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Moored Current Meter Data from the Atlantic North Equatorial Countercurrent Near 6°N 28°W (February - September, 1983) Vol. XXXIV

by

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Technical Report

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ABSTRACT

This report presents current and wind data from the first of three surface mooring deployments in the Atlantic North Equatorial Countercurrent near 6° N and 28° W. A Vector Averaging Wind Recorder (VAWR) measured wind velocity, sea surface temperature and air temperature, barometric pressure and solar insolation. Four Vector Measuring Current Meters (VMCM) measured current velocity and temperature at depths of 20, 50, 75 and 150 m. The mooring was deployed on February 25 and recovered (and replaced) on September 13, 1983.

PREFACE

This volume is the thirty-fourth in a series of Data Reports presenting moored current meter and associated data collected by the WHOI Buoy Group.

Volumes I-XVI present data prior to 1976 and are not listed below.

Volumes XVII through XXXIII present data obtained during the years 1972-1983, either by year or experiment (see notes).

A data directory and bibliography for the years 1963-1978 has been published, as WHOI Technical Report 79-88.

Volume XXXIV presents data from one mooring of the SEQUAL experiment, 1983.

Volume No.	WHOI Ref. No.		Notes Year Experiment
XVII	78-49	Tarbell, S., A. Spencer and R. E. Payne	1975-1977 POLYMODE Array II
XVIII	79-65	Tarbell, S., M. G. Briscoe and R. A. Weller	1978 JASIN
XIX	79-34 Array I	Spencer, A., C. Mills	1974-1975 POLYMODE and R. Payne
XX	79-56	Spencer, A.	1974 Rise Array
XXI	79-85	Mills, C. and P. Rhines.	1978 W.B.U.C.
XXII	79-87	Tarbell, S. and R. Payne.	1973 measurements
XXIII	80-40	Tarbell, S. and R. Payne.	1978 POLYMODE Array III
XXIV	80-41	Spencer, A., K. O'Neill and J. R. Luyten	1976 INDEX
XXV	81-12	Spencer, A., E. D'Asaro and L. Armi	1977 B.B.L. Expt.
XXVI	81-45	Chausse, D. and R. Payne	1972 measurements
XXVII	81-68	McKee, T., E. Francis and N. Hogg	1975,78 topographic expts.
XXVIII	81-73	Mills, C., S. Tarbell, W. B. Owens and R. Payne	1978 L.D.E.
XXIX	82-16	Levy, E., A. Spencer, G. Needell, G. Hund and J. R. Luyten	1979 INDEX
XXX	82-43	Levy, E., S. A. Tarbell and N. P. Fofonoff	1979-1980 GSE/NSOI
XXXI	83-30	Levy, E. and S. A. Tarbell	1980-1982 WesPac
XXXII	83-46	Levy, E.	1979-1981 Vema Channel
XXXIII	84-6	Spencer, Ann and D. Chausse	1981 NPBC

Table of Contents

INTRODUCTION

In February 1983 an array of six current meter moorings was launched in the equatorial Atlantic as part of SEQUAL (Seasonal Equatorial Atlantic, see Anon., 1983). The moorings were kept in place for six months and were reset two times for a total of one and a half years. This data report presents current and temperature data from the first setting of one of these moorings, SA4, located near the center of the North Equatorial Countercurrent at 6°N 28°W. The location of the mooring is shown in Figure 1, which summarizes the surface velocity for the months August through October, measured by ship drifts. The data are noteworthy because they are the longest velocity series yet obtained in the Countercurrent and they show a significant portion of the subsurface seasonal variation of the Countercurrent and its vertical structure (Richardson, submitted).

This report is presented in three general sections. The first section contains introductory text and information about the instruments, data processing procedures, and quality of the data. The second section summarizes the data sets graphically in composite displays of velocity components and temperatures (Figures 3-6). The third section displays the data from each individual instrument (Figures 7-29). Included are tables of statistics, time series plots, histograms, progressive vector diagrams, scatter plots and spectral plots.

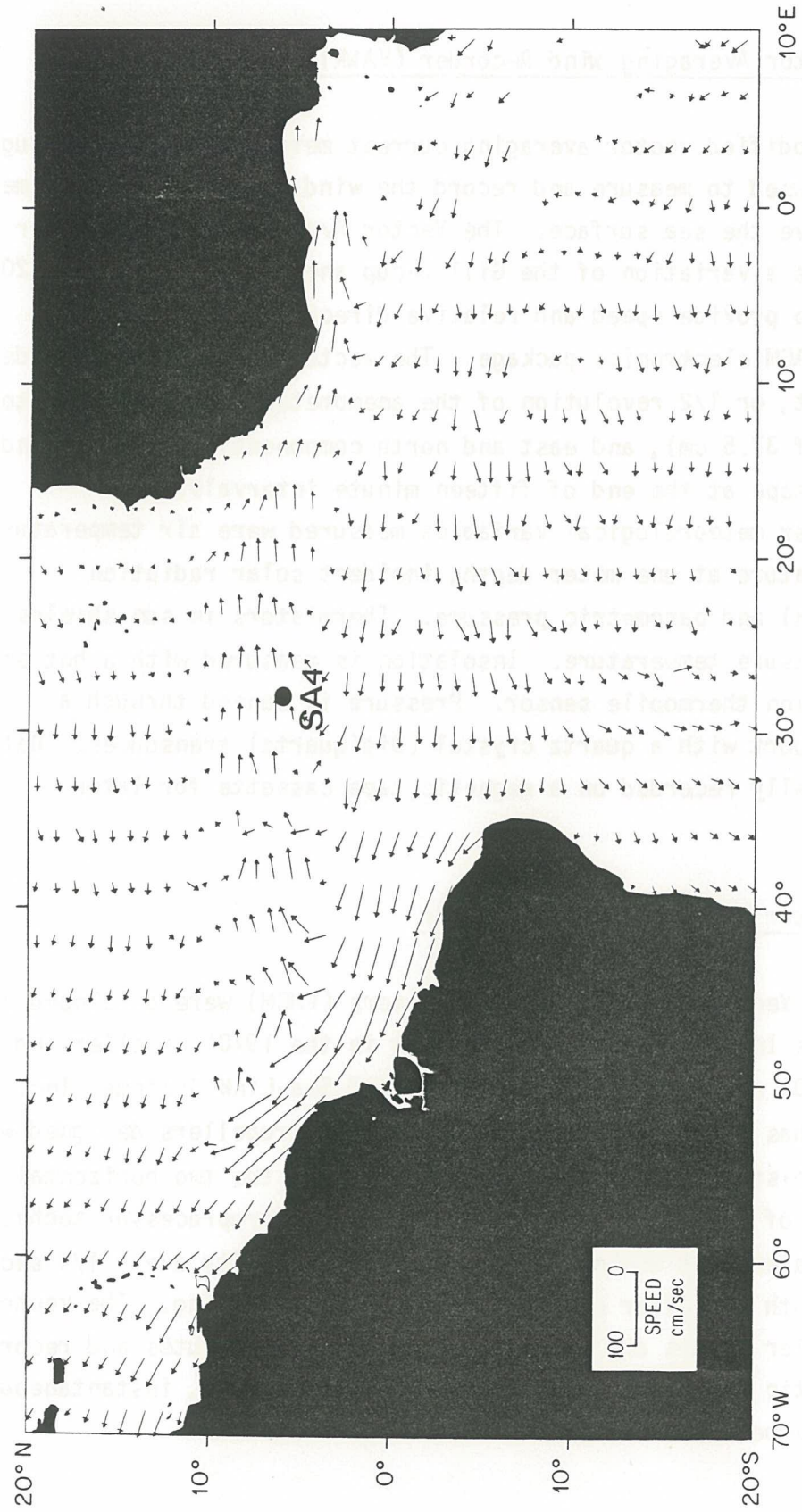


Figure 1: Location of mooring SA4 at 6 N and 28 W. Vectors are calculated from ship drifts for August through October (from Richardson and McKee, 1984).

INSTRUMENTATION

Vector Averaging Wind Recorder (VAWR)

A modified vector averaging current meter (VACM) (McCullough, 1975) was used to measure and record the wind velocity at three meters height above the sea surface. The Vector Averaging Wind Recorder (VAWR) uses a variation of the Gill 3-cup anemometer and a 17 x 20 cm windvane to provide speed and relative direction inputs to the standard VACM electronics package. The vector calculation is made every count, or 1/2 revolution of the anemometer (corresponding to a wind run of 37.5 cm), and east and north components are summed and stored on tape at the end of fifteen minute intervals.

Other meteorological variables measured were air temperature, sea temperature at one meter depth, incident solar radiation (insolation) and barometric pressure. Thermistors in sun shields are used to measure temperature. Insolation is measured with a hot and cold junction thermopile sensor. Pressure is sensed through a two-plate port with a quartz crystal (Digiquartz) transducer. Data are internally recorded on a magnetic tape cassette for later processing.

Vector Measuring Current Meter

The Vector Measuring Current Meters (VMCM) were developed at the Scripps Institution of Oceanography in the 1970's (Weller and Davis, 1980) and were manufactured by EG&G Sea-Link Systems, Inc. Each VMCM has a pair of orthogonally mounted propellers designed with accurate co-sinusoidal response. They measure the two horizontal components of velocity. The instrument uses microprocessor technology and calculates east and north components of velocity every 1/4 second based on both propeller counts and the compass reading. The vector and propeller values are accumulated for fifteen minutes and recorded on a magnetic tape cassette. A record count (clock), instantaneous compass, temperature and pressure are also recorded.

Table 1

MOORING CONFIGURATION

Component	Length in meters	Instrument #
VAWR on surface toroid buoy	-3	V0184
1/2 inch chain	6	
7/16 inch wire rope with fairing	10	
VMCM	20	VM013
7/16 inch wire rope with fairing	27.6	
VMCM	50	VM007
7/16 inch wire rope with fairing	22.6	
VMCM	75	VM003
7/16 inch wire rope with fairing	72.6	
VMCM	150	VM005
7/16 inch wire rope with fairing	149.6	
3/8 inch jacketed wire rope	700	
3/4 inch nylon	3221	
17 inch glass spheres on 26 m of 1/2 inch chain	26	
1/2 inch chain	4	
Acoustic Release	1	109
1/2 inch chain	1	
1 1/8 inch nylon	20	
7/16 inch jacketed wire rope	15	
1/2 inch chain	6	
Anchor (6300 pound dry weight)	4363	

Note: Numbers underlined represent depths of the instruments below the sea surface and the bottom depth.

DATA PROCESSING

Data from instrument cassettes (VAWR and VMCM) were transcribed to 9-track magnetic tapes, converted to scientific units, edited to remove launch and retrieval transients and bad points, and linearly interpolated across missing or erroneous data cycles. All directional data has been processed and plotted in degrees true. The VAWR records vector components in the oceanographic convention ("east" means wind blowing toward the east). Data quality was determined, and is noted in Table 2.

Low passed versions of the data series were formed by using a Gaussian filter with either a 5 day half-width (the composite plots shown in section 2), or a 24 hour half-width (individual plots shown for each instrument in section 3), and then subsampling the filtered series once a day.

Woods Hole Oceanographic Institution Buoy data are identified by a mooring number (e.g. SA4 is the mooring designation), a sequential instrument position number (e.g., SA41 is the first instrument down on mooring SA4), a letter to indicate the data version (e.g., SA41A is the first editing of SA41), and a number to indicate the time sampling interval for that data record (e.g., SA41A1H is the one hour averaged version).

PROGRAMS

Statistics

Mean, standard error, variance, kurtosis, skewness and extrema are computed on the filtered and unfiltered time series. East and north covariance, correlation coefficients, major axis, minor axis and ellipse are computed for the vectors. For reference, note that a Gaussian random variable would have a kurtosis of three and a skewness of zero.

See Volume XVII (POLYMODE Array II) and XX (Rise Array, 1974) of this series for a more detailed discussion of these parameters. The variance, beginning with Volume XXXII (Vema Channel, 1979-1981), is now computed using (n-1) rather than n.

Hourly and one day (filtered) statistics are displayed in Figures 7 and 13 through 16.

Time Series

Velocity vectors plotted from a zero line along a time scale are known as stick plots. The stick plots, displayed as a composite in Figure 5 and individually in Figures 8 and 9, and 17 through 20, are plotted such that East is up relative to the time axis. This was done because the average velocity is eastward.

Individual variables and the stick plots are plotted against time from one day Gaussian filtered series. Composite plots of temperature and speeds are displayed in Figures 4 and 6.

Histograms

The variables temperature, velocity components, speed and direction are shown as frequency of occurrence versus amplitude plots. They are shown in Figures 10 and 21 through 24.

Progressive Vector and Scatter Plots

Progressive vector plots are based on the filtered time series in Figure 3 and on unfiltered time series in the other figures. The current vectors are placed tail-to-head so as to show the path that a perfect particle in a perfectly homogeneous flow would have travelled. Flow regimes and low frequency behavior are apparent on these plots. Each plot begins with an asterisk. The first day of each month is marked with a triangle, and every month is annotated.

Every daily averaged point from the series is plotted in a scatter plot, in which east and north components are plotted as points on a polar diagram. The line drawn through the points is the principal axis, which is the line of the major axis of the ellipse of variance. For a more detailed description of the principal axis see Fofonoff (1969). This line denotes the orientation angle but is not a measure of the length of the major axis.

Progressive vectors and scatter plots are shown in Figures 11, 25 and 26.

Spectra

Velocity and temperature data are displayed as auto-spectra using the program "PROSPECT" (Hunt, 1982). Horizontal kinetic energy (HKE) is shown in the auto spectra, where the HKE spectrum is half of the sum of the spectra of the east and north components. It has the advantage of not being tied to a particular coordinate system. The HKE and temperature spectra have units of (cm^2/sec^2)/cph and $°C^2$/cph, respectively, and are one-sided, i.e., the area under the spectrum is equal to the variance of the original record.

For calculation of these spectra, the estimates were averaged over three adjacent frequency bands. No data-windowing or prewhitening was done. The plots are log-log rather then "variance preserving", i.e., the contributions of various frequency bands to the total variance are not in proportion to the displayed areas.

The velocity data are also displayed as rotary spectra. "PROSPECT" computes the circular decomposition of a two-dimensional vector series into clockwise and anti-clockwise harmonic components. The clockwise and anti-clockwise spectra actually form one continuous spectrum between $\pm$ the Nyquist frequency, the positive frequencies corresponding to anti-clockwise rotations of the velocity vector, and negative frequencies to the clockwise rotations. No data-averaging, data-windowing or prewhitening was done.

For plotting, "PROSPECT" averages the spectra in increasingly large groups at the high frequencies to reduce superfluous points. The velocity and temperature spectra (plotted from the hourly data series) are displayed in Figures 12, 27 through 29.

Table 2

DATA QUALITY

File	Start Date	End Date	Comments
SA40	83-II-25	83-V-14	Failed due to water in the case. Good data until 14 May.
SA41	83-II-25	83-IX-12	Good data
SA42	83-II-25	83-IX-12	Good data
SA43	83-II-25	83-IX-12	Good data
SA44	83-II-25	83-IX-12	Good data

ACKNOWLEDGMENTS

Many people share credit for the quality of data returned from this mooring. They include the officers and crews of the R/V CONRAD and the R/V KNORR, and the scientific participants from Woods Hole Oceanographic Institution, North Carolina State University and the University of Rhode Island. Dr. Richard Payne (Woods Hole Oceanographic Institution) was responsible for the vector averaging wind recorder and other meteorological sensors.

This experiment was funded by National Science Foundation grants OCE83-17112 and OCE82-11108.

REFERENCES

Anon., 1983, SEQUAL - A study of the equatorial Atlantic Ocean. EOS, Transactions, American Geophysical Union, 63, 218.

Fofonoff, N. P., 1969, Spectral characteristics of internal waves in the ocean. Deep Sea Research, Supplement to Vol. 16, pp. 59-71.

Hunt, M., 1982, A program for spectral analysis of time series "PROSPECT", Woods Hole Oceanographic Institution Internal Document.

McCullough, J. R., 1975, Vector averaging current meter speed, calibration and recording technique. Woods Hole Oceanographic Institution Technical Report WHOI-75-44, 35 p.

Richardson, P. L., Moored current meter measurements in the Atlantic North Equatorial Countercurrents during 1983. Journal of Geophysical letters (submitted).

Richardson, P. L. and T. K. McKee, 1984, Average seasonal variation of the Atlantic equatorial currents from historical ship drifts. Journal of Physical Oceanography (in press).

REFERENCES (continued)

Spencer, A., 1979, A compilation of moored current meter data, Whitehorse profiles and associated oceanographic observations, Vol. XX Woods Hole Oceanographic Institution Technical Report WHOI-79-56.

Tarbell, S. A., A. Spencer, and R. E. Payne, 1978, A compilation of moored current meter data and associated oceanographic observations, Vol. XVII (Polymode Array II data). Woods Hole Oceanographic Institution Technical Report WHOI-78-49.

Weller, R. A. and R. E. Davis, 1980, A vector measuring current meter. Deep Sea Research, 27A, pp. 565-582.

FIGURES

SECTION 2: Summary plots of the data. The velocity and temperature data were smoothed with a five day (half-width) Gaussian shaped filter to reduce tidal and inertial fluctuations.

Figure 2: Positions of mooring determined by satellite tracking.

Figure 3: Composite progressive vector plot for the four current meters.

Figure 4: Composite temperature time series for the four current meters.

Figure 5: Composite vector time series for the four current meters.

Figure 6: Composite speed time series for the east and north components for the four current meters.

SECTION 3: Individual Plots.

The order of the individual plots is as follows: statistics, variables versus time, histograms, scatter plots, progressive vector diagrams, rotary spectrum (east and north components), and auto spectra (velocity and temperature).

Figures 7-12: Wind recorder data series.

Figures 13-29: Current meter data series.

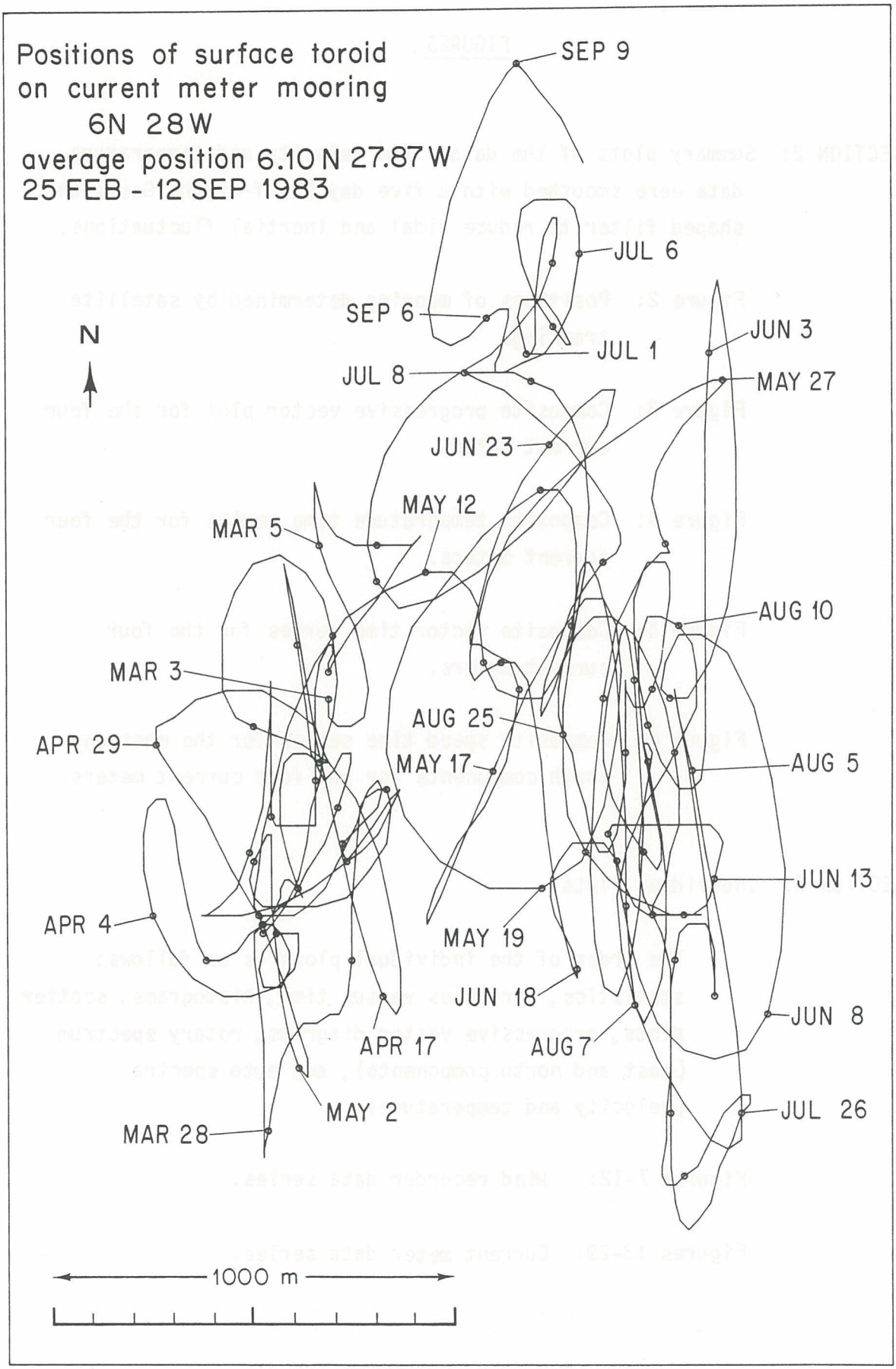


Figure 2: Positions of mooring determined by satellite tracking.

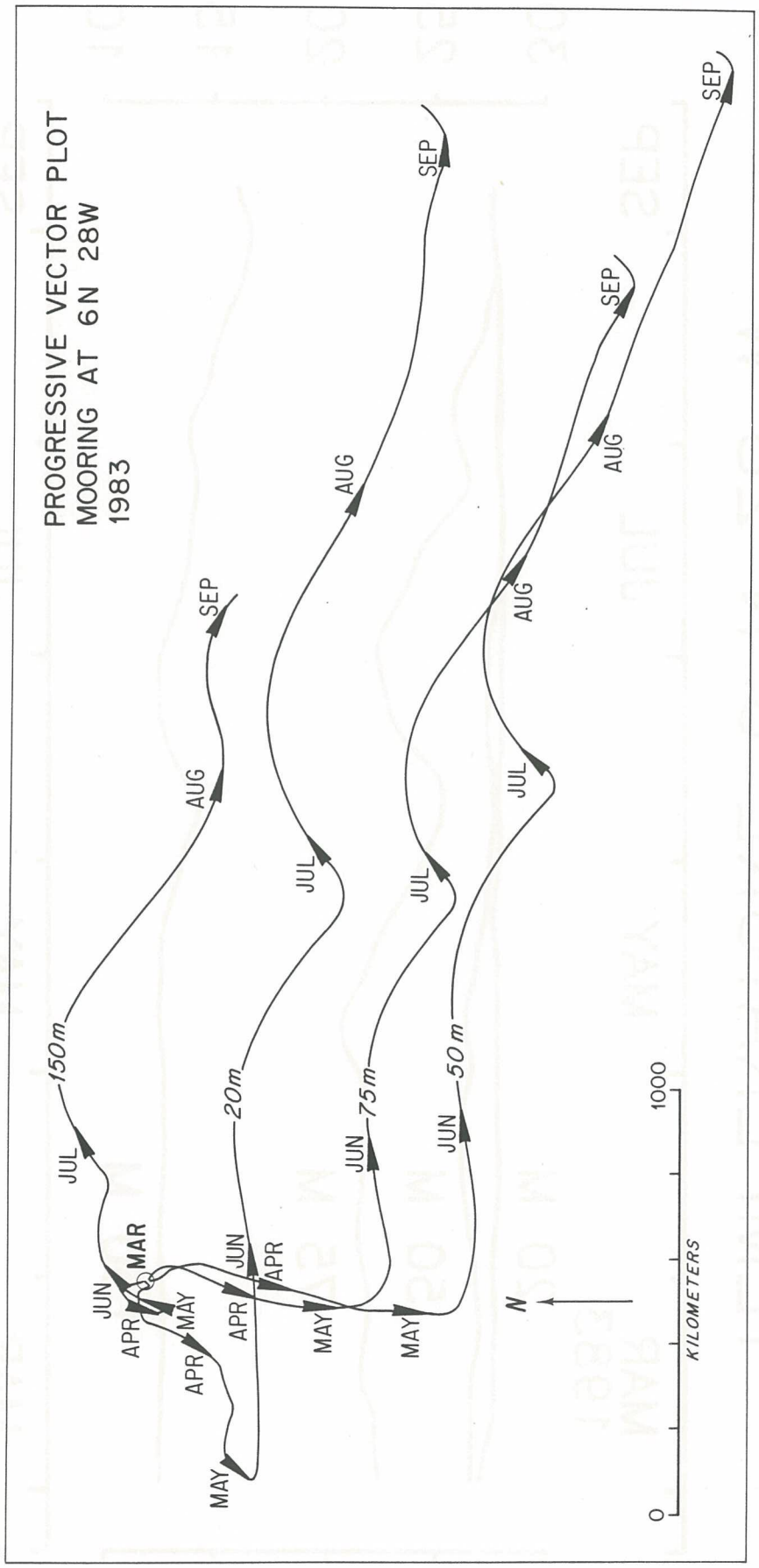


Figure 3: Composite progressive vector plot for the four current meters.

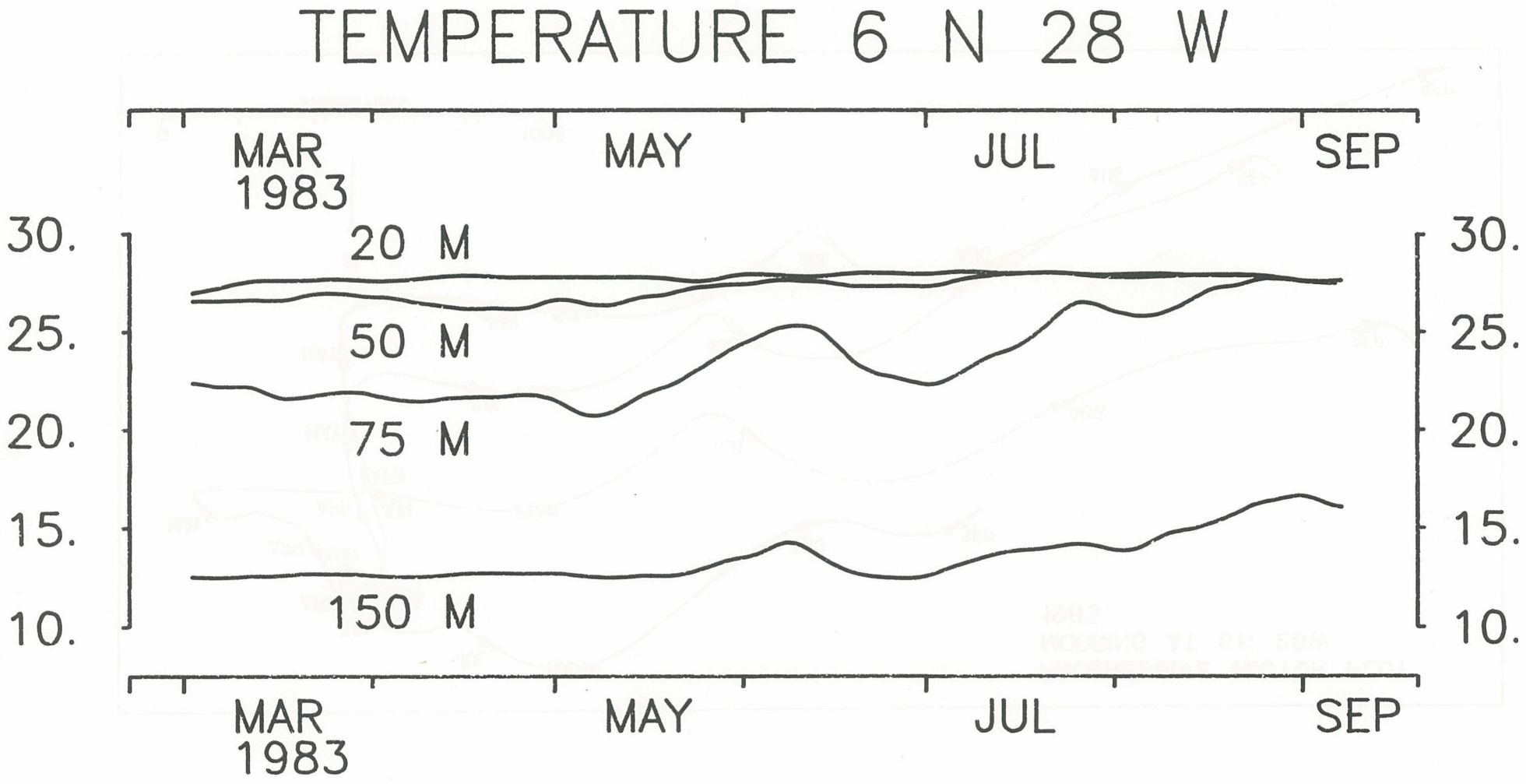


Figure 4: Composite temperature time series for the four current meters.

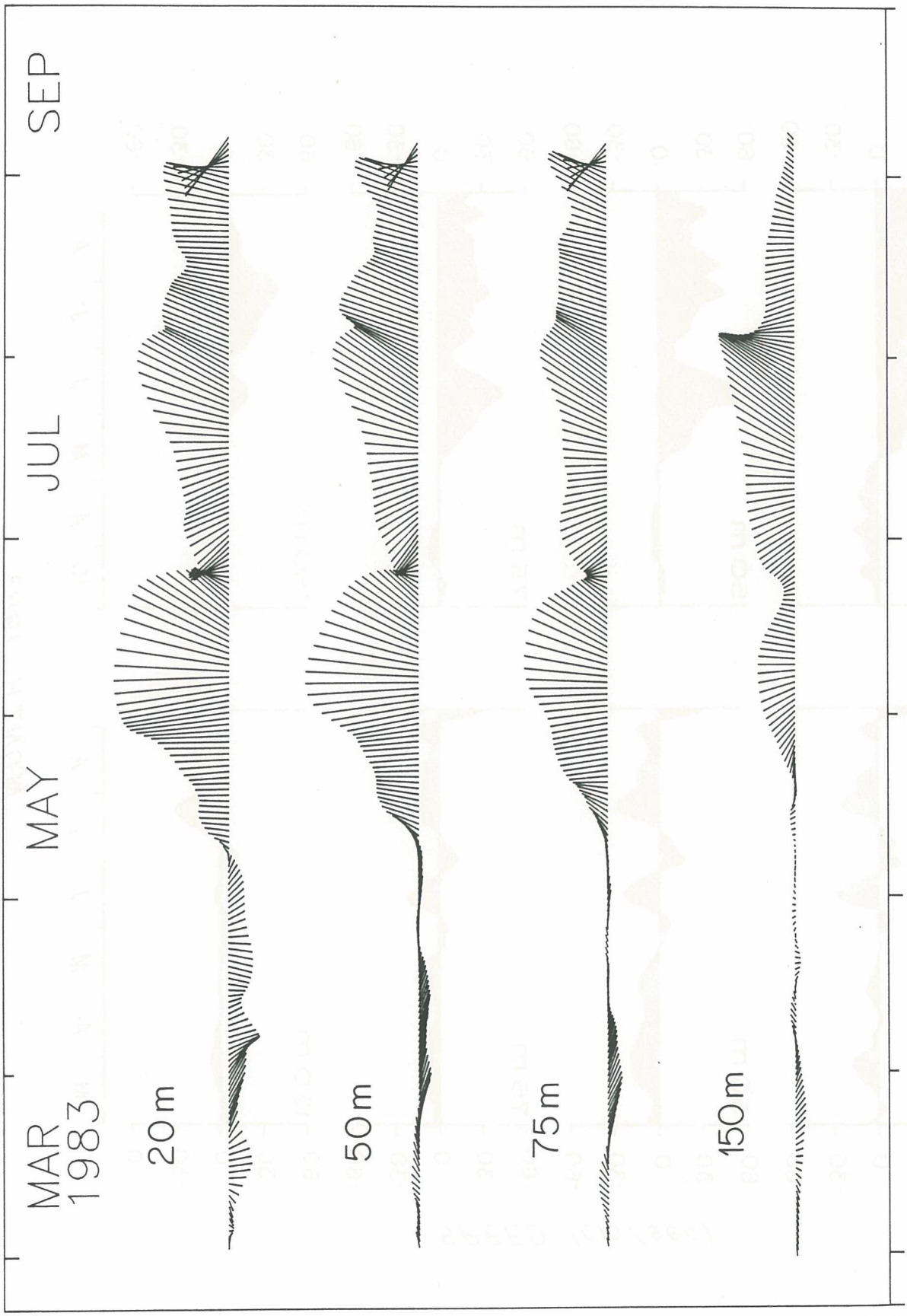


Figure 5: Composite vector time series for the four current meters.

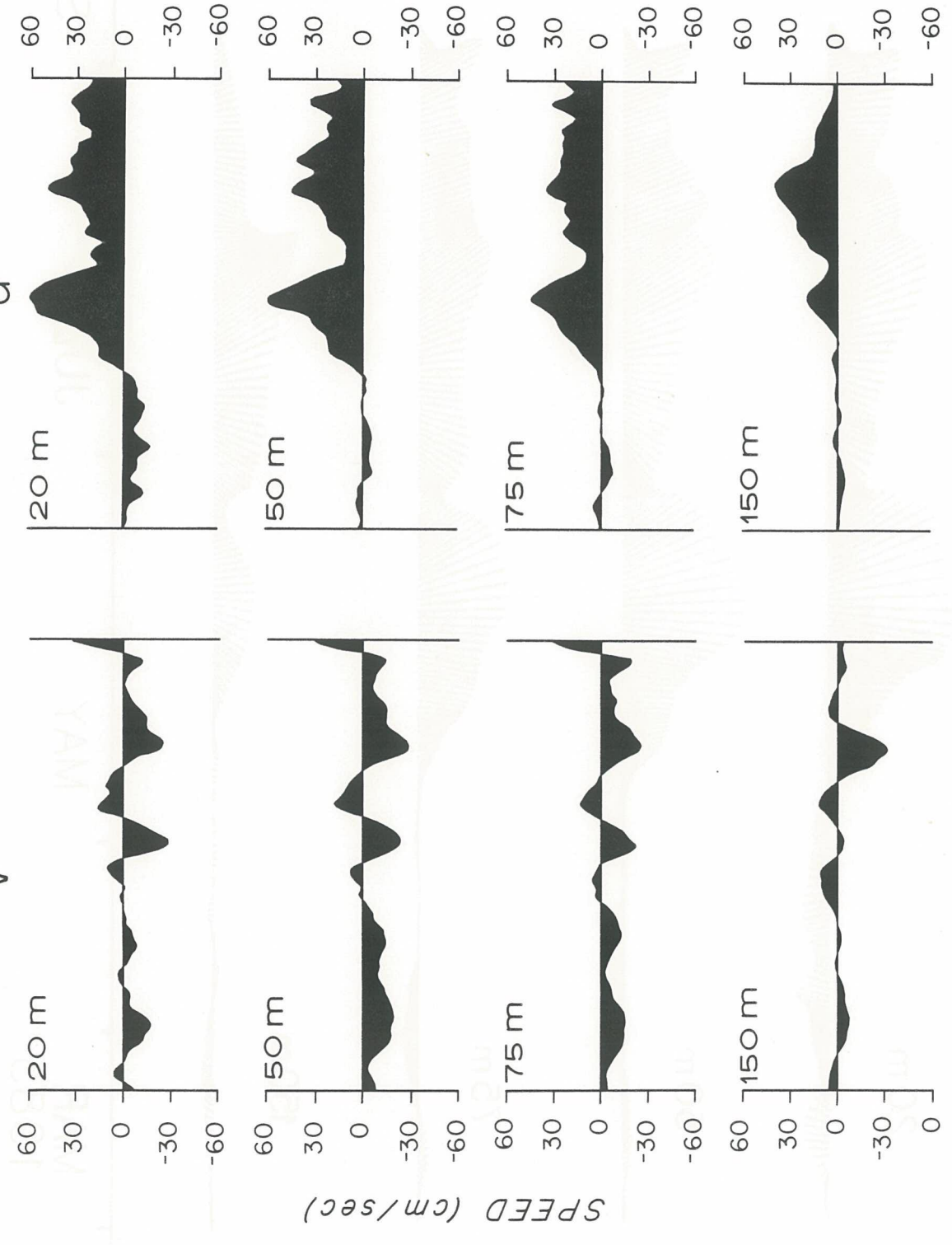


Figure 6: Composite speed time series for the east and north components for the four current meters.

```
**********************************************************************
** SA40B1H      *    1864 POINTS  FROM 83- II -25  TO  83-  V -14
  INST.  V-184WR    DEPTH    -2 M.    BOTTOM DEPTH  4363 M.
  UNITS  =        M/S          M/S          M/S          DEG C
VARIABLE ------  EAST -------  NORTH -------  SPEED -------  SEA T
MEAN          -3.749       -4.110        5.956       27.639
STD.ERR.  =     .431E-1      .472E-1       .407E-1      .602E-2
VARIANCE  =    3.462        4.159         3.093        .675E-1
KURTOSIS  =    2.866        5.854         3.047        5.577
SKEWNESS  =    0.238        1.206        -0.385       -0.933
MINIMUM   =   -9.310      -10.304         0.145       26.700
MAXIMUM   =    2.276        6.205        10.909       28.741
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =      0.467        ***      MAJAX    =        2.095
CORR.COEFF. =      0.123        ***      MINAX    =        1.796
ORIENTATION =     26.630        ***      ELLIPSE  =        0.143
COMMENTS    =
**********************************************************************
```

```
**********************************************************************
** SA40CM1DG    *      76 POINTS  FROM 83- II -26  TO  83-  V -12
  INST.  V-184WR    DEPTH    -2 M.    BOTTOM DEPTH  4363 M.
  UNITS  =        CM/SEC       CM/SEC       CM/SEC       DEG C
VARIABLE ------  EAST -------  NORTH -------  SPEED -------  TEMP
MEAN        -378.463     -416.724      577.851       27.644
STD.ERR.  =   17.304       14.821        17.093        .247E-1
VARIANCE  = 22755.965    16694.287     22204.221        .404E-1
KURTOSIS  =    2.341        4.269         2.577        5.313
SKEWNESS  =    0.428        0.755        -0.439       -1.408
MINIMUM   =  -677.281     -657.685      209.364       26.887
MAXIMUM   =   -13.519       19.113      845.742       27.990
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =   5836.027        ***      MAJAX    =      161.106
CORR.COEFF. =      0.299        ***      MINAX    =      113.912
ORIENTATION =     58.722        ***      ELLIPSE  =        0.293
COMMENTS    =
**********************************************************************
```

Figure 7

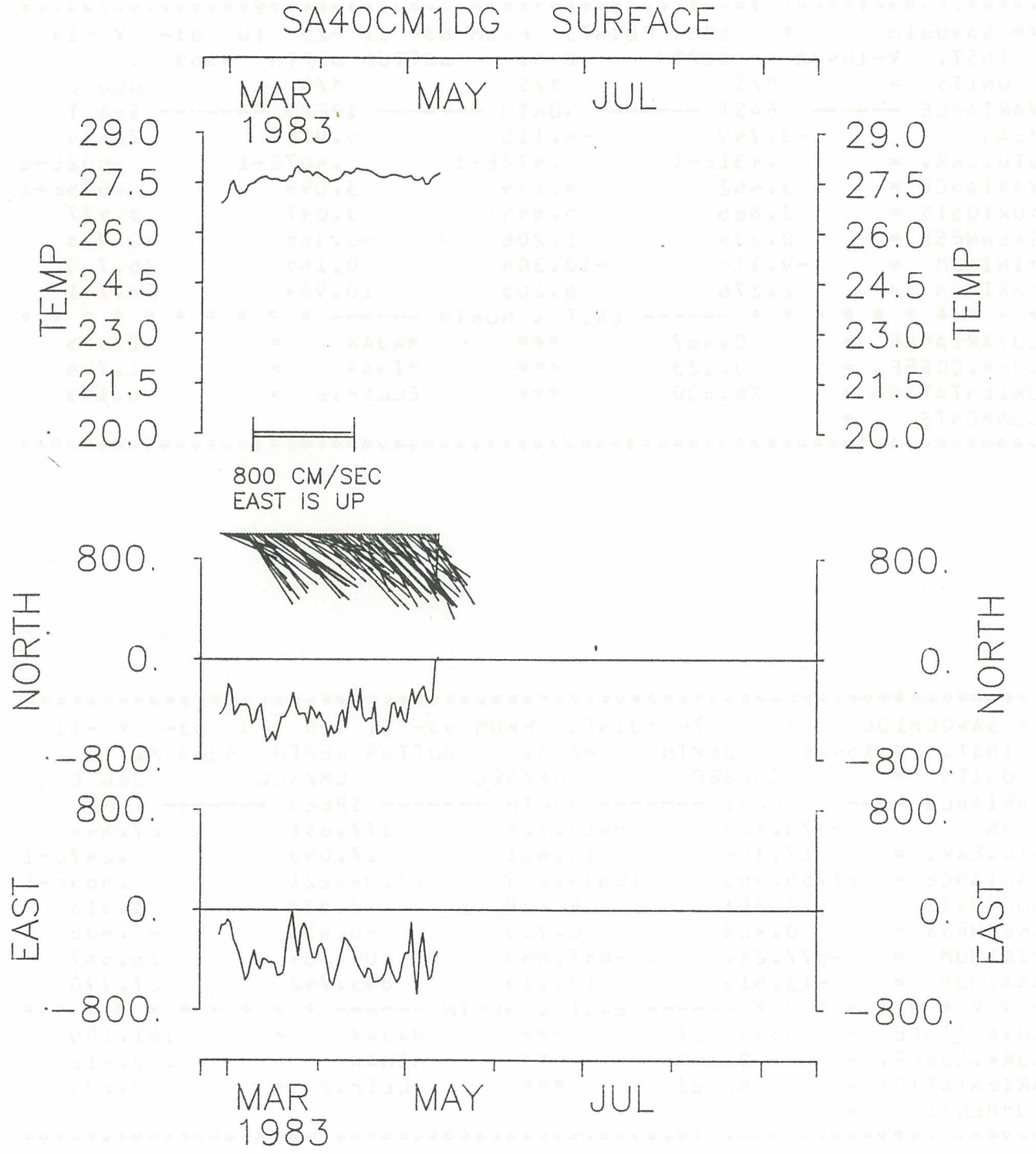

SA40CM1DG SURFACE
MAR
1983
MAY
JUL
TEMP
29.0
27.5
26.0
24.5
23.0
21.5
20.0
800 CM/SEC
EAST IS UP
NORTH
800.
0.
-800.
EAST
800.
0.
-800.
MAR
1983
MAY
JUL

Figure 8

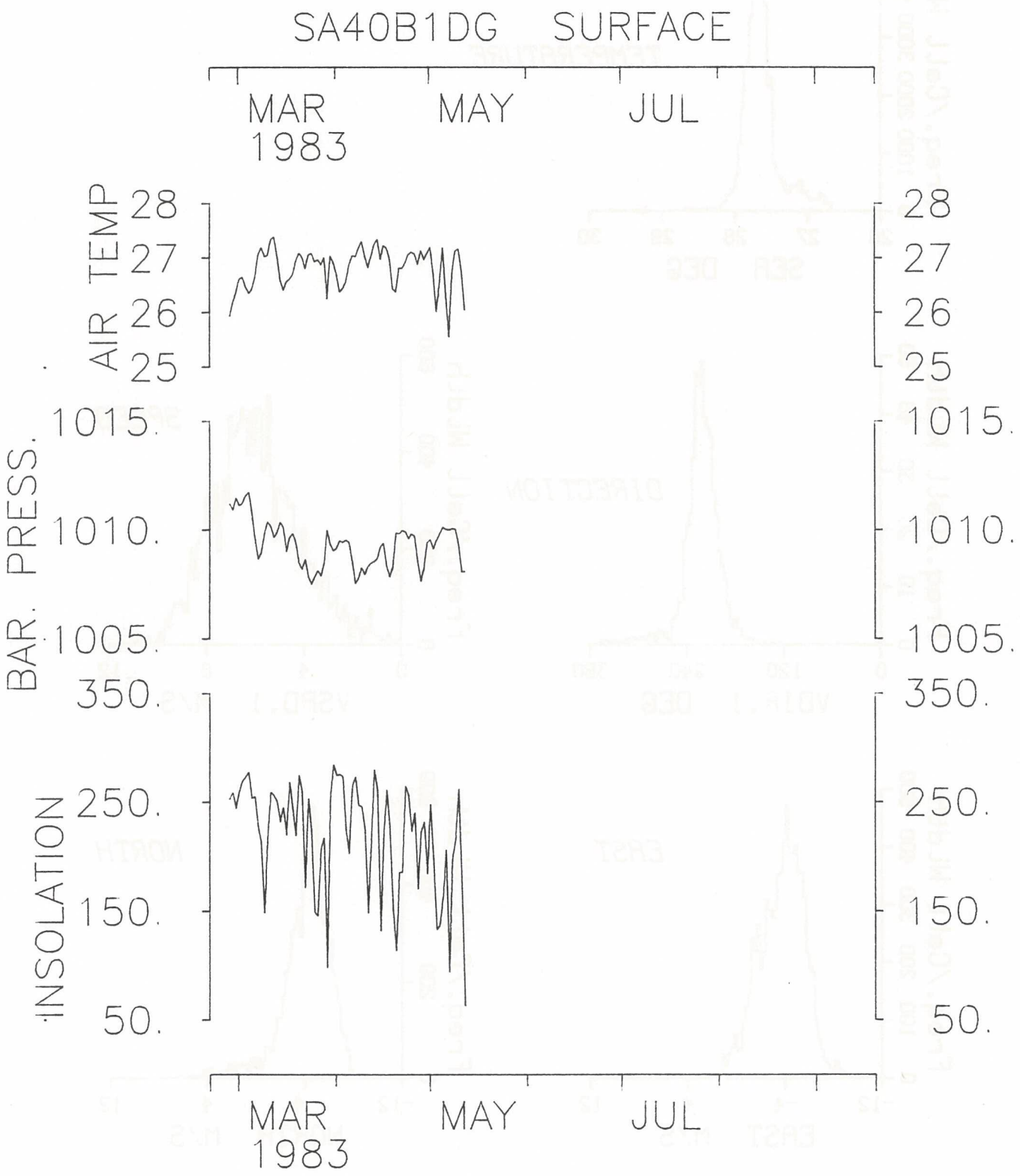

SA40B1DG SURFACE
MAR
1983
MAY
JUL
AIR TEMP
28
27
26
25
BAR. PRESS.
1015.
1010.
1005.
INSOLATION
350.
250.
150.
50.
MAR
1983
MAY
JUL

Figure 9

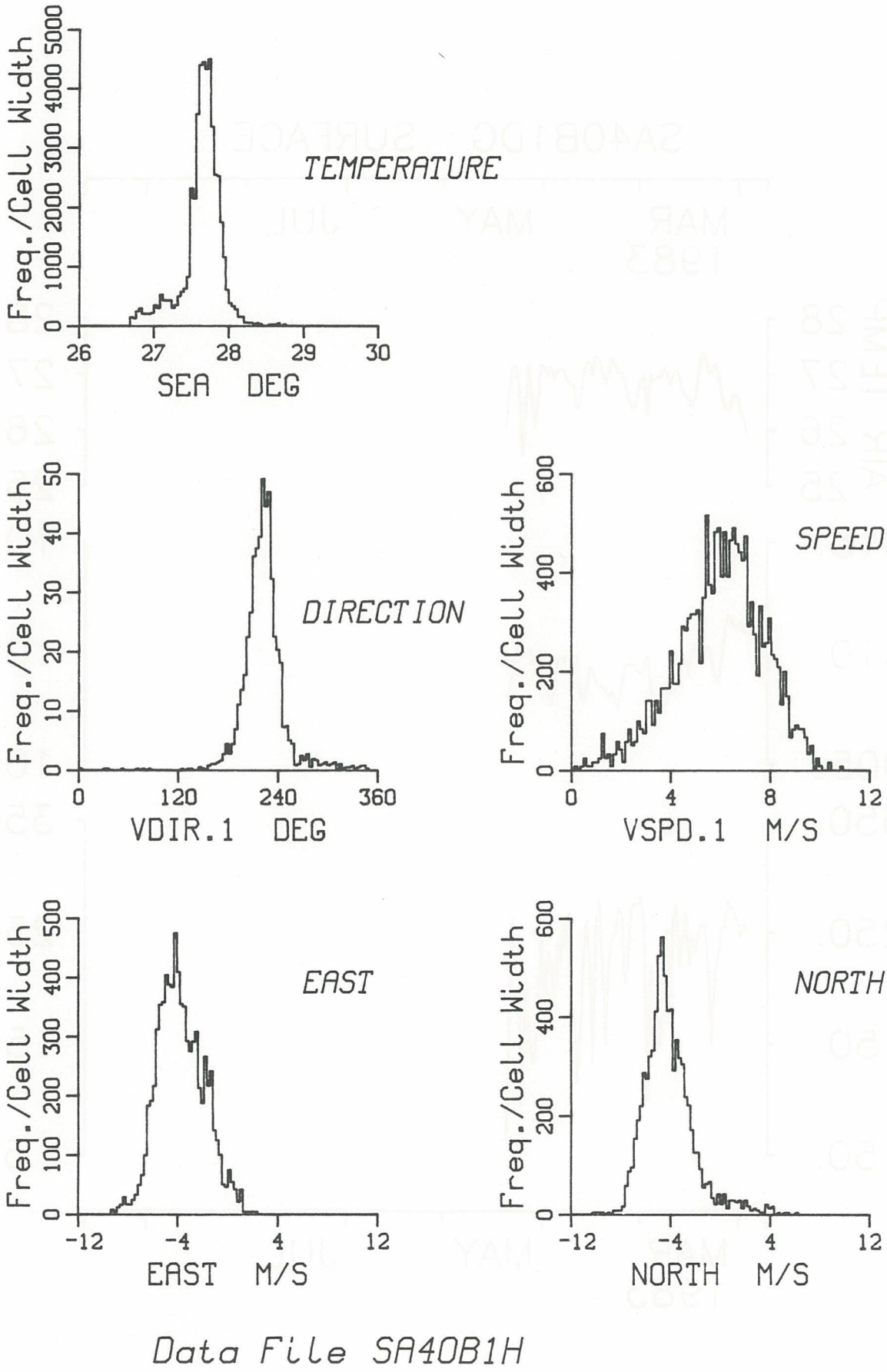
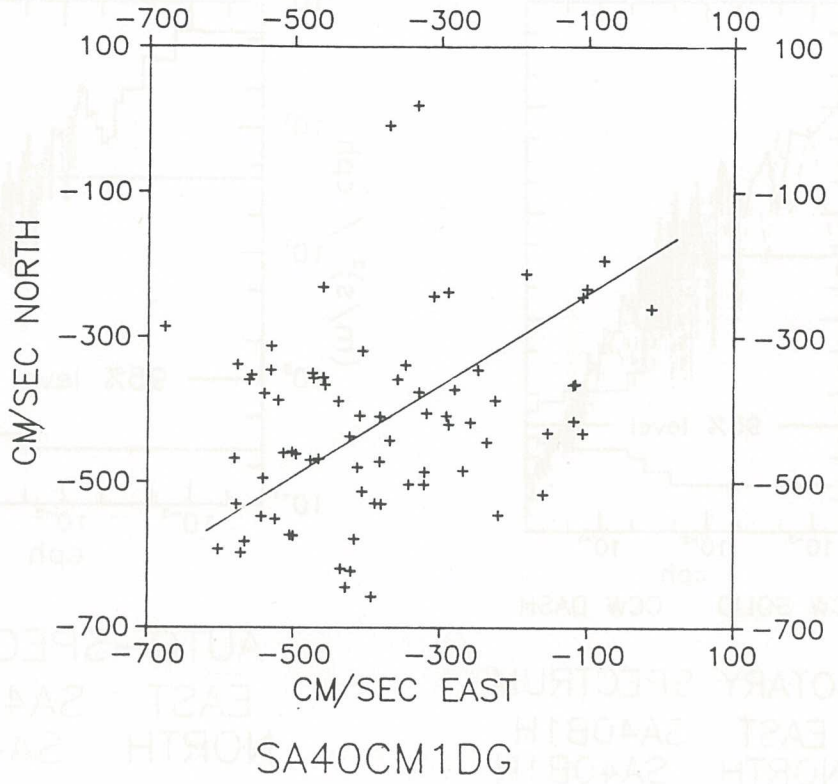

Freq./Cell Width
0 1000 2000 3000 4000 5000
TEMPERATURE
26 27 28 29 30
SEA DEG
Freq./Cell Width
0 10 20 30 40 50
DIRECTION
0 120 240 360
VDIR.1 DEG
Freq./Cell Width
0 200 400 600
SPEED
0 4 8 12
VSPD.1 M/S
Freq./Cell Width
0 100 200 300 400 500
EAST
-12 -4 4 12
EAST M/S
Freq./Cell Width
0 200 400 600
NORTH
-12 -4 4 12
NORTH M/S
Data File SA40B1H

Figure 10


−700
−500
−300
−100
100
CM/SEC NORTH
CM/SEC EAST
SA40CM1DG

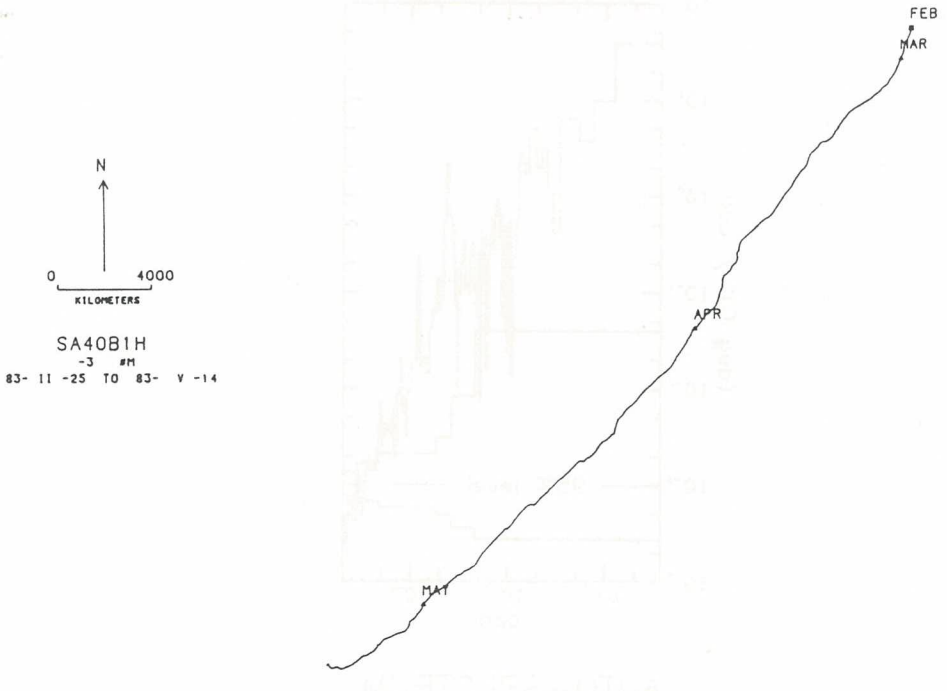
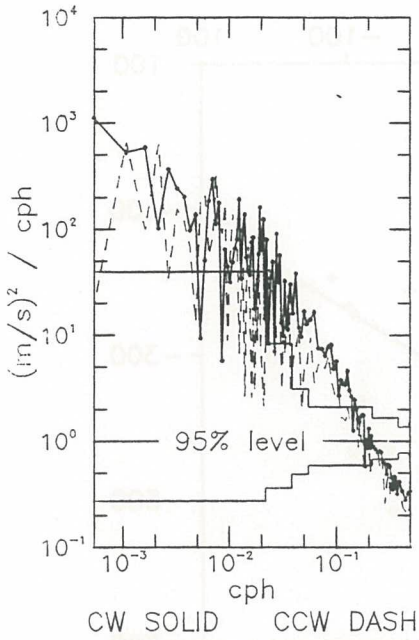
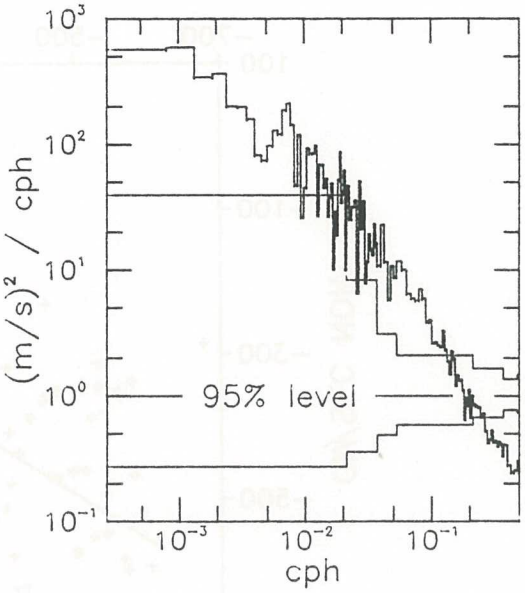

N
0
4000
KILOMETERS
SA40B1H
-3 #M
83- 11 -25 TO 83- V -14
FEB
MAR
APR
MAY

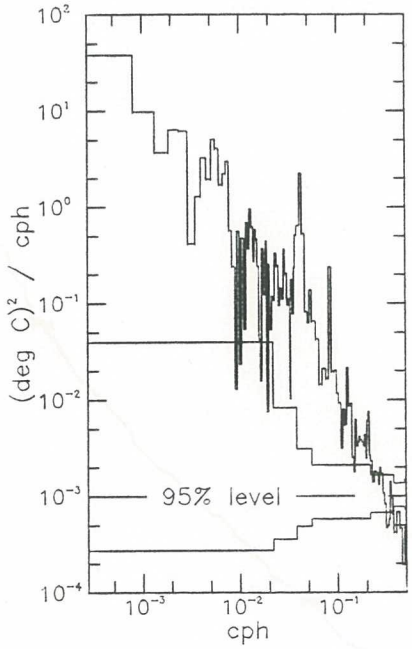
Figure 11



ROTARY SPECTRUM
EAST SA40B1H
NORTH SA40B1H



AUTO-SPECTRUM
EAST SA40B1H
NORTH SA40B1H



AUTO-SPECTRUM
SEA TEMP SA40B1H

Figure 12

```
**********************************************************************
** SA41A1H     *    4777 POINTS FROM 83- II -25  TO  83- IX -12
  INST.  VM-013     DEPTH   20 M.    BOTTOM DEPTH  4363 M.
  UNITS  =        CM/S          CM/S          CM/S          DEG C
VARIABLE ------  EAST ------- NORTH ------- SPEED ------- TEMP
MEAN          16.926        -2.833        29.128        27.743
STD.ERR.  =    0.352         0.240         0.255          .348E-2
VARIANCE  =  591.231       274.387       311.592          .578E-1
KURTOSIS  =    2.215         3.402         2.770         6.894
SKEWNESS  =    0.224         0.329         0.628        -1.672
MINIMUM   =  -38.642       -58.005         0.548        26.749
MAXIMUM   =   84.945        54.718        91.864        28.151
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE   =     -7.450        ***      MAJAX  =       24.316
CORR.COEFF.  =     - .185E-1     ***      MINAX  =       16.558
ORIENTATION  =     91.346        ***      ELLIPSE =       0.319
COMMENTS     =
**********************************************************************
```

```
**********************************************************************
** SA41A1DG    *     198 POINTS FROM 83- II -26  TO  83- IX -11
  INST.  VM-013     DEPTH   20 M.    BOTTOM DEPTH  4363 M.
  UNITS  =        CM/S          CM/S          CM/S          DEG C
VARIABLE ------  EAST ------- NORTH ------- SPEED ------- TEMP
MEAN          16.918        -2.920        27.374        27.746
STD.ERR.  =    1.637         1.033         1.200          .165E-1
VARIANCE  =  530.796       211.330       283.253          .536E-1
KURTOSIS  =    2.046         3.668         2.521         7.234
SKEWNESS  =    0.210         0.454         0.620        -1.733
MINIMUM   =  -24.146       -39.610         1.621        26.785
MAXIMUM   =   70.084        43.975        70.113        28.103
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE   =    -11.662        ***      MAJAX  =       22.990
CORR.COEFF.  =     - .348E-1     ***      MINAX  =       14.486
ORIENTATION  =     92.088        ***      ELLIPSE =       0.370
COMMENTS     =
**********************************************************************
```

Figure 13

```
**********************************************************************
** SA42A1H     *    4776 POINTS  FROM 83- II -25  TO  83- IX -12
  INST.  VM-007     DEPTH   50 M.   BOTTOM DEPTH  4363 M.
  UNITS  =        CM/S          CM/S          CM/S          DEG C
VARIABLE ------  EAST  ------- NORTH ------- SPEED ------- TEMP
MEAN          17.514         -6.844         26.979         27.200
STD.ERR. =     0.284          0.222          0.226          .102E-1
VARIANCE =   384.034        234.351        243.996          0.495
KURTOSIS =     2.706          3.723          3.093          2.772
SKEWNESS =     0.442          0.615          0.716         -0.779
MINIMUM  =   -26.423        -49.892          .443E-1       23.726
MAXIMUM  =    81.955         49.258         83.155         28.247
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =     16.513          ***      MAJAX  =         19.641
CORR.COEFF. =      .550E-1        ***      MINAX  =         15.248
ORIENTATION =     83.779          ***      ELLIPSE =         0.224
COMMENTS    =
**********************************************************************
```

```
**********************************************************************
** SA42A1DG    *     197 POINTS  FROM 83- II -26  TO  83- IX -10
  INST.  VM-007     DEPTH   50 M.   BOTTOM DEPTH  4363 M.
  UNITS  =        CM/S          CM/S          CM/S          DEG C
VARIABLE ------  EAST  ------- NORTH ------- SPEED ------- TEMP
MEAN          17.560         -7.163         25.596         27.199
STD.ERR. =     1.315          0.947          1.058          .448E-1
VARIANCE =   340.811        176.559        220.387          0.395
KURTOSIS =     2.520          4.085          2.971          1.631
SKEWNESS =     0.456          0.840          0.748         -0.322
MINIMUM  =   -14.704        -32.624          1.847         25.661
MAXIMUM  =    70.561         39.132         72.147         28.080
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =     12.715          ***      MAJAX  =         18.441
CORR.COEFF. =      .518E-1        ***      MINAX  =         13.217
ORIENTATION =     85.600          ***      ELLIPSE =         0.283
COMMENTS    =
**********************************************************************
```

Figure 14

```
**********************************************************************
** SA43A1H      *    4776 POINTS  FROM 83- II -25  TO  83- IX -12
  INST.  VM-003      DEPTH    75 M.    BOTTOM DEPTH   4363 M.
  UNITS  =         CM/S           CM/S           CM/S          DEG C
VARIABLE ------   EAST  -------  NORTH  -------  SPEED  -------  TEMP
MEAN           14.687          -5.372          24.494          23.754
STD.ERR.  =     0.247           0.221           0.188           .346E-1
VARIANCE  =   290.892         233.890         169.298           5.709
KURTOSIS  =     2.270           3.774           2.417           1.873
SKEWNESS  =      .317E-1        0.546           0.406           0.248
MINIMUM   =   -32.536         -47.047           0.225          18.257
MAXIMUM   =    68.459          62.129          68.476          28.020
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =     8.468          ***      MAJAX  =          17.090
CORR.COEFF. =      .325E-1       ***      MINAX  =          15.252
ORIENTATION =    81.727          ***      ELLIPSE =          0.103
COMMENTS    =
**********************************************************************
```

```
**********************************************************************
** SA43A1DG     *     197 POINTS  FROM 83- II -26  TO  83- IX -10
  INST.  VM-003      DEPTH    75 M.    BOTTOM DEPTH   4363 M.
  UNITS  =         CM/S           CM/S           CM/S          DEG C
VARIABLE ------   EAST  -------  NORTH  -------  SPEED  -------  TEMP
MEAN           14.684          -5.715          22.153          23.727
STD.ERR.  =     1.099           0.896           0.879           0.159
VARIANCE  =   237.856         158.156         152.307           4.986
KURTOSIS  =     1.999           3.904           2.162           1.838
SKEWNESS  =      .741E-1        0.690           0.395           0.500
MINIMUM   =   -18.349         -32.340           1.550          20.212
MAXIMUM   =    50.238          37.717          51.089          27.352
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =     8.832          ***      MAJAX  =          15.415
CORR.COEFF. =      .455E-1       ***      MINAX  =          12.506
ORIENTATION =    83.752          ***      ELLIPSE =          0.189
COMMENTS    =
**********************************************************************
```

Figure 15

```
**********************************************************************
** SA44A1H      *    4777 POINTS  FROM 83- II -25  TO  83- IX -12
  INST.  VM-005     DEPTH  150 M.    BOTTOM DEPTH  4363 M.
  UNITS  =        CM/S           CM/S           CM/S          DEG C
VARIABLE ------  EAST  ------- NORTH ------- SPEED ------- TEMP
MEAN           9.239          -0.972         14.463         13.533
STD.ERR.  =    0.190           0.149          0.180          .190E-1
VARIANCE  =  171.781         106.467        155.347          1.726
KURTOSIS  =    3.037           5.130          4.673          4.088
SKEWNESS  =    0.904          -1.009          1.435          1.326
MINIMUM   =  -19.952         -46.222          0.111         11.720
MAXIMUM   =   62.138          50.279         73.931         19.324
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =   -49.870          ***       MAJAX   =        14.096
CORR.COEFF. =    -0.369          ***       MINAX   =         8.916
ORIENTATION =   118.391          ***       ELLIPSE =         0.367
COMMENTS    =
**********************************************************************
```

```
**********************************************************************
** SA44A1DG     *     198 POINTS  FROM 83- II -26  TO  83- IX -11
  INST.  VM-005     DEPTH  150 M.    BOTTOM DEPTH  4363 M.
  UNITS  =        CM/S           CM/S           CM/S          DEG C
VARIABLE ------  EAST  ------- NORTH ------- SPEED ------- TEMP
MEAN           9.261          -1.014         13.381         13.530
STD.ERR.  =    0.891           0.673          0.882          .894E-1
VARIANCE  =  157.123          89.565        153.976          1.584
KURTOSIS  =    2.979           5.714          4.636          3.412
SKEWNESS  =    0.979          -1.330          1.482          1.235
MINIMUM   =   -7.625         -39.934          0.659         12.252
MAXIMUM   =   45.151          16.280         55.502         17.114
* * * * * * * * * * ------ EAST & NORTH ------ * * * * * * * * * *
COVARIANCE  =   -52.012          ***       MAJAX   =        13.580
CORR.COEFF. =    -0.438          ***       MINAX   =         7.811
ORIENTATION =   118.499          ***       ELLIPSE =         0.425
COMMENTS    =
**********************************************************************
```

Figure 16

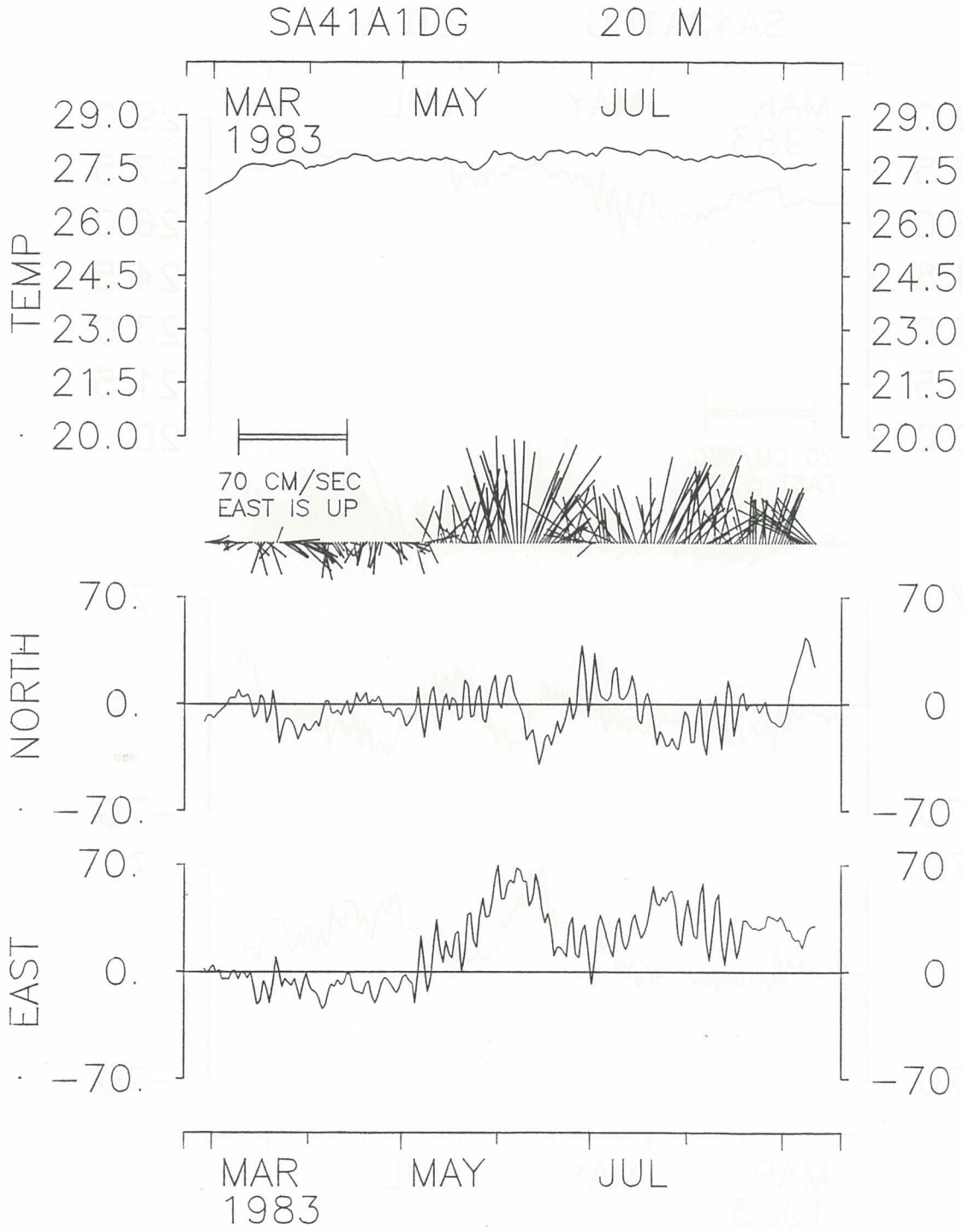

SA41A1DG
20 M
MAR
1983
MAY
JUL
TEMP
29.0
27.5
26.0
24.5
23.0
21.5
20.0
70 CM/SEC
EAST IS UP
NORTH
70.
0.
-70.
EAST
70.
0.
-70.
MAR
1983
MAY
JUL

Figure 17

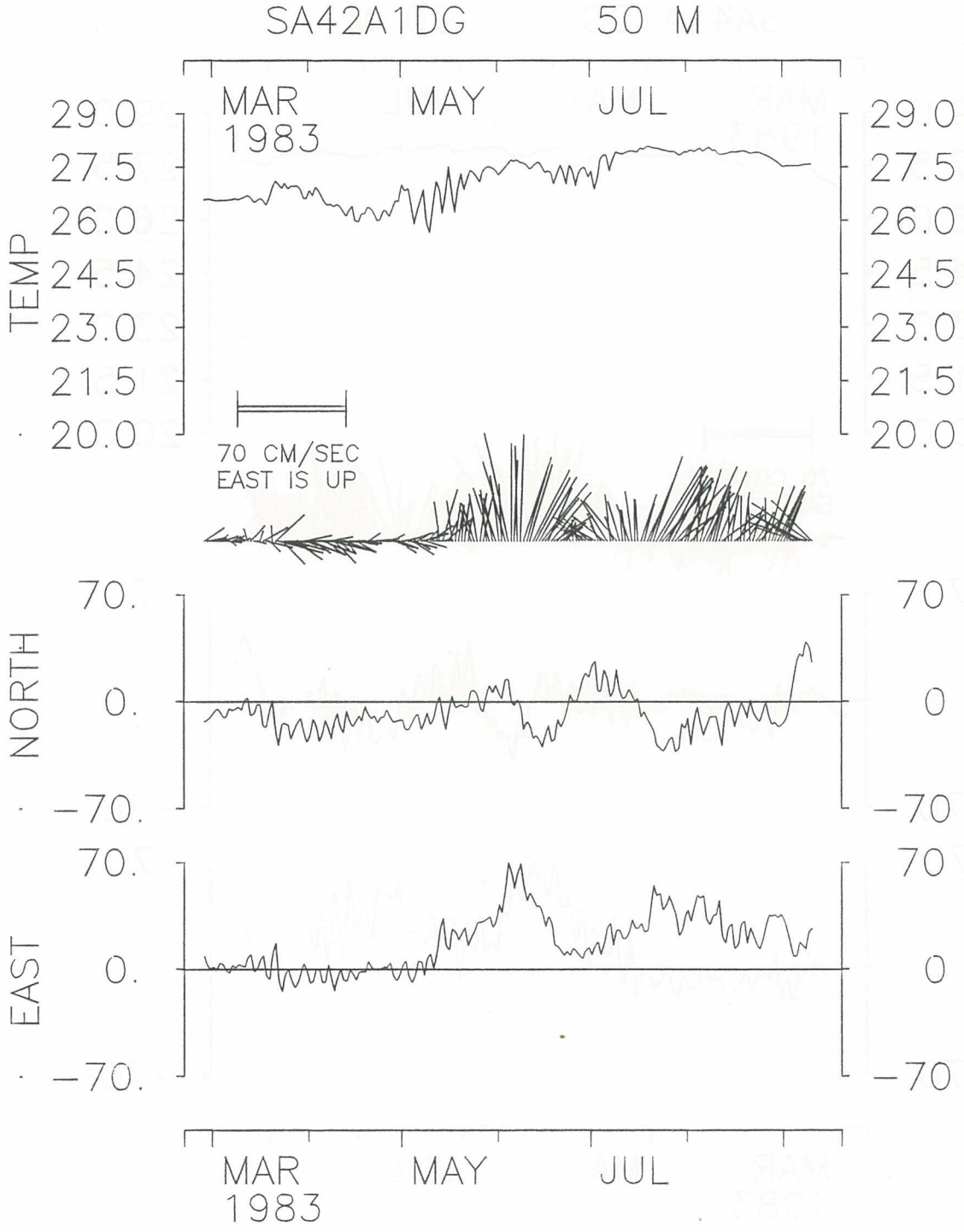

SA42A1DG
50 M
MAR
1983
MAY
JUL
TEMP
29.0
27.5
26.0
24.5
23.0
21.5
20.0
70 CM/SEC
EAST IS UP
NORTH
70.
0.
-70.
EAST
70.
0.
-70.
MAR
1983
MAY
JUL

Figure 18

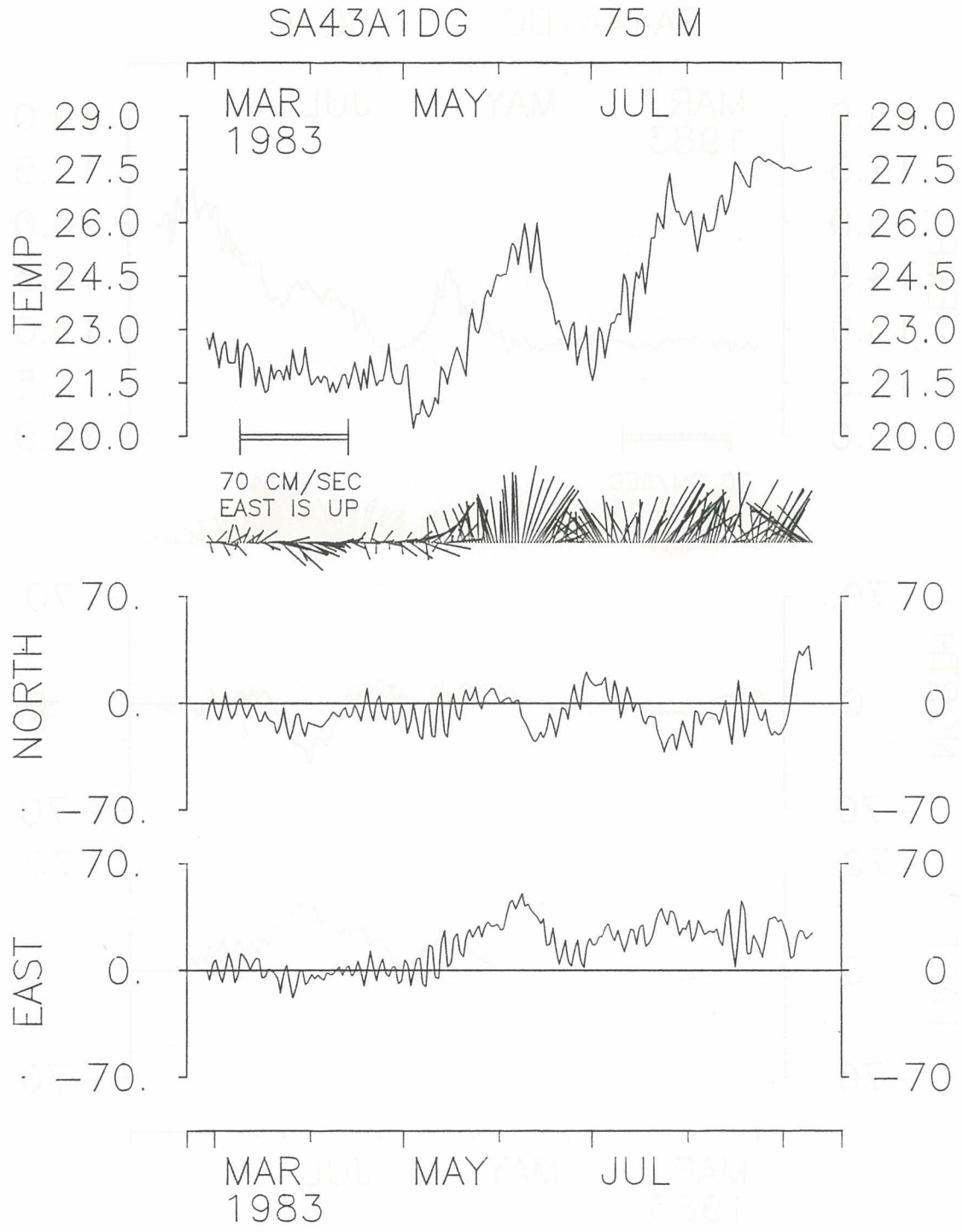

SA43A1DG 75 M
MAR
1983
MAY
JUL
TEMP
29.0
27.5
26.0
24.5
23.0
21.5
20.0
70 CM/SEC
EAST IS UP
NORTH
70.
0.
-70.
EAST
70.
0.
-70.
MAR
1983
MAY
JUL

Figure 19

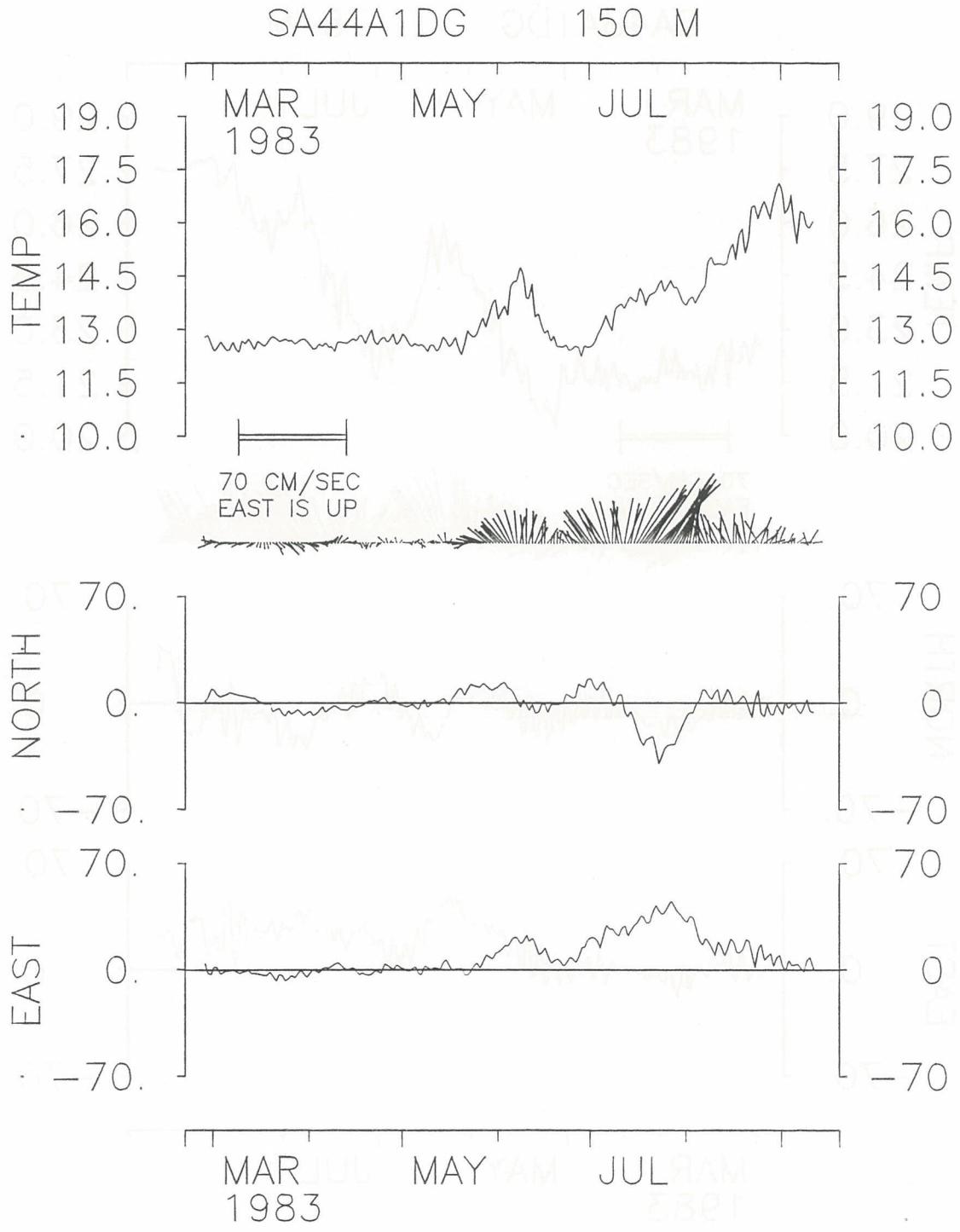

SA44A1DG 150 M
MAR
1983
MAY
JUL
TEMP
19.0
17.5
16.0
14.5
13.0
11.5
10.0
70 CM/SEC
EAST IS UP
NORTH
70.
0.
−70.
EAST
70.
0.
−70.
MAR
1983
MAY
JUL

Figure 20

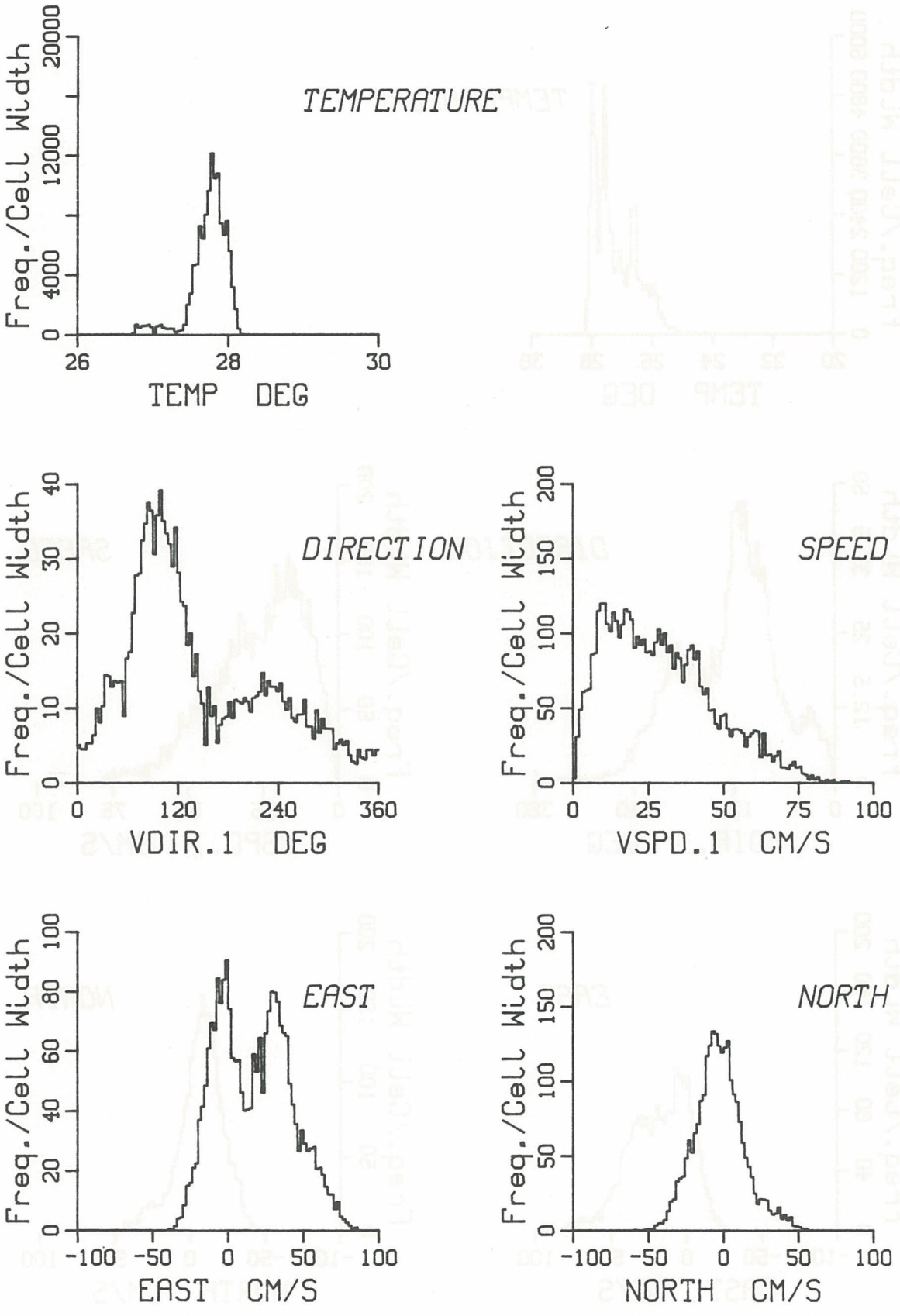

TEMPERATURE
Freq./Cell Width
0
4000
12000
20000
26
28
30
TEMP DEG
DIRECTION
Freq./Cell Width
0
10
20
30
40
0
120
240
360
VDIR.1 DEG
SPEED
Freq./Cell Width
0
50
100
150
200
0
25
50
75
100
VSPD.1 CM/S
EAST
Freq./Cell Width
0
20
40
60
80
100
-100
-50
0
50
100
EAST CM/S
NORTH
Freq./Cell Width
0
50
100
150
200
-100
-50
0
50
100
NORTH CM/S
Data File SA41A1H : Depth = 20m

Figure 21

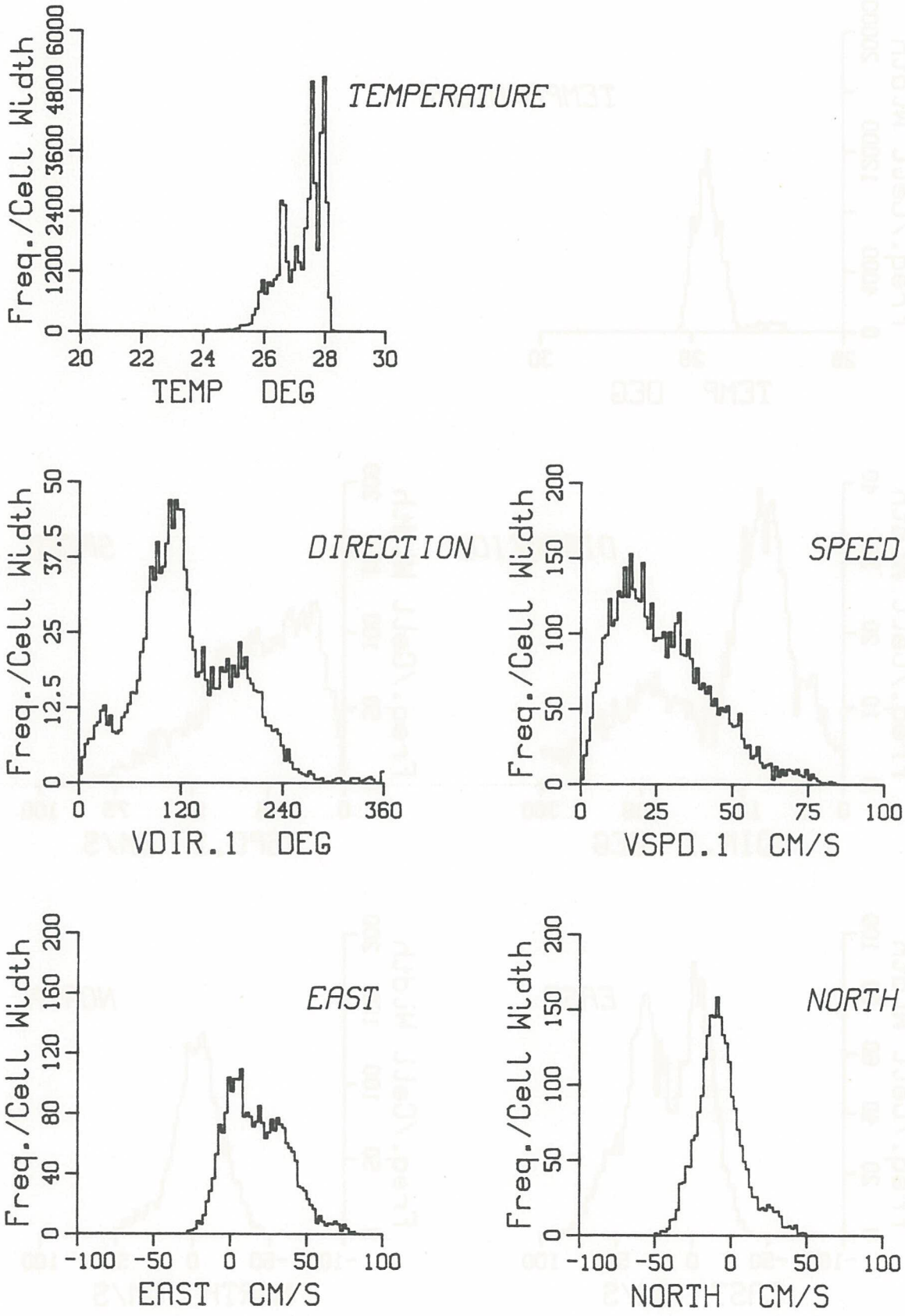

TEMPERATURE
Freq./Cell Width
0 1200 2400 3600 4800 6000
20 22 24 26 28 30
TEMP DEG
DIRECTION
Freq./Cell Width
0 12.5 25 37.5 50
0 120 240 360
VDIR.1 DEG
SPEED
Freq./Cell Width
0 50 100 150 200
0 25 50 75 100
VSPD.1 CM/S
EAST
Freq./Cell Width
0 40 80 120 160 200
-100 -50 0 50 100
EAST CM/S
NORTH
Freq./Cell Width
0 50 100 150 200
-100 -50 0 50 100
NORTH CM/S
Data File SA42A1H : Depth = 50m

Figure 22

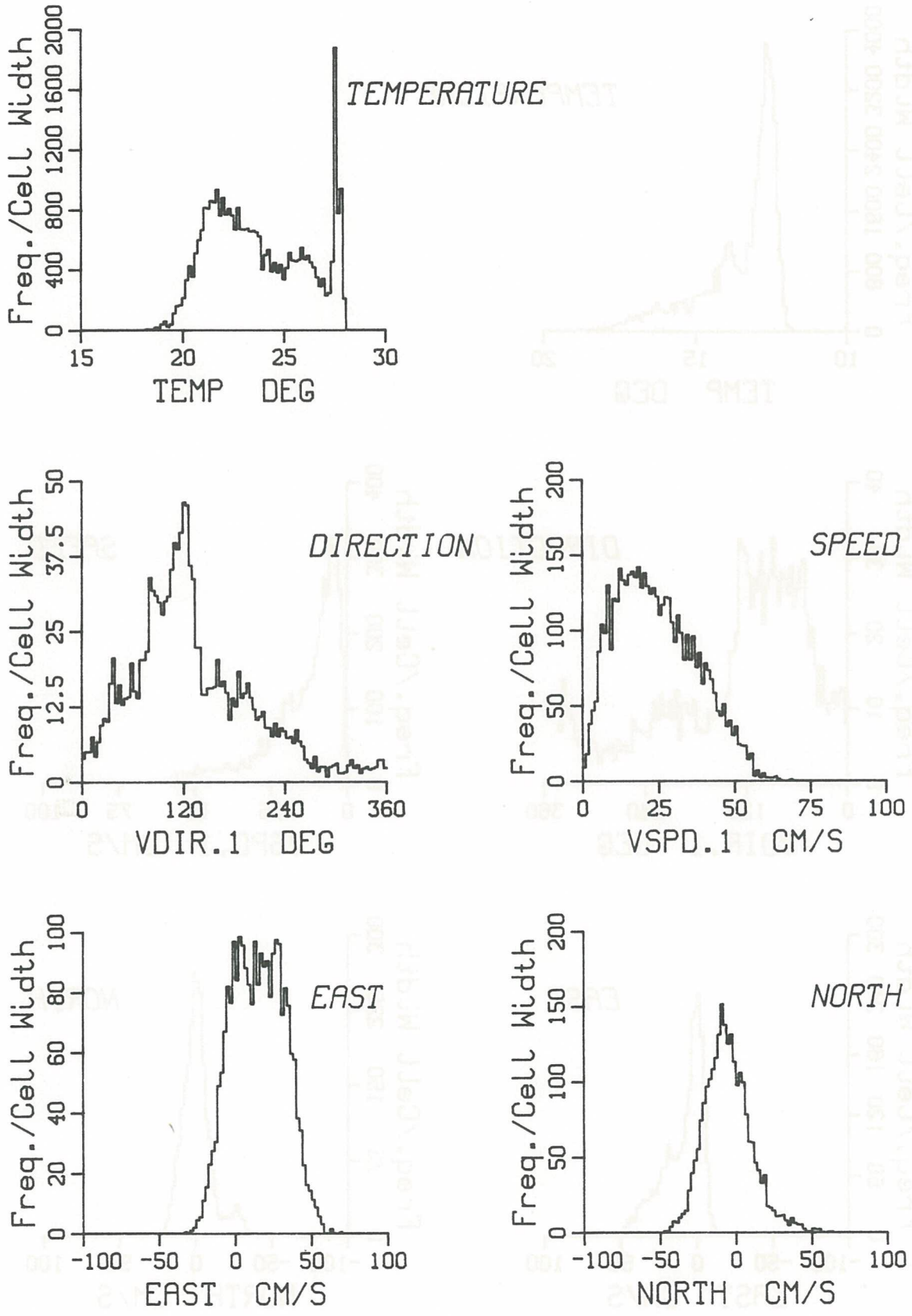

TEMPERATURE
Freq./Cell Width
0 400 800 1200 1600 2000
15 20 25 30
TEMP DEG
DIRECTION
Freq./Cell Width
0 12.5 25 37.5 50
0 120 240 360
VDIR.1 DEG
SPEED
Freq./Cell Width
0 50 100 150 200
0 25 50 75 100
VSPD.1 CM/S
EAST
Freq./Cell Width
0 20 40 60 80 100
-100 -50 0 50 100
EAST CM/S
NORTH
Freq./Cell Width
0 50 100 150 200
-100 -50 0 50 100
NORTH CM/S
Data File SA43A1H : Depth = 75m

Figure 23

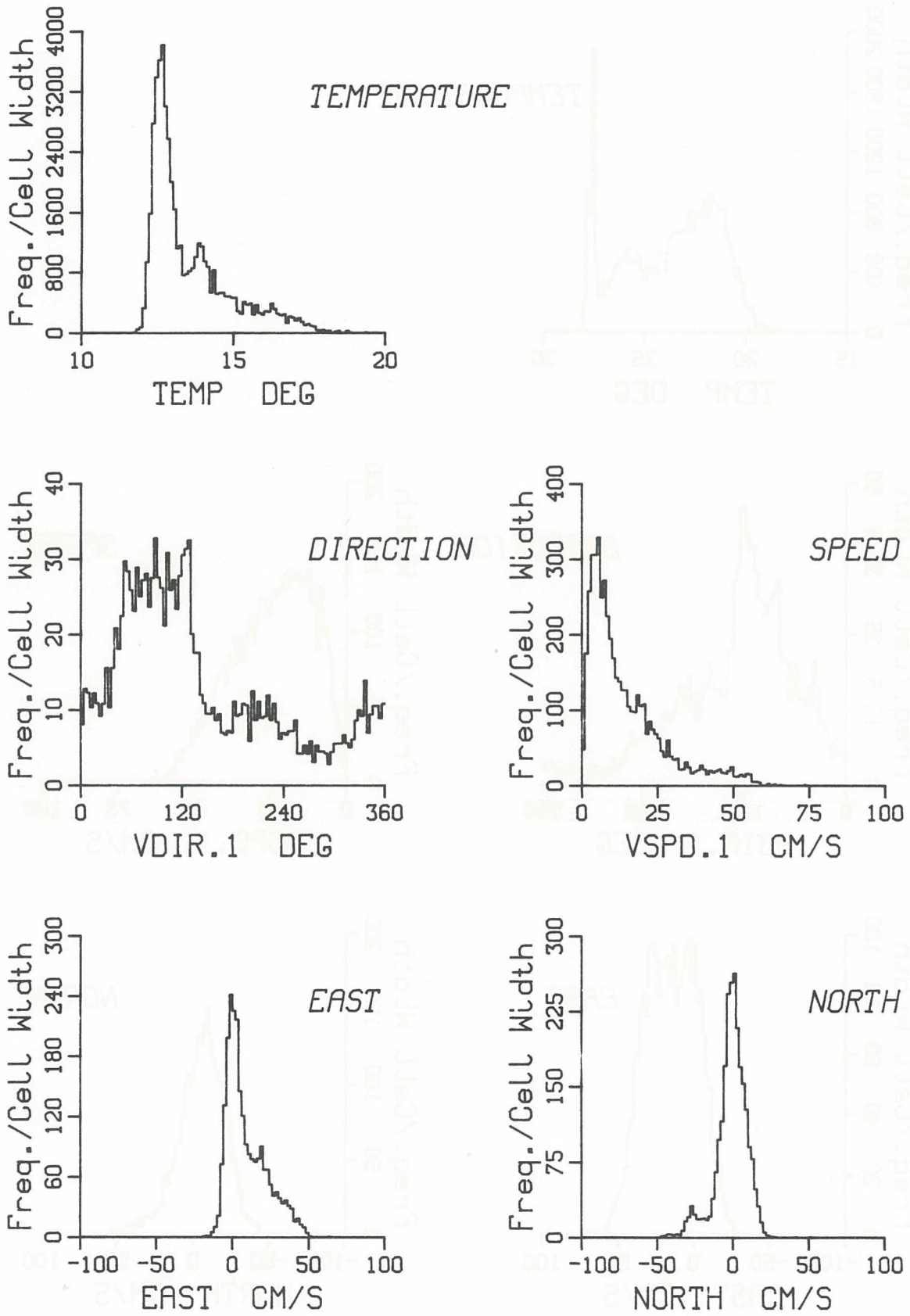

TEMPERATURE
Freq./Cell Width
0 800 1600 2400 3200 4000
10 15 20
TEMP DEG
DIRECTION
Freq./Cell Width
0 10 20 30 40
0 120 240 360
VDIR.1 DEG
SPEED
Freq./Cell Width
0 100 200 300 400
0 25 50 75 100
VSPD.1 CM/S
EAST
Freq./Cell Width
0 60 120 180 240 300
-100 -50 0 50 100
EAST CM/S
NORTH
Freq./Cell Width
0 75 150 225 300
-100 -50 0 50 100
NORTH CM/S
Data File SA44A1H : Depth = 150m

Figure 24

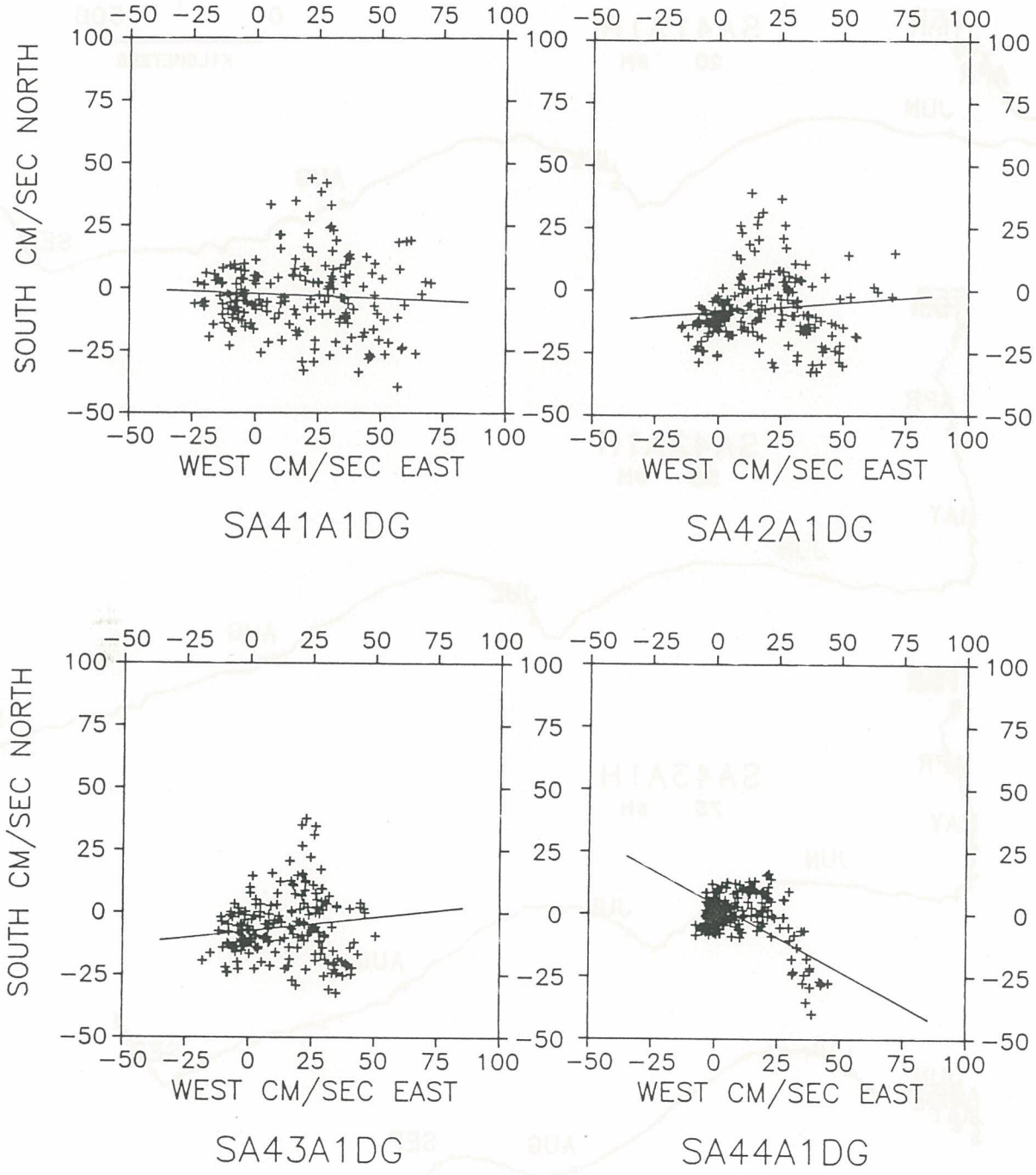

SOUTH CM/SEC NORTH
WEST CM/SEC EAST
SA41A1DG
SA42A1DG
SA43A1DG
SA44A1DG

Figure 25

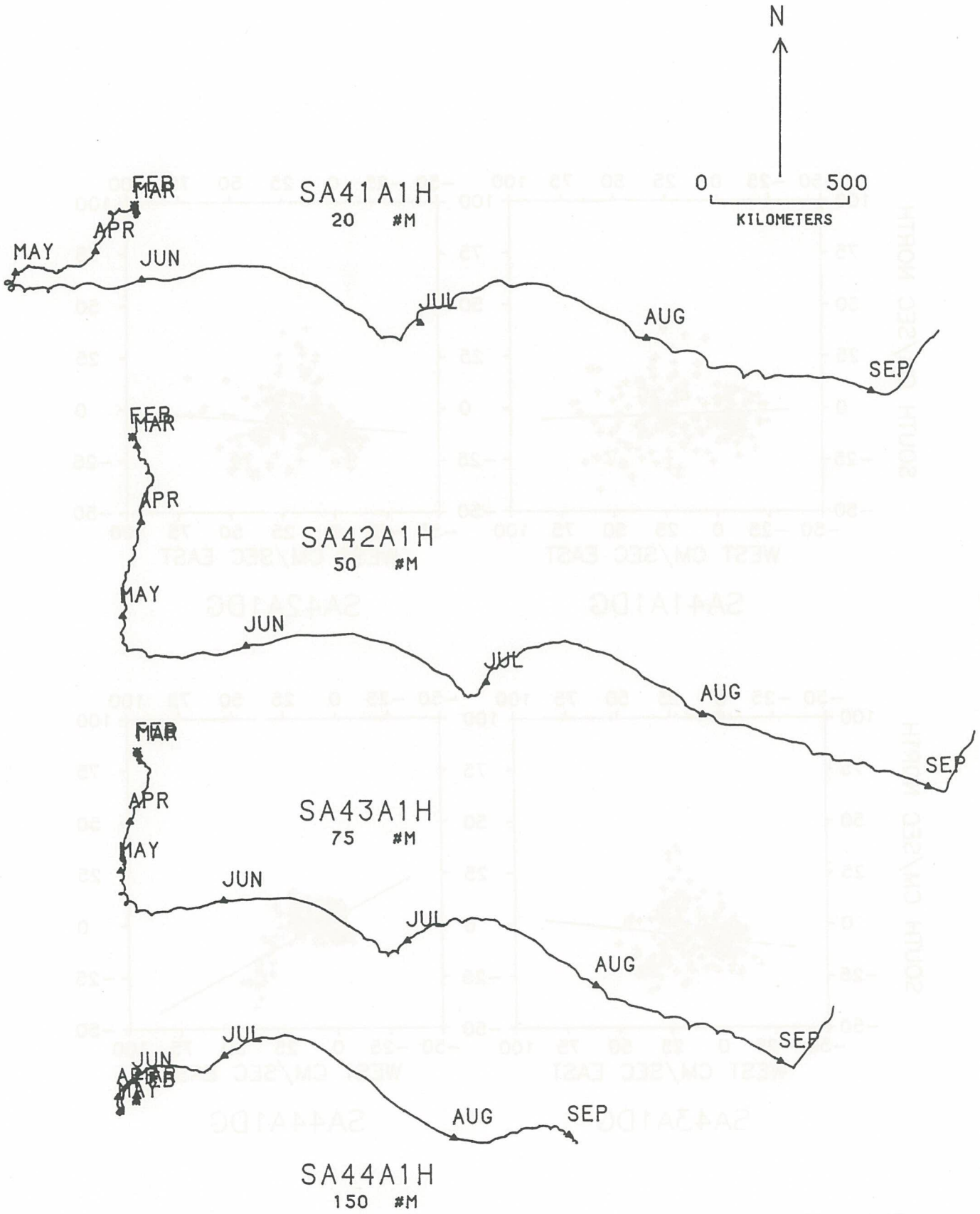
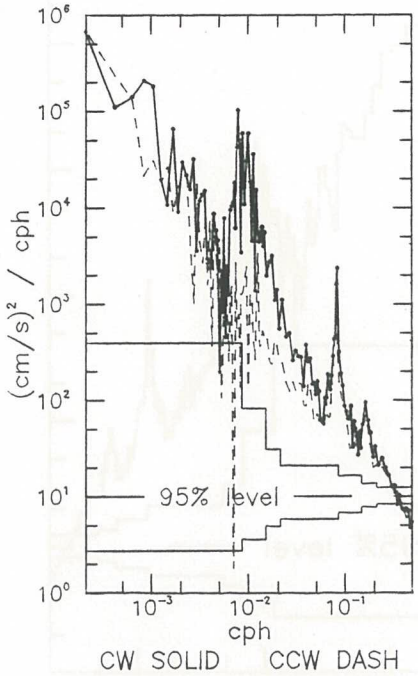
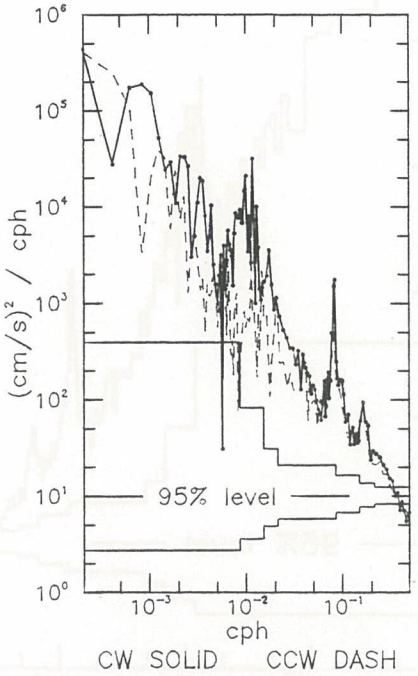

N
0
500
KILOMETERS
SA41A1H
20 #M
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
SA42A1H
50 #M
SA43A1H
75 #M
SA44A1H
150 #M

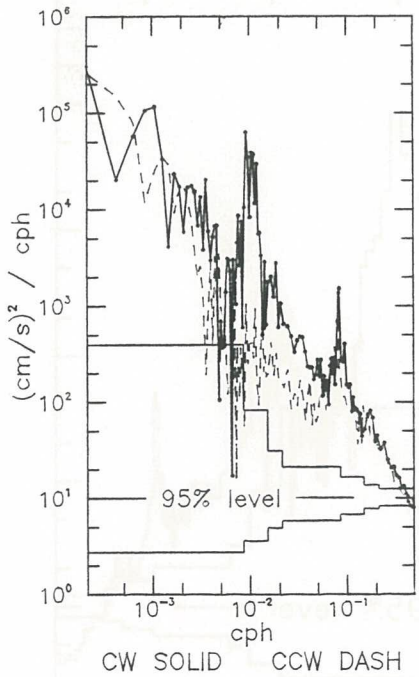
Figure 26



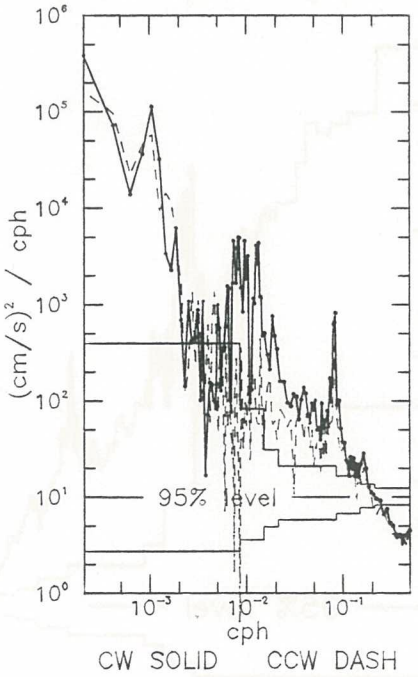
ROTARY SPECTRUM
CLOCKWISE IS SOLID LINE
SA41A1H



ROTARY SPECTRUM
CLOCKWISE IS SOLID LINE
SA42A1H



ROTARY SPECTRUM
CLOCKWISE IS SOLID LINE
SA43A1H



ROTARY SPECTRUM
CLOCKWISE IS SOLID LINE
SA44A1H

Figure 27

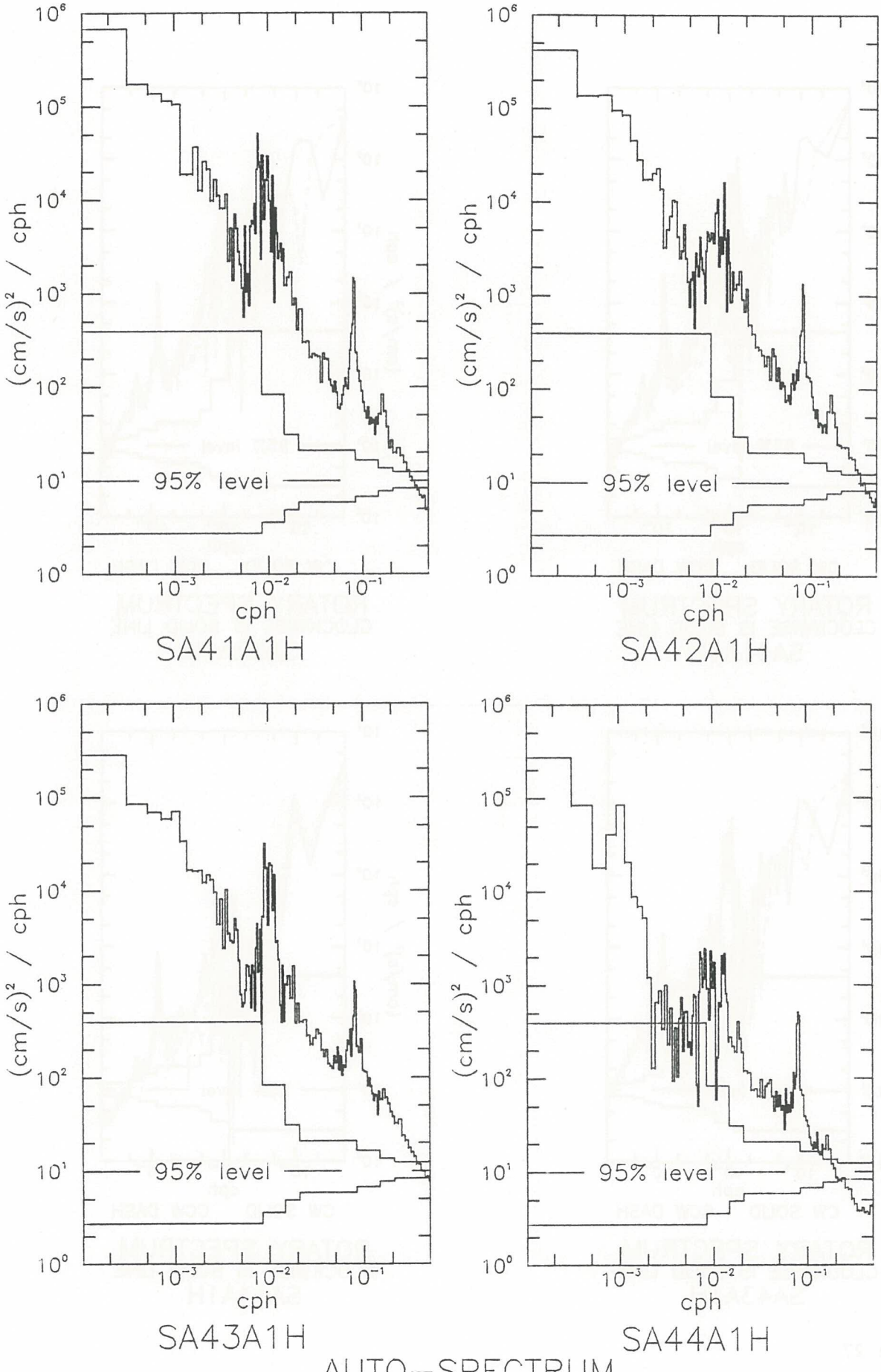
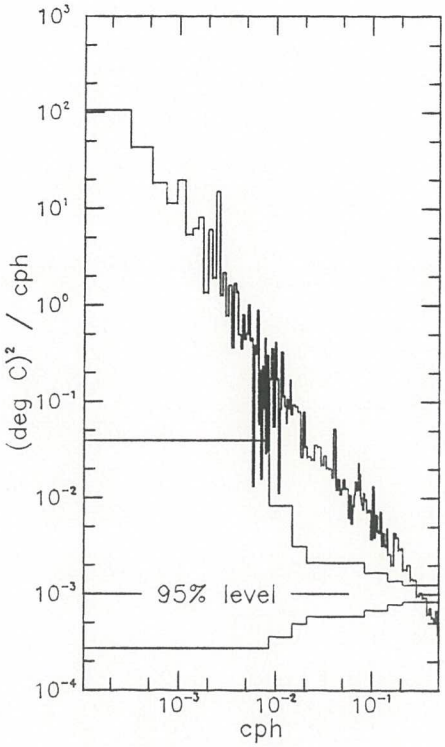
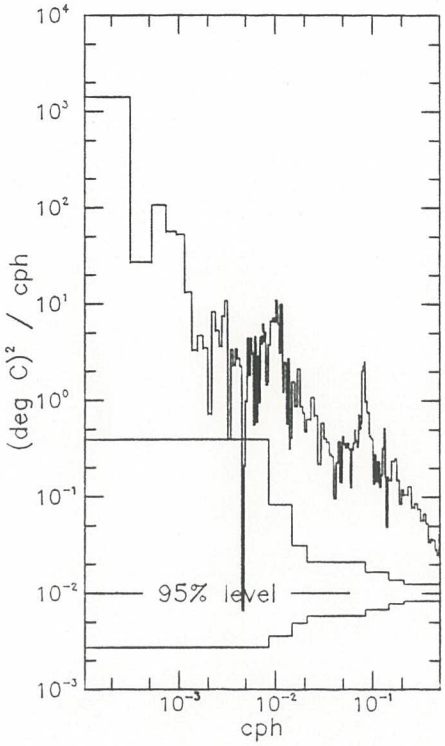

10^6
10^5
10^4
10^3
10^2
10^1
10^0
$(cm/s)^2$ / cph
95% level
10^{-3}
10^{-2}
10^{-1}
cph
SA41A1H
SA42A1H
SA43A1H
SA44A1H
AUTO-SPECTRUM

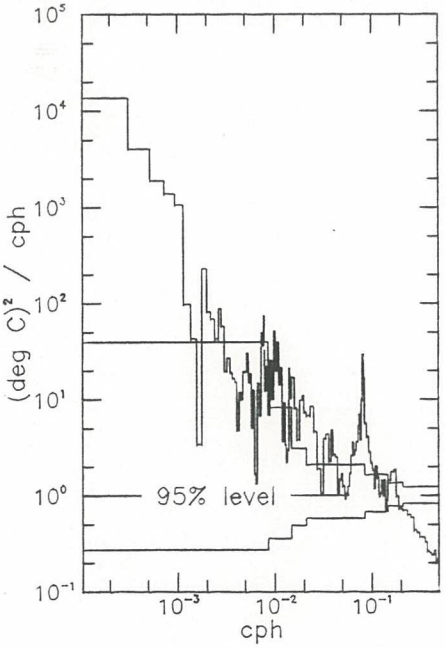
Figure 28



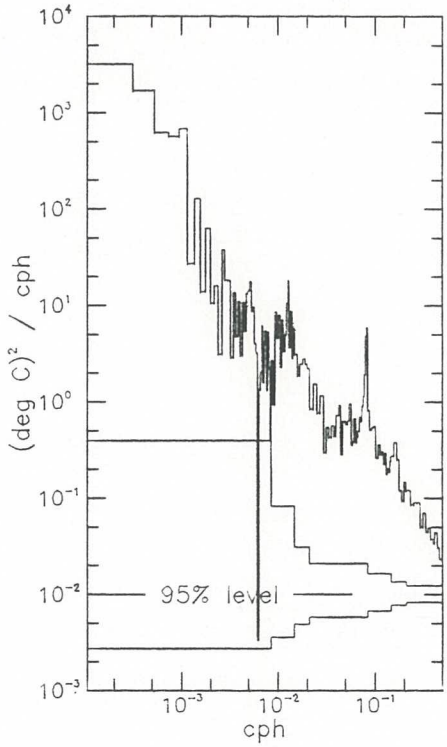
TEMP SA41A1H



TEMP SA42A1H



TEMP SA43A1H



TEMP SA44A1H

Figure 29

50272-101

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4. Title and Subtitle

Moored Current Meter Data from the Atlantic North Equatorial Countercurrent Near 6° N 28° W (February - September, 1983) Vol. XXXIV

5. Report Date

6. May 1984

7. Author(s)

Ellen Levy and Philip L. Richardson

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Woods Hole, Massachusetts 02543

10. Project/Task/Work Unit No.

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(C) OCE82-17112
(G) OCE82-11108

12. Sponsoring Organization Name and Address

National Science Foundation

13. Type of Report & Period Covered

Technical

14.

15. Supplementary Notes

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16. Abstract (Limit: 200 words)

This report presents current and wind data from the first of three surface mooring deployments in the Atlantic North Equatorial Countercurrent near 6° N and 28° W. A Vector Averaging Wind Recorder (VAWR) measured wind velocity, sea surface temperature and air temperature, barometric pressure and solar insolation. Four Vector Measuring Current Meters (VMCM) measured current velocity and temperature at depths of 20, 50, 75 and 150 m. The mooring was deployed on February 25 and recovered (and replaced) on September 13, 1983.

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2. ocean temperatures
3. moored instruments

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c. COSATI Field/Group

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