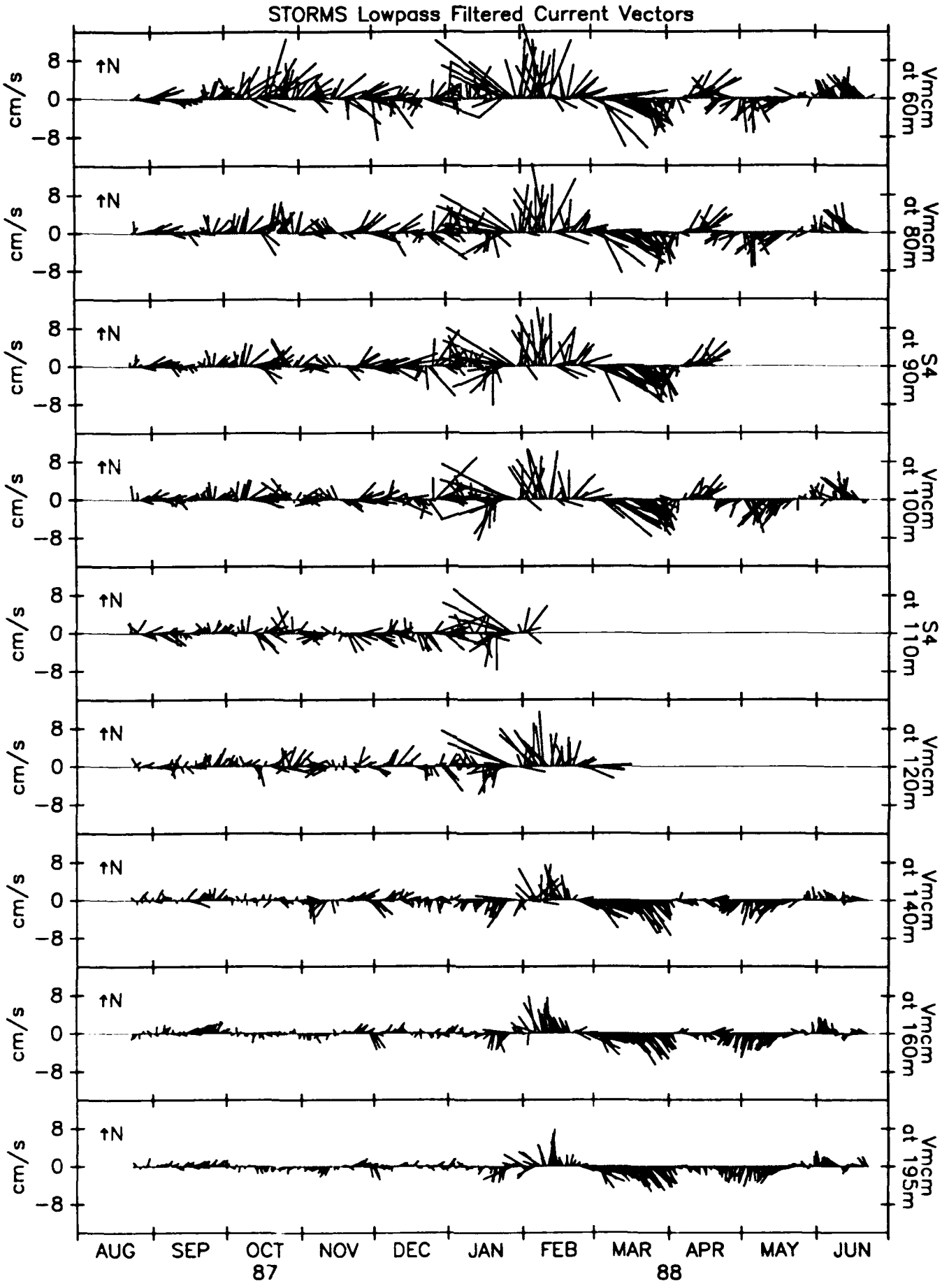
On the following 6 pages are observations from VMCMs at 60, 80, 100, 120, 140, 160 and 195 m; S-4s at 90 and 110 m; and RCM-5s at 500, 1000, 2000, 3000 and 4000 m. Velocity is displayed as u-component, v-component and vector stick plot. Data are low-pass filtered (40 hour half-power) and decimated to daily values.

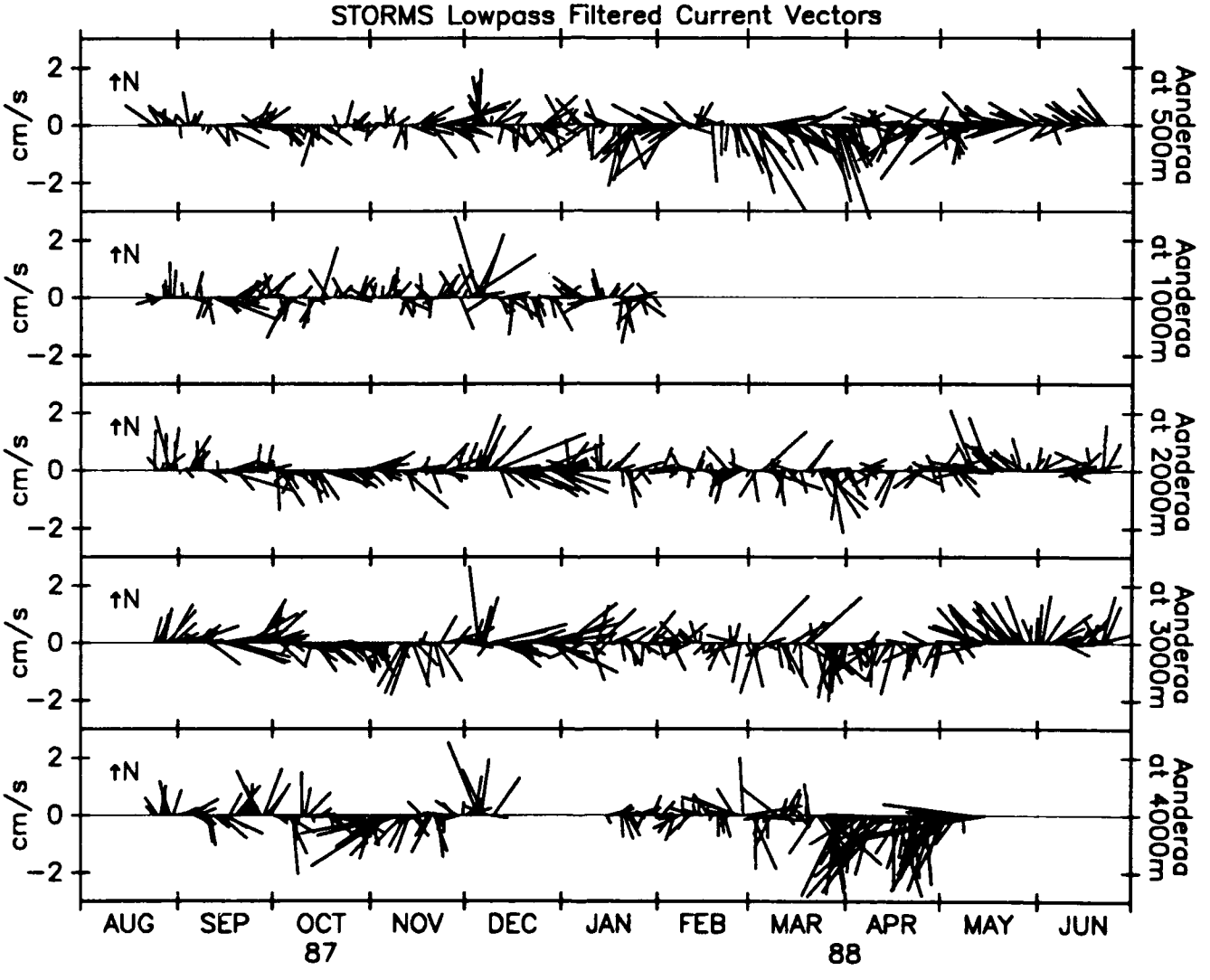

STORMS Lowpass Filtered U Velocities
cm/s
8
0
-8
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88


STORMS Lowpass Filtered U Velocities
cm/s
2
0
−2
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88


STORMS Lowpass Filtered V Velocities
cm/s
8
0
−8
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

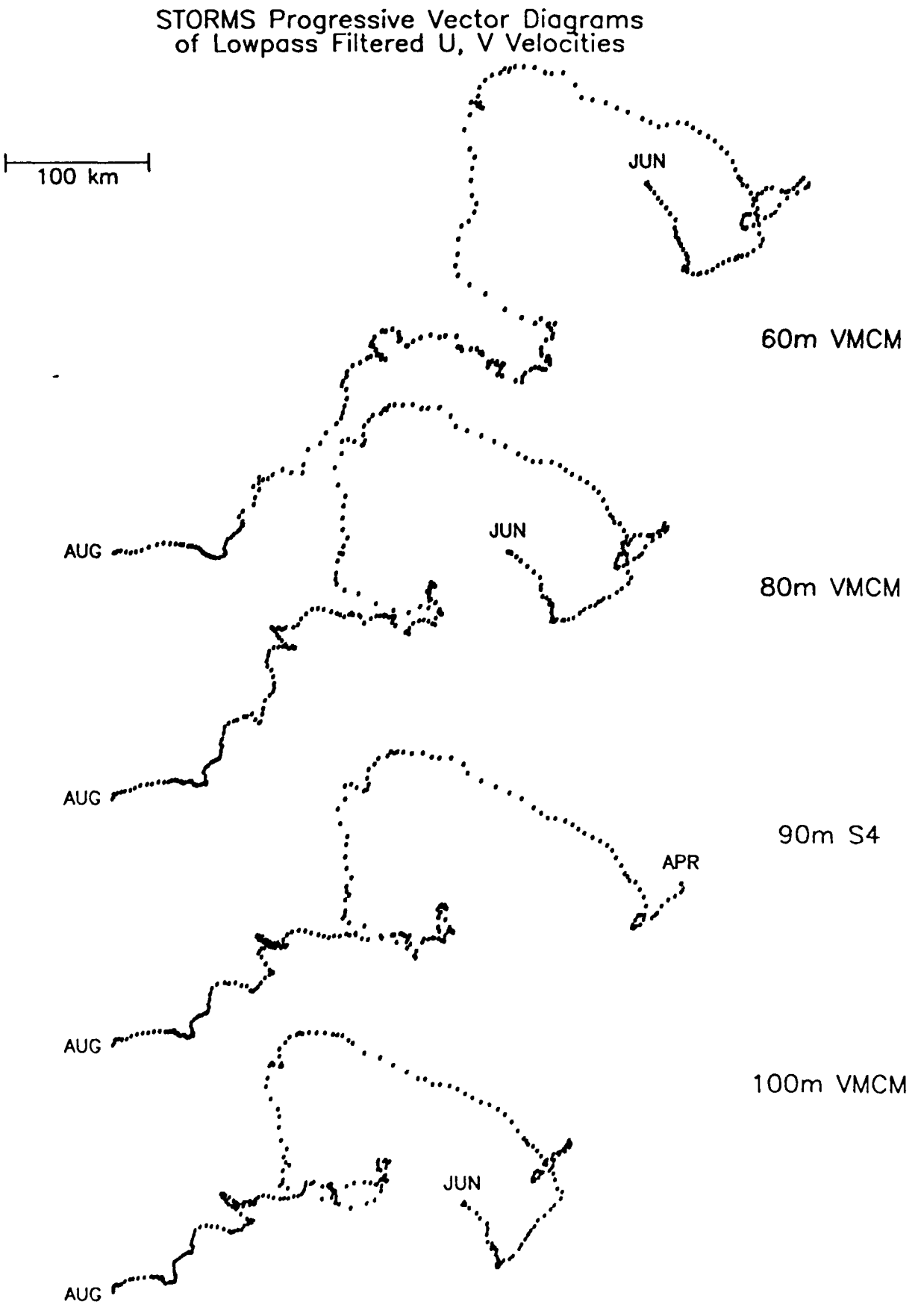

STORMS Lowpass Filtered V Velocities
cm/s
2
0
−2
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88


STORMS Lowpass Filtered Current Vectors
↑N
cm/s
8
0
−8
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

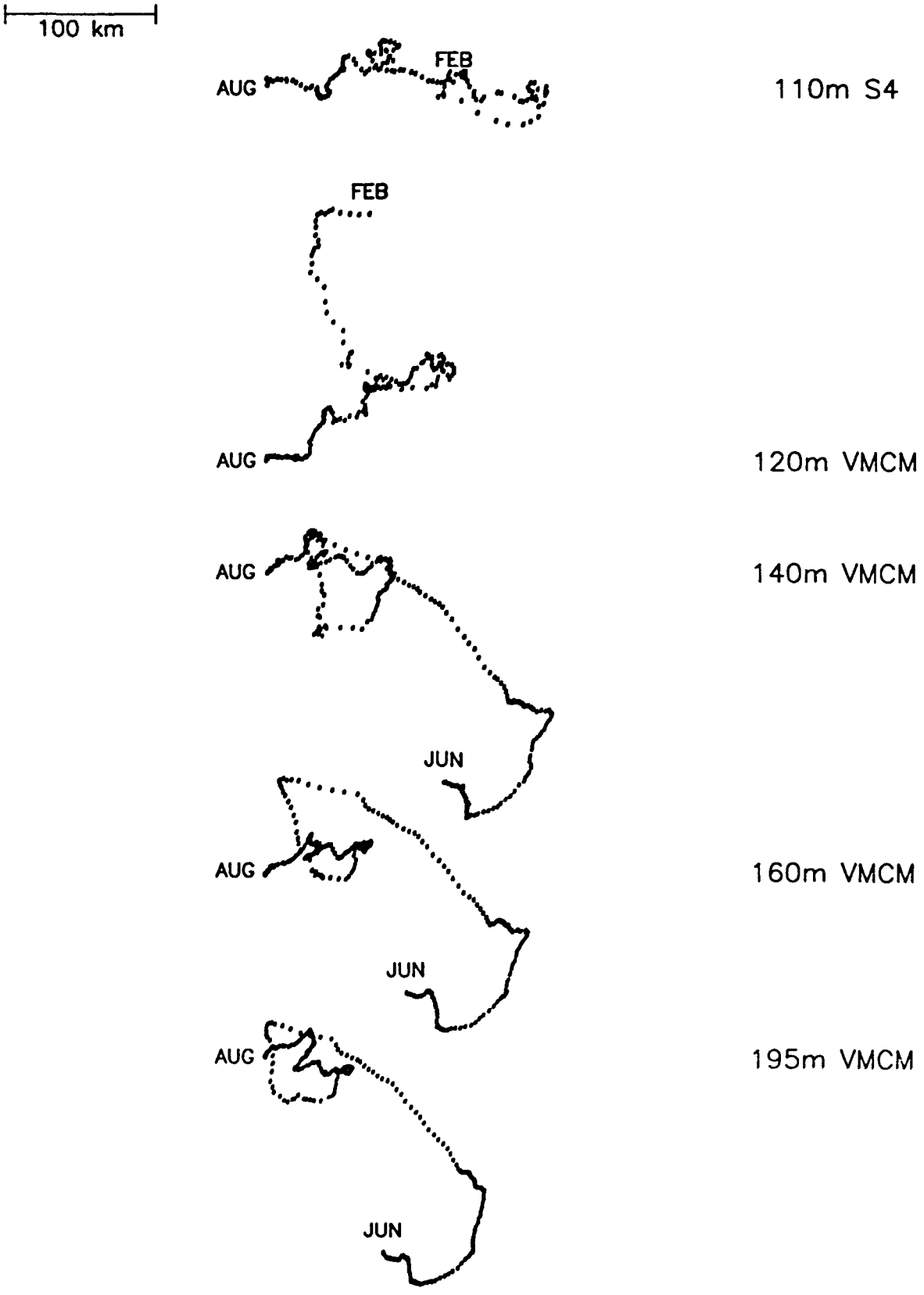

STORMS Lowpass Filtered Current Vectors
↑N
cm/s
2
0
−2
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

TIME SERIES OF VELOCITY: LOW-PASS FILTERED

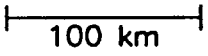
On the following 3 pages are progressive vector diagrams calculated from VM-CMs at 60, 80, 100, 120, 140, 160, and 195 m; S-4s at 90 and 110 m; and RCM-5s at 500, 1000, 2000, and 3000 m. Daily values are plotted after being low-pass filtered (40 hour half-power).


STORMS Progressive Vector Diagrams
of Lowpass Filtered U, V Velocities
100 km
JUN
60m VMCM
AUG
JUN
80m VMCM
AUG
90m S4
APR
AUG
100m VMCM
JUN
AUG

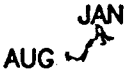
STORMS Progressive Vector Diagrams of Lowpass Filtered U, V Velocities



STORMS Progressive Vector Diagrams of Lowpass Filtered U, V Velocities



500m AANDERAA



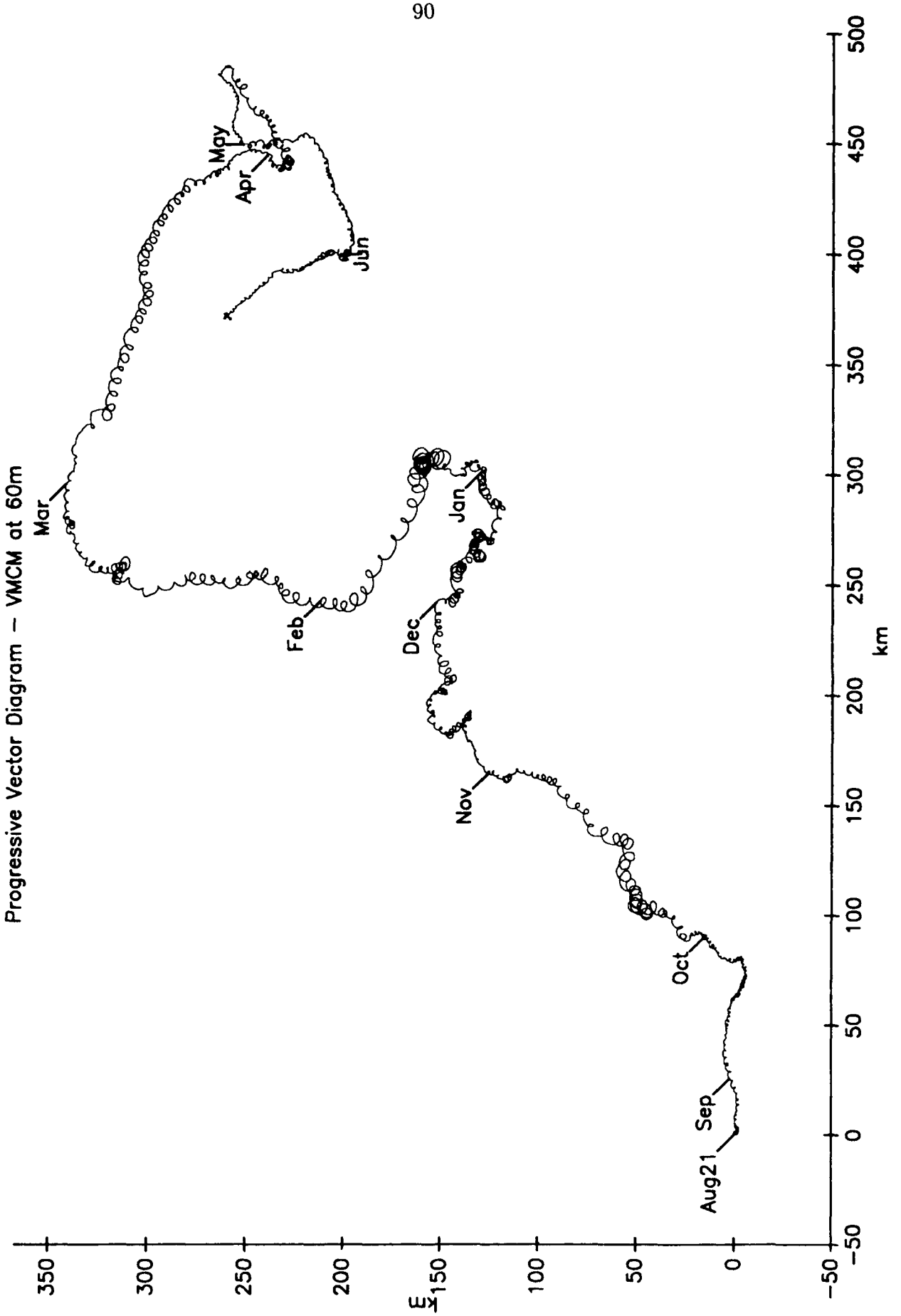
1000m AANDERAA

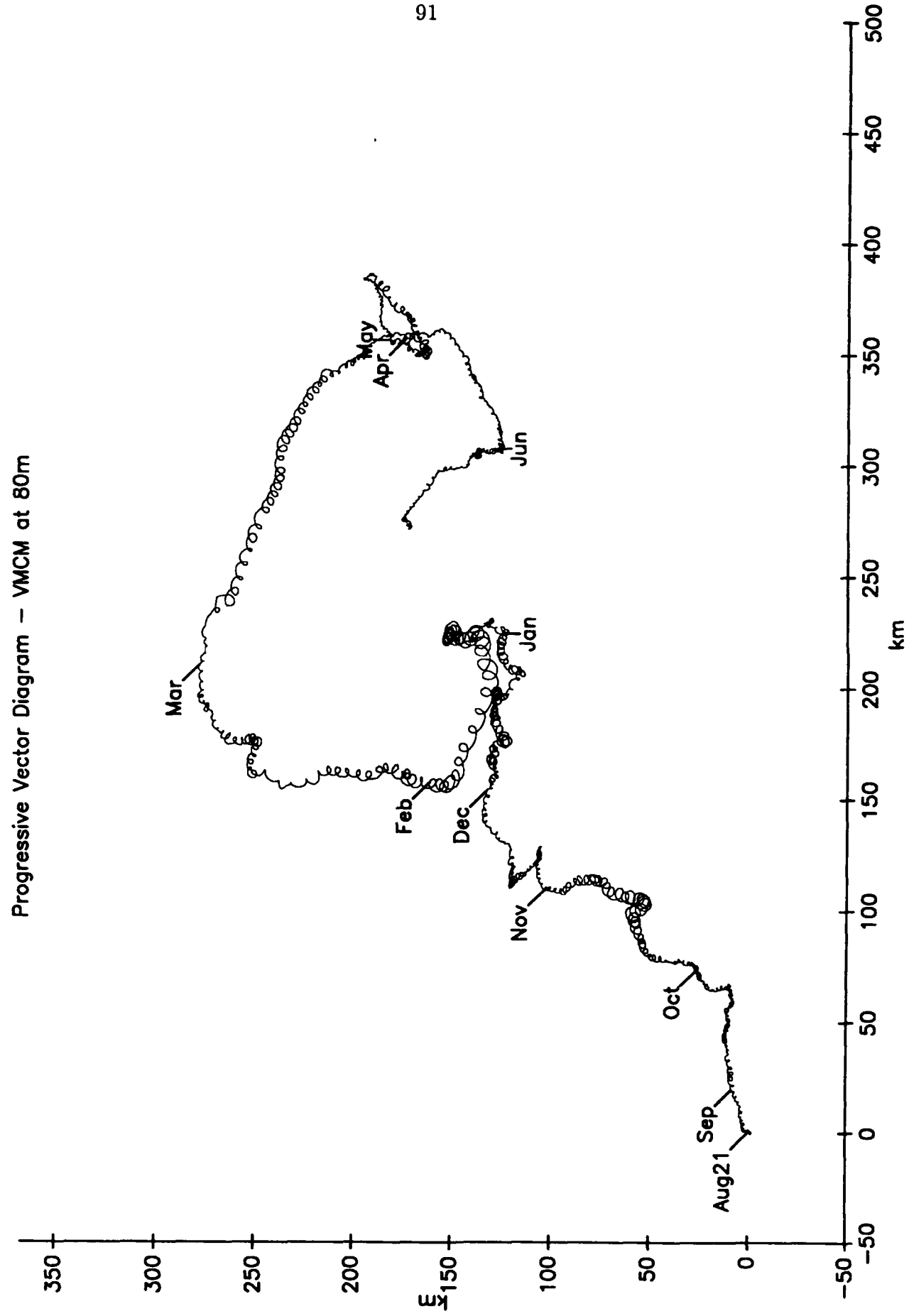
2000m AANDERAA

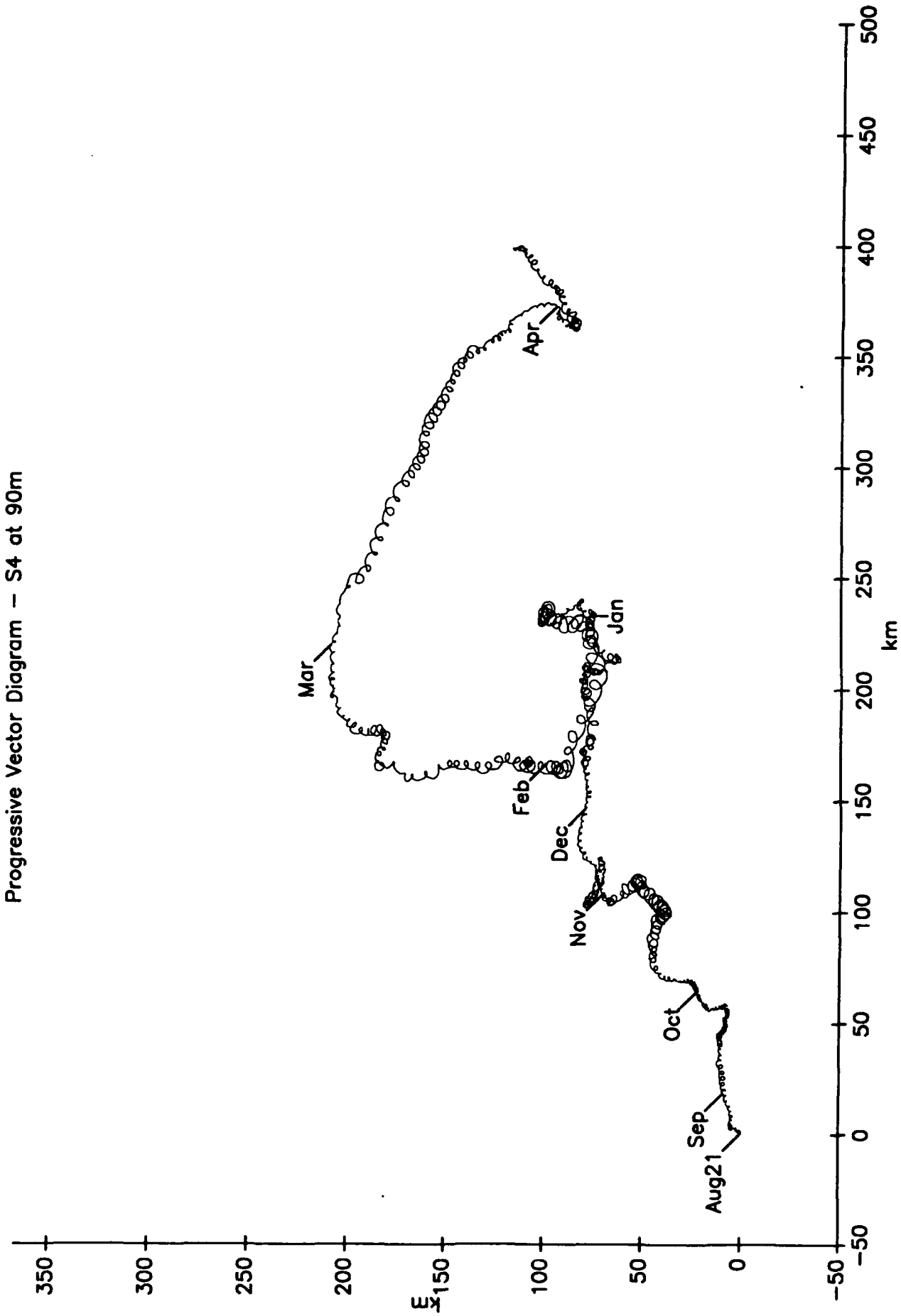
3000m AANDERAA

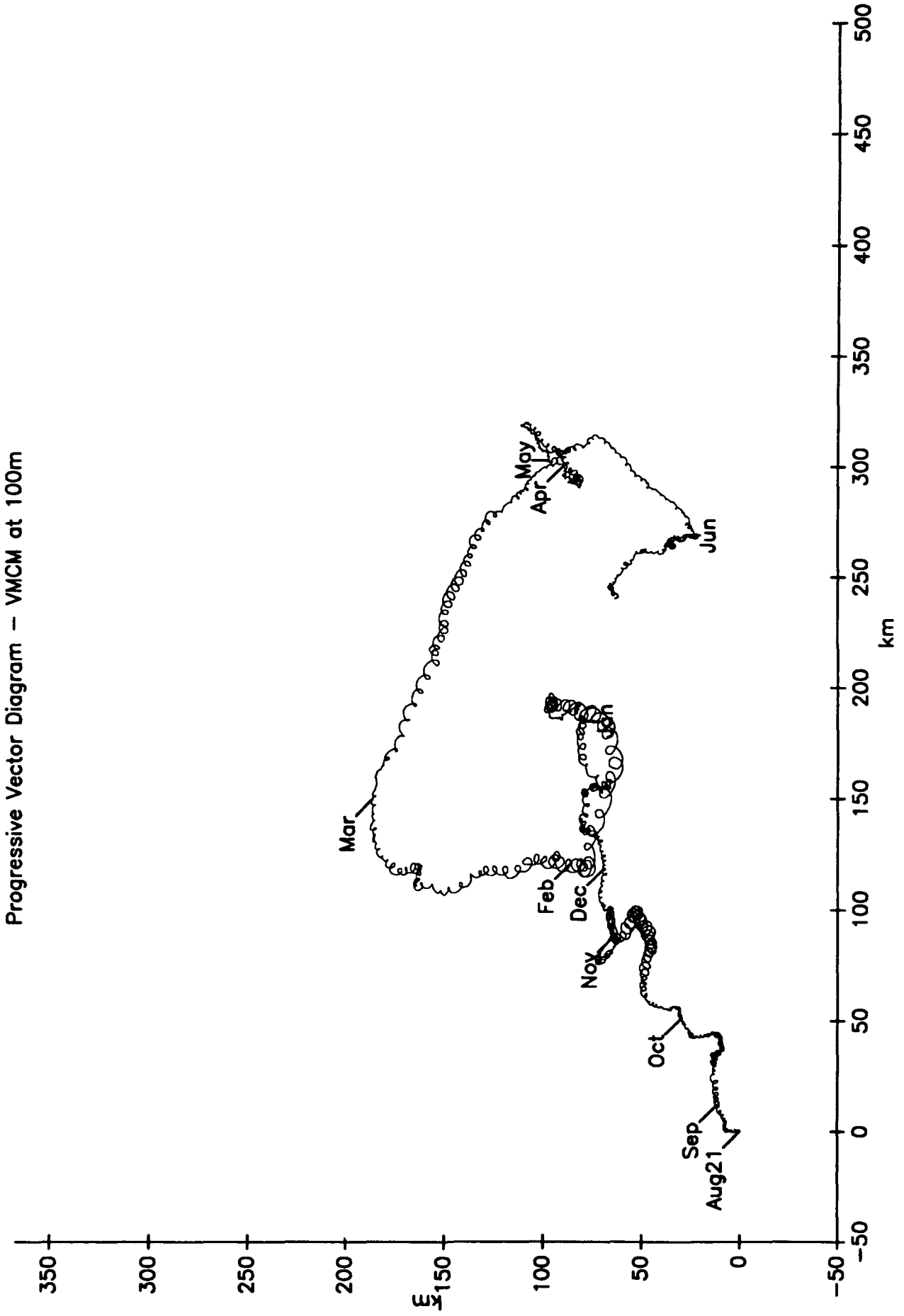
TIME SERIES OF VELOCITY: UNFILTERED

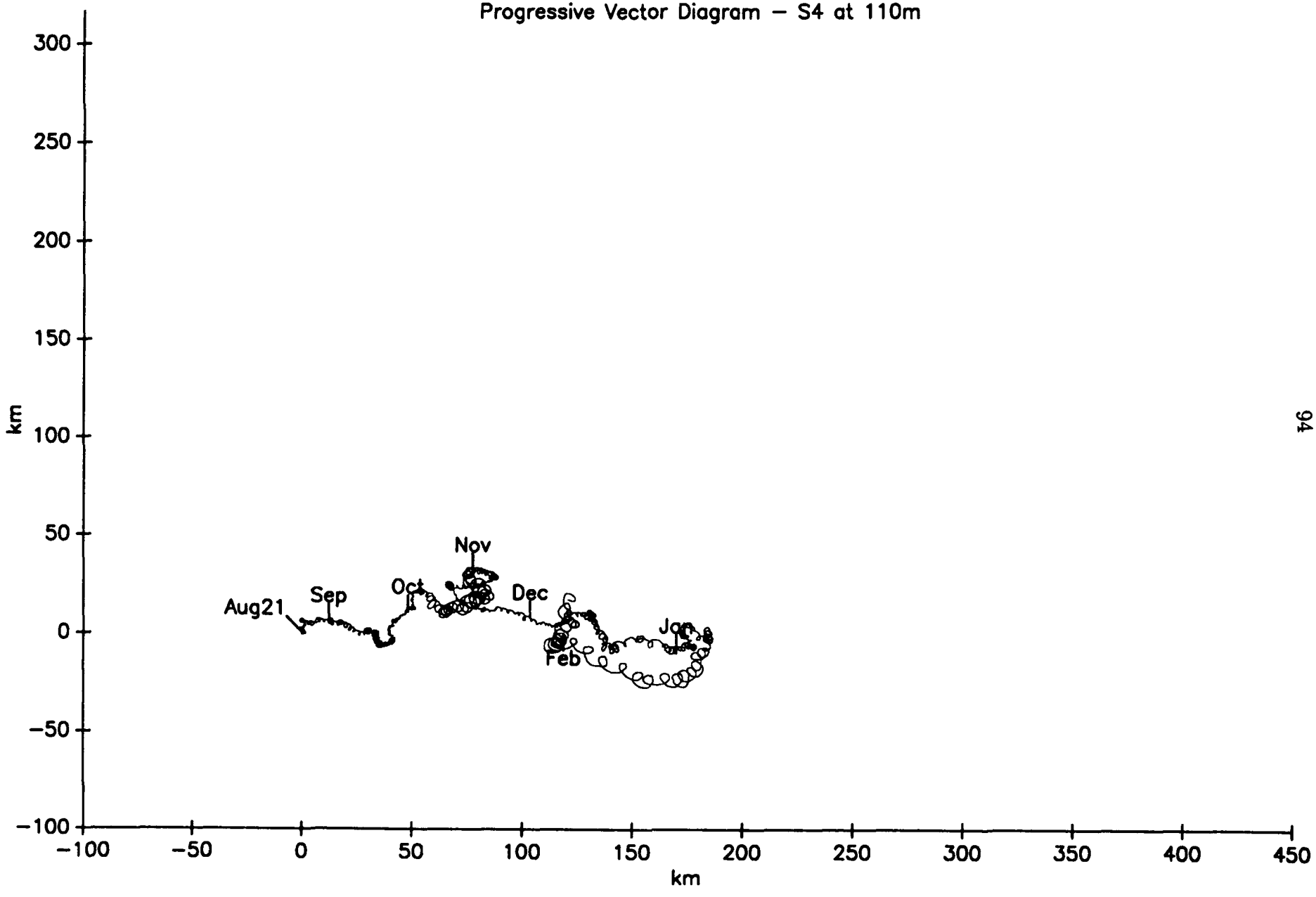
On the following 13 pages are progressive vector diagrams calculated from VMCMs at 60, 80, 100, 120, 140, 160, and 195 m; S-4s at 90 and 110 m; and RCM-5s at 500, 1000, 2000, and 3000 m. Sampling interval is 15 minutes for VMCMs, 12 minutes for S-4s and 1 hour for RCM-5s. Note that the velocity scale changes by a factor of one-half for observations deeper than 500 m.

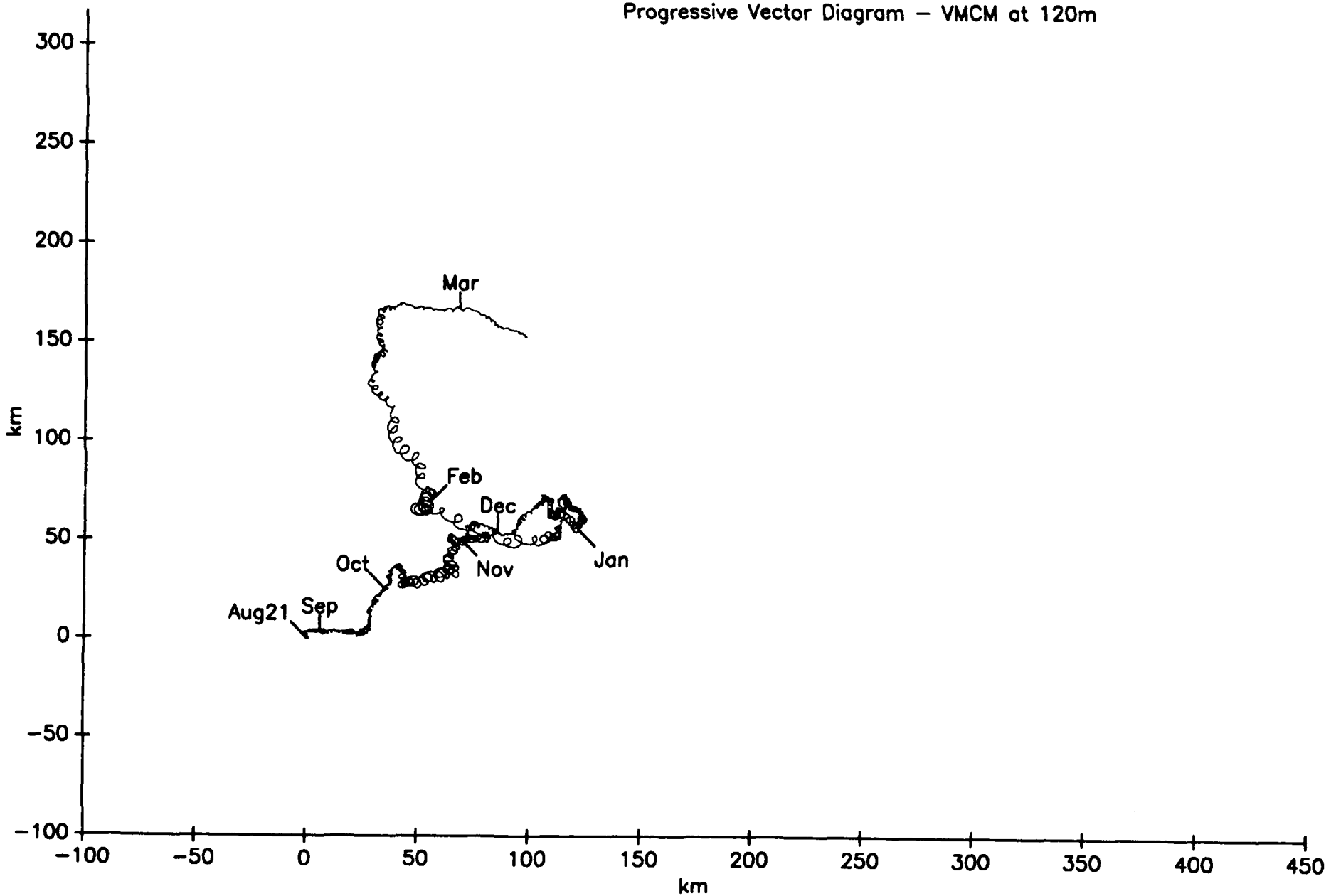

Progressive Vector Diagram – VMCM at 60m
Aug21
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
km
N
350
300
250
200
150
100
50
0
−50
−50
0
50
100
150
200
250
300
350
400
450
500

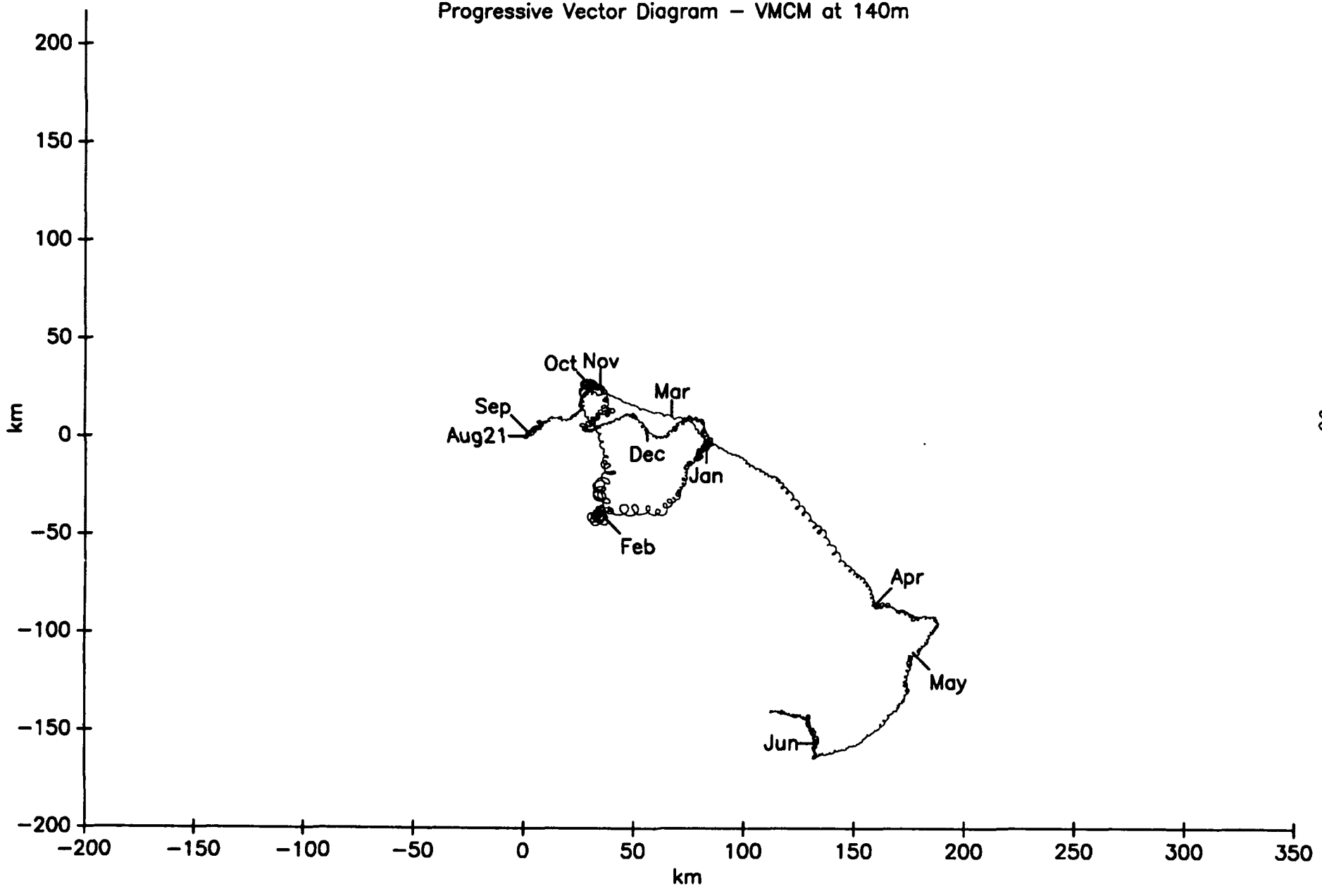

Progressive Vector Diagram – VMCM at 80m
Aug21
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
km
km
350
300
250
200
150
100
50
0
−50
0
50
100
150
200
250
300
350
400
450
500

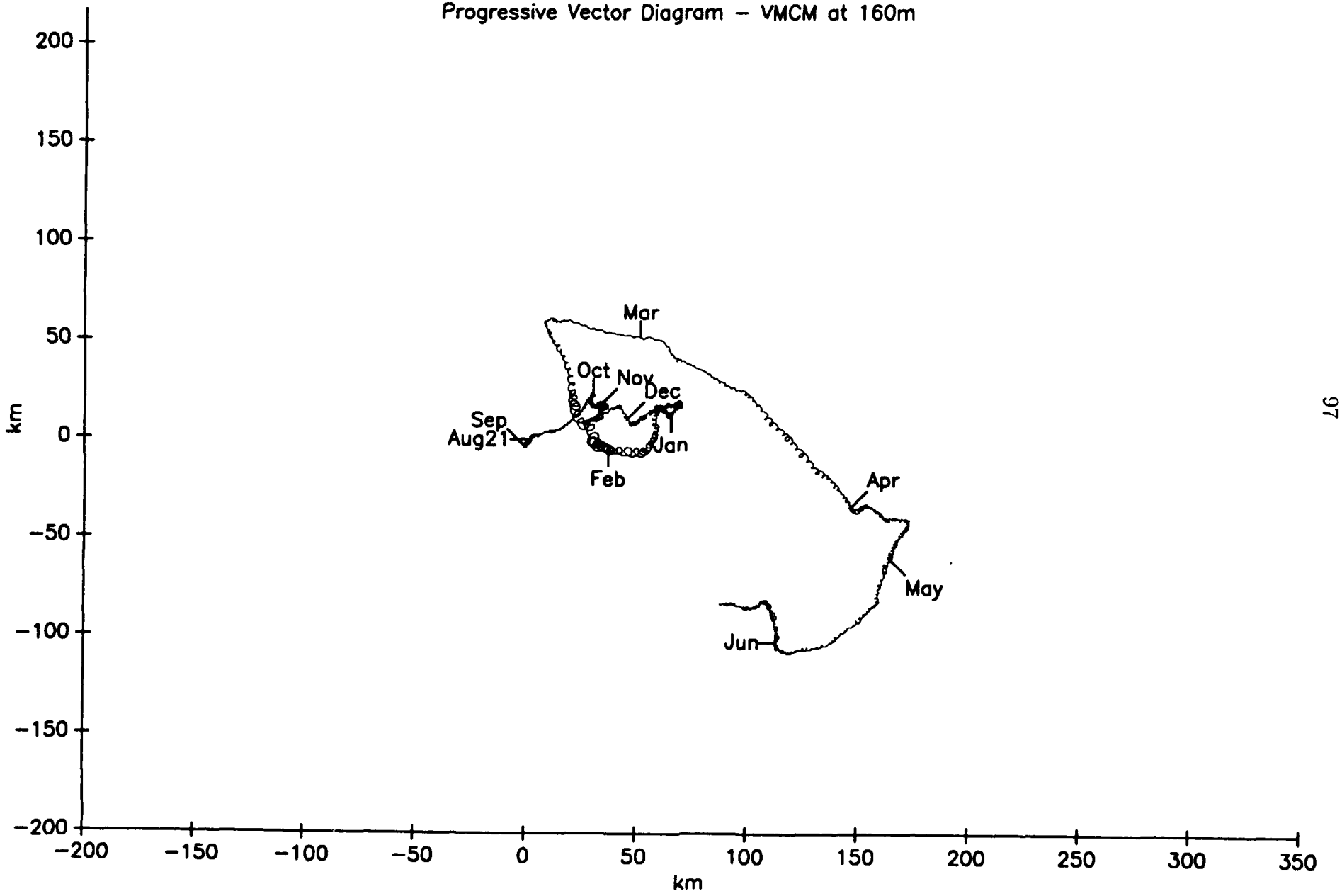

Progressive Vector Diagram – S4 at 90m
Aug21
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
km
350
300
250
200
150
100
50
0
-50
-50
0
50
100
150
200
250
300
350
400
450
500

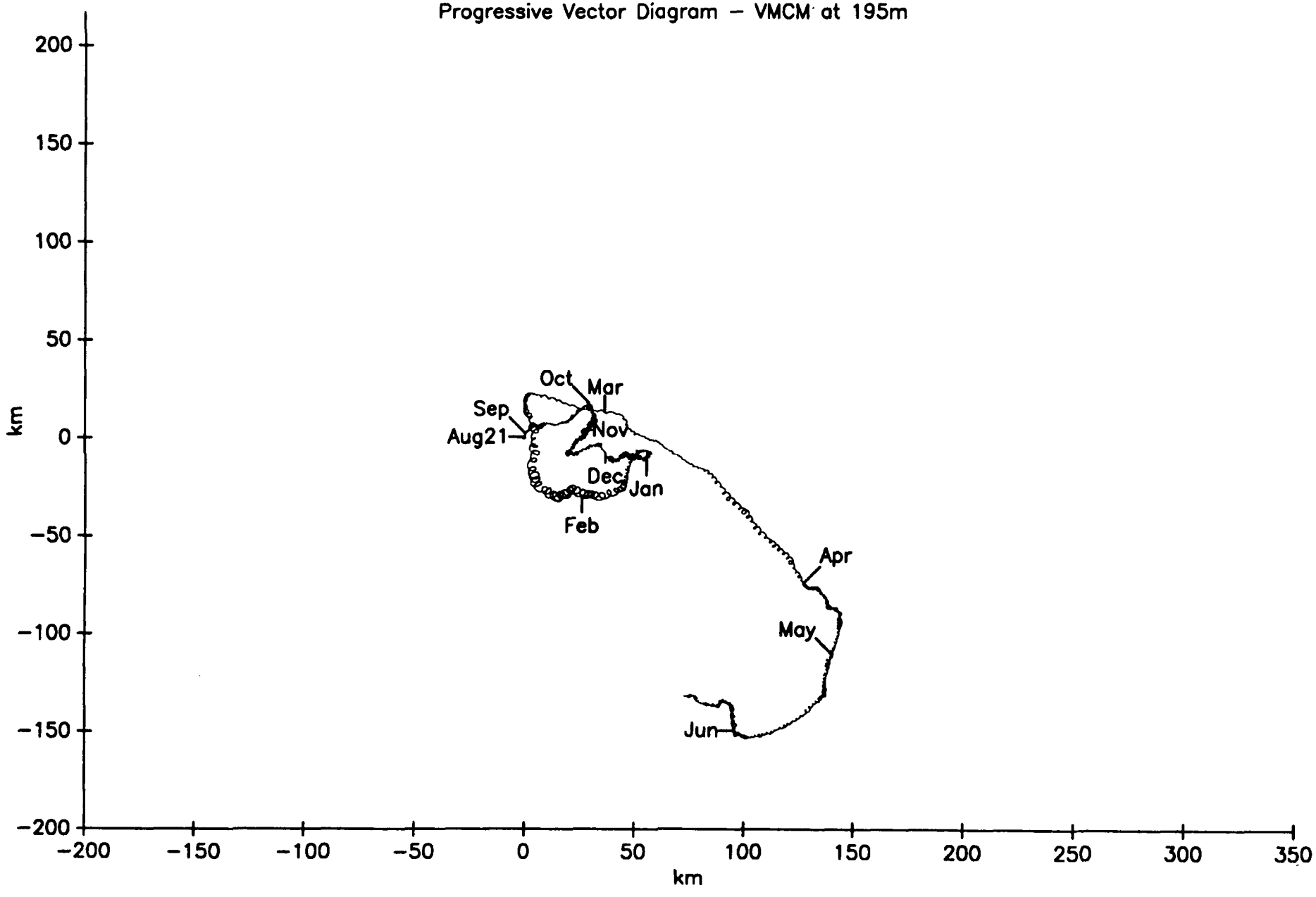

Progressive Vector Diagram – VMCM at 100m
Mar
Apr
May
Jun
Jul
Aug21
Sep
Oct
Nov
Dec
Feb
km
350
300
250
200
150
100
50
0
-50
500
450
400
350
300
250
200
150
100
50
0
-50

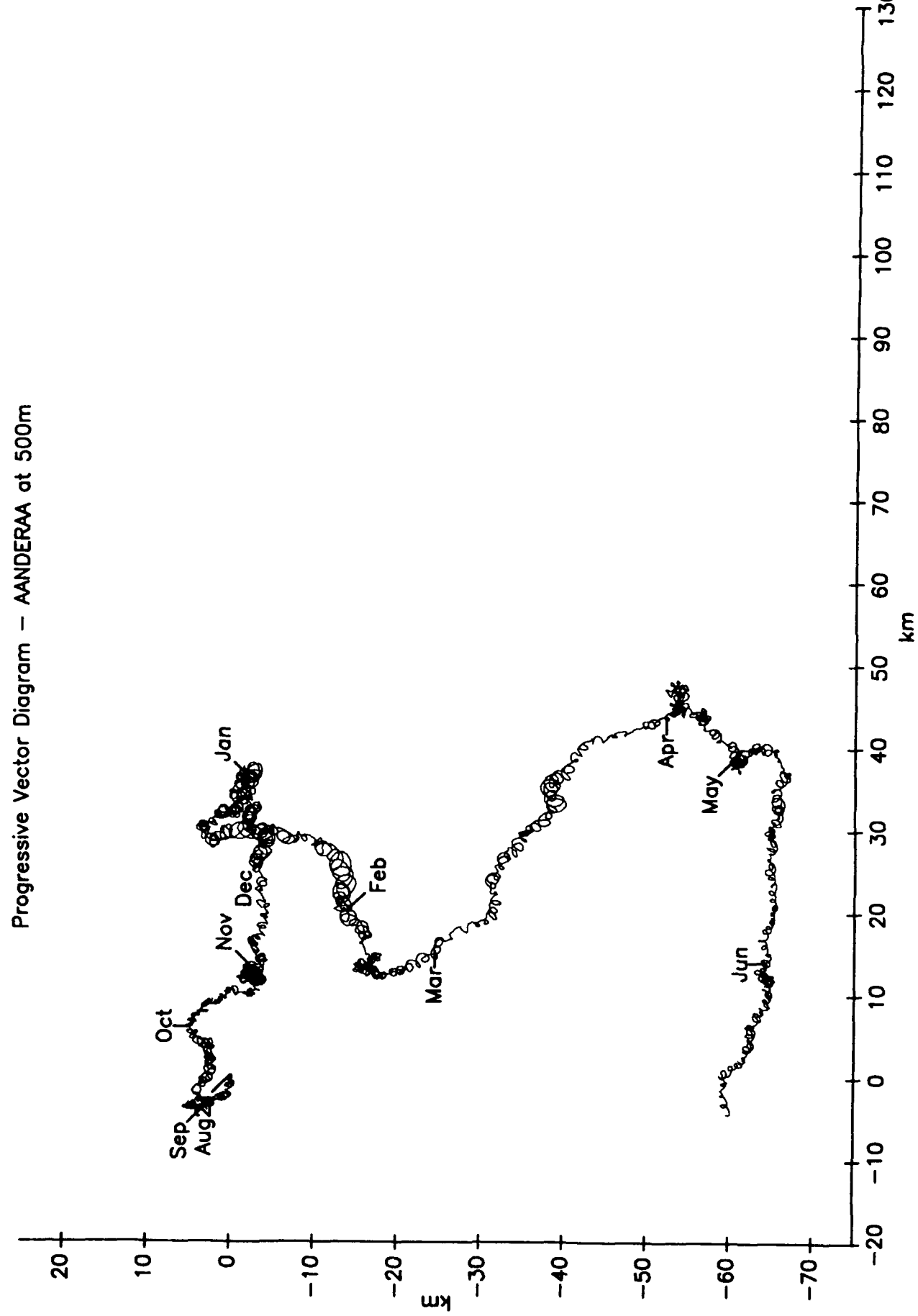

Progressive Vector Diagram – S4 at 110m
300
250
200
150
100
50
0
−50
−100
km
Aug21
Sep
Oct
Nov
Dec
Jan
Feb
−100
−50
0
50
100
150
200
250
300
350
400
450
km

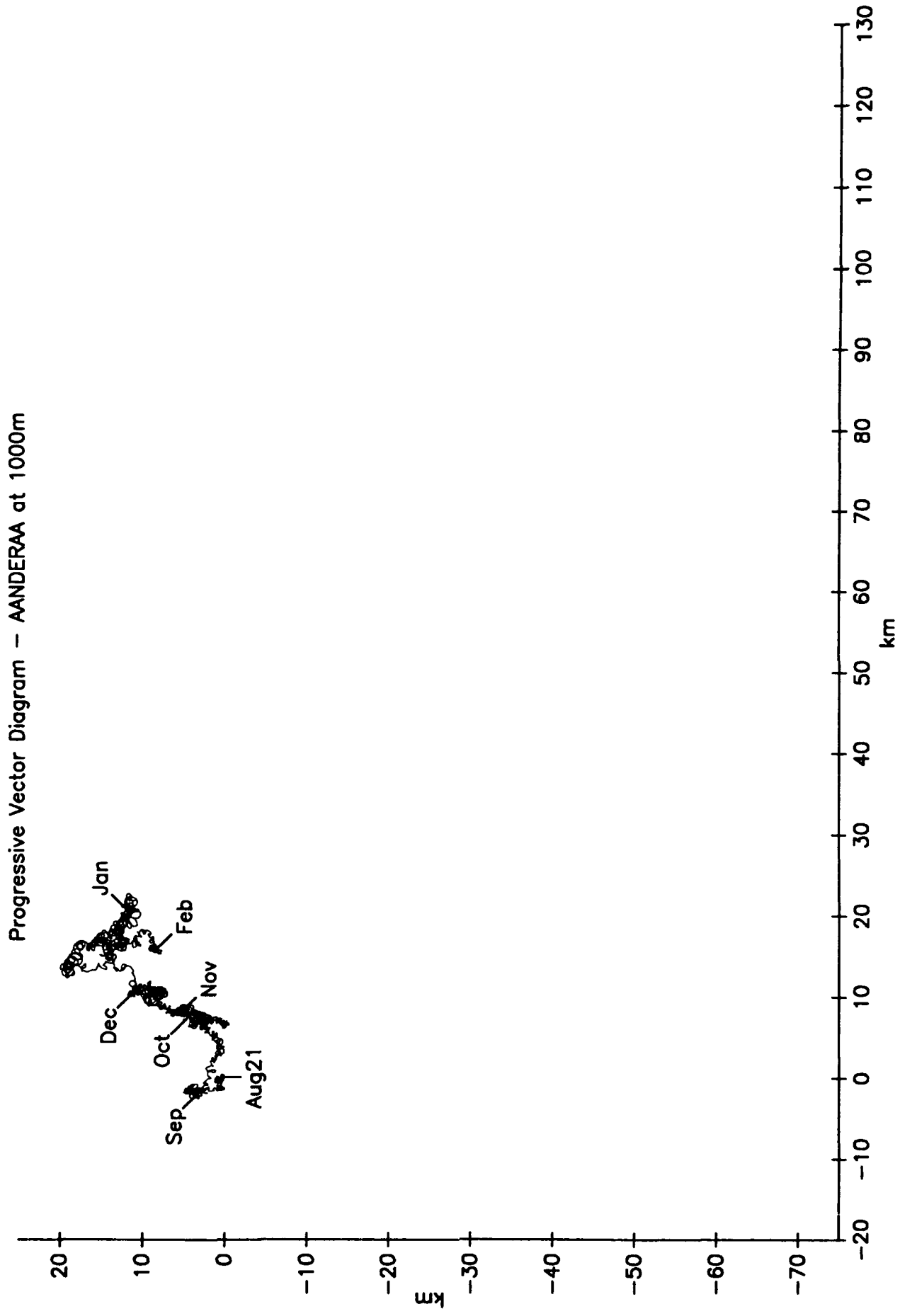

Progressive Vector Diagram – VMCM at 120m
km
km
300
250
200
150
100
50
0
-50
-100
-100
-50
0
50
100
150
200
250
300
350
400
450
Mar
Feb
Dec
Jan
Nov
Oct
Sep
Aug21

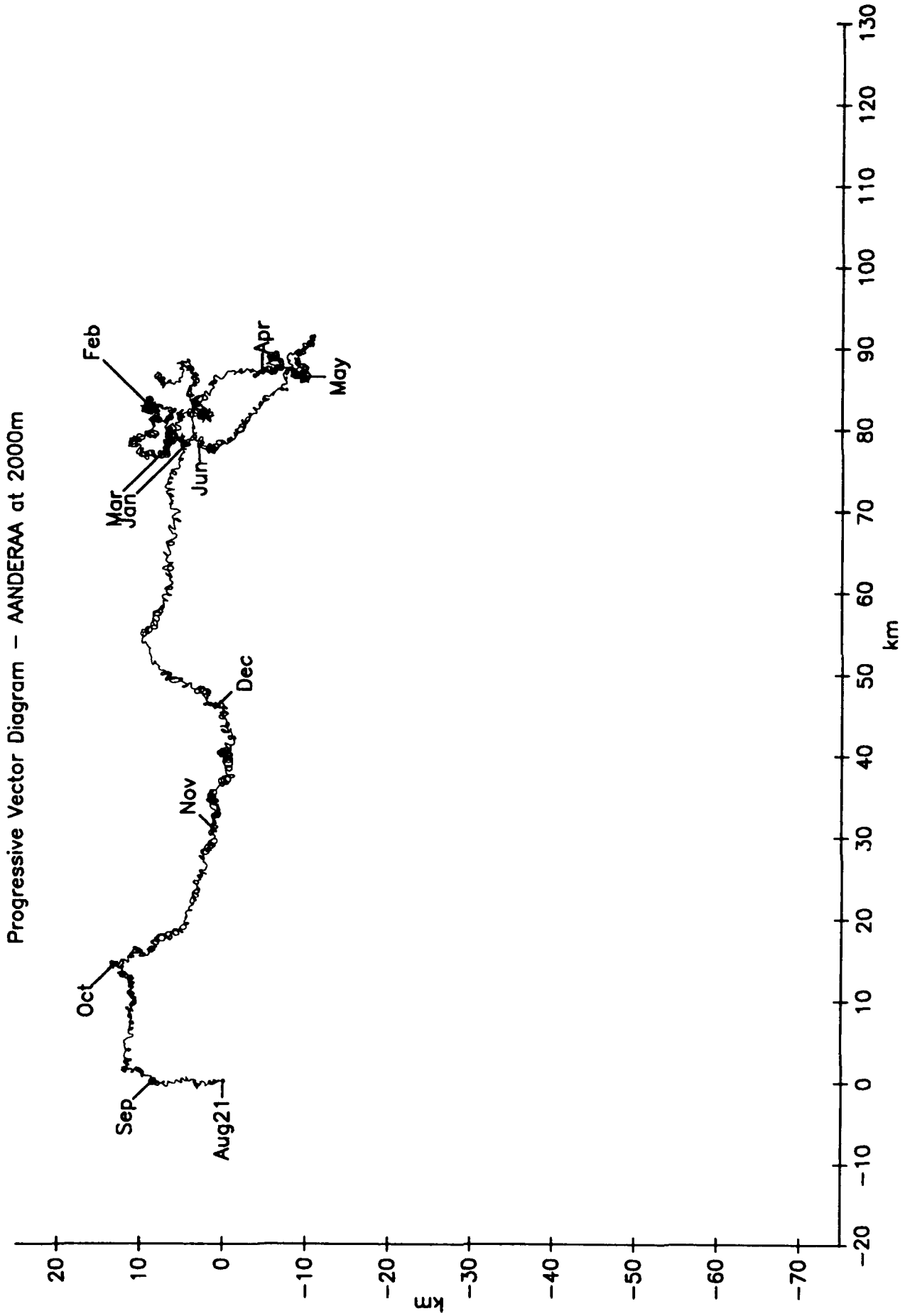

Progressive Vector Diagram – VMCM at 140m
200
150
100
50
0
−50
−100
−150
−200
km
−200
−150
−100
−50
0
50
100
150
200
250
300
350
km
Oct
Nov
Mar
Sep
Aug21
Dec
Jan
Feb
Apr
May
Jun

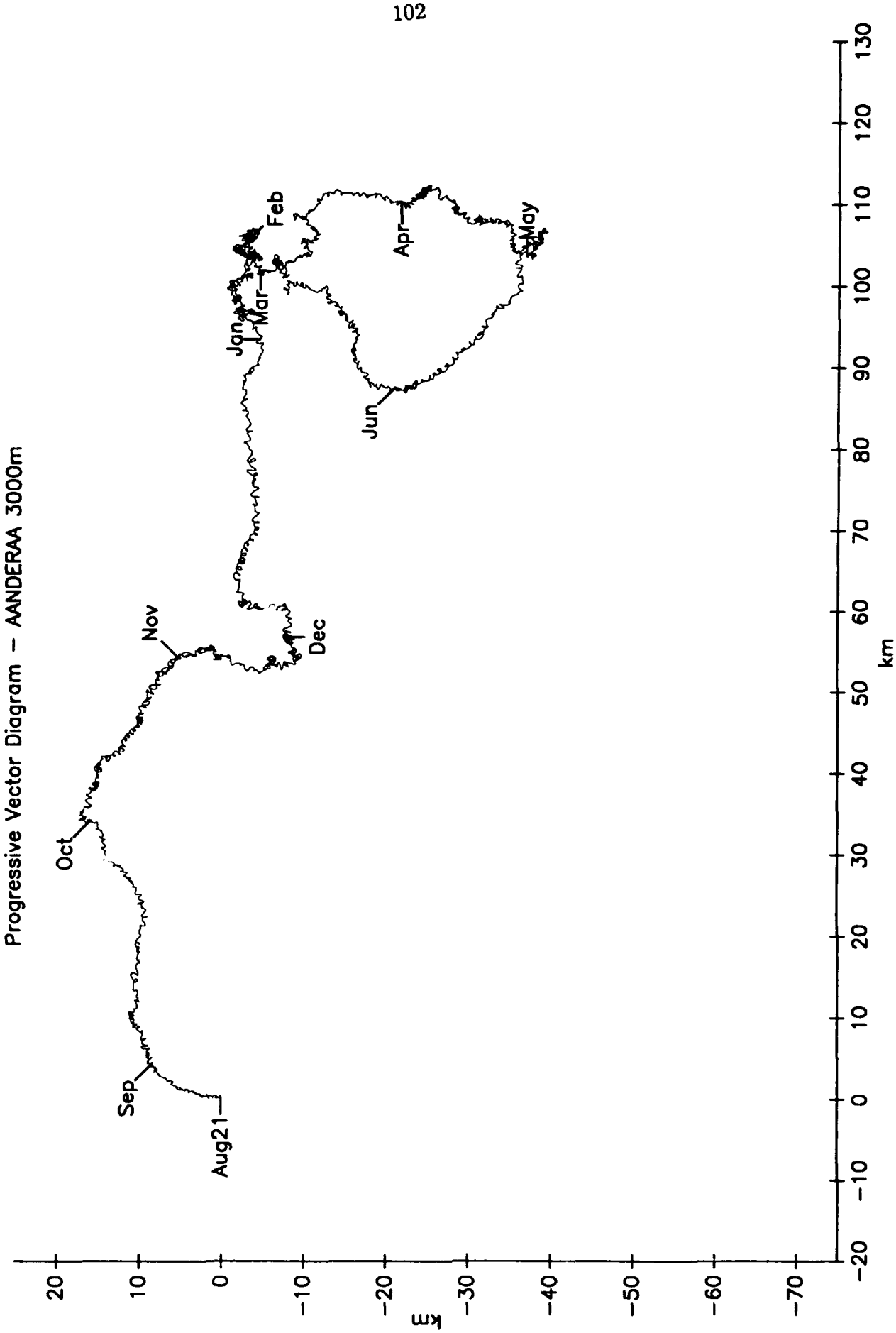

Progressive Vector Diagram – VMCM at 160m
200
150
100
50
0
−50
−100
−150
−200
km
−200
−150
−100
−50
0
50
100
150
200
250
300
350
km
Mar
Oct
Nov
Dec
Sep
Aug21
Jan
Feb
Apr
May
Jun


Progressive Vector Diagram – VMCM at 195m
200
150
100
50
0
−50
−100
−150
−200
km
Oct
Mar
Sep
Aug21
Nov
Dec
Jan
Feb
Apr
May
Jun
−200
−150
−100
−50
0
50
100
150
200
250
300
350
km


Progressive Vector Diagram – AANDERAA at 500m
Sep
Aug
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
km
km

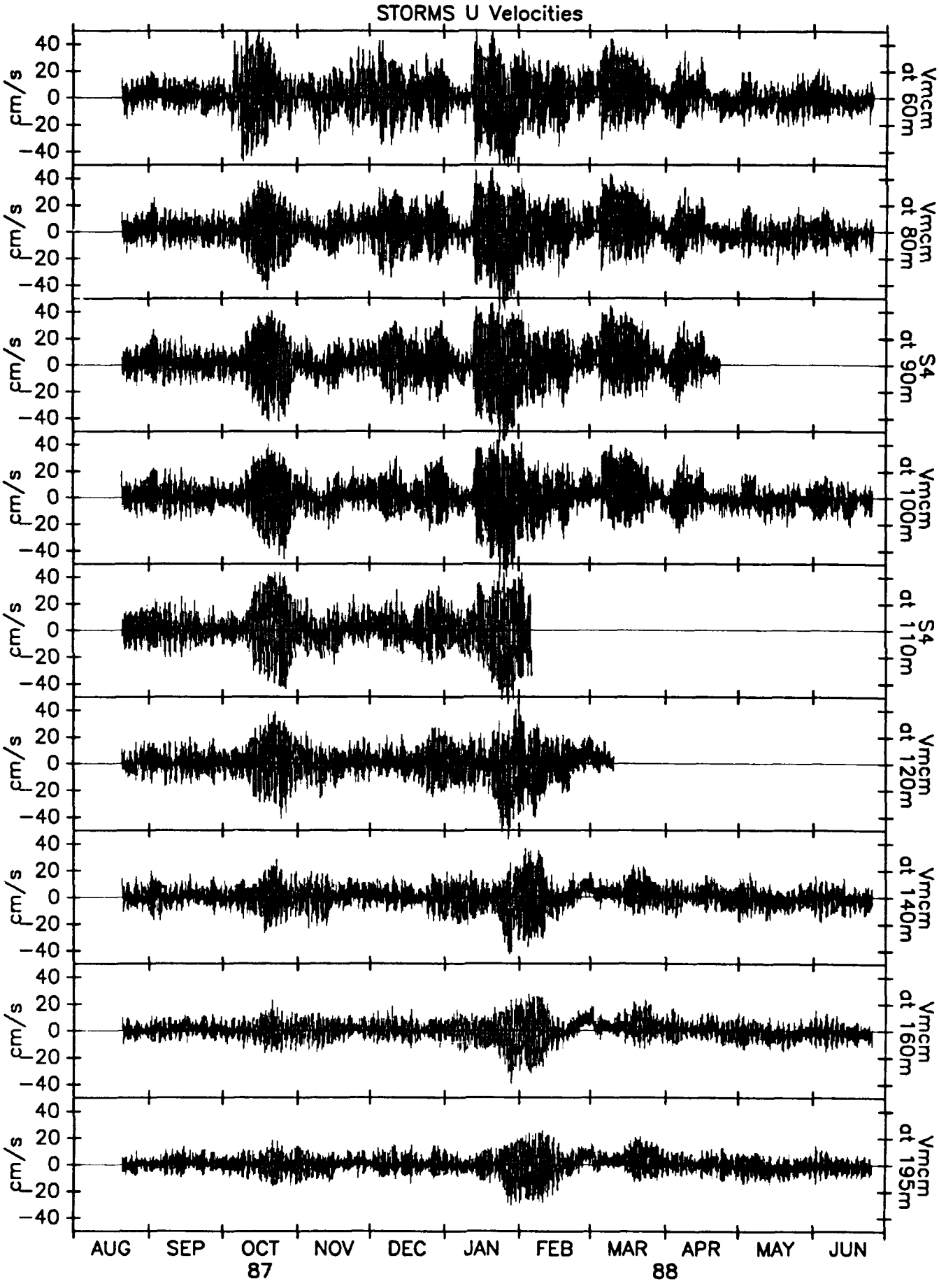

Progressive Vector Diagram – AANDERAA at 1000m
Jan
Feb
Nov
Dec
Oct
Aug21
Sep
km
km
20
10
0
−10
−20
−30
−40
−50
−60
−70
−20
−10
0
10
20
30
40
50
60
70
80
90
100
110
120
130

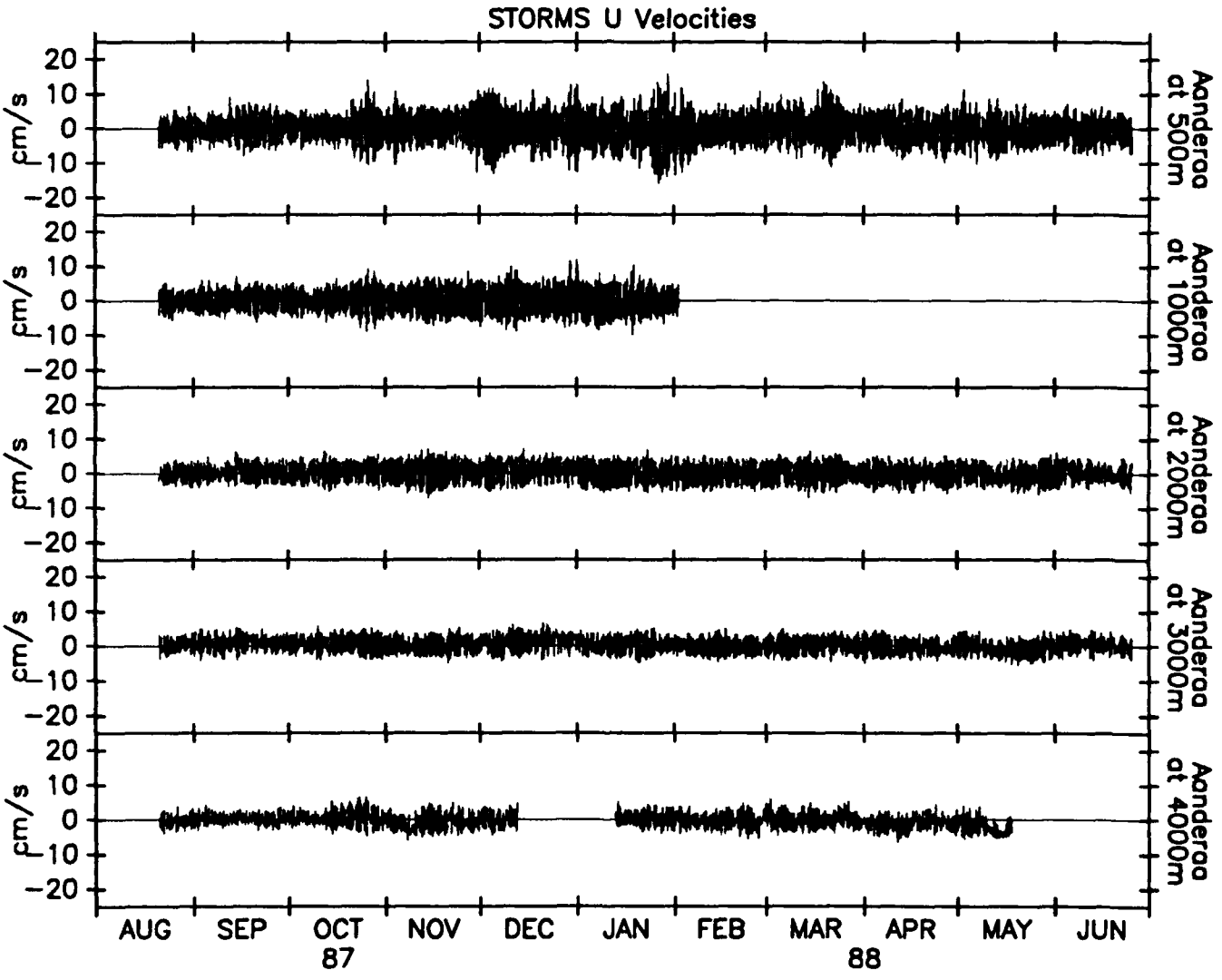

Progressive Vector Diagram – AANDERAA at 2000m
Feb
Apr
May
Mar
Jan
Jun
Dec
Nov
Oct
Sep
Aug21
km
km

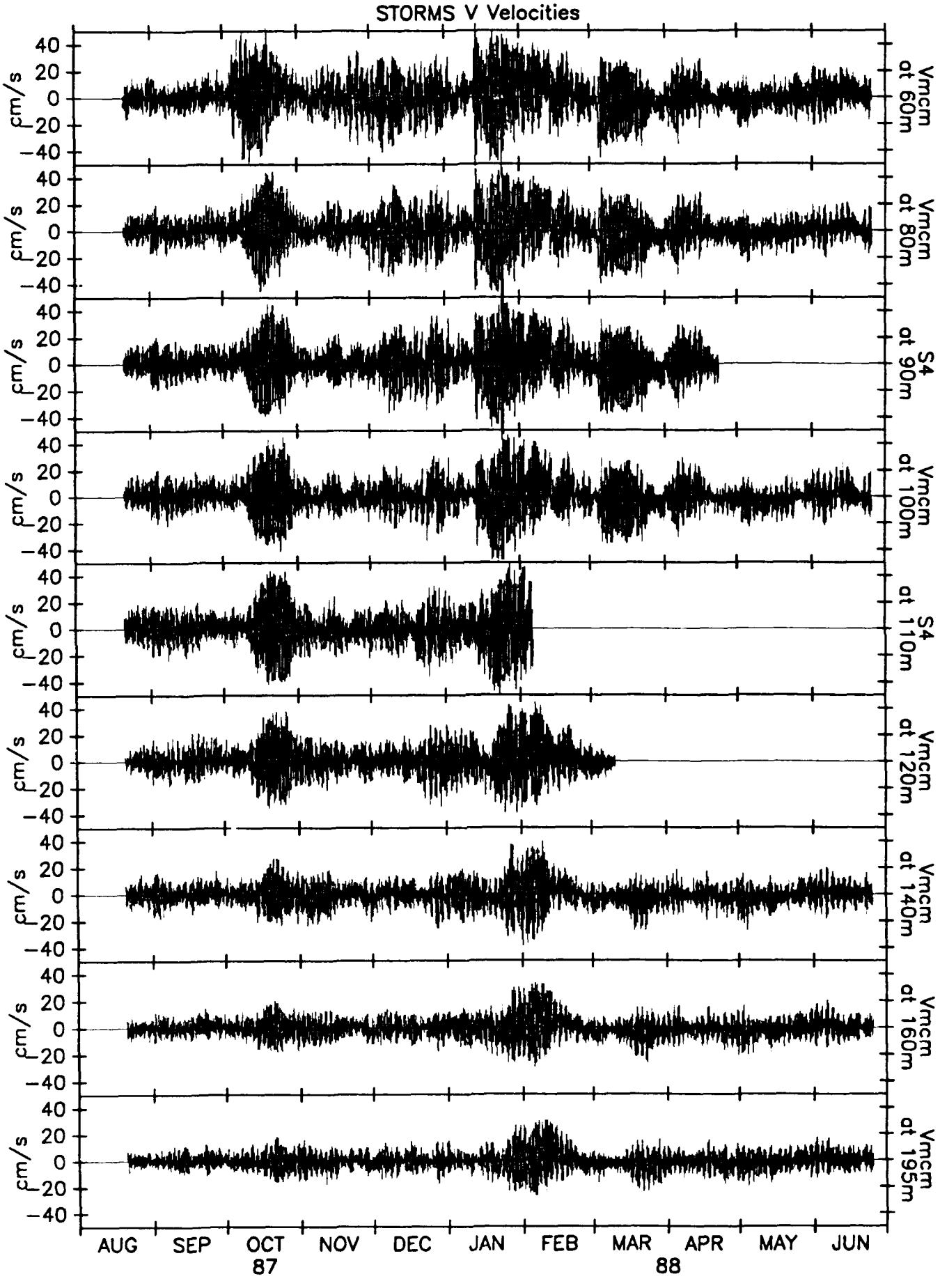

Progressive Vector Diagram – AANDERAA 3000m
Aug21
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
km
km

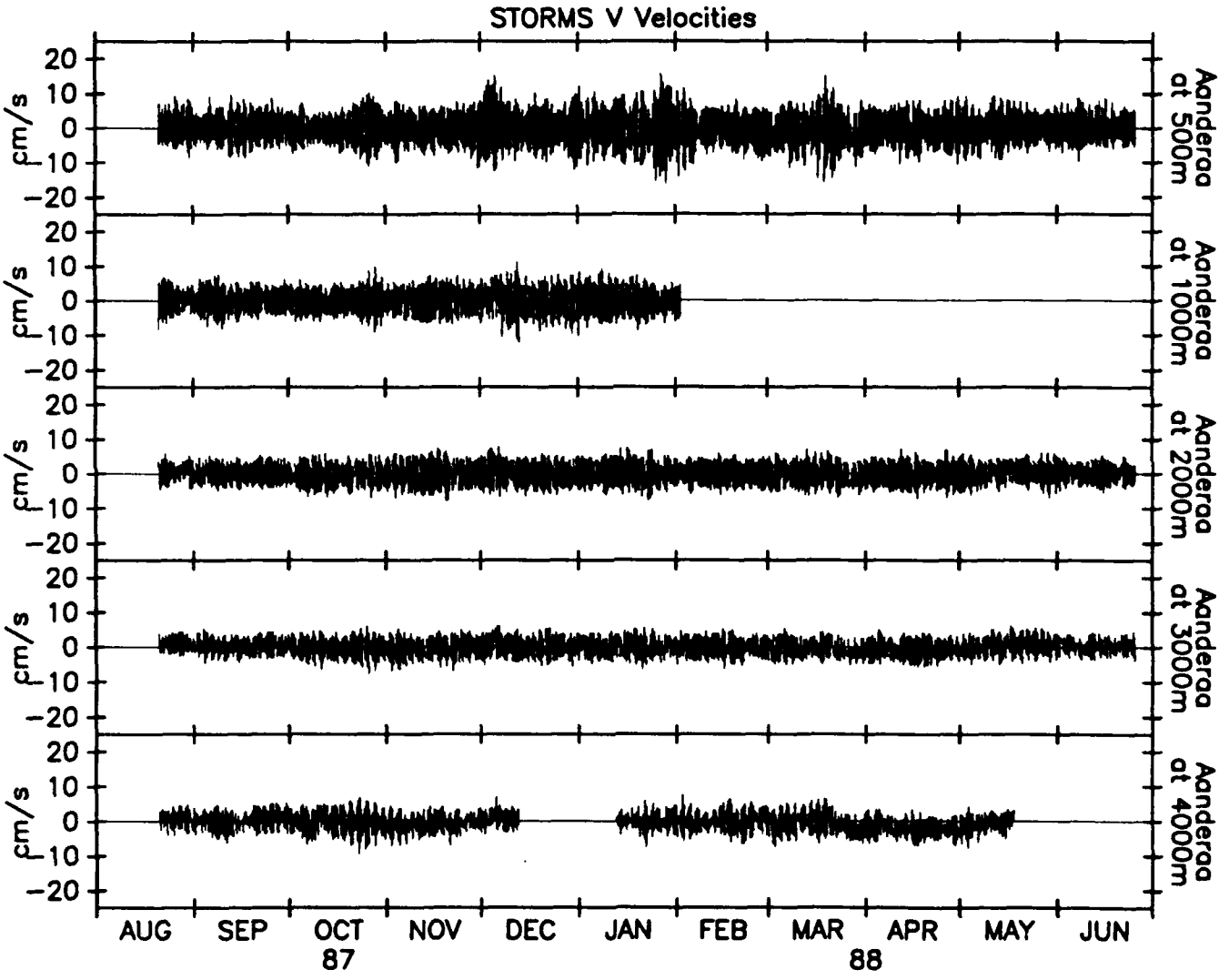
TIME SERIES OF VELOCITY: UNFILTERED

On the following 4 pages are the u and v components of velocity from VMCMs at 60, 80, 100, 120, 140, 160, and 195 m; S-4s at 90 and 110 m; and RCM-5s at 500, 1000, 2000, 3000 and 4000 m. Sampling interval is 15 minutes for VMCMs, 12 minutes for S-4s and 1 hour for RCM-5s. Note that the velocity scale changes by a factor of one-half for observations deeper than 500 m.


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

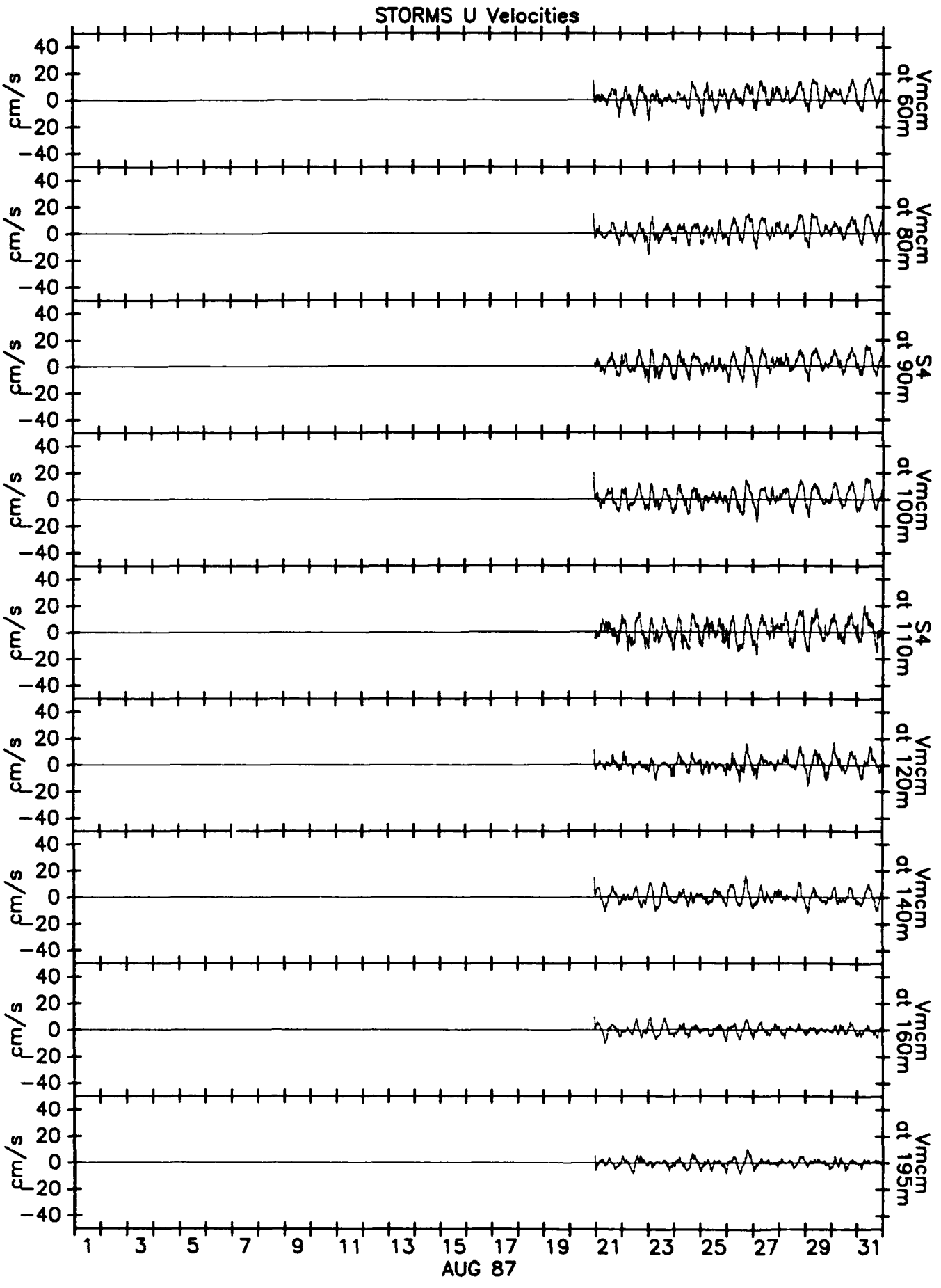

STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

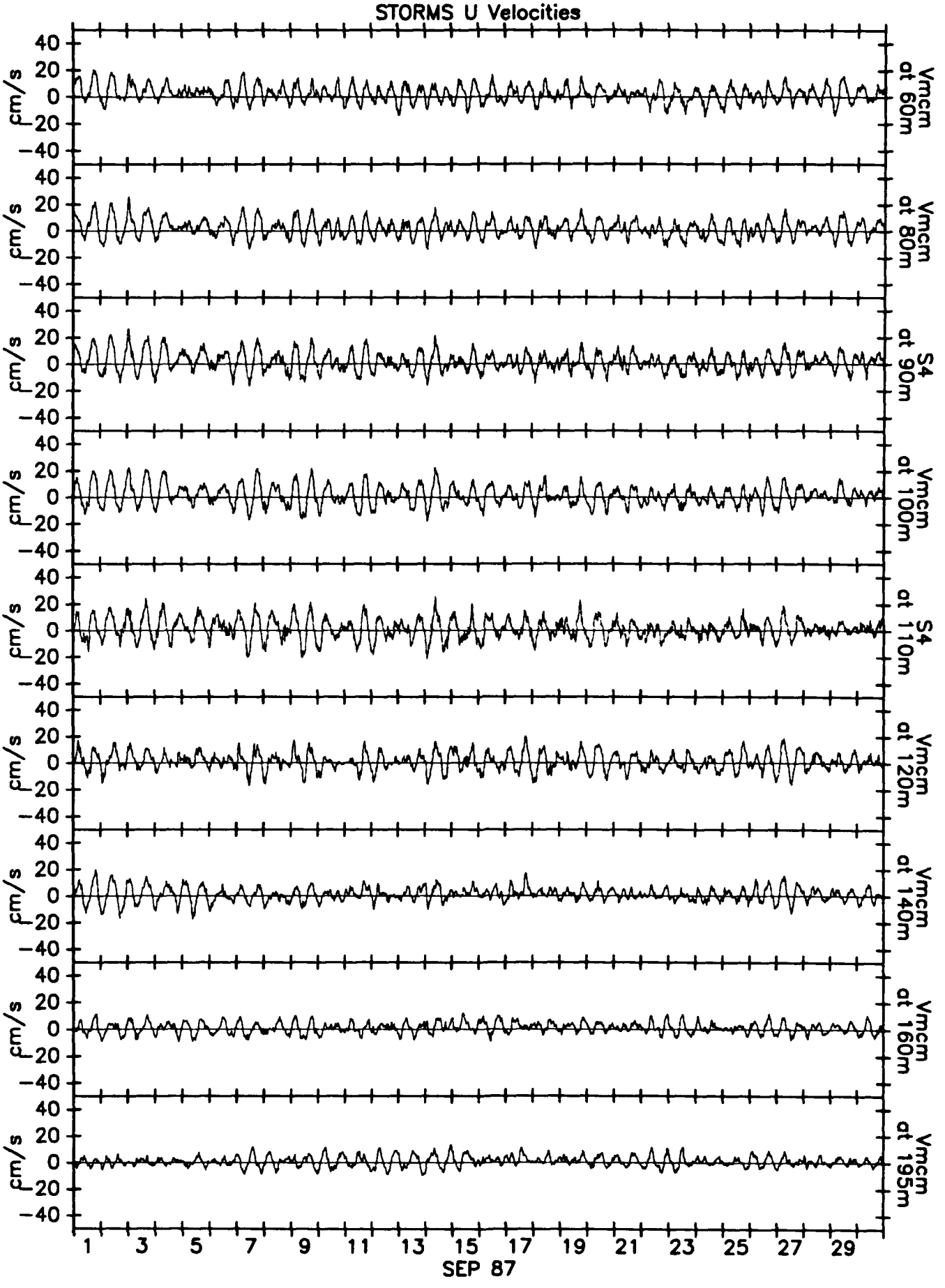

STORMS V Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

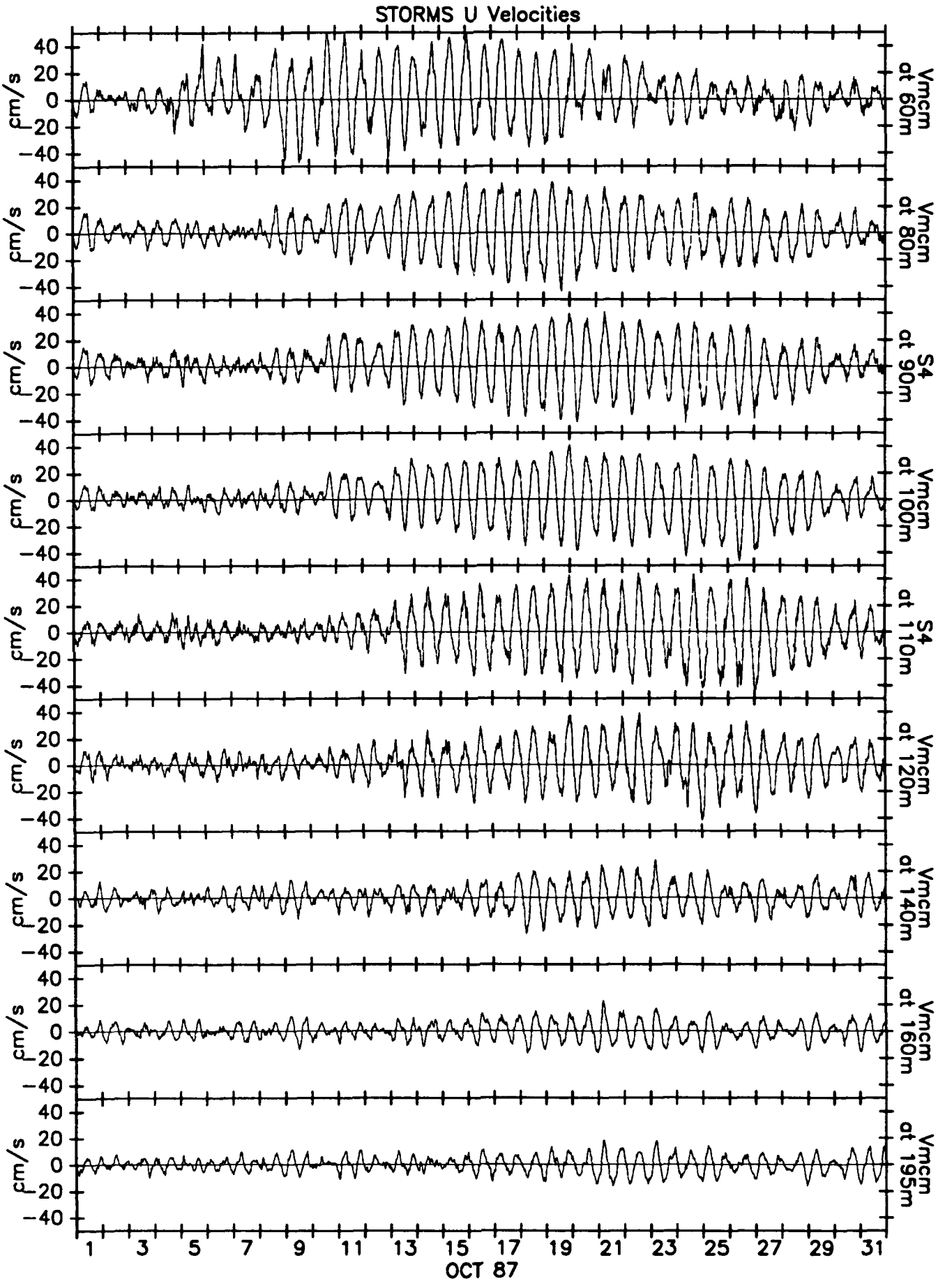

STORMS V Velocities
20
10
0
−10
−20
cm/s
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
87
88

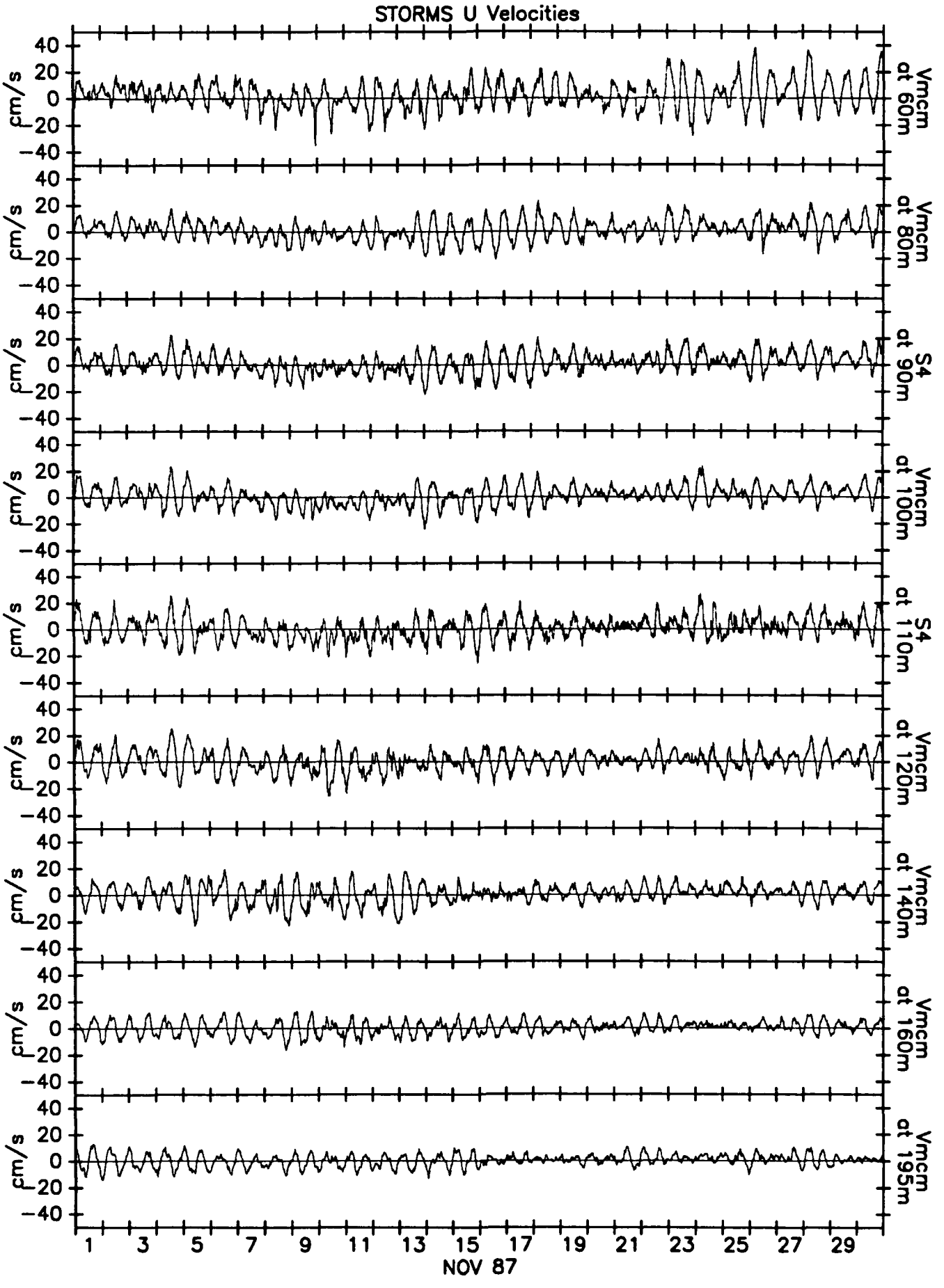
TIME SERIES OF VELOCITY: UNFILTERED

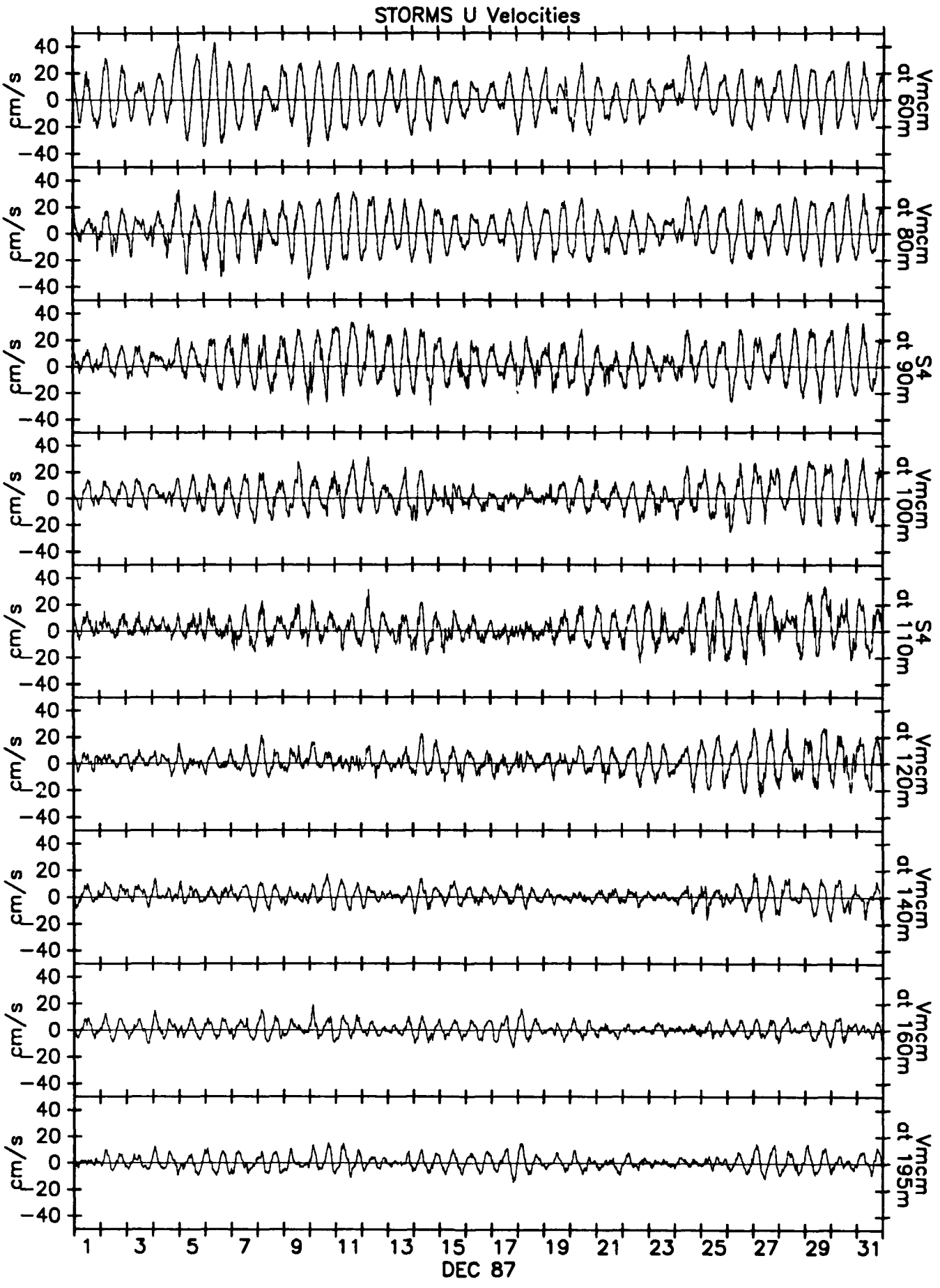
On the following 44 pages are the u and v components of velocity from VMCMs at 60, 80, 100, 120, 140, 160, and 195 m; S-4s at 90 and 110 m; and RCM-5s at 500, 1000, 2000, 3000 and 4000 m. One month is plotted per page. Sampling interval is 15 minutes for VMCMs, 12 minutes for S-4s and 1 hour for RCM-5s. Note that the velocity scale changes by a factor of one-half for observations deeper than 500 m.

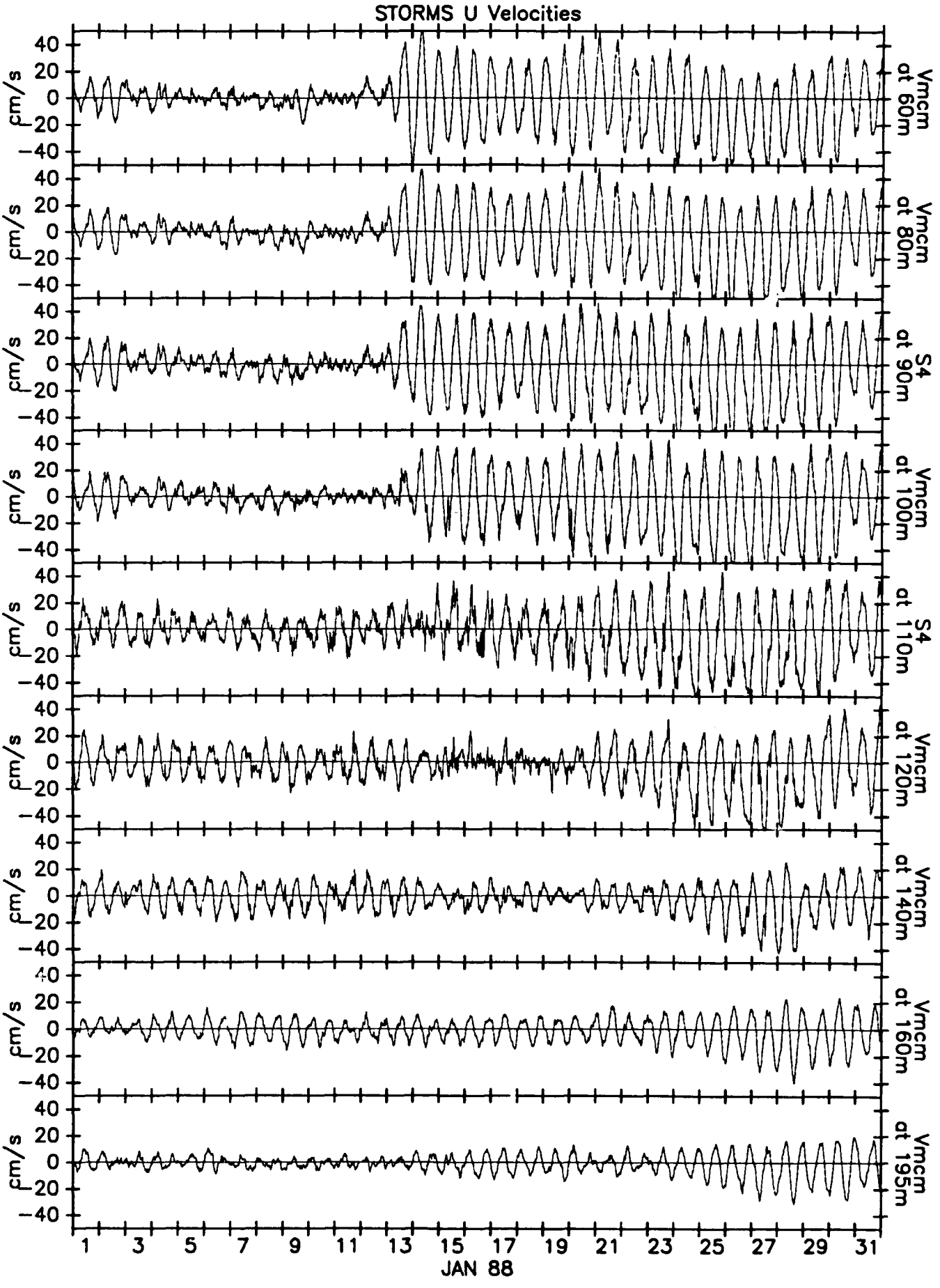

STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87

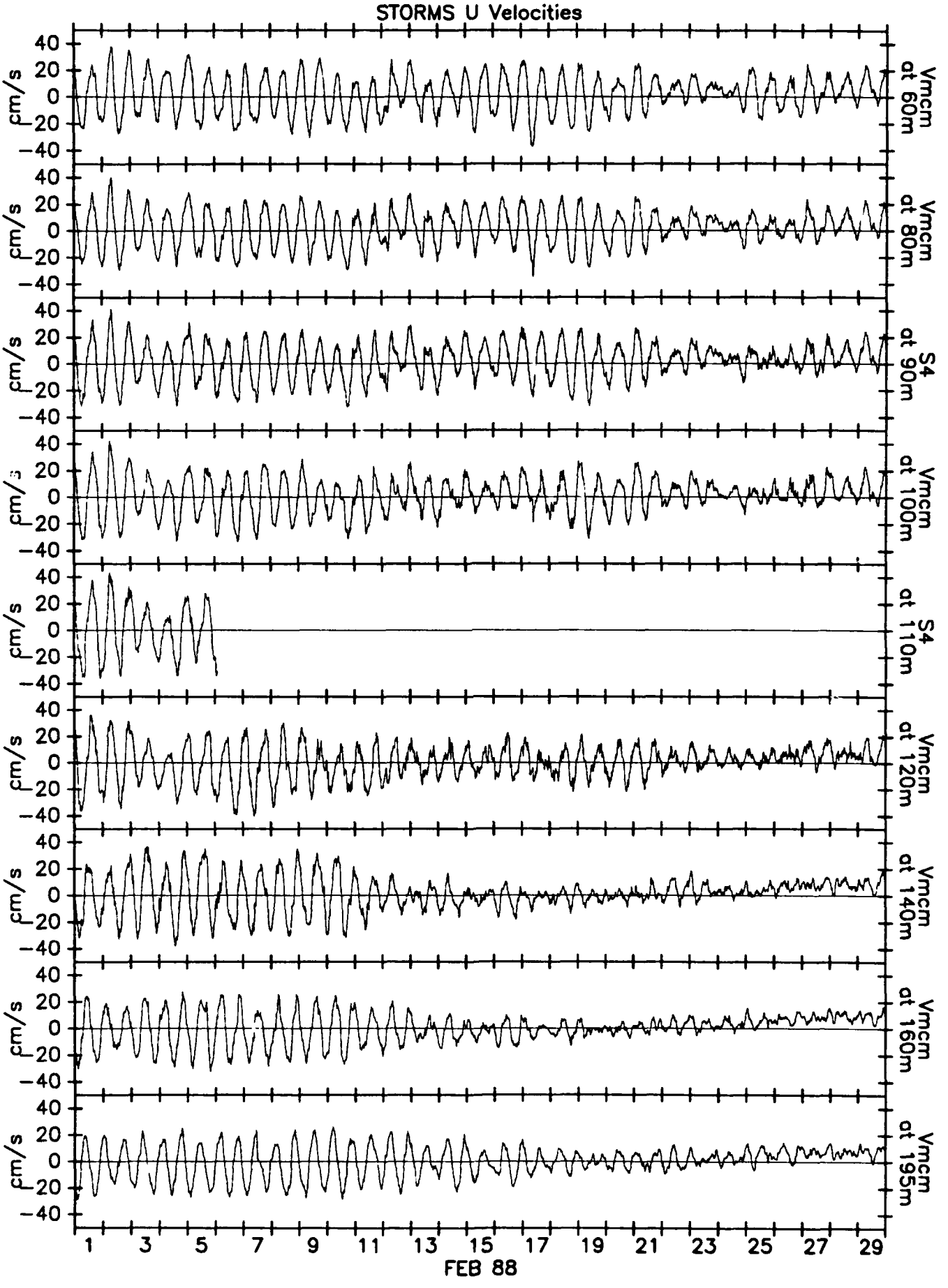

STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
SEP 87


STORMS U Velocities
cm/s
40
20
0
−20
−40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
NOV 87


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
DEC 87


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
JAN 88


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1
3
5
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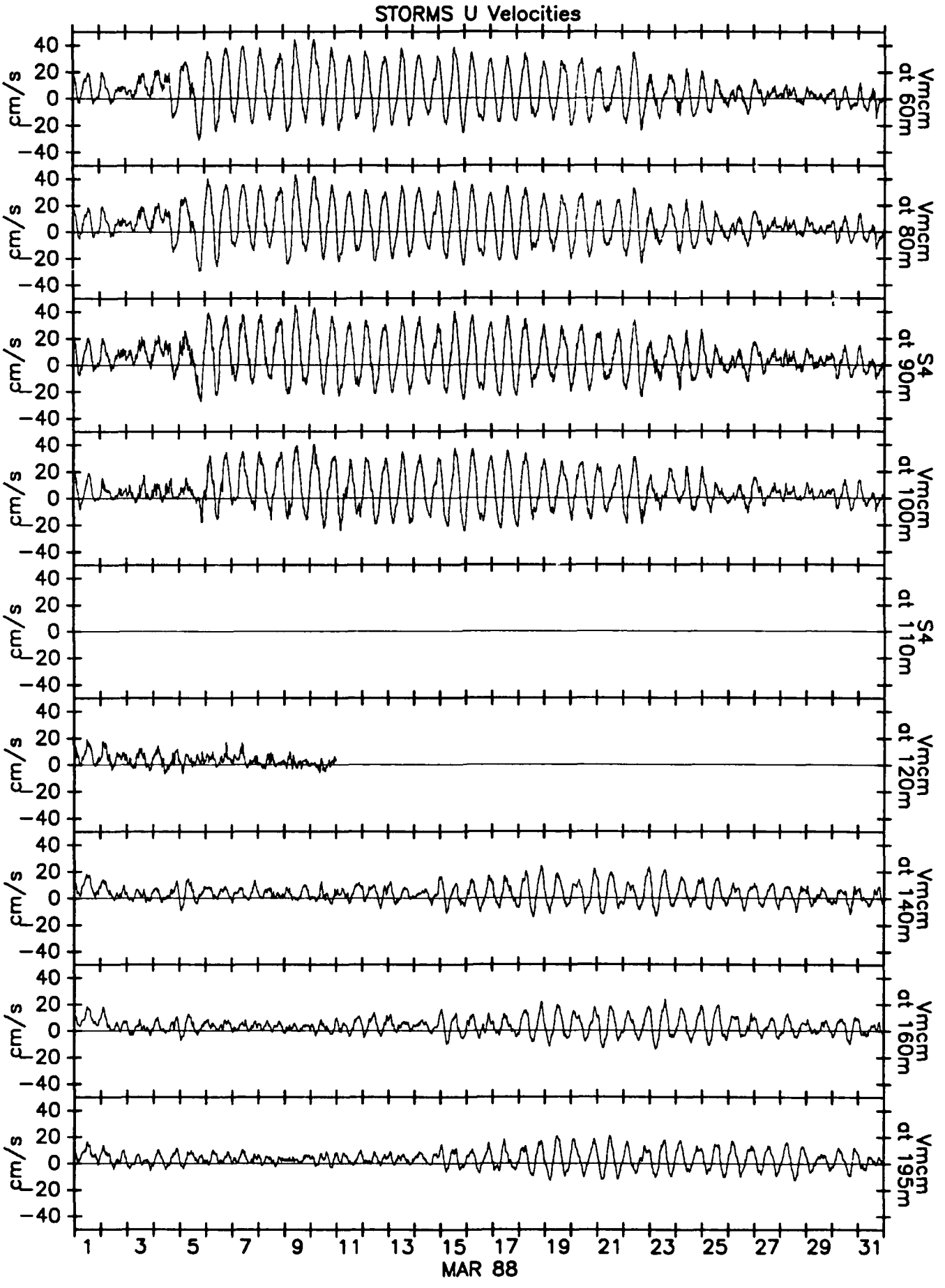
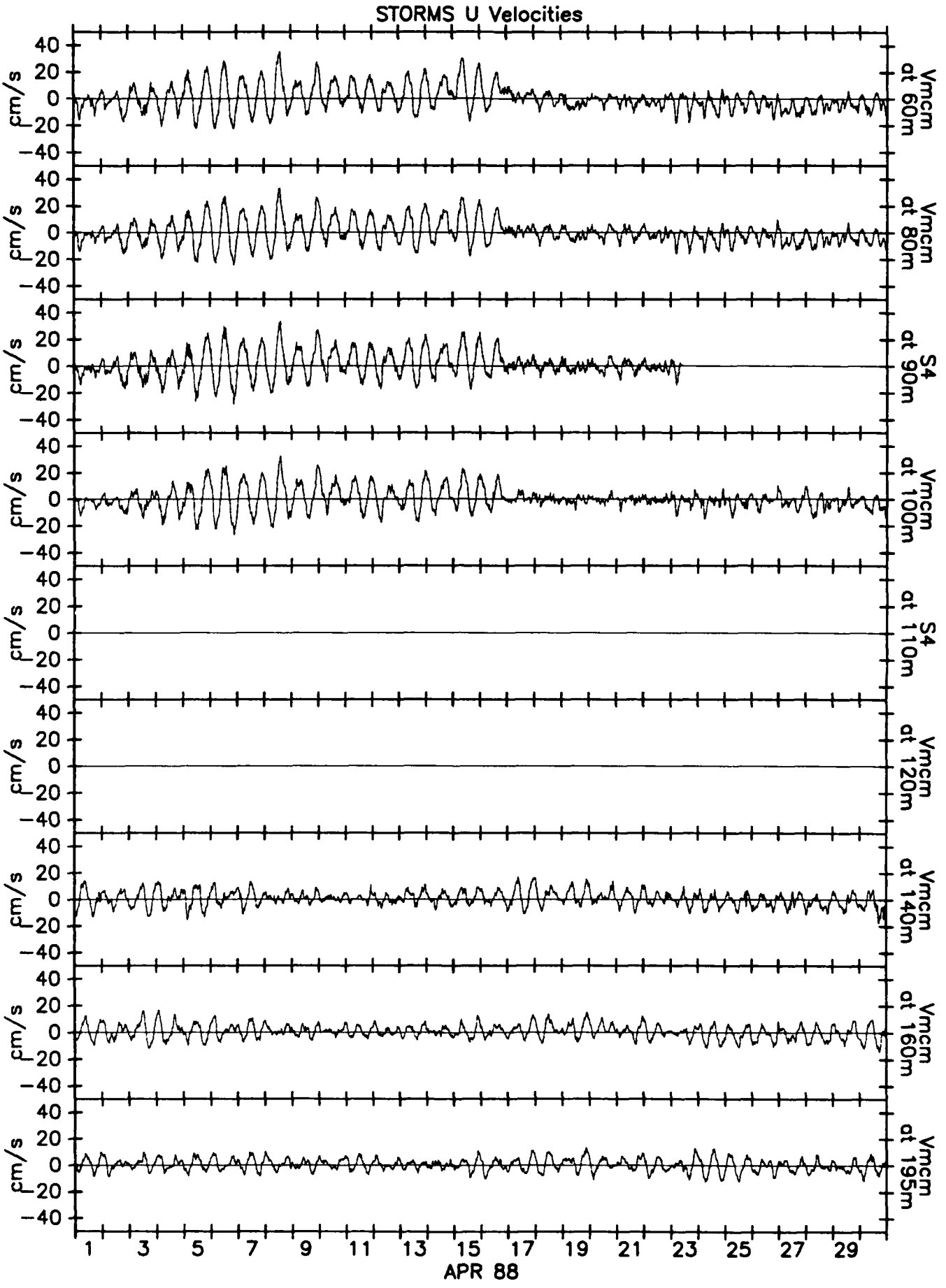
17
19
21
23
25
27
29
FEB 88


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAR 88


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1
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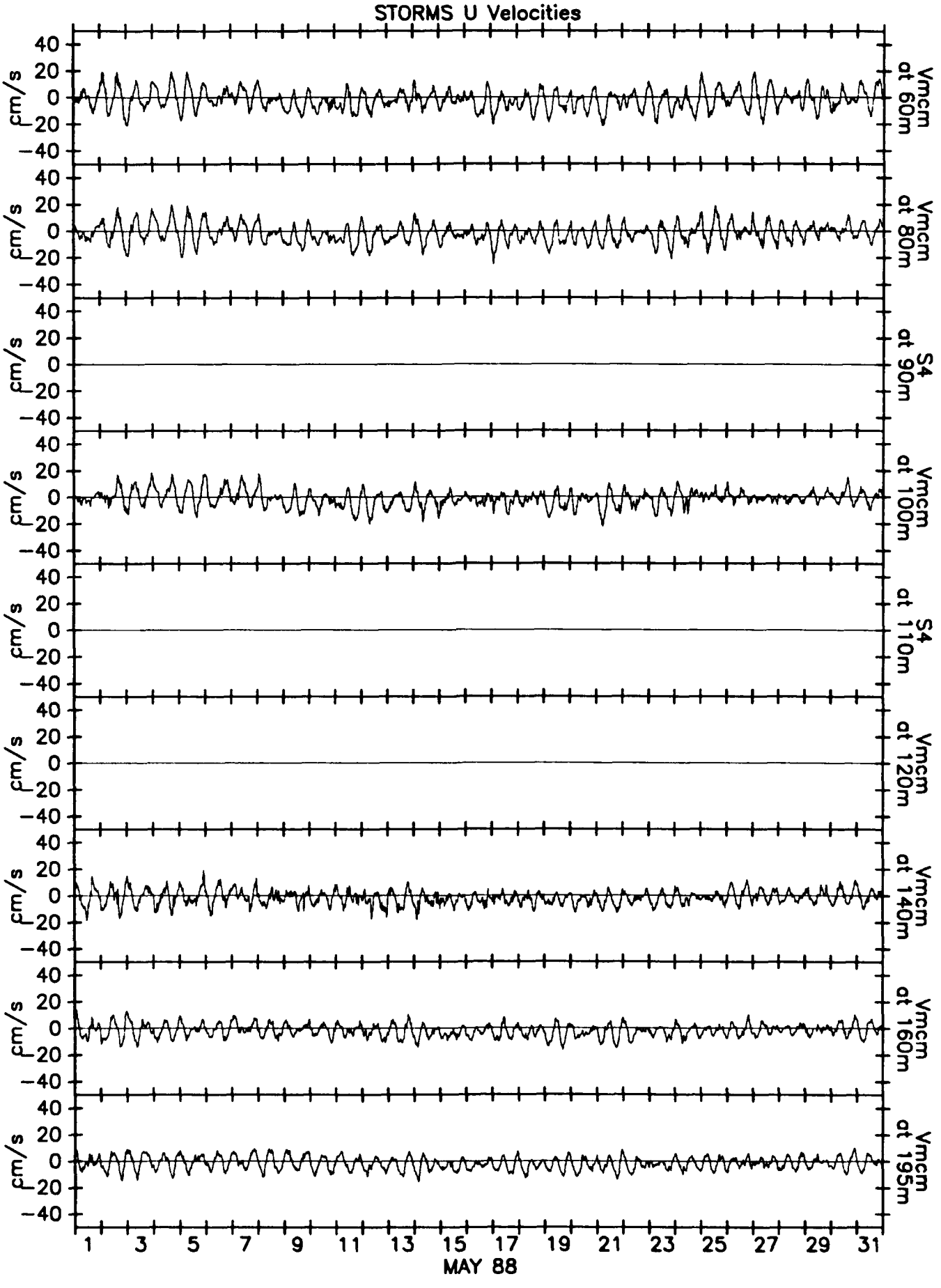
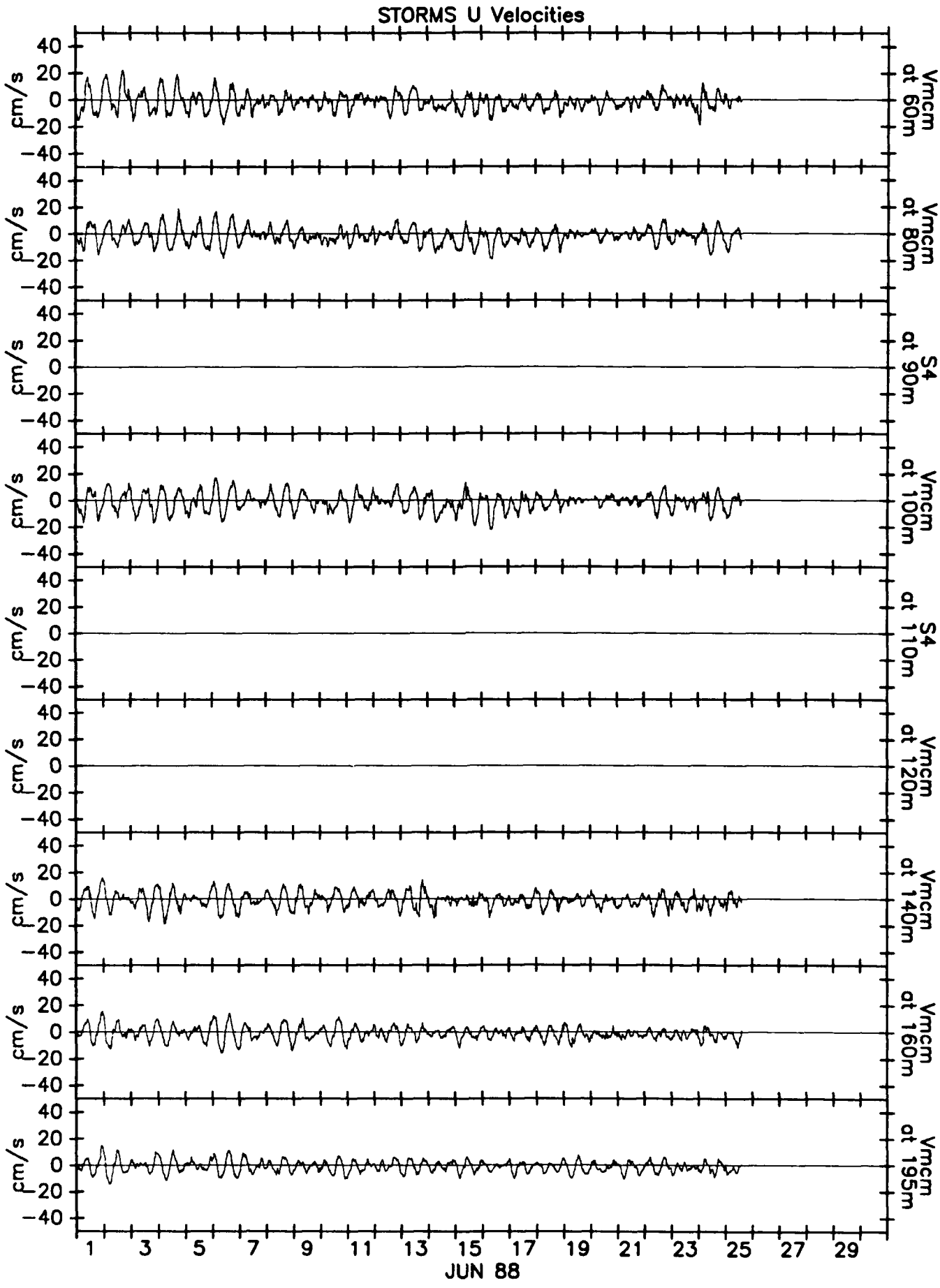
29
APR 88


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88


STORMS U Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1
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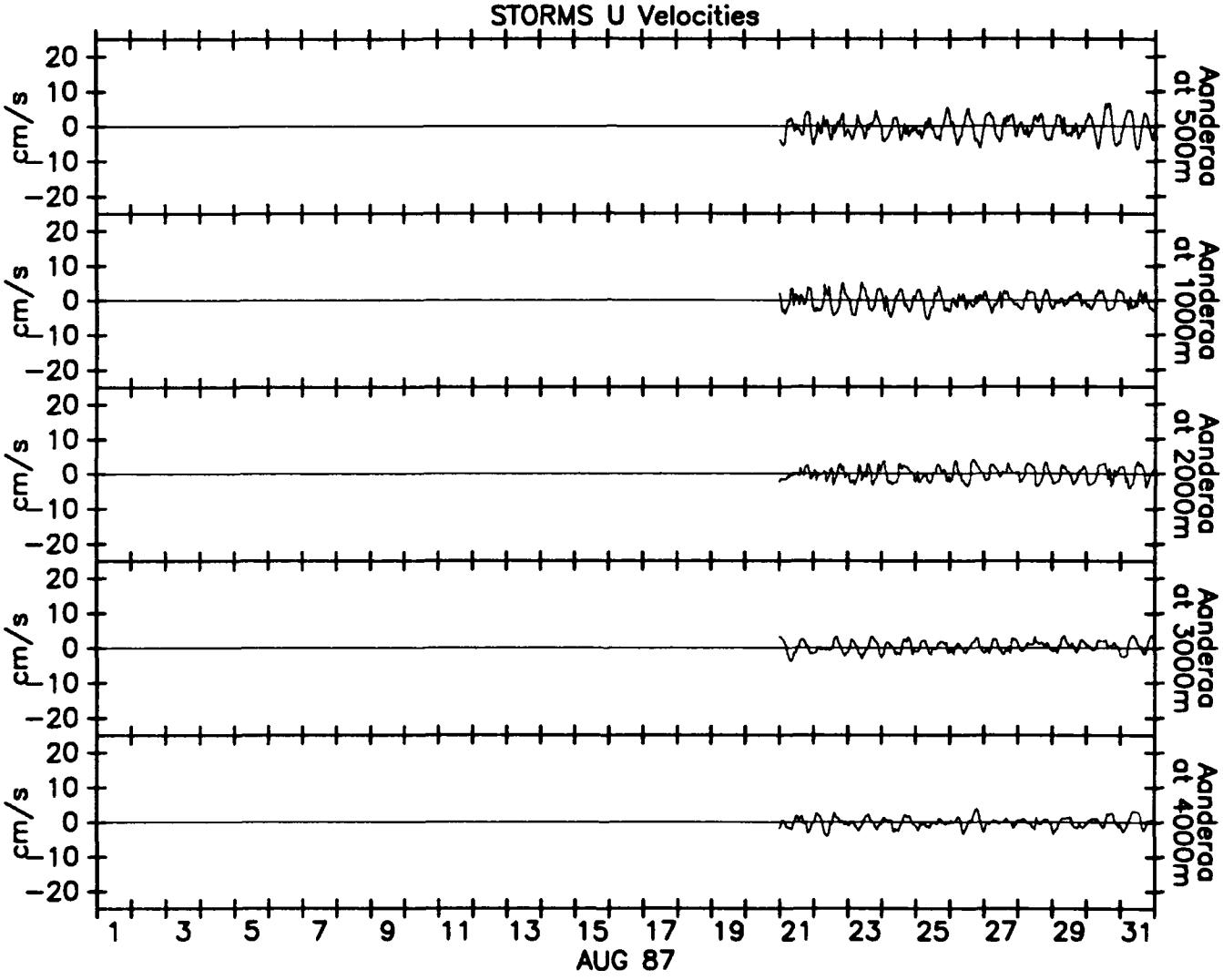
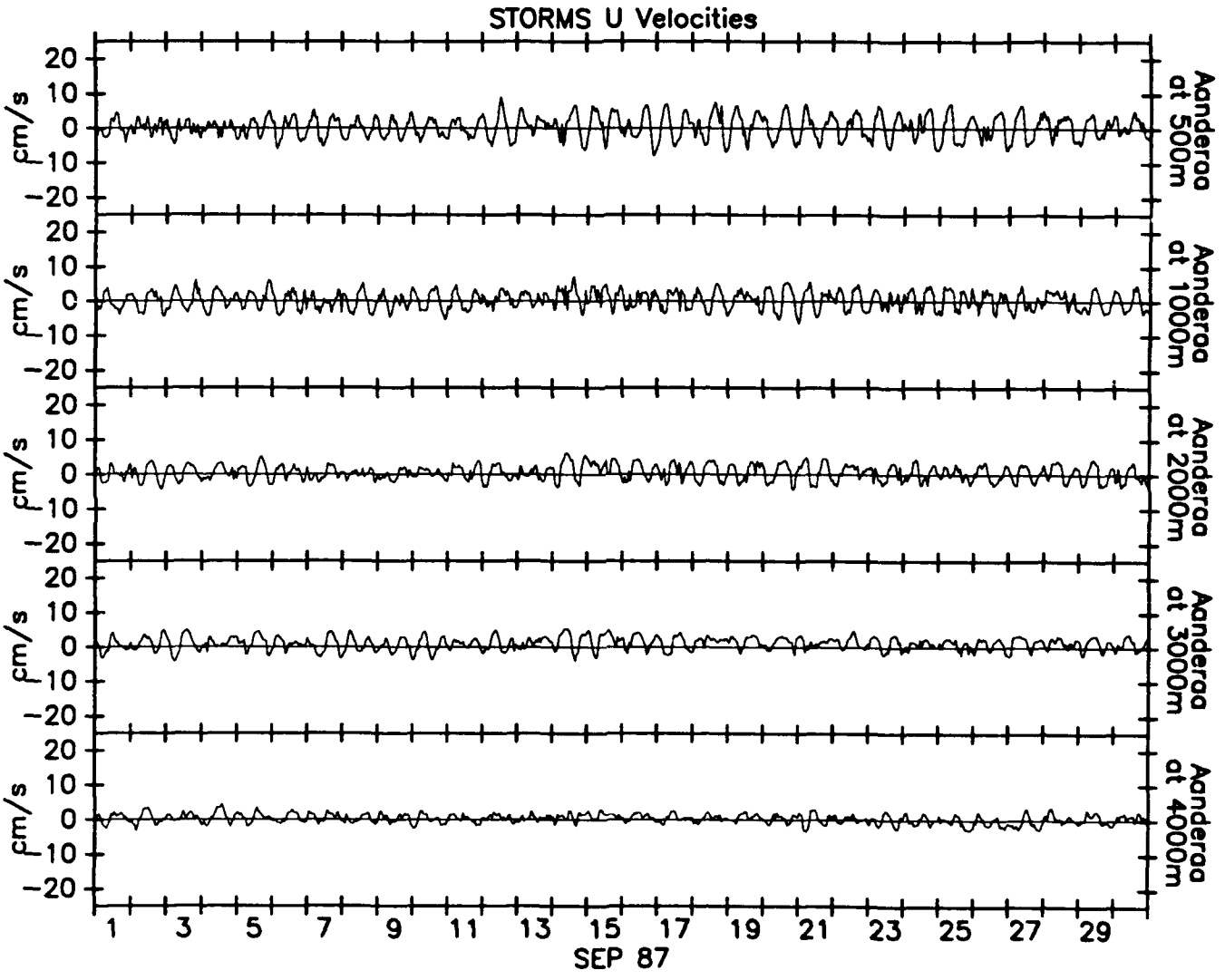
JUN 88


STORMS U Velocities
20
10
0
−10
−20
cm/s
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87


STORMS U Velocities
20
10
0
-10
-20
cm/s
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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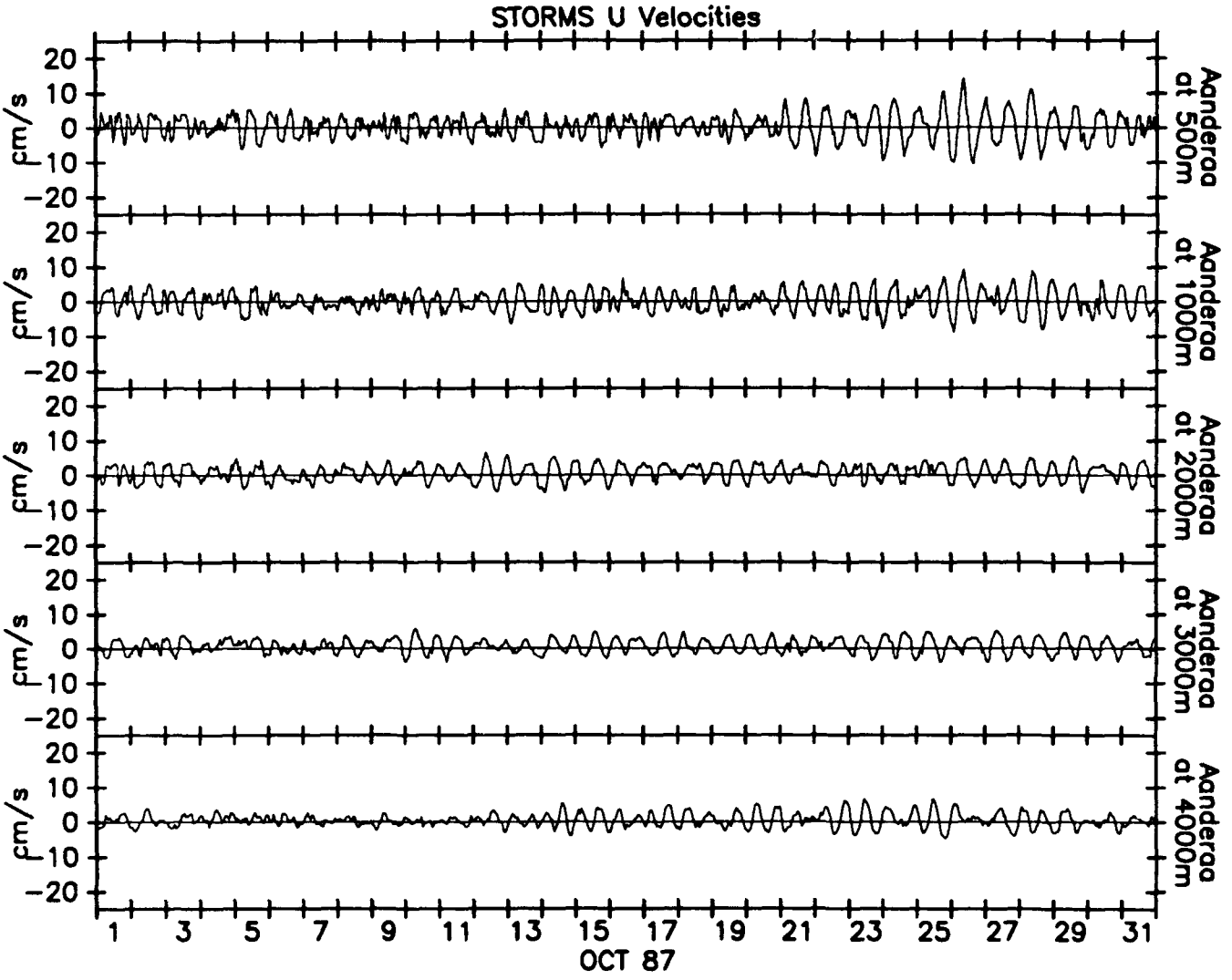
29
SEP 87


STORMS U Velocities
cm/s
20
10
0
−10
−20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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27
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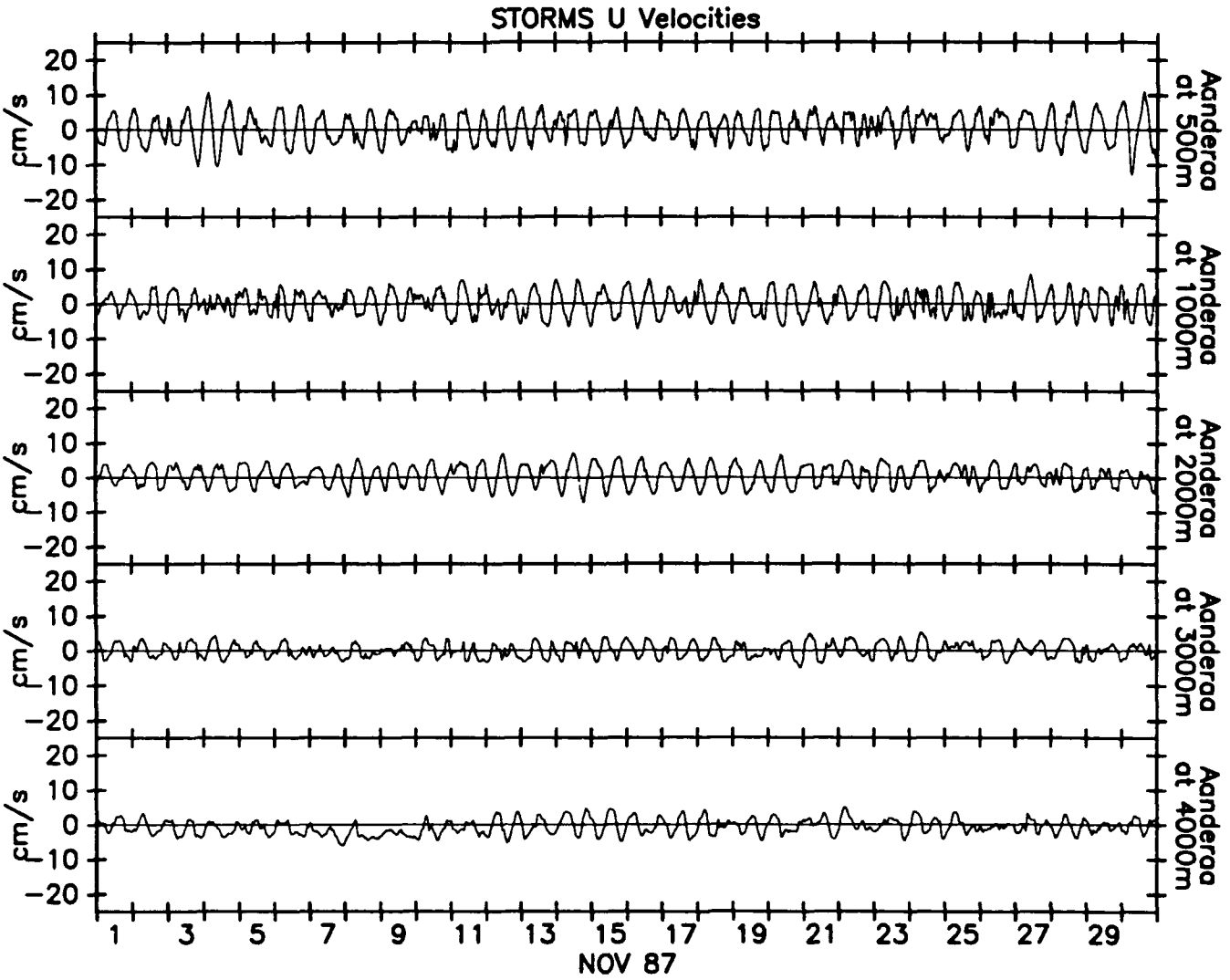
31
OCT 87


STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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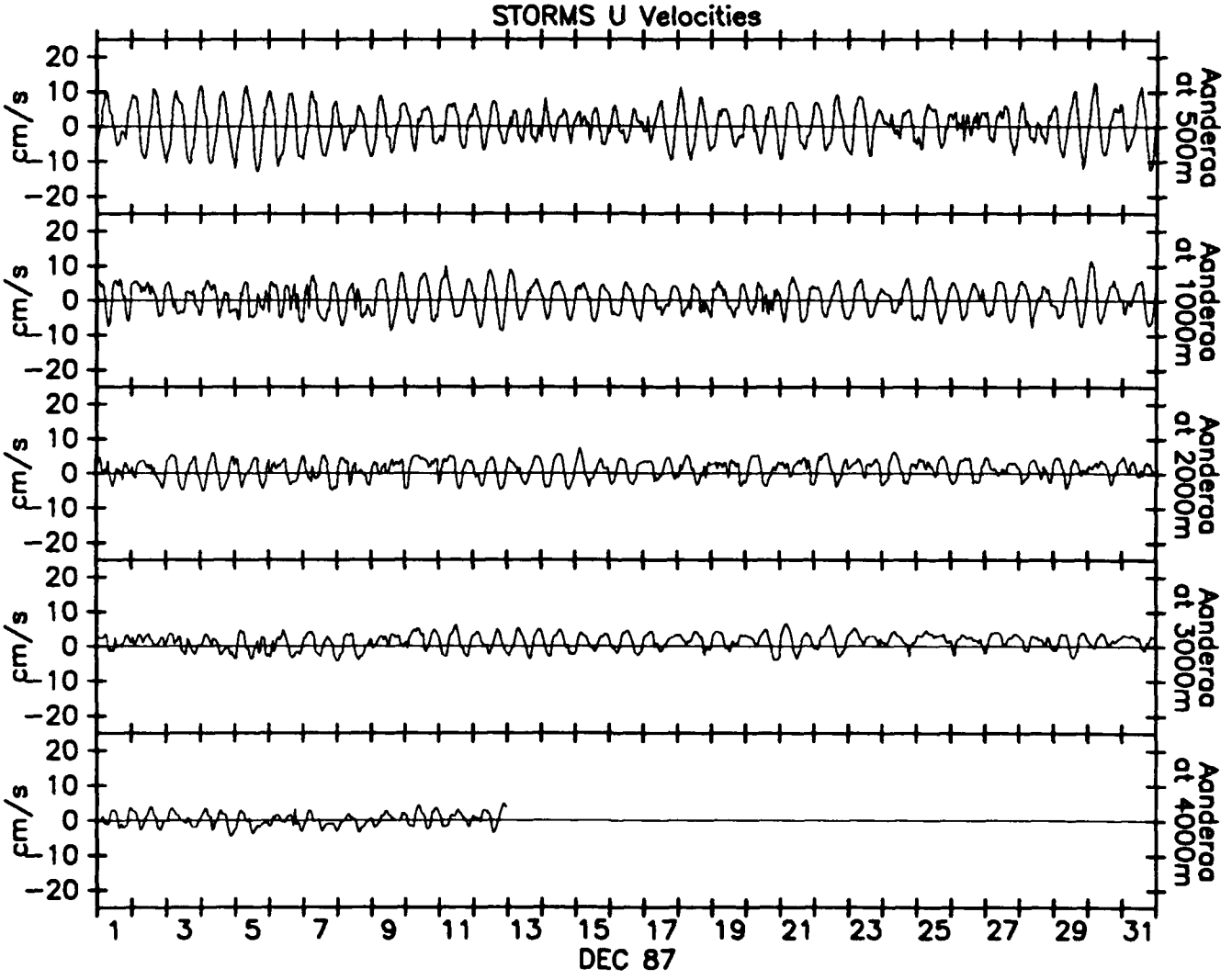
NOV 87


STORMS U Velocities
cm/s
20
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0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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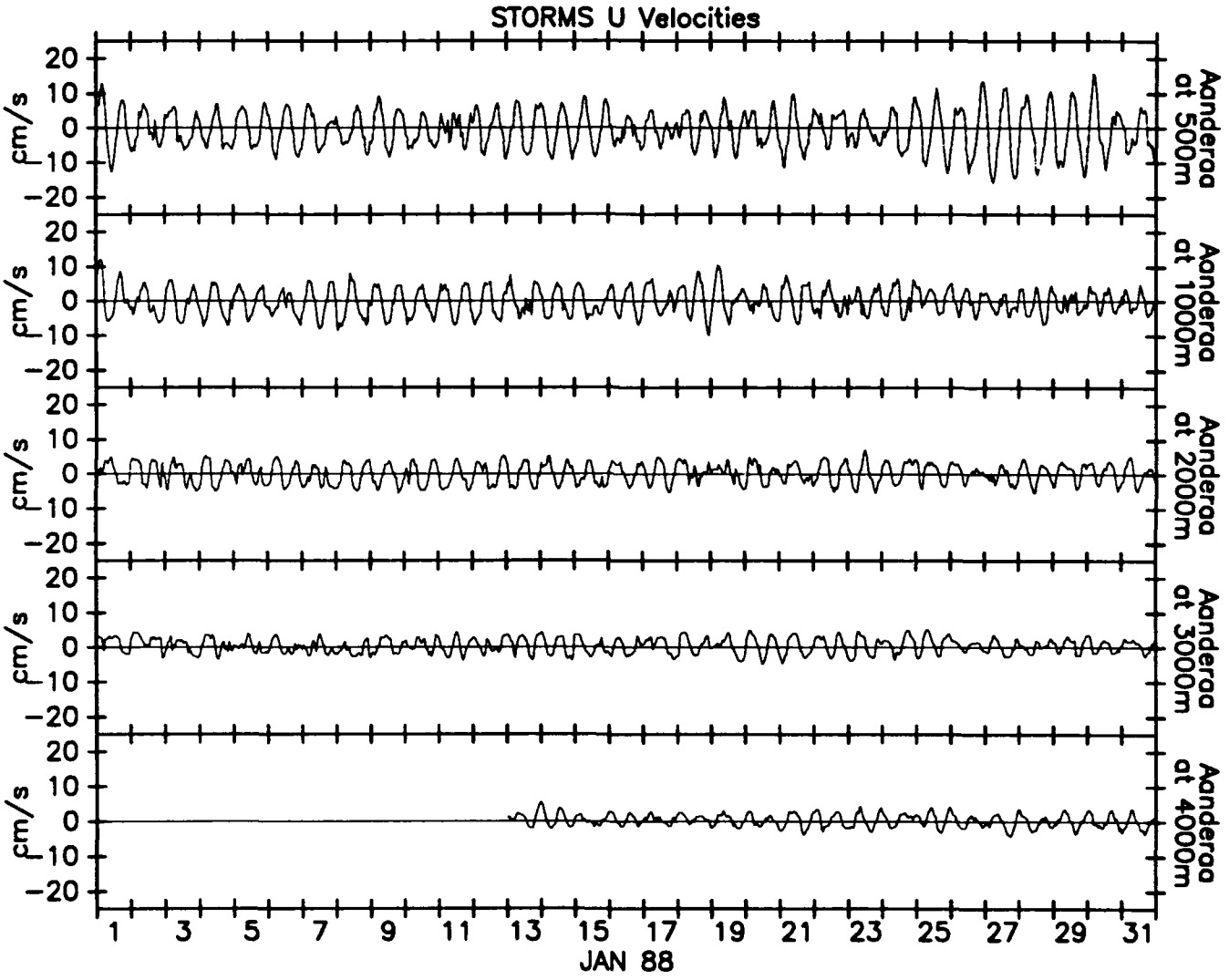
DEC 87


STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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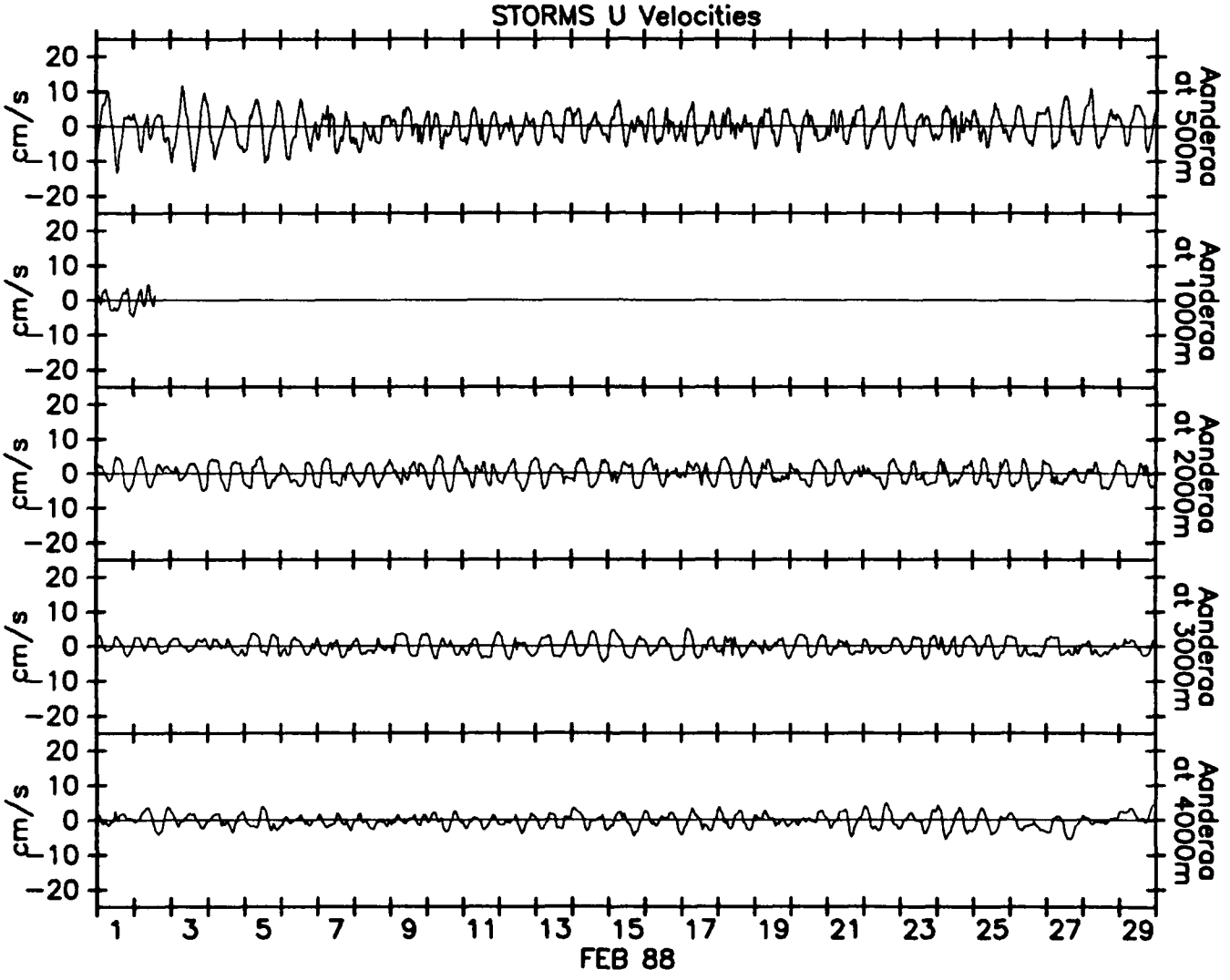
21
23
25
27
29
31
JAN 88


STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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17
19
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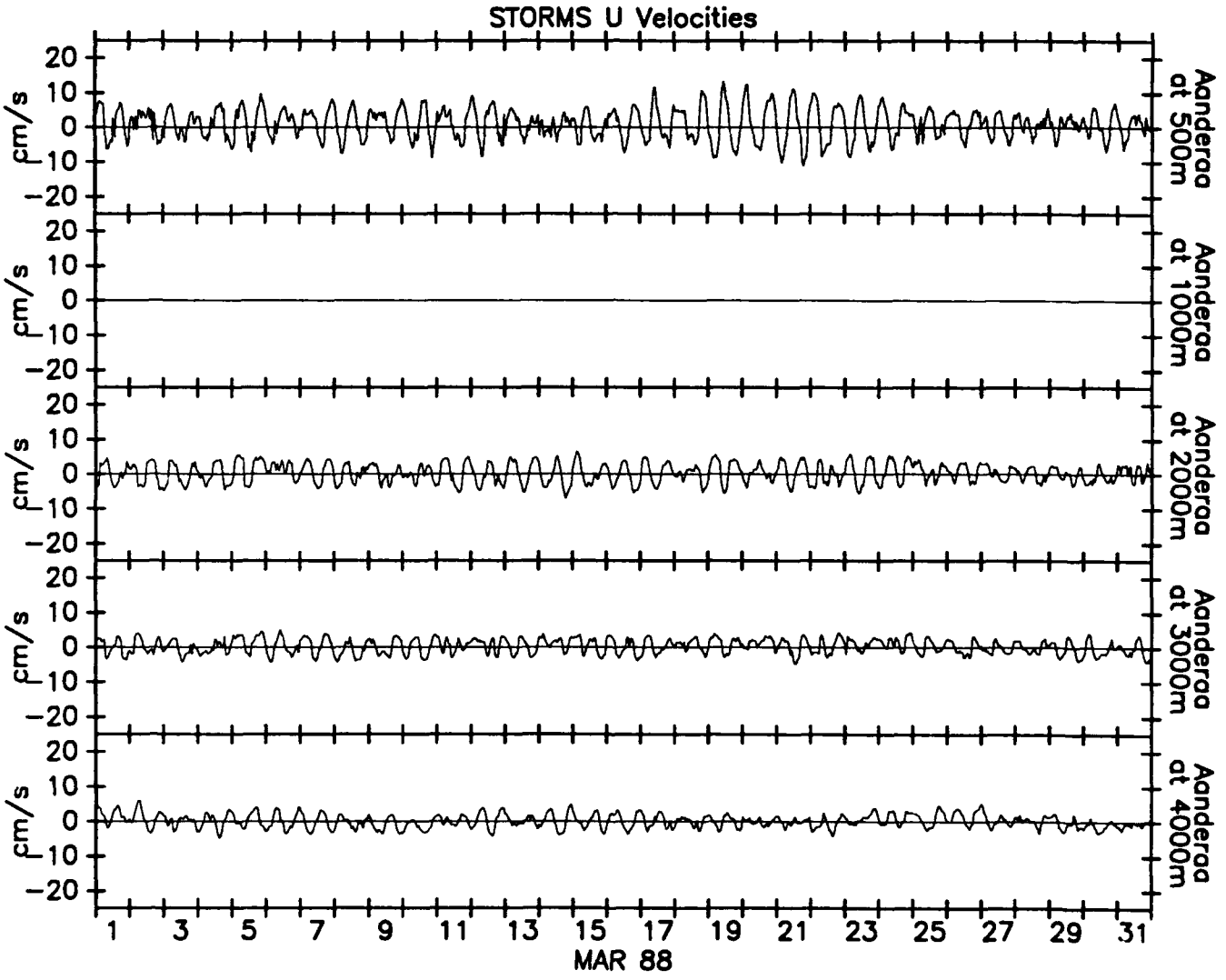
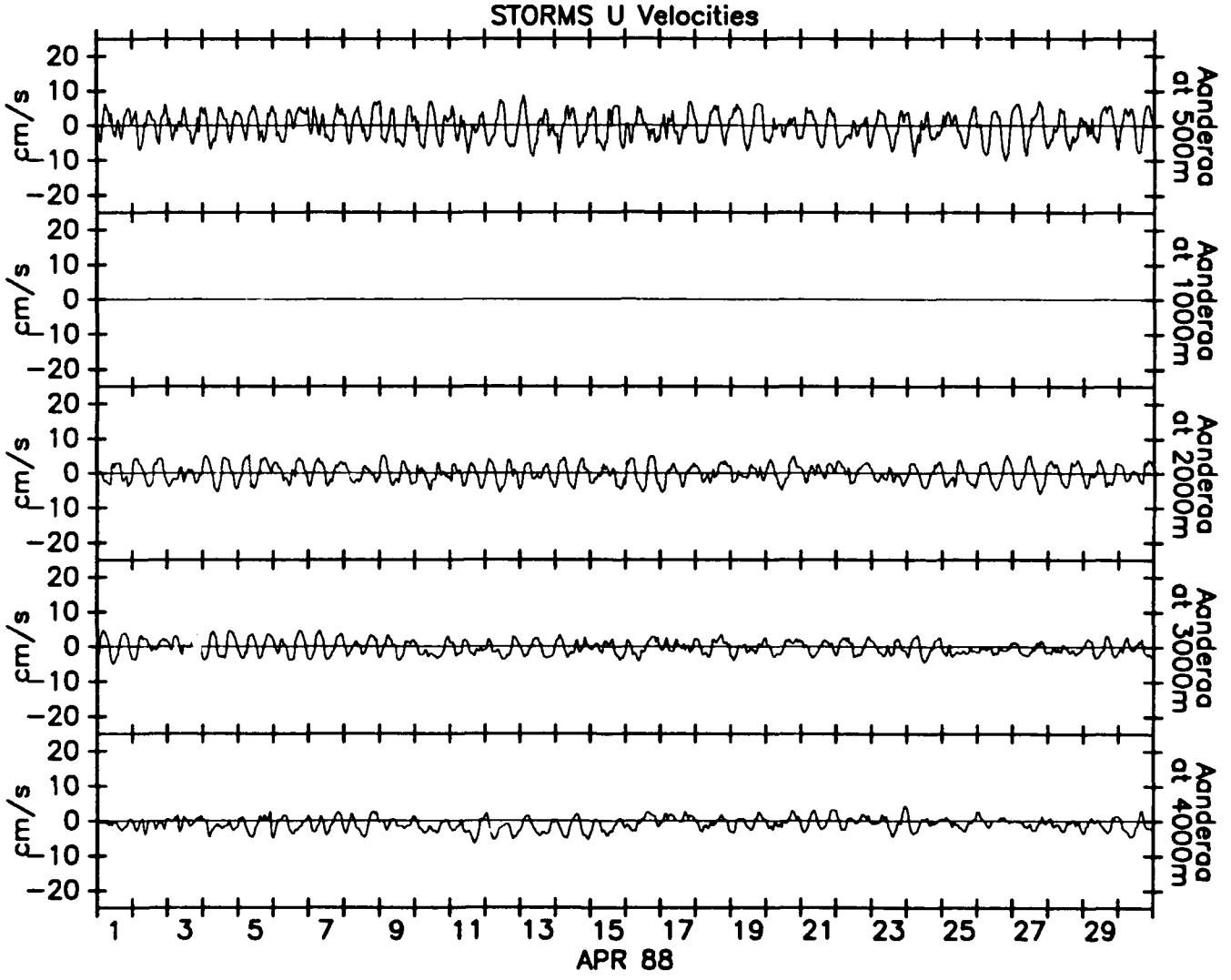
23
25
27
29
FEB 88


STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
MAR 88


STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
1
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9
11
13
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19
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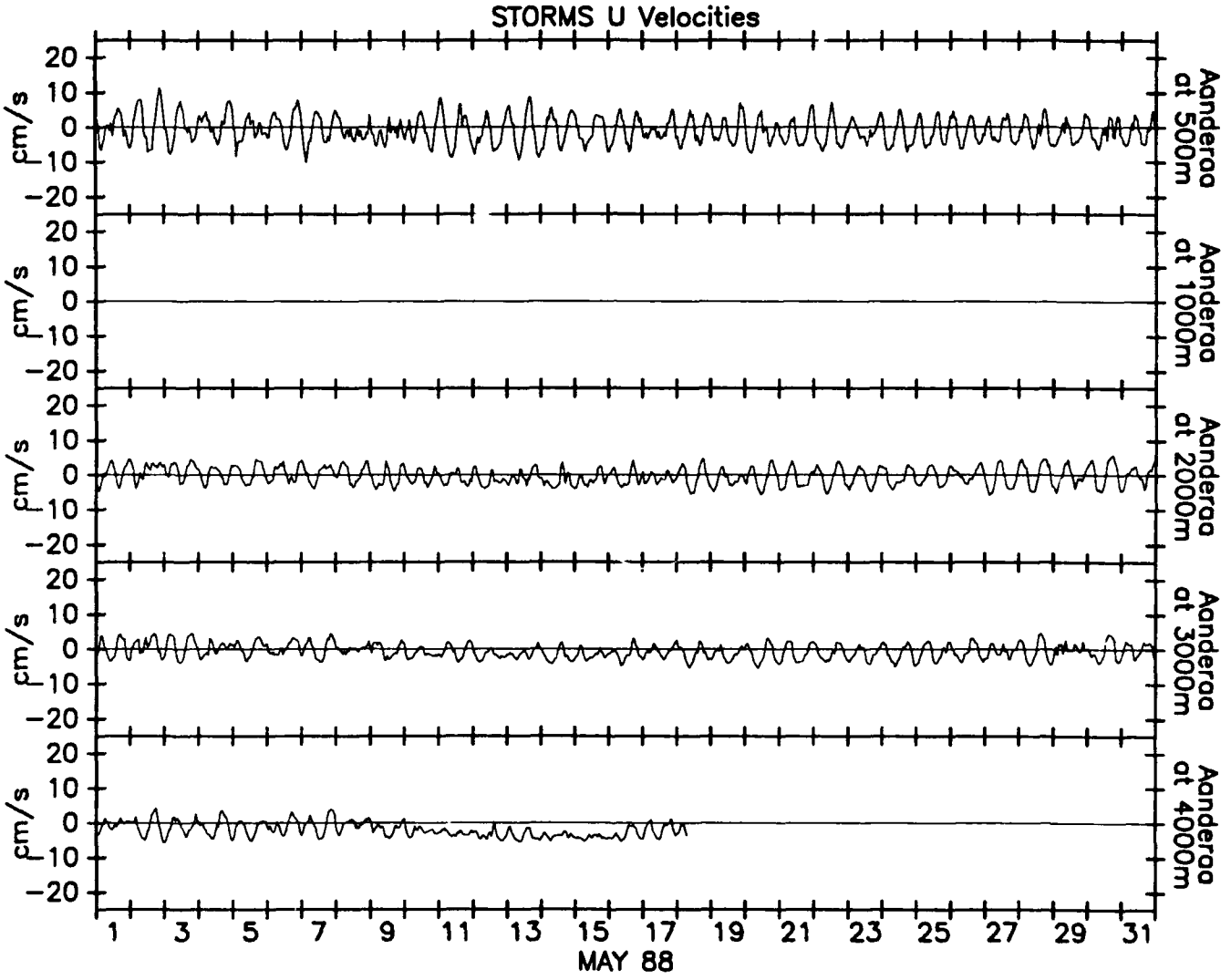
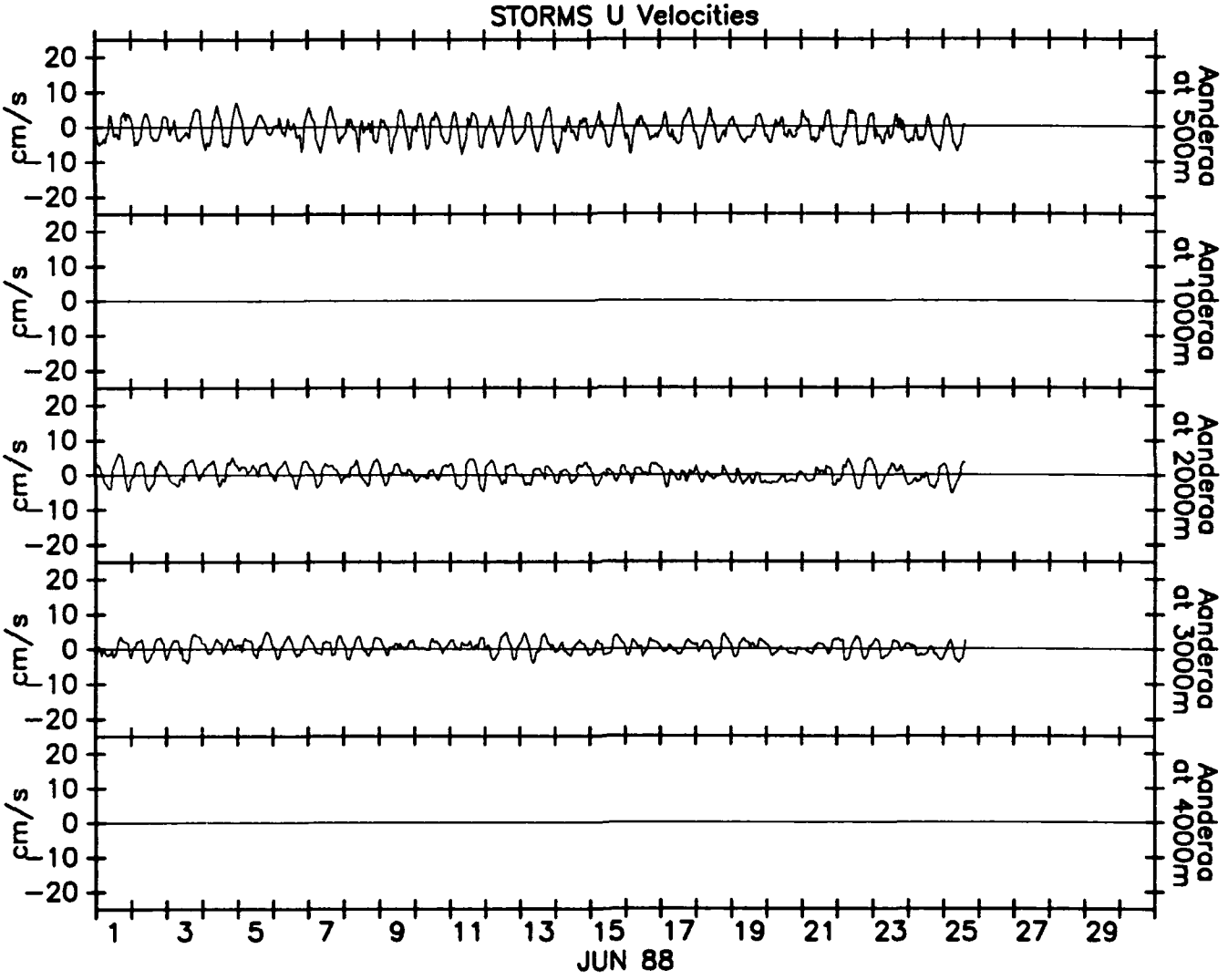
25
27
29
APR 88


STORMS U Velocities
cm/s
20
10
0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88


STORMS U Velocities
cm/s
20
10
0
−10
−20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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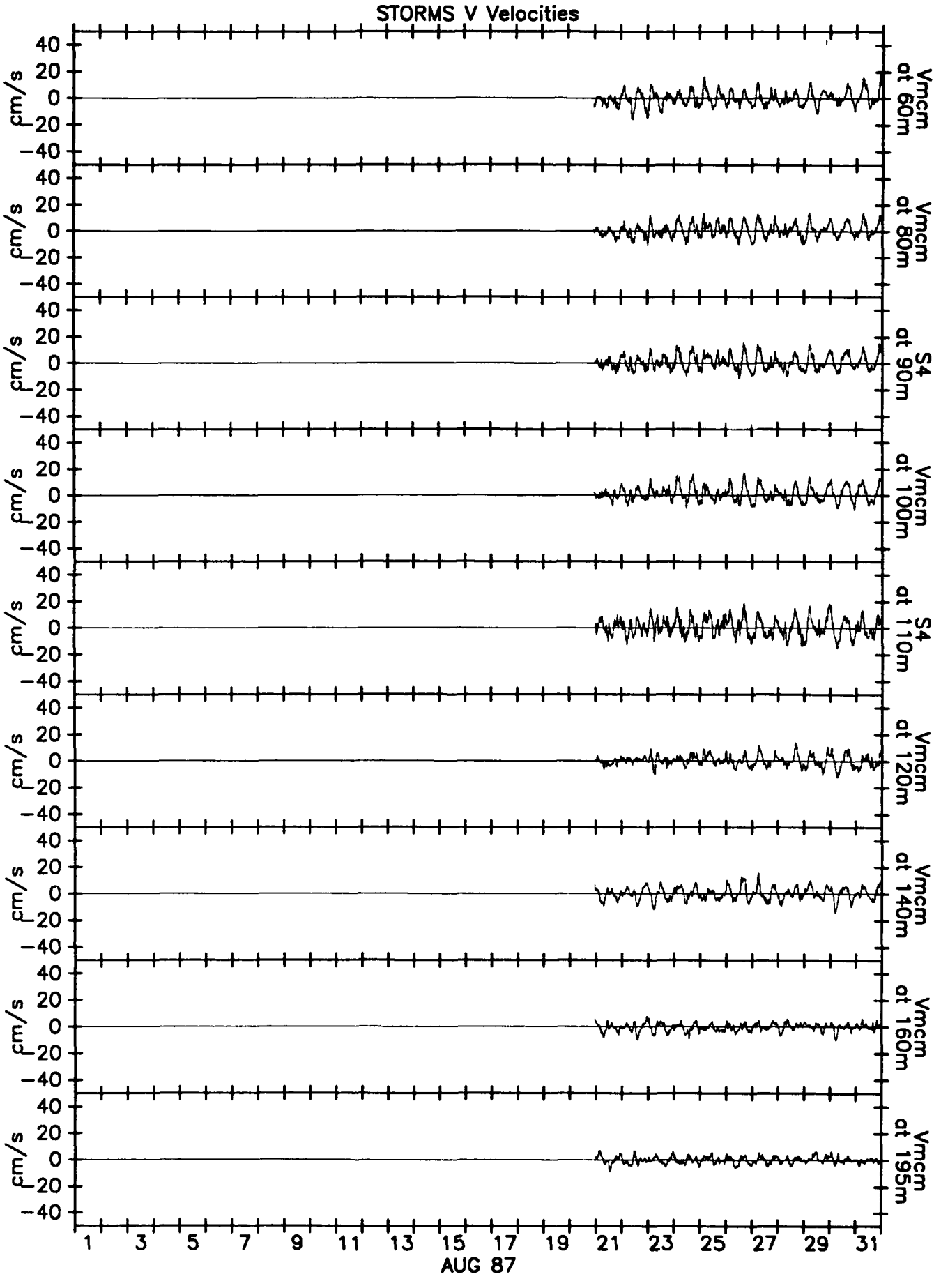
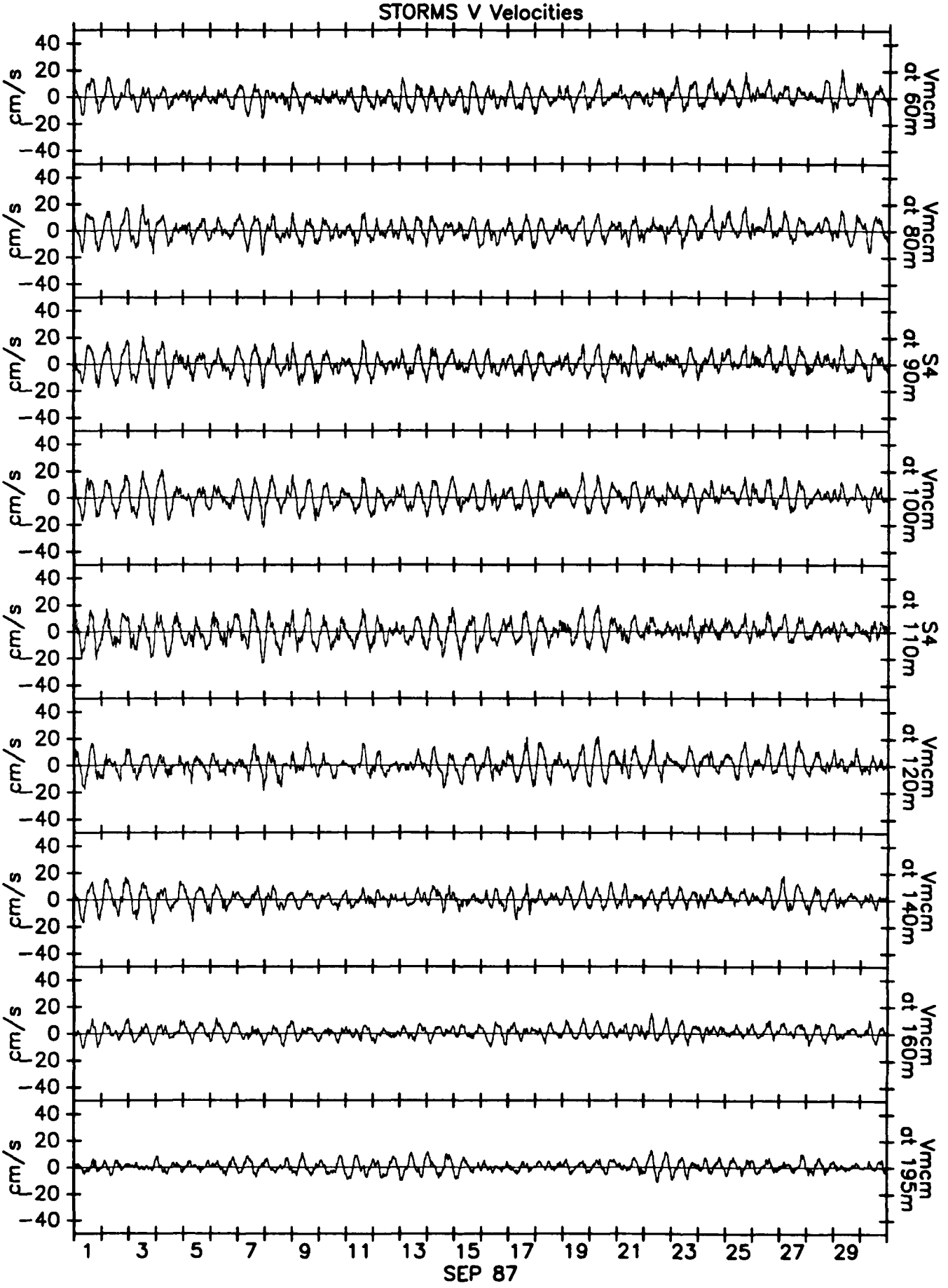
JUN 88


STORMS V Velocities
cm/s
40
20
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87


STORMS V Velocities
40
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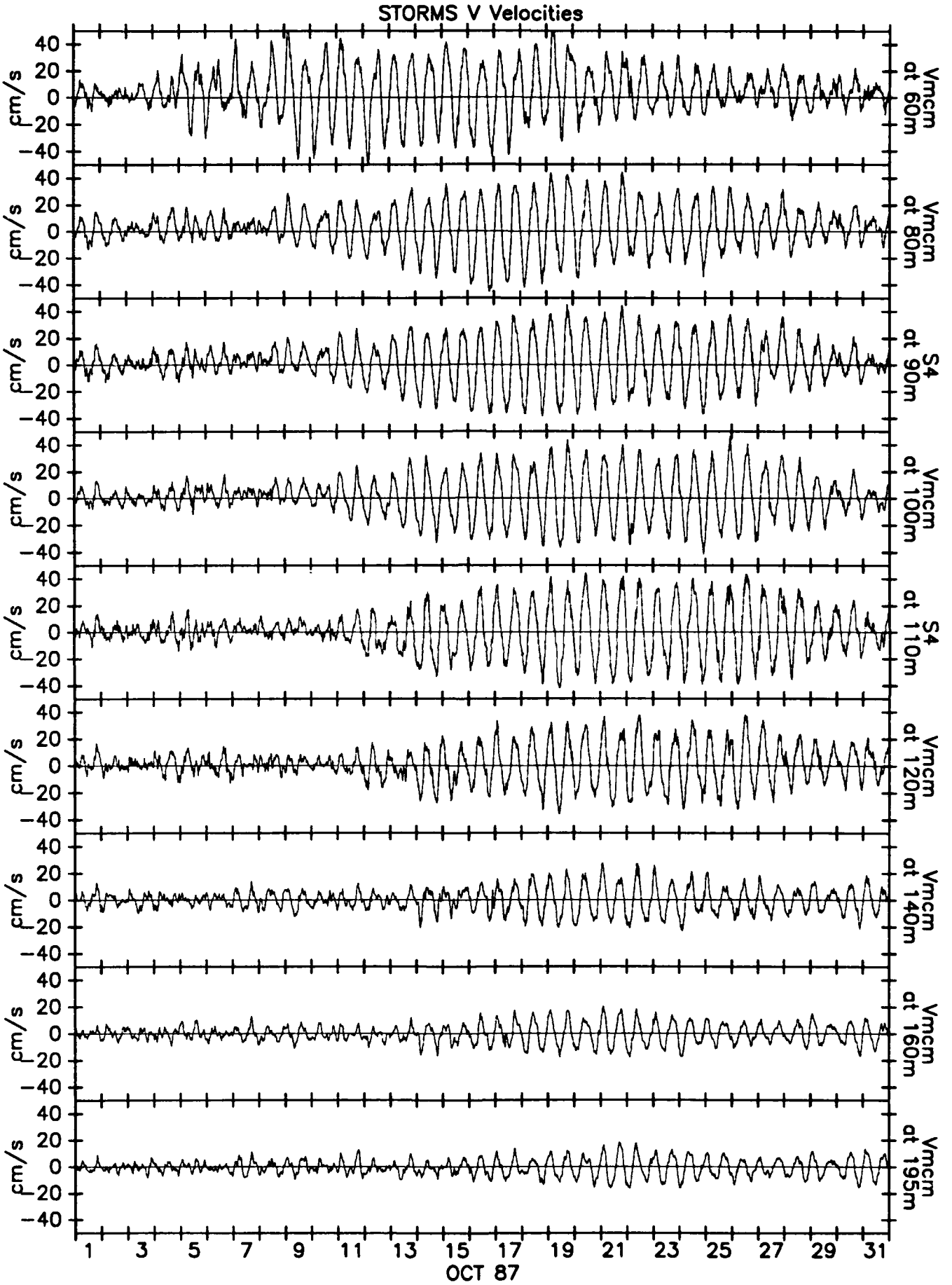
0
-20
-40
cm/s
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
SEP 87


STORMS V Velocities
cm/s
40
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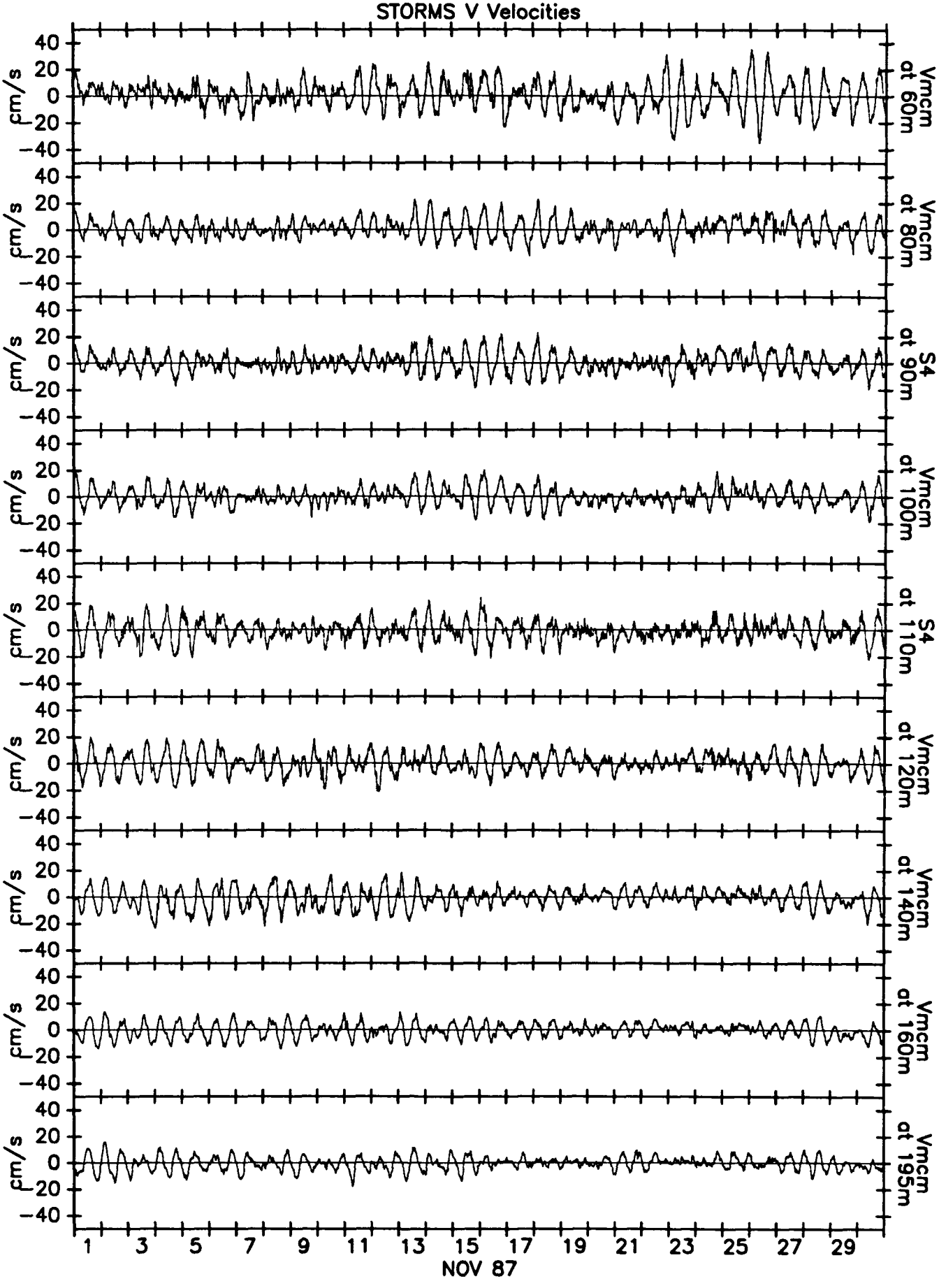
0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87


STORMS V Velocities
cm/s
40
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0
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
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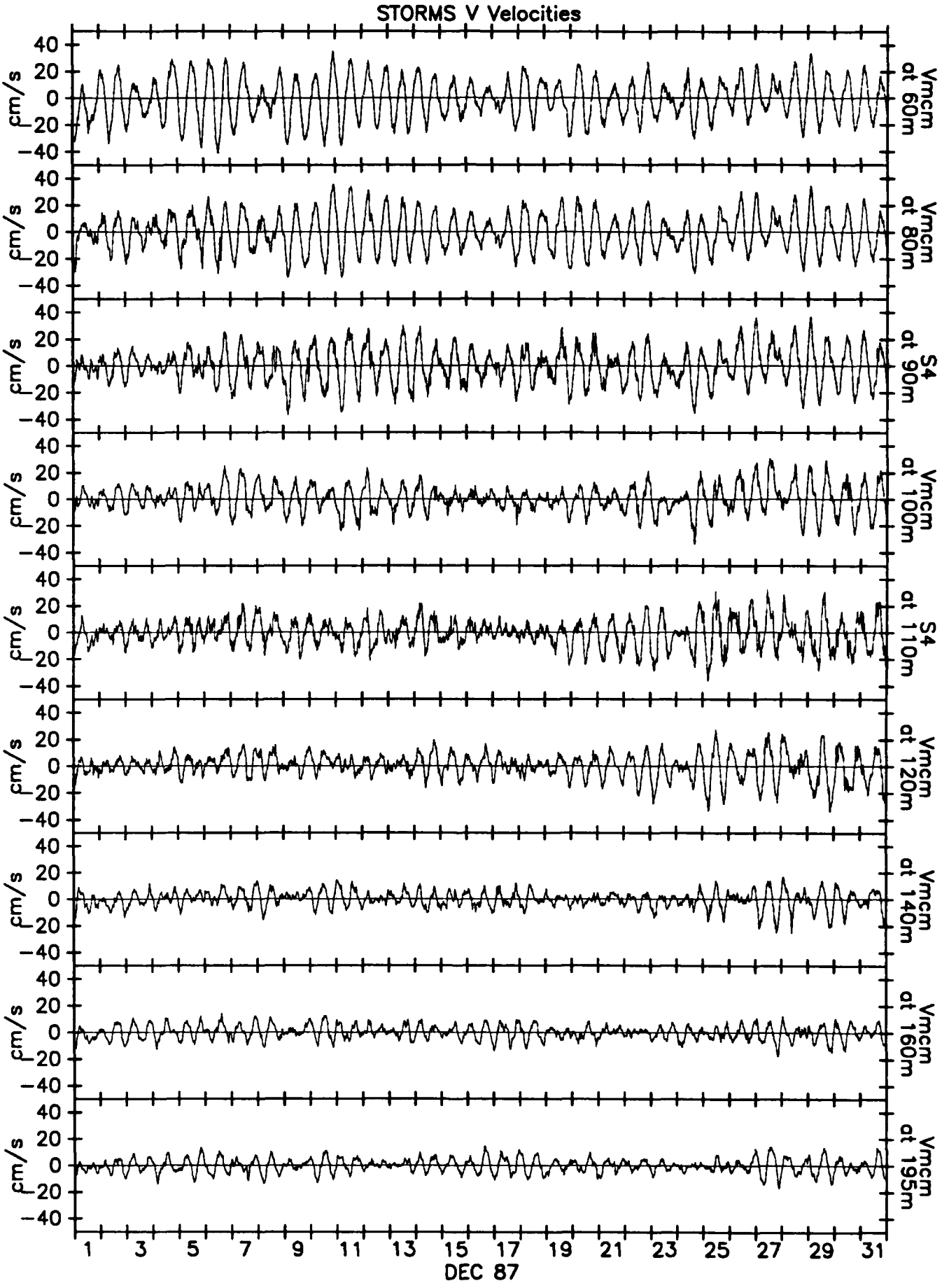
NOV 87


STORMS V Velocities
cm/s
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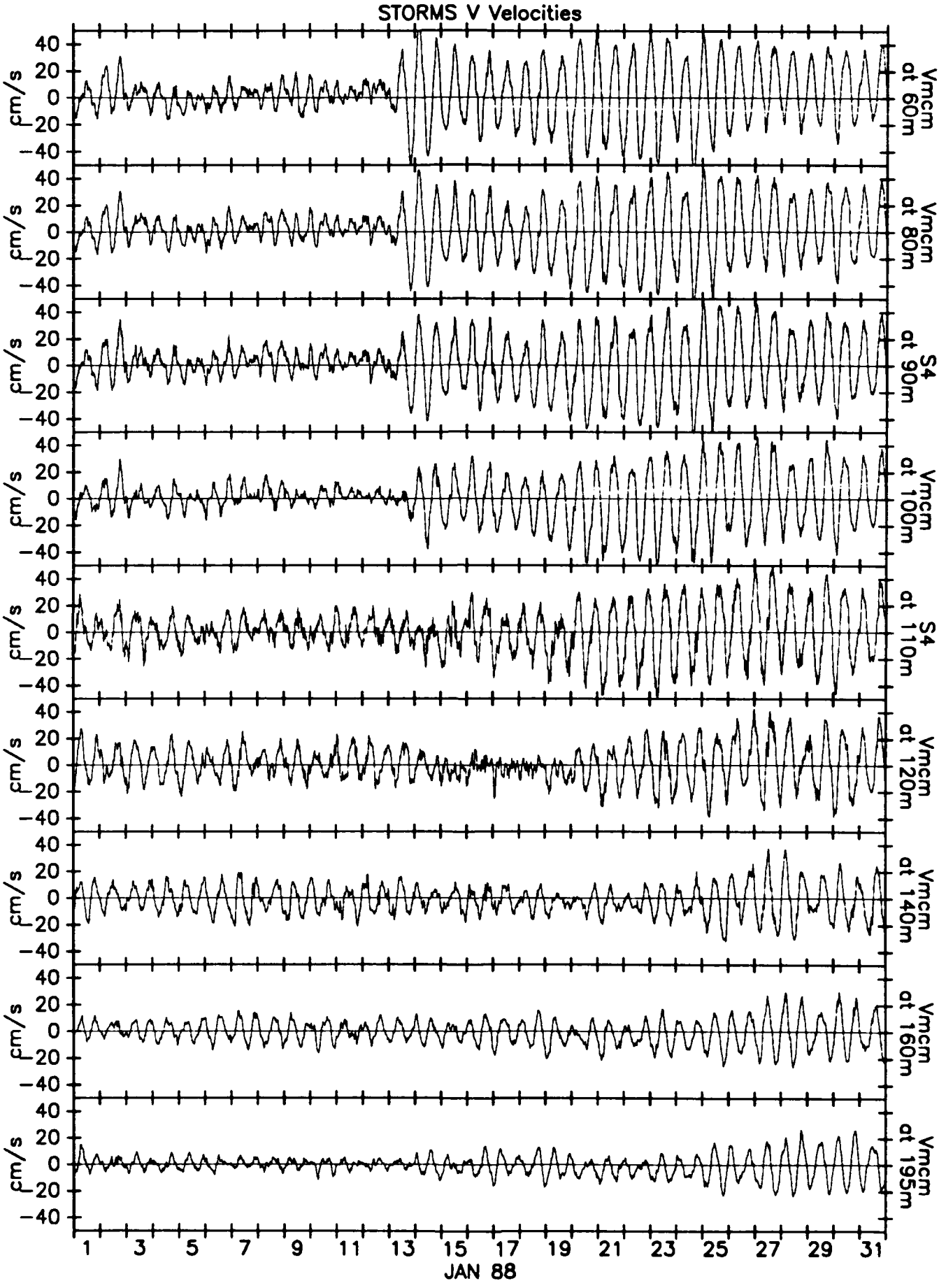
-20
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
DEC 87


STORMS V Velocities
cm/s
40
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0
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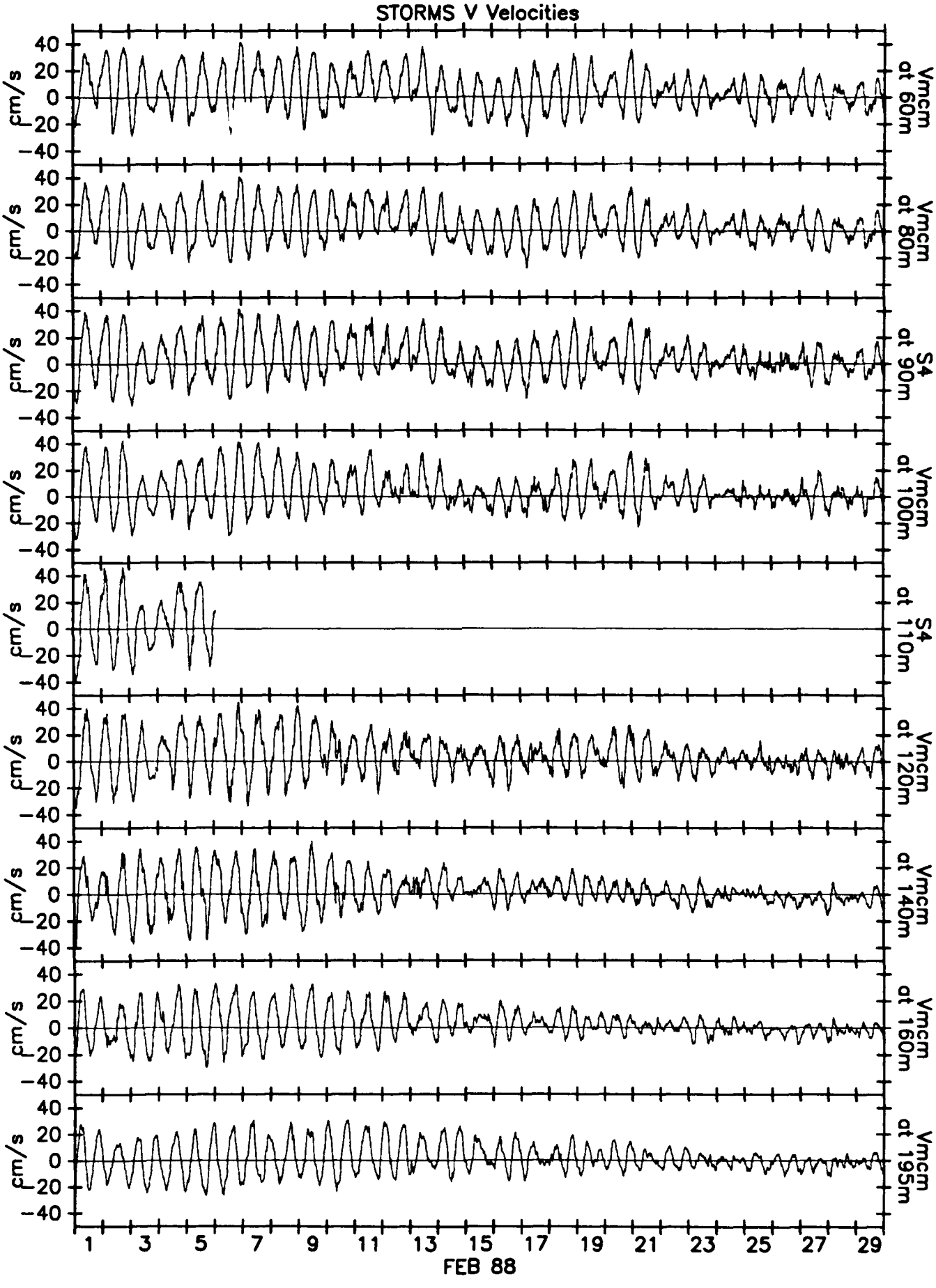
-40
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
JAN 88


STORMS V Velocities
cm/s
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Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
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Vmcm at 195m
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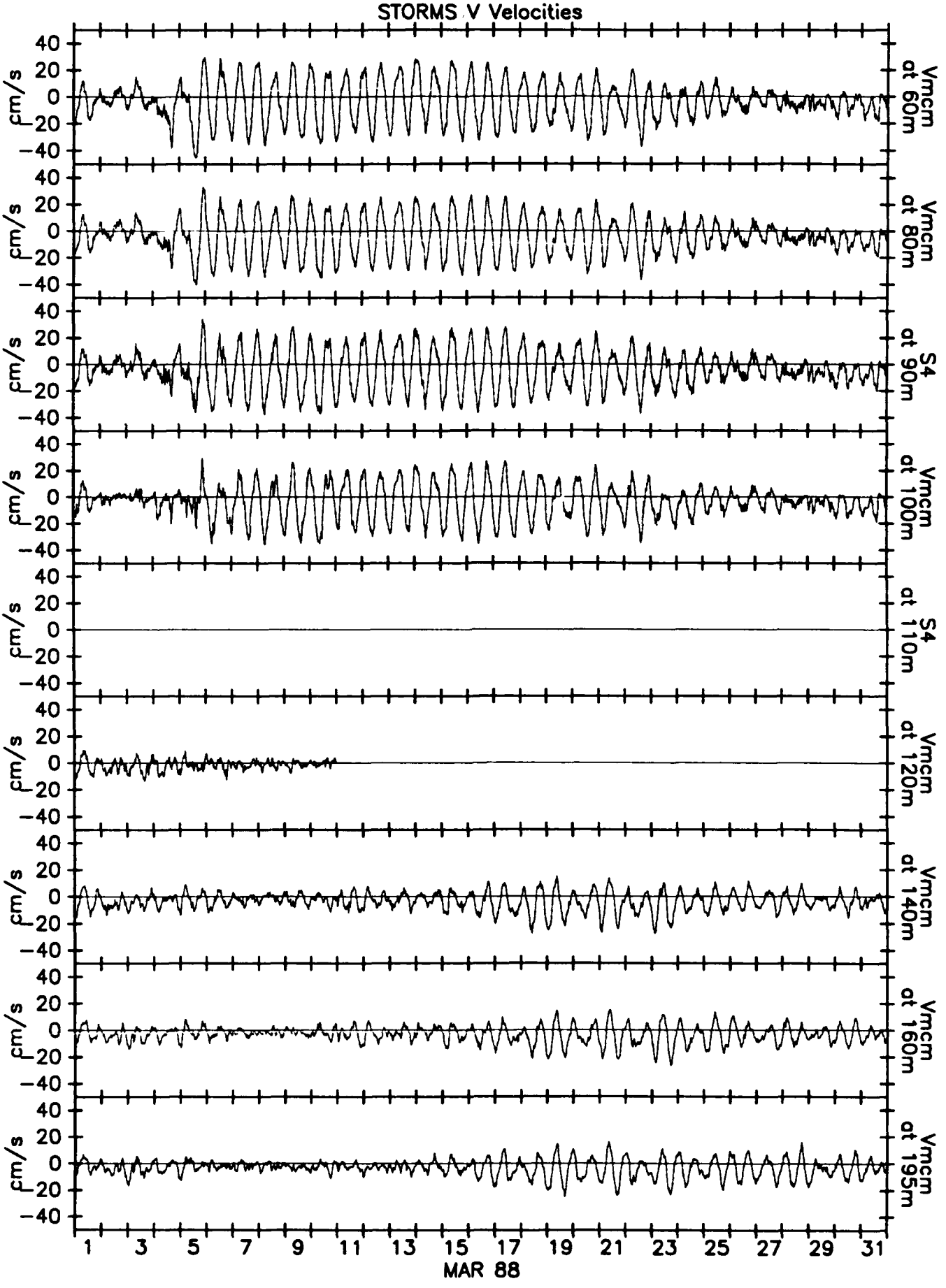
FEB 88


STORMS V Velocities
cm/s
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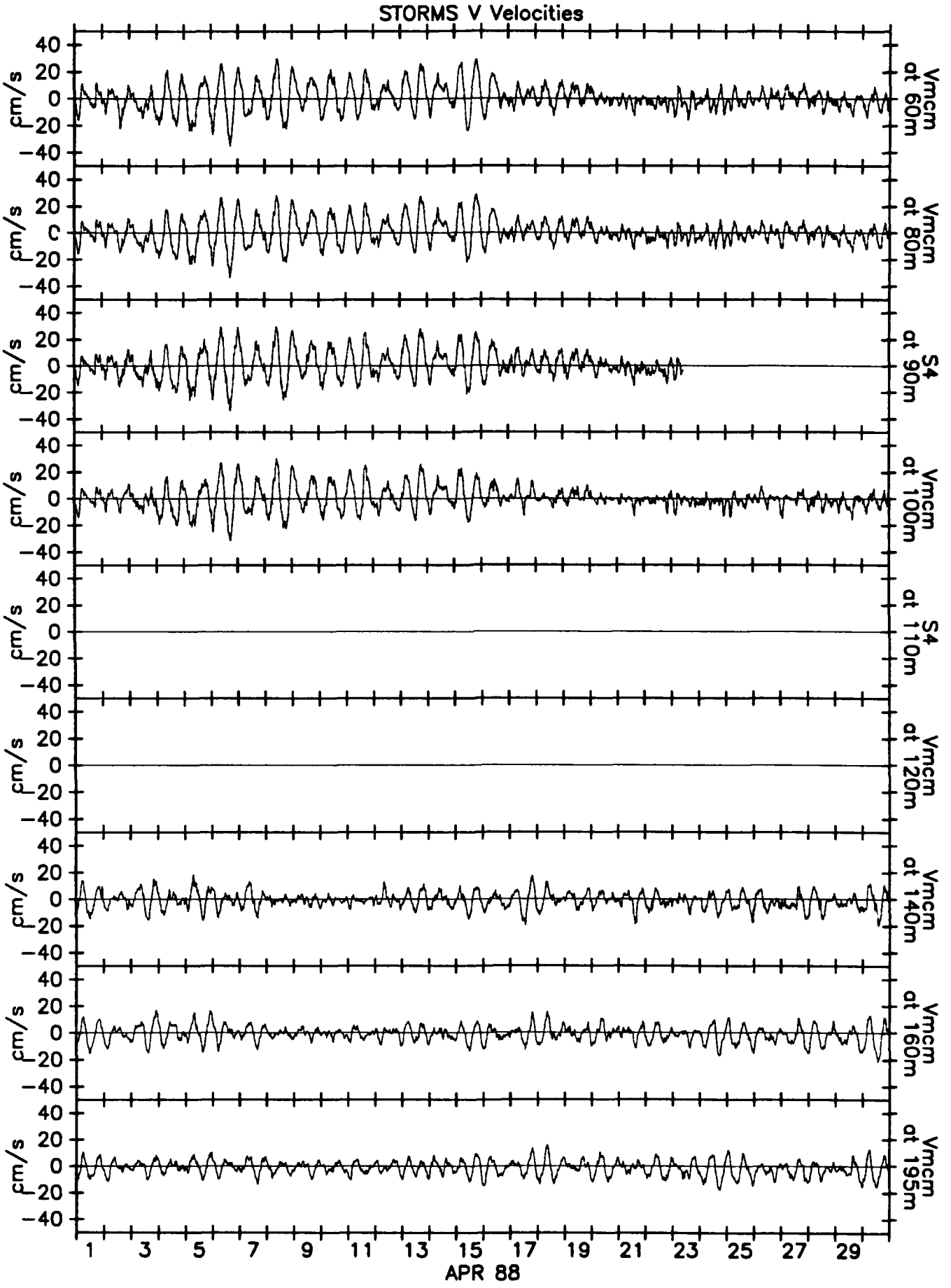
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAR 88


STORMS V Velocities
cm/s
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Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
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Vmcm at 160m
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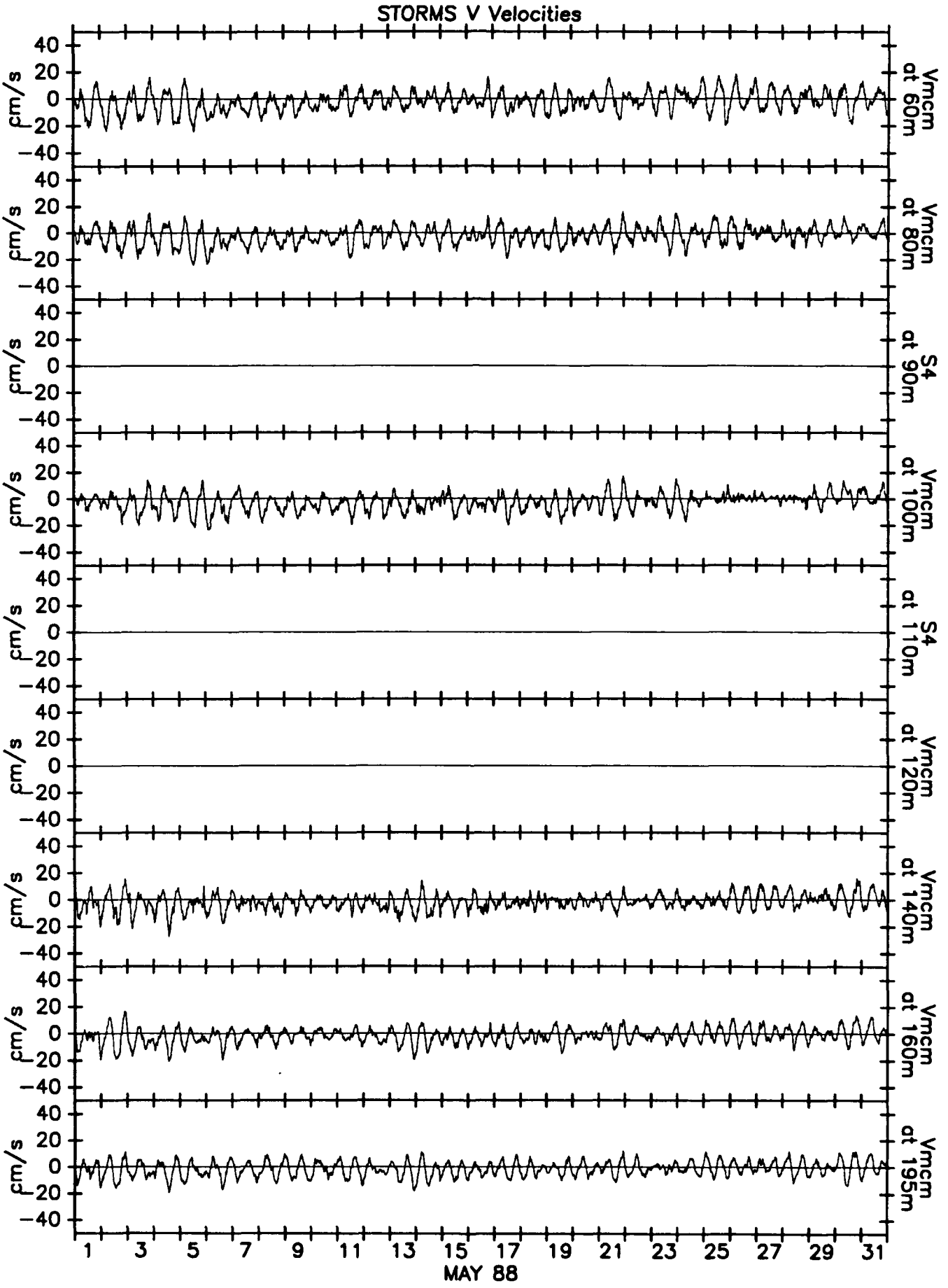
APR 88


STORMS V Velocities
cm/s
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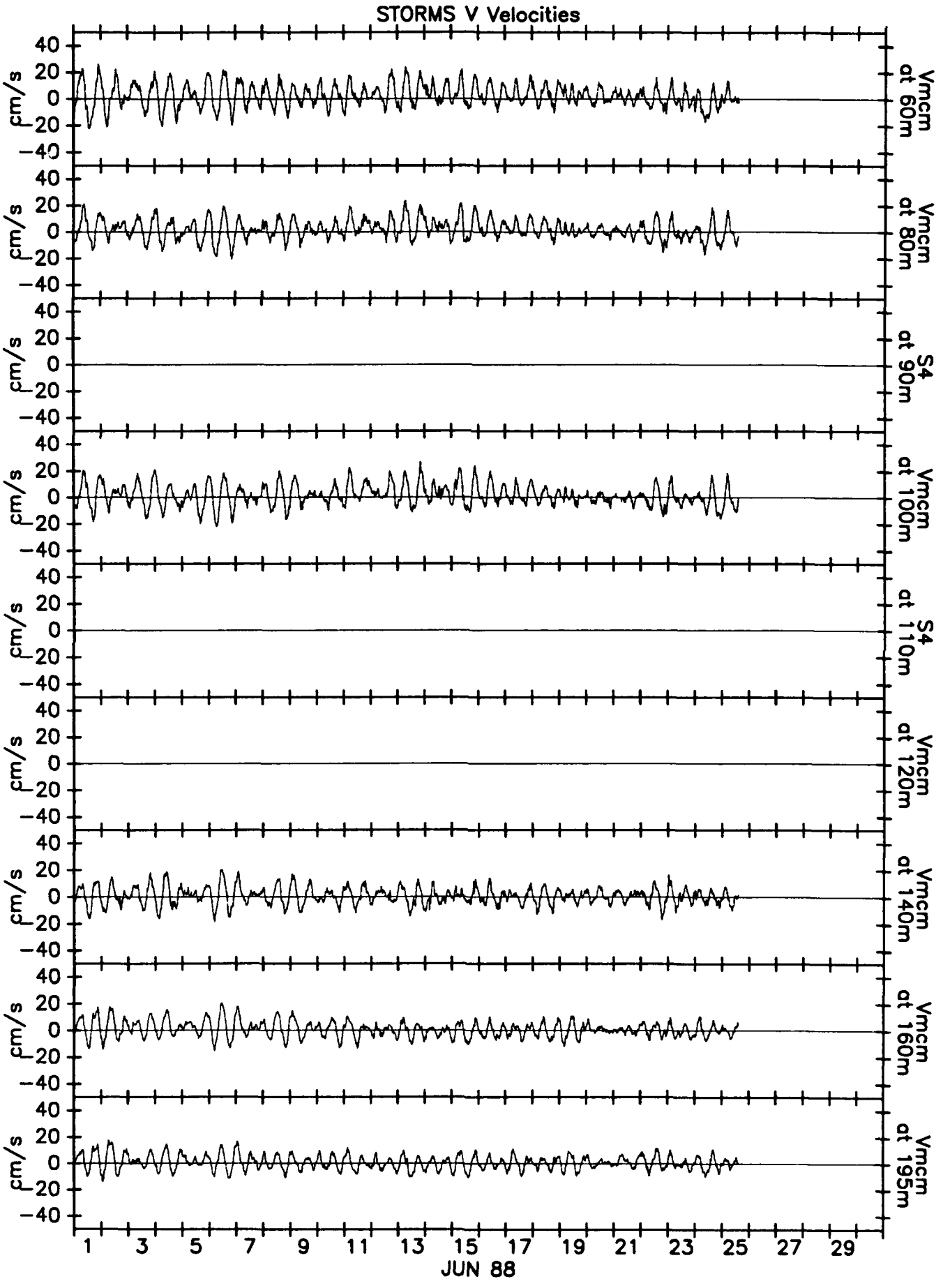
Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
MAY 88


STORMS V Velocities
cm/s
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Vmcm at 60m
Vmcm at 80m
S4 at 90m
Vmcm at 100m
S4 at 110m
Vmcm at 120m
Vmcm at 140m
Vmcm at 160m
Vmcm at 195m
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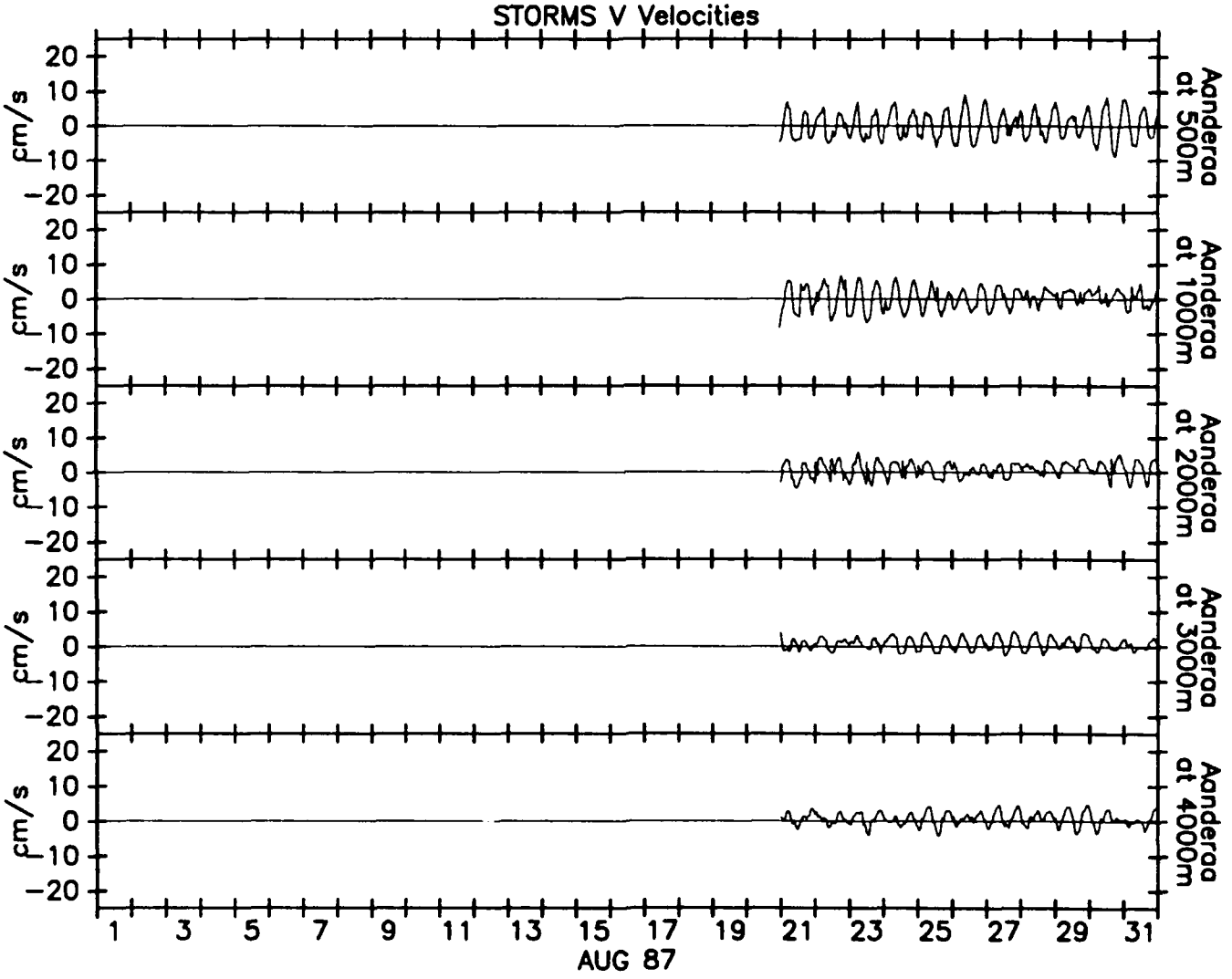
JUN 88


STORMS V Velocities
cm/s
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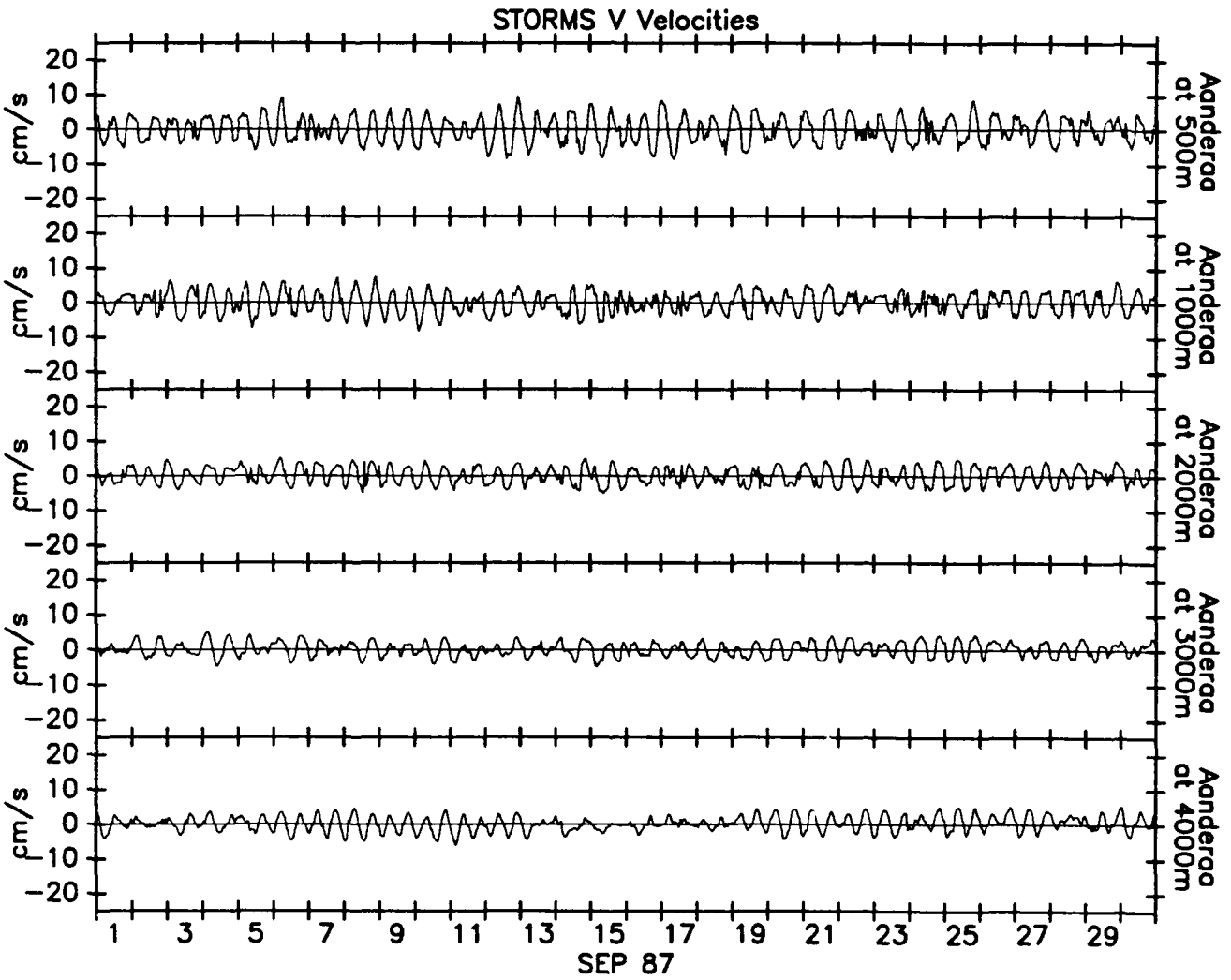
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
AUG 87


STORMS V Velocities
cm/s
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Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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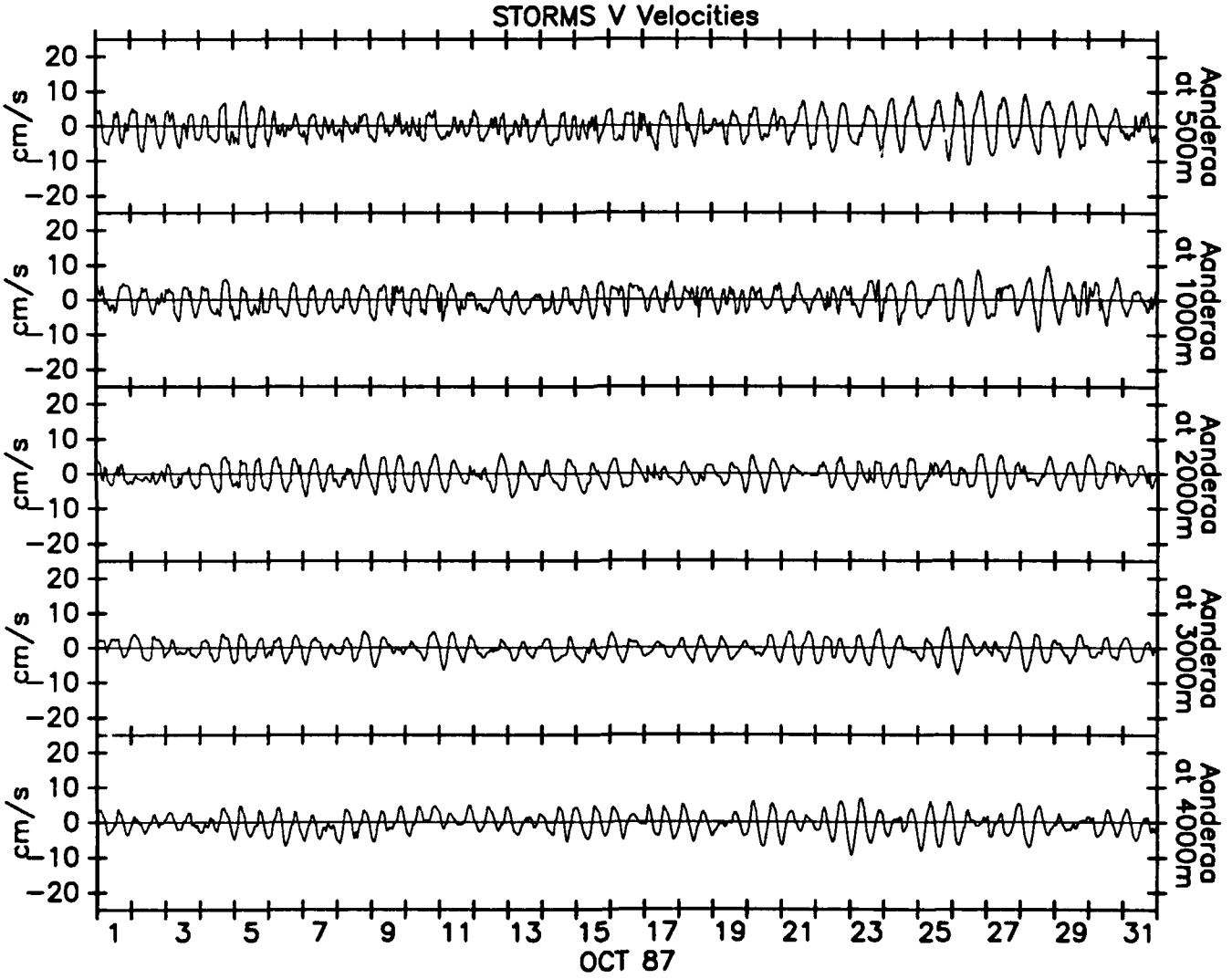
SEP 87


STORMS V Velocities
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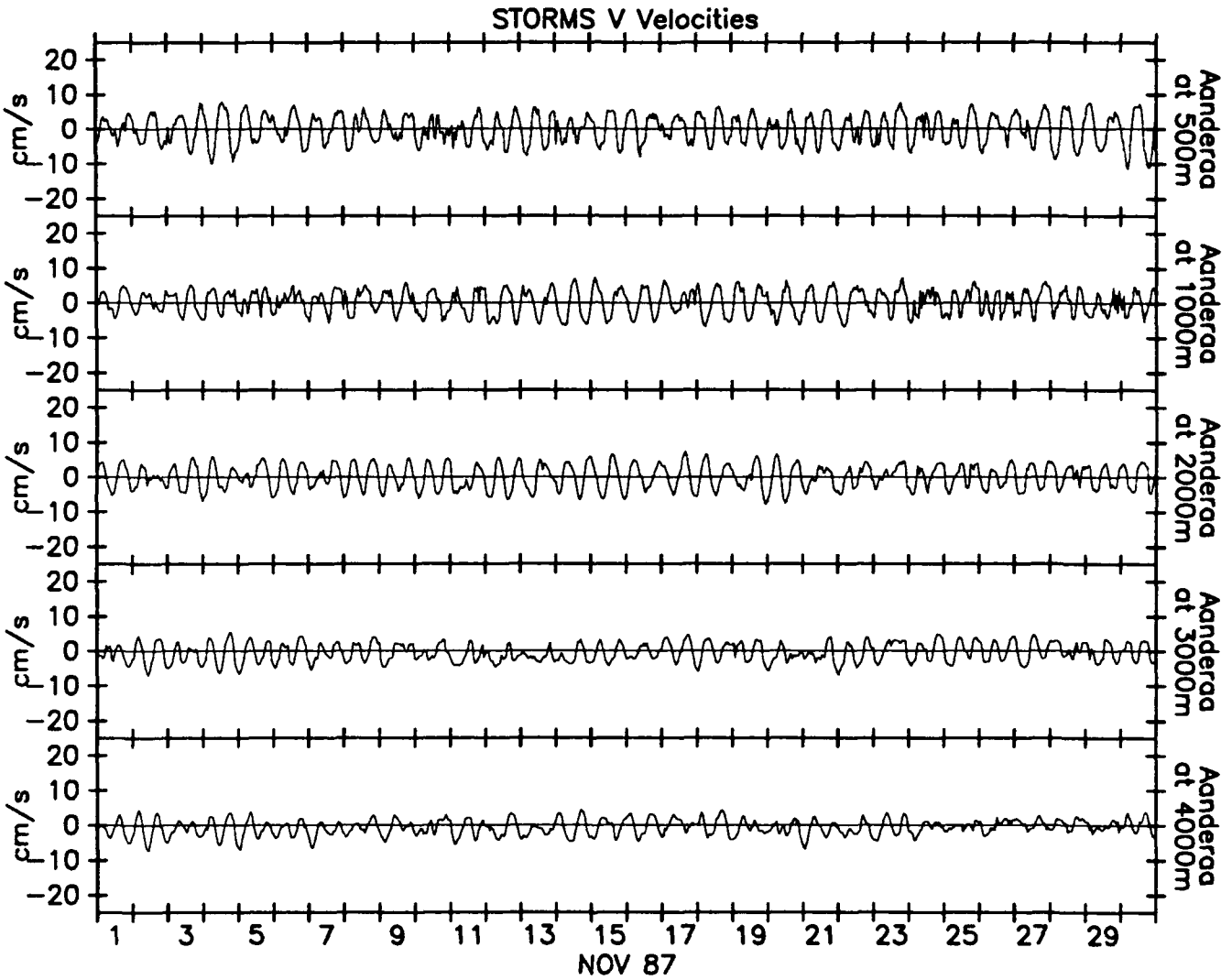
−10
−20
cm/s
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
OCT 87


STORMS V Velocities
cm/s
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Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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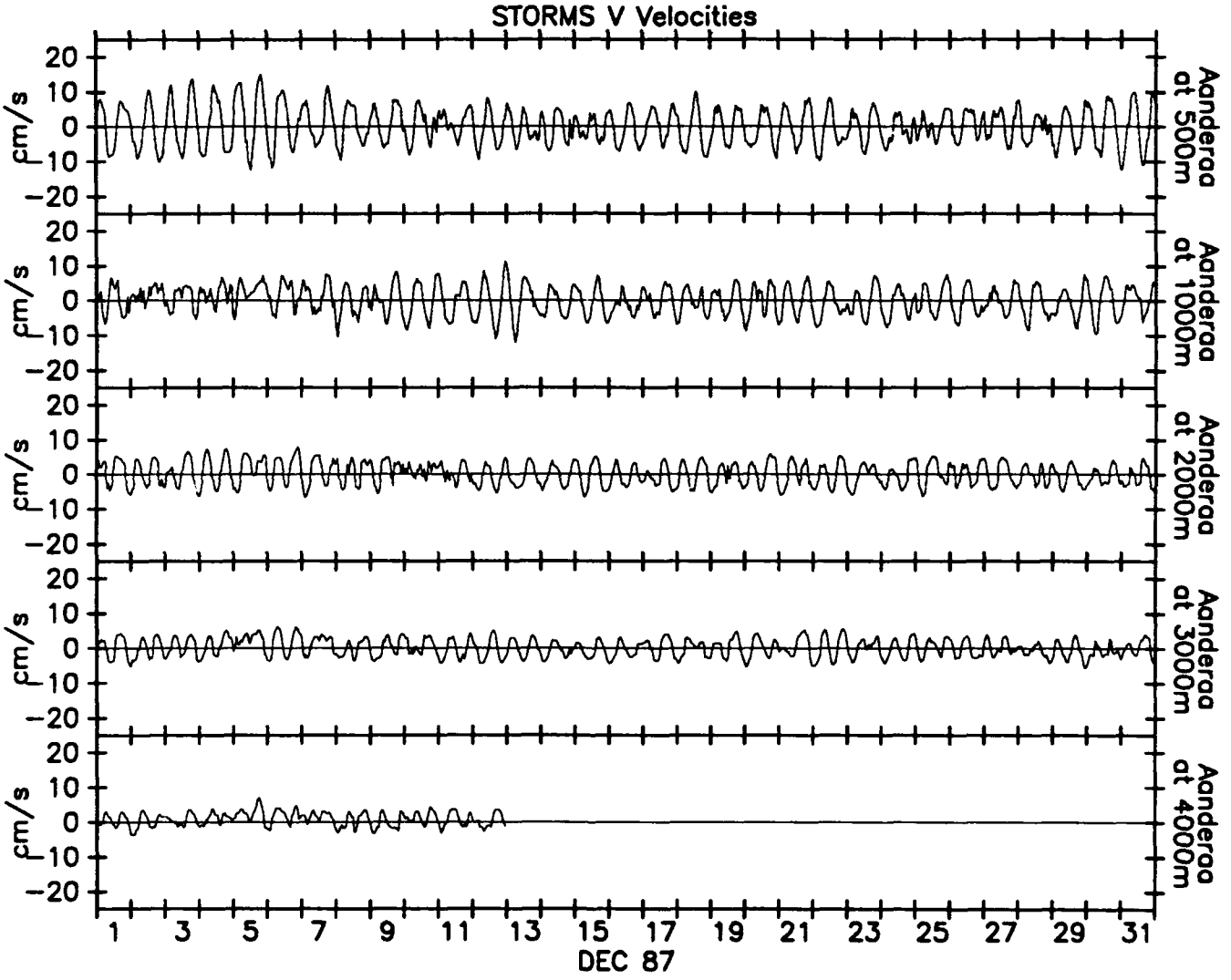
NOV 87


STORMS V Velocities
cm/s
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Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
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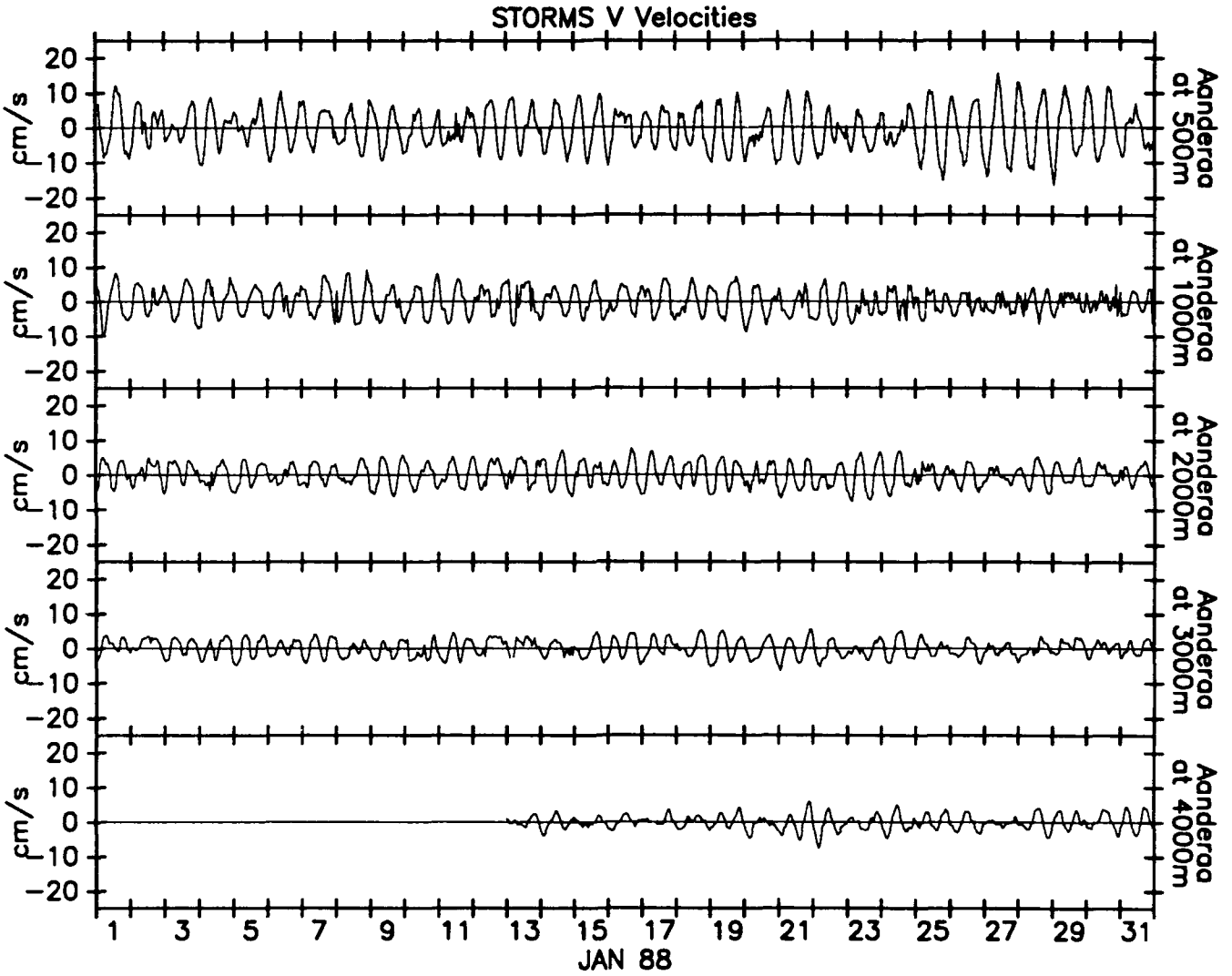
DEC 87


STORMS V Velocities
cm/s
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Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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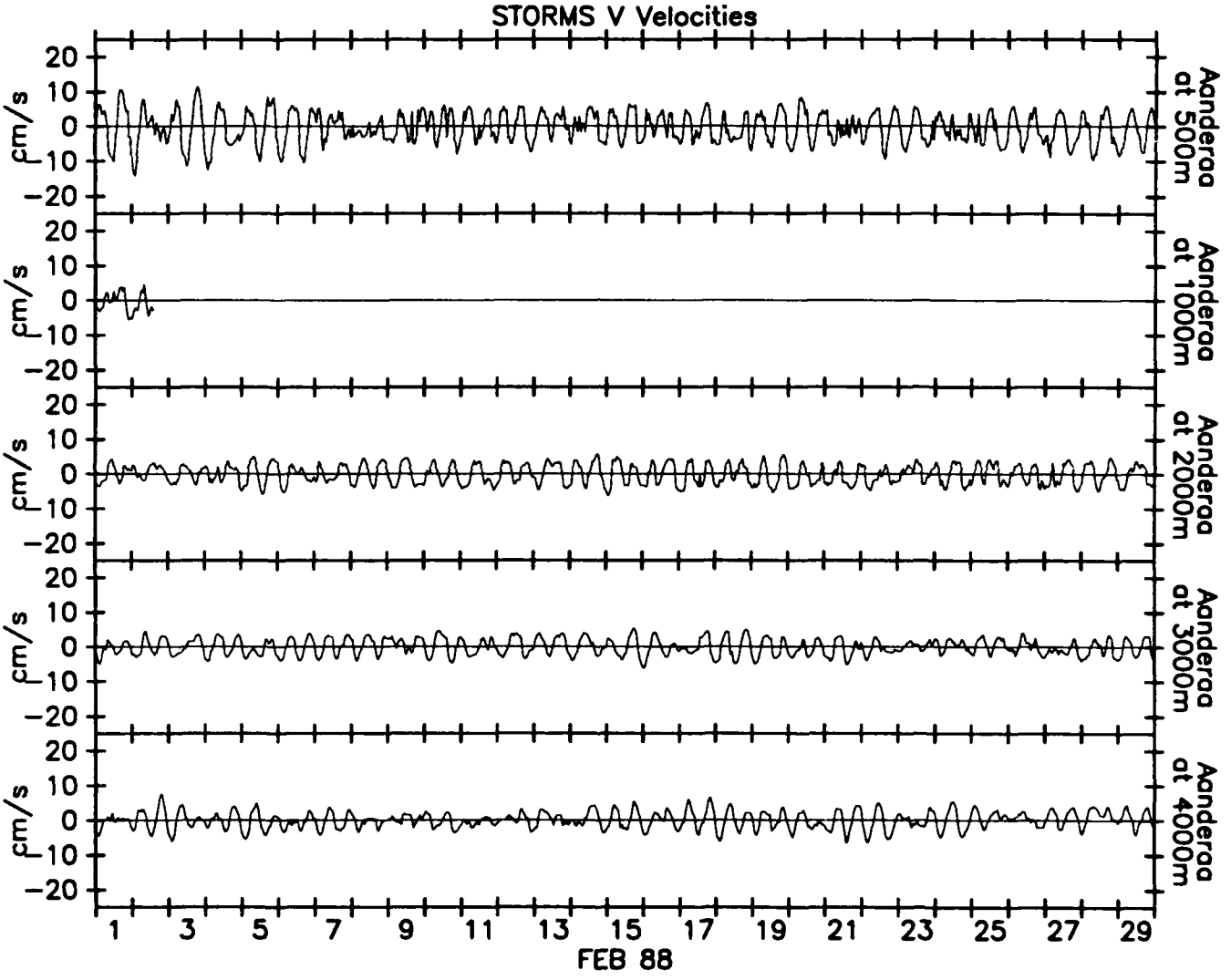
JAN 88


STORMS V Velocities
cm/s
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Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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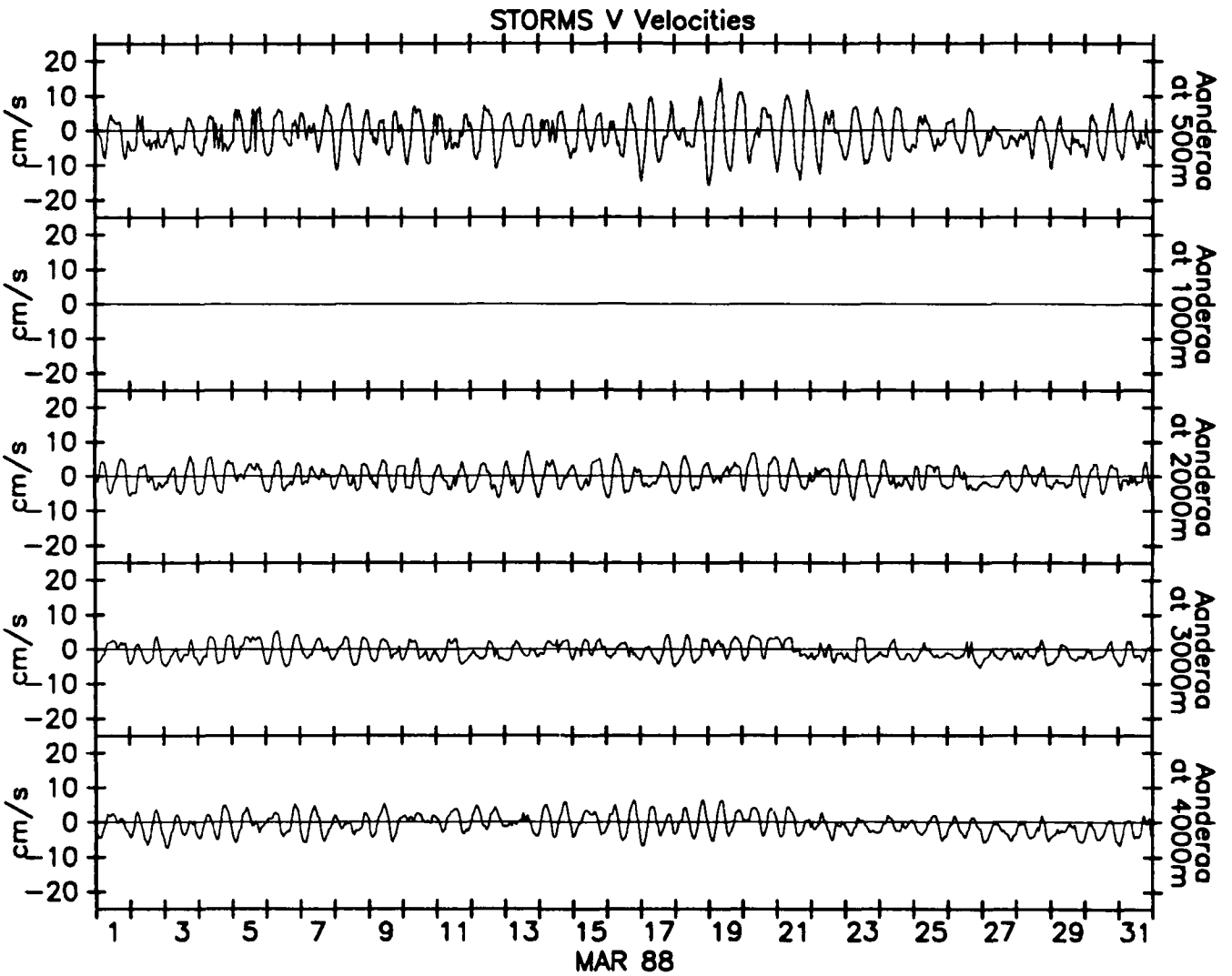
FEB 88


STORMS V Velocities
cm/s
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Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
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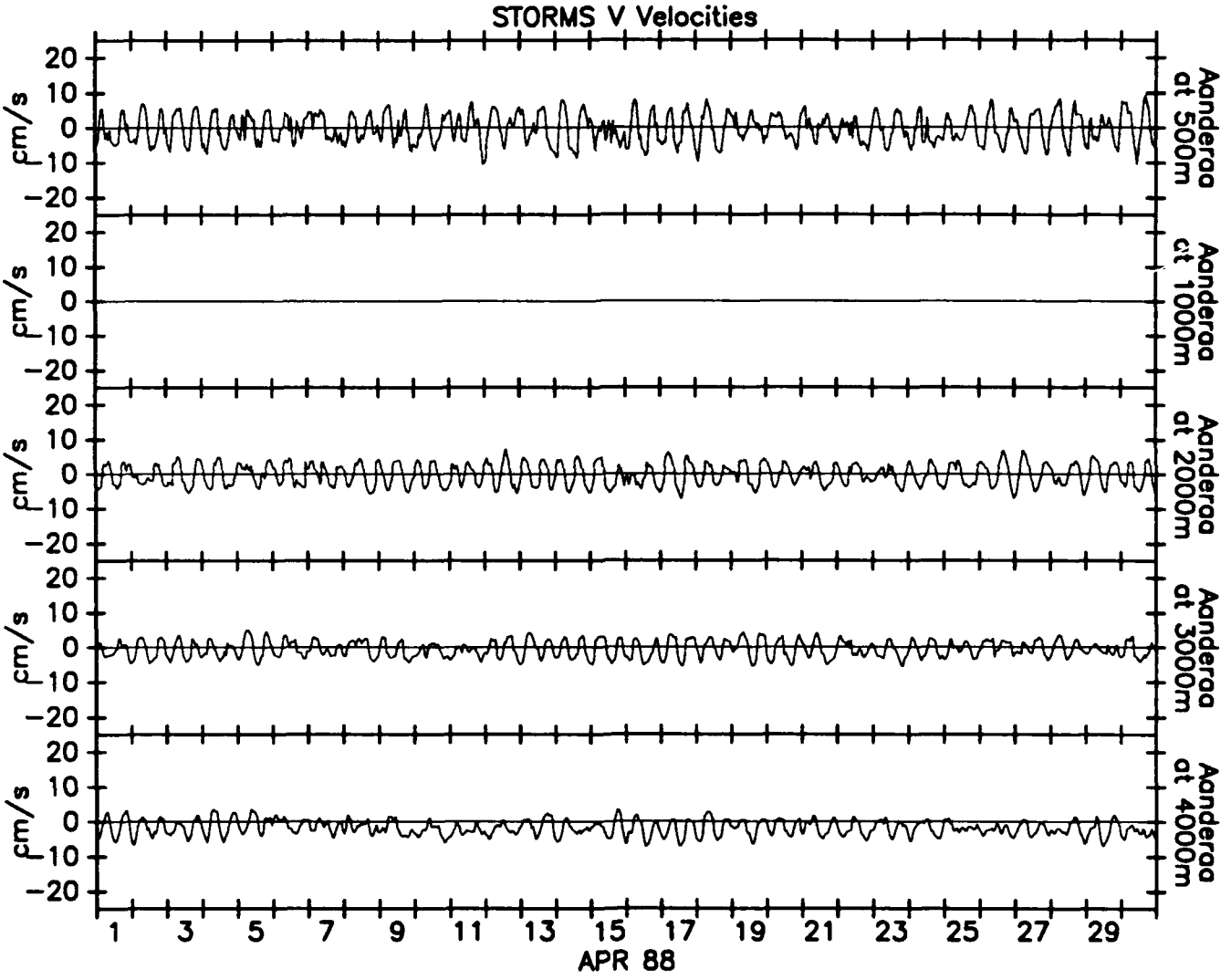
MAR 88


STORMS V Velocities
cm/s
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-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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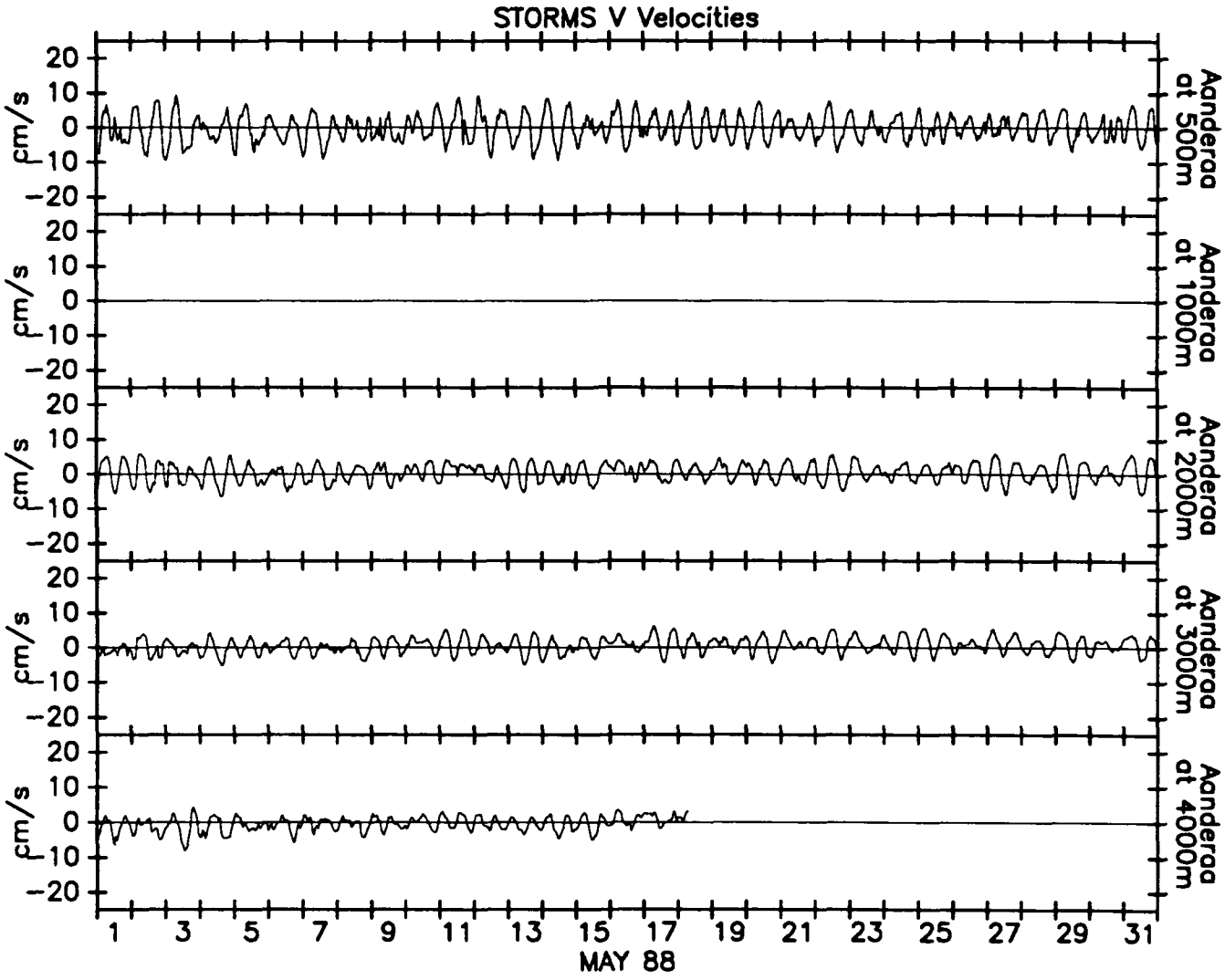
APR 88


STORMS V Velocities
cm/s
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0
-10
-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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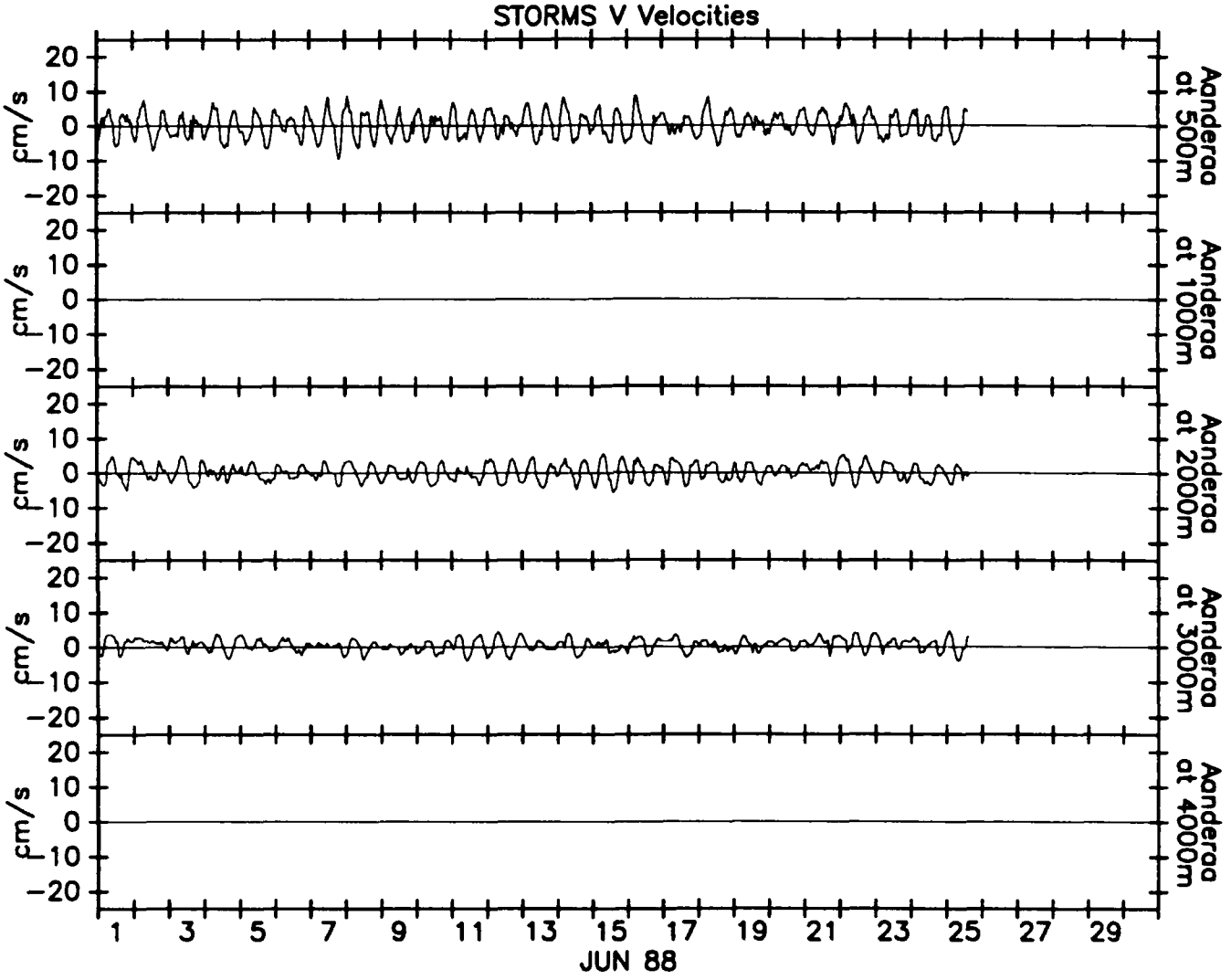
MAY 88


STORMS V Velocities
cm/s
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-20
Aanderaa at 500m
Aanderaa at 1000m
Aanderaa at 2000m
Aanderaa at 3000m
Aanderaa at 4000m
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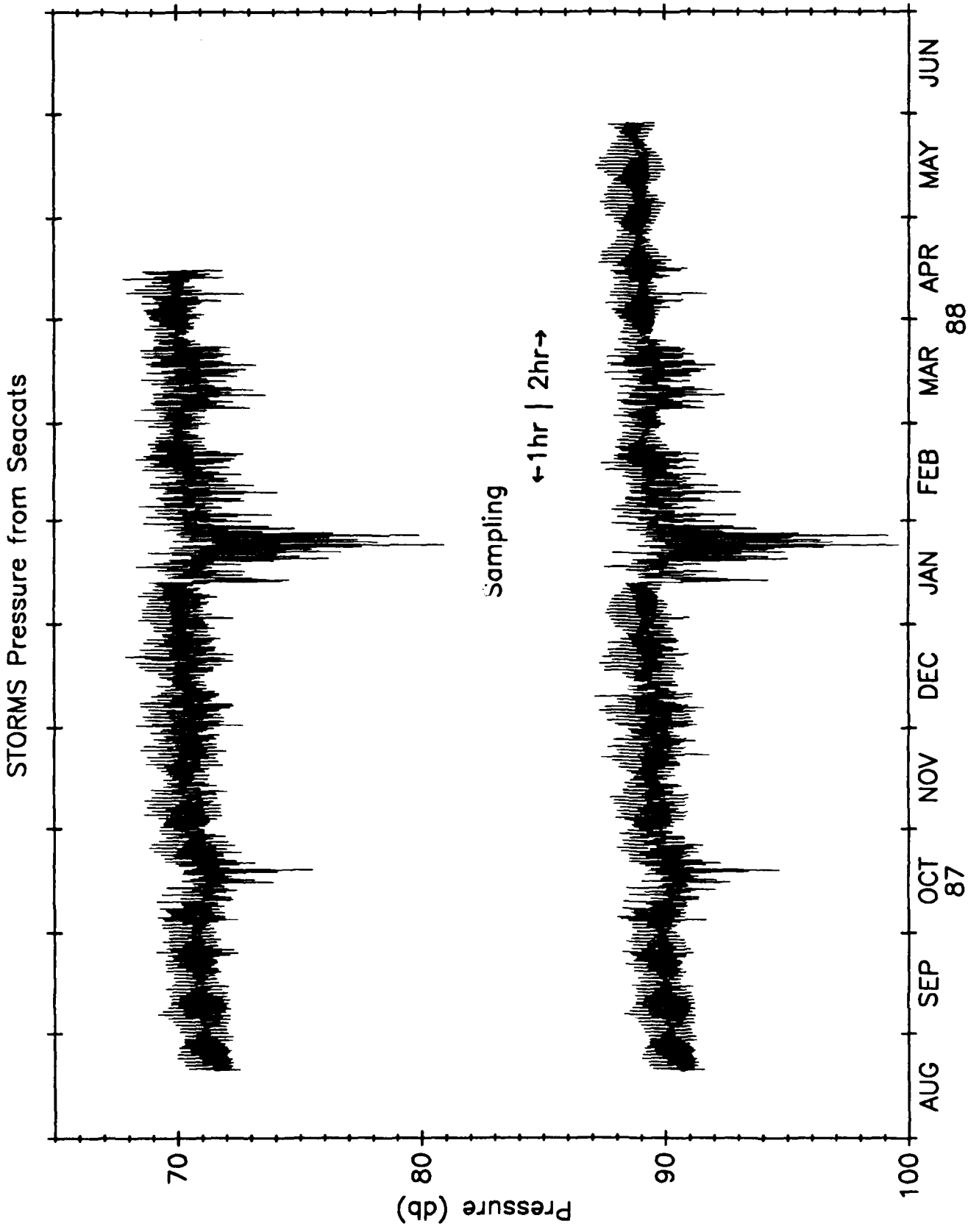
JUN 88

TIME SERIES OF PRESSURE

Observations are from pressure sensors attached to Seacats at 70 and 89 m. Sampling rate was 1 hour before 3/4/88 and 2 hours after.


STORMS Pressure from Seacats
Pressure (db)
70
80
90
100
AUG
SEP
OCT
87
NOV
DEC
JAN
FEB
MAR
APR
88
MAY
JUN
Sampling
←1hr | 2hr→