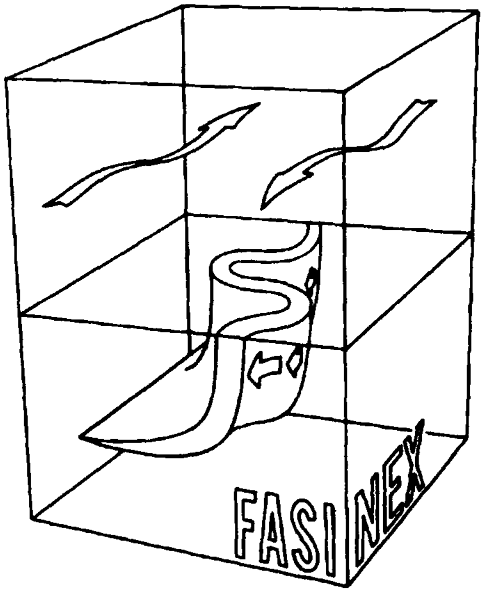
WHOI Technical Report 88-63

FASINEX

(Frontal Air-Sea Interaction Experiment)



FASINEX Moored Current Meter Array Data Report including

WHOI Meteorologically Instrumented Surface Moorings
(F2-845, F4-846, F6-847, F8-848, F10-849)
and
WHOI Long Term Subsurface Moorings
(F1-829, F12-830)

Nancy J. Pennington
Robert A. Weller
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December 1988

FASINEX Contribution No. 46

WHOI-88-63

Frontal Air-Sea Interaction Experiment (FASINEX) January - June 1986

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Technical Report
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Abstract

The Frontal Air-Sea Interaction Experiment (FASINEX) examined air-sea interaction in the vicinity of sea surface temperature fronts in the Subtropical Convergence Zone (STCZ). Mooring measurements were made from five surface, four Profiling Current Meter (PCM) and two longer duration subsurface moorings. The surface and PCM moorings, which made up the FASINEX central array ~~were~~ set in January 1986 and remained on station for six months. ~~The two~~ outlying subsurface moorings, set 90 miles south and 30 miles north of the central array were deployed in October 1984 and were recovered with the central array moorings in June 1986.

The surface moorings collected oceanographic and meteorological data, using a 3-meter instrumented discus buoy and eight to ten Vector Measuring Current Meters (VMCMs) and Vector Averaging Current Meters (VACMs). The surface buoy carried a Vector Measuring Wind recorder (VAWR) and a Meteorological Recorder (MR) which measured wind speed and direction, sea surface temperature (SST), air temperature, insolation, barometric pressure and relative humidity. The MR also transmitted meteorological and engineering data via ARGOS. The VMCMs and VACMs, placed from 10 to 4000 m, measured oceanic velocities and temperatures. The subsurface moorings measured oceanic velocities and temperature from ~~160 to~~ 4060 m, carrying a total of seven VACMs and a WOTAN (Wind Observations Through Ambient Noise).

This report presents meteorological and oceanographic data from the seven W.H.O.I. moorings, with major emphasis on the surface mooring data. Details of the moored array and a statement of data return and quality are also included. (JES)

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1. Introduction

The Frontal Air-Sea Interaction Experiment (FASINEX) was a field study conducted in the subtropical convergence zone (STCZ) southwest of Bermuda. The six month experiment used moorings, ships, aircraft and satellite remote sensing to gather data in the vicinity of sea surface temperature fronts. (See Stage and Weller, 1985 and 1986 for details on the background, scientific objectives and experimental plan.)

The time line (Figure 1) for FASINEX shows when the moorings were deployed relative to the other components of the field experiment. Five surface moorings with meteorologically instrumented buoys and four Profiling Current Meter (PCM) moorings were on station for six months. The surface moorings (designated F2, F4, F6, F8 and F10) and the PCM moorings (F3, F5, F7 and F9) were set in January 1986 at the beginning of the intensive field experiment, and made up the FASINEX central array. Current meters on the surface moorings were concentrated at and above 160 m in the upper ocean in order to resolve both variability associated with the oceanic fronts and the response of the upper ocean velocity and temperature fields to local atmospheric forcing. Additional current meters were placed at 700, 1000 and 4000 m in order to examine links between structure in the upper ocean and the interior. The subsurface moorings (F1 and F12) were set in October 1984 to serve as a large-scale, long term historical deep ocean data set in the FASINEX area, matching the surface mooring current meters at 160, ~630, 1000 and 4000 m.

Locating the site

The FASINEX area (25°-30°N, 68°-72°W) was chosen because of the existence of well-defined mesoscale-oceanic sea-surface temperature features in this location. These open ocean fronts provided a scientifically interesting location, while being logistically convenient for oceanographic and meteorological field work. Oceanographic studies of Voorhis (1969)(Figure 2) and the investigations carried out during the FRONTS 80 experiment supplied descriptions of the fronts found in the subtropical convergence zones. These features are relatively long-lived and have surface temperature gradients as high as 1.1°C km^{-1}. Associated with the temperature field is a quasi-geostrophic flow field with jet-like flow parallel to the front with speeds of up to approximately 70 cm s^{-1} and widths of approximately 30 km (Voorhis, 1969; Leetma and Voorhis, 1978). This experiment was designed to investigate the role of horizontal variability in air-sea interaction.

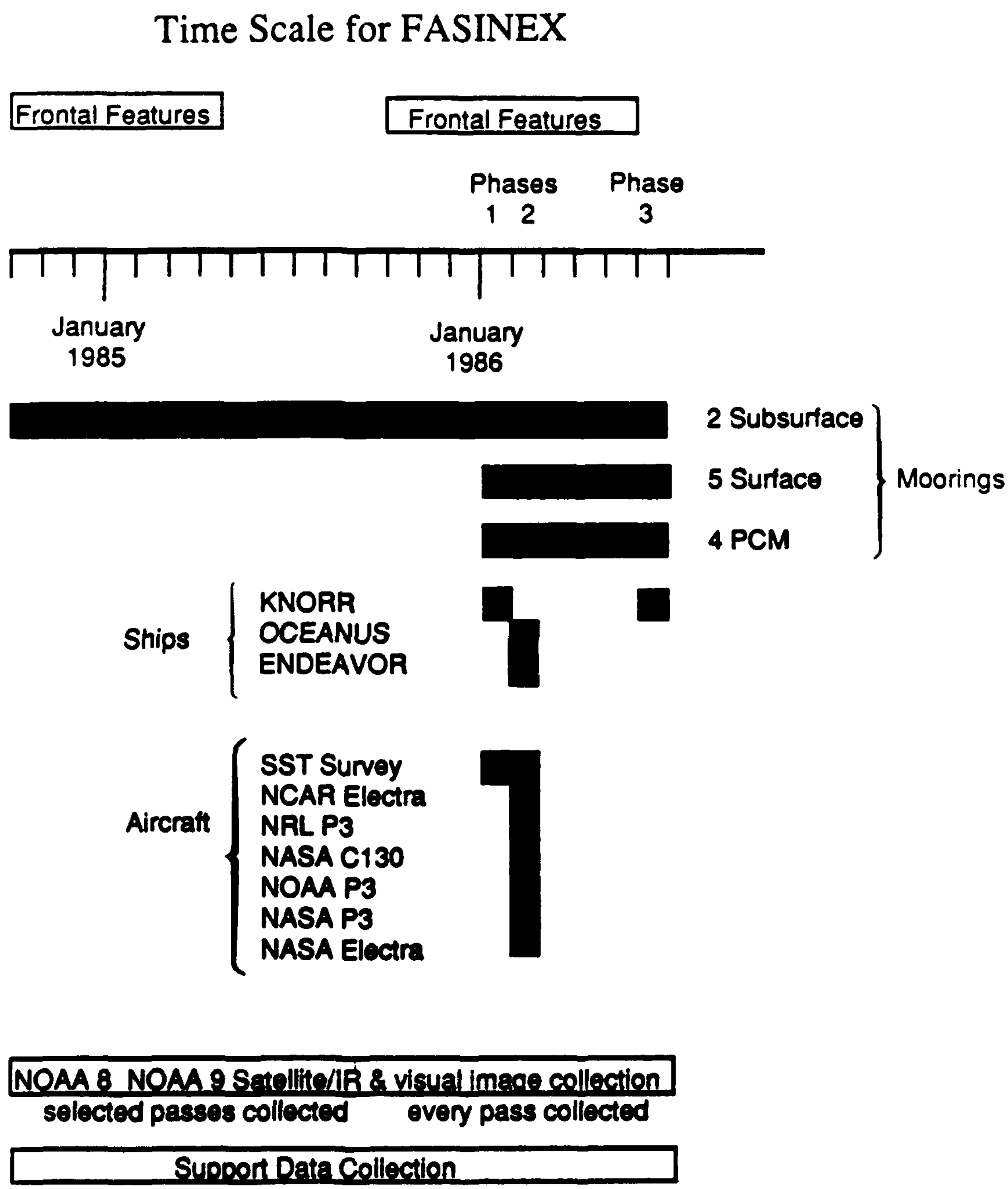


Figure 1. The schedule of the field work conducted during FASINEX.

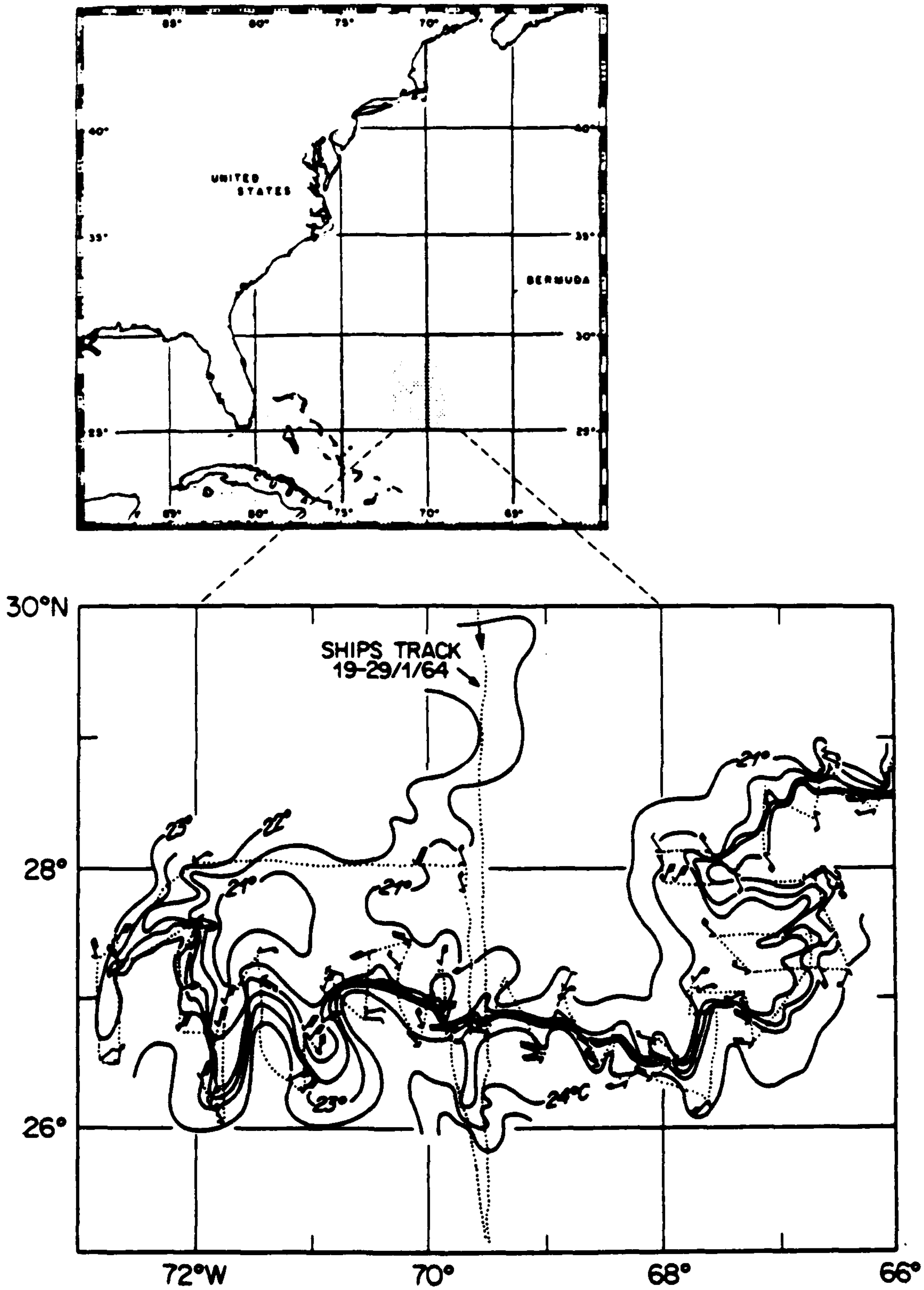


Figure 2. (Top) The area chosen for FASINEX field work and (bottom) an example taken from Voorhis(1969) of the SST pattern found in the area of interest. The track of the ship is shown as a dotted line. Surface currents are shown as arrows where each fletch indicates 10 cm s^{-1}.

Sea surface temperature fronts with their strong surface signature can be detected in infrared satellite images (AVHRR -Advanced Very High resolution Radiometer) from October to May of each year. In preparation for FASINEX, a historical satellite data set was collected and processed beginning in 1982 for the FASINEX area. In analysis of over 3000 satellite-derived SST fields of the FASINEX area, P. Cornillon and E. Bohm (U.R.I.) located all fronts for which the temperature change across the front exceeded 0.25°C. The periods covered were from October 1982 through June 1983, October 1983 through June 1984 and October 1984 to June 1985. The resulting frontal locations were grouped to provide a sense of both of the spatial density of the frontal locations and of the persistence of these positions from one month to the next. Figure 3 is a composite of the frontal locations in February in 1983, 1984 and 1985 respectively. It was noted that there was considerable interannual variation in the location and a number of fronts in the FASINEX study area. The incidence and persistence of fronts was further verified by XBT (expendable bathythermograph) sections through the region collected from a ship-of-opportunity program (SOOP) run by D. Evans (U.R.I). Using this information, the six month time period was selected to begin in late winter when the fronts would be strong and easily detected in infrared satellite images. The FASINEX site also had clear skies for satellite remote sensing (AVHRR) coverage, low eddy kinetic energy (Wyrtki et al., 1976), flat bottom topography (Johnson and Vogt, 1971), good LORAN C reception and was a workable distance from Bermuda.

Mooring Deployment - FASINEX Phase One

In early January 1986, the R.V. KNORR sailed from Woods Hole, carrying all the instrumentation for the nine moorings to be set in the FASINEX central array area. A computer system capable of receiving (from the Applied Technology Satellite (ATS) system) and processing AVHRR images was placed on the ship by P. Cornillon. While the ship was still several days from the designated area, an image was received on board showing a strong front at 27°N, 70°W (Figure 4). Two AXBT surveys, completed by the Navy, located the same front. In order to confirm the exact location and orientation of the front, an extensive XBT survey was run in the vicinity of the feature. Figure 5 shows the AVHRR frontal location, ship track and frequency of 800 m XBT drops (Figure 6) and the surface temperature contours in the area of the FASINEX XBT radiator pattern. Five days were spent mapping the front before the mooring array was configured and mooring operations were started. During the first leg, two surface and two PCM moorings were set spanning the front (Figure 7). The surface mooring

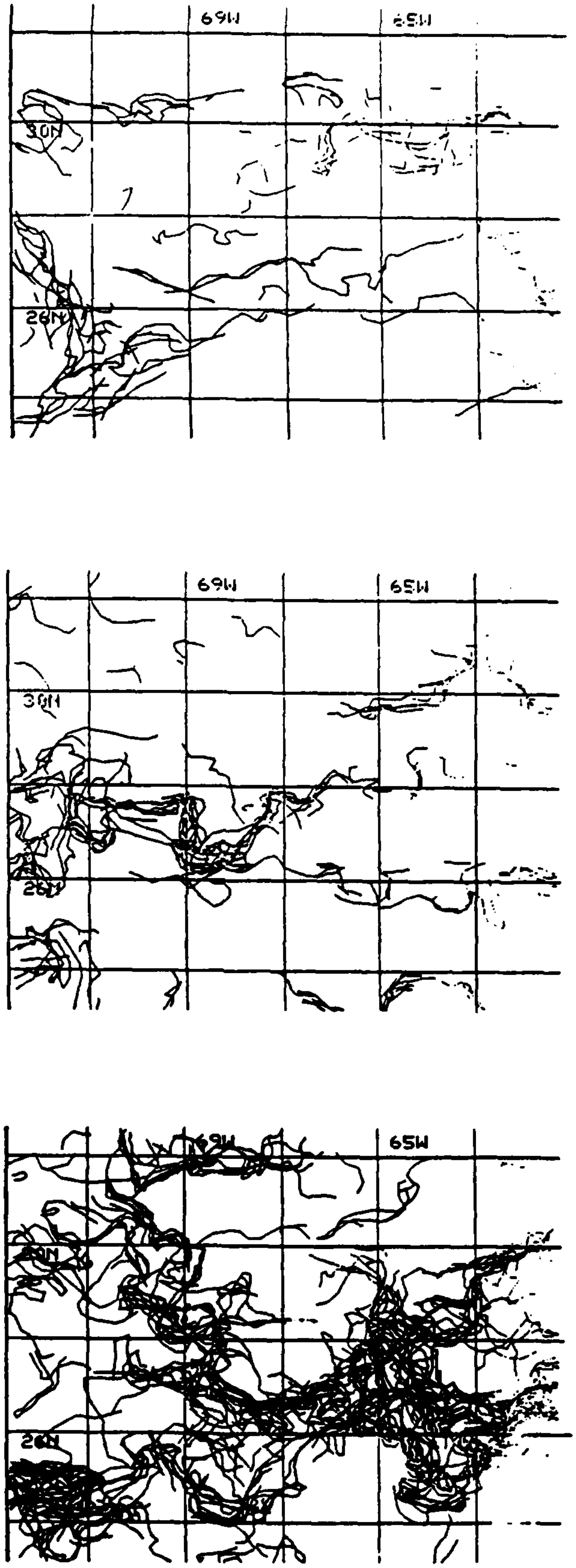


Figure 3. Composite locations of SST fronts found in AVHRR images for February 1983, 1984 and 1985. (Produced by P. Cornillon, U.R.I.)

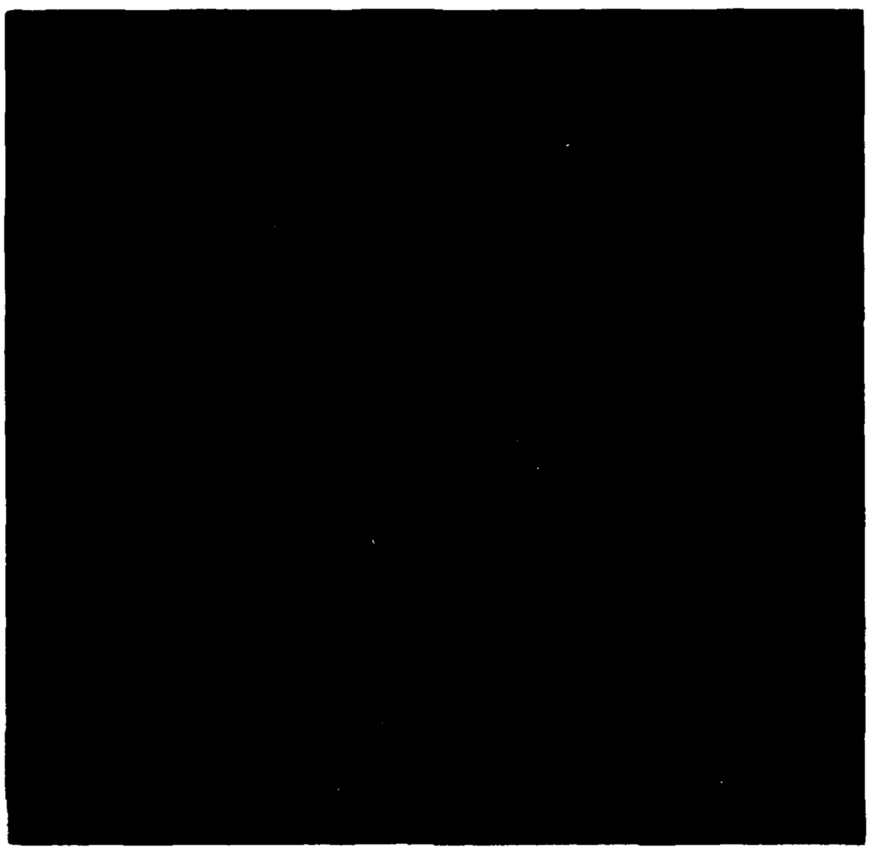


Figure 4. AVHRR composite image from January 2 and 3, 1986.

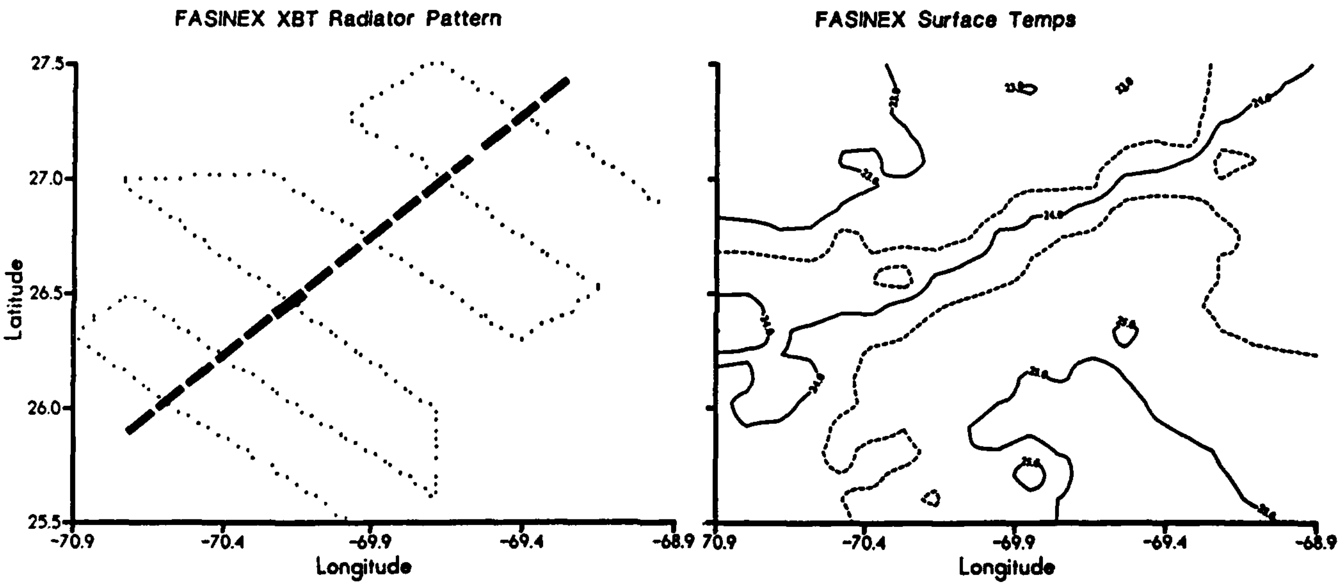


Figure 5. (a) The XBT pattern used to pinpoint the front. Dashed line shows the AVHRR frontal position, (•) show XBT drops and (b) SST contours from the survey.

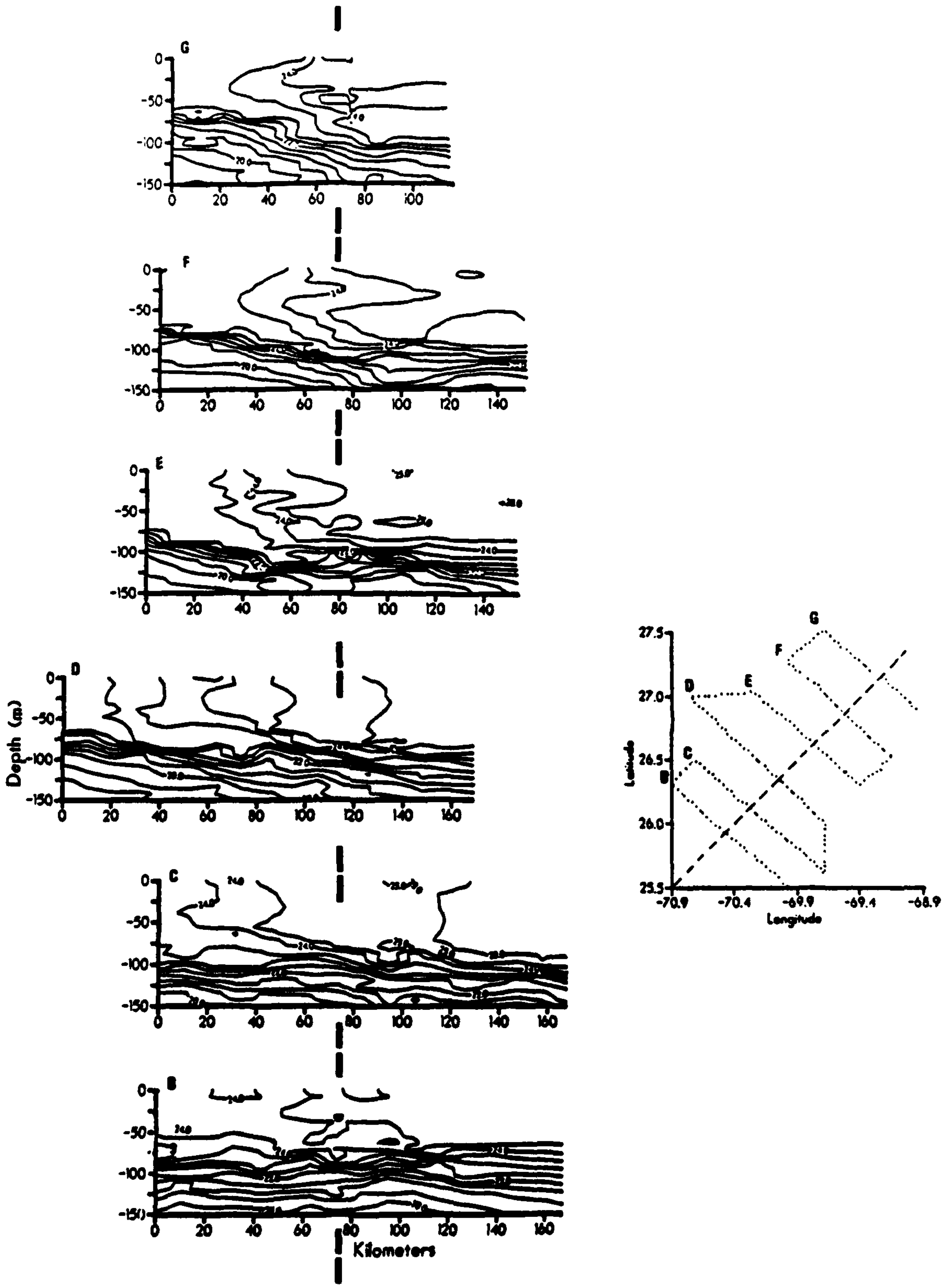


Figure 6. XBT sections perpendicular to front. Dashed line shows January 2-3, 1986 AVHRR position. Letters (B-G) denote legs of the radiator pattern.

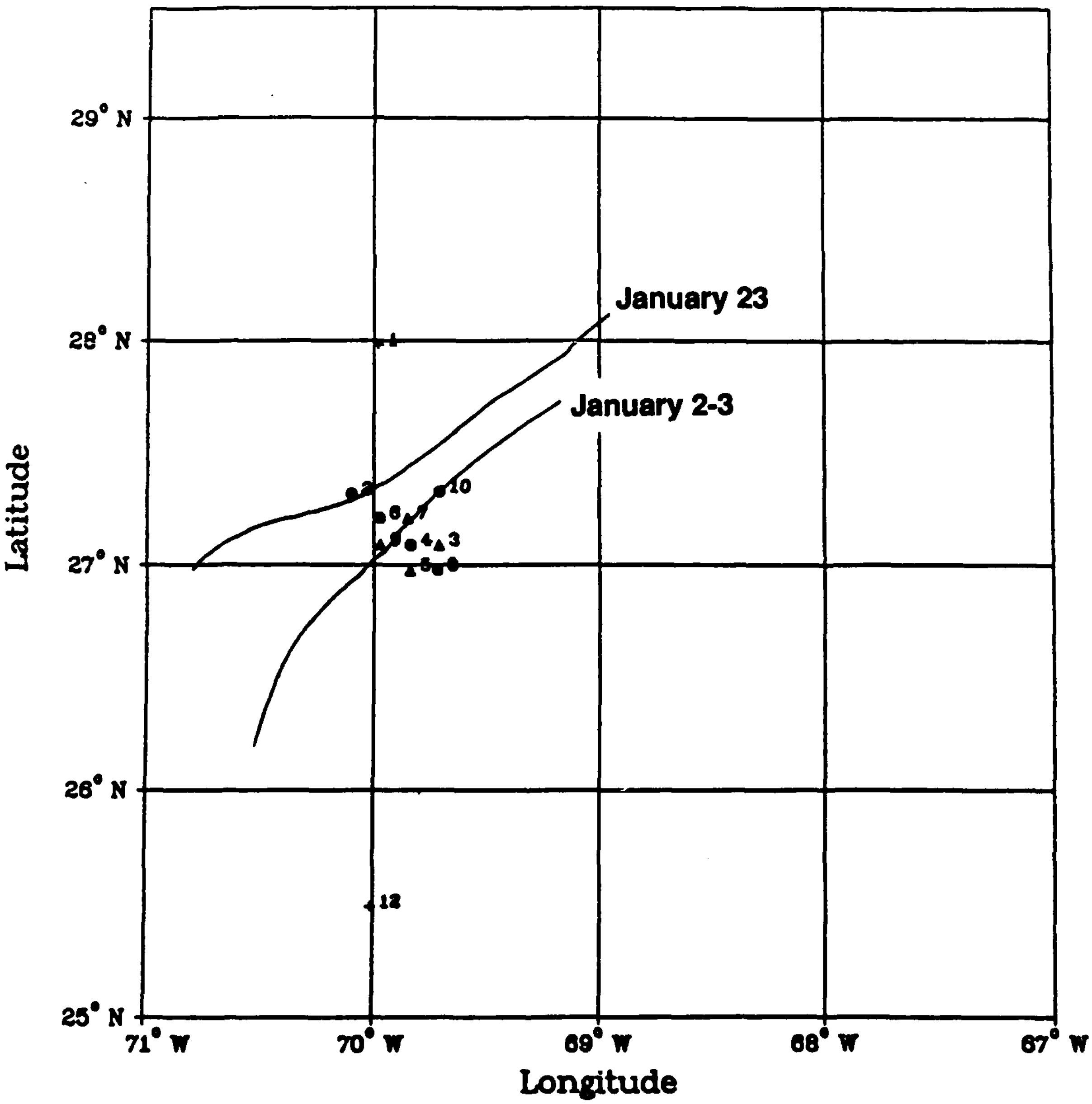


Figure 7. Anchor positions for the FASINEX surface and PCM moorings, showing their location relative to the frontal feature during the deployment cruise.

F2 was to be north of the front, with F4 and the PCM moorings being part of a tight pattern set right on the front. When the ship returned in six days after a port call to Bermuda, the front had moved northwest approximately 22 n.m., as seen in the AVHRR data. The remaining moorings were set with F6 and F8 completing a southeast - northwest line perpendicular to the front and F10 forming a right triangle. The two remaining PCM moorings were set to complete a box pattern straddling the F2-F8 line. (See Pennington and Weller, 1986a for the mooring cruise summaries.)

FASINEX Phase Two

Phase Two immediately followed the month-long deployment cruise. This month-long cooperative field period involved two ships, R.V. OCEANUS and R.V. ENDEAVOR and six aircraft, NRL P3, NCAR Electra, NASA C130, NASA P3, NOAA P3 and NASA Electra. Scientific goals dictated that the field work during Phase Two focus on an oceanic front, so the area of interest shifted from the central array to the location of the frontal feature which had moved off to the northwest of the mooring area. (See Pennington and Weller, 1986b for Phase Two cruise summaries.) Although the majority of work was completed northwest of the central moorings, OCEANUS (Figure 8) made two surveys around the array and several of the aircraft overflew the area. The ships and aircraft worked jointly to measure with high resolution, over a limited time, the temporal and spatial variability of frontal features and investigate the processes acting at the front. The ships' primary oceanographic goal was to observe and characterize three dimensional structure and across frontal features. The meteorological goals were to collect sections (radiosonde and atmospheric sounder) perpendicular and parallel to the front, and make stress measurements in the vicinity of the moored array; both these efforts were done in conjunction with the aircraft flights.

Section 7 presents the mooring meteorological and oceanic data on an expanded time scale from February 10, 1986 to March 10, 1986. As seen in the SST plots, a frontal feature was in the area of the moorings during this time period, (Figure 9) while the original front sat off to the northwest and was the one the ship and aircraft concentrated on surveying. Several other fronts moved through the central array during the six month experiment.

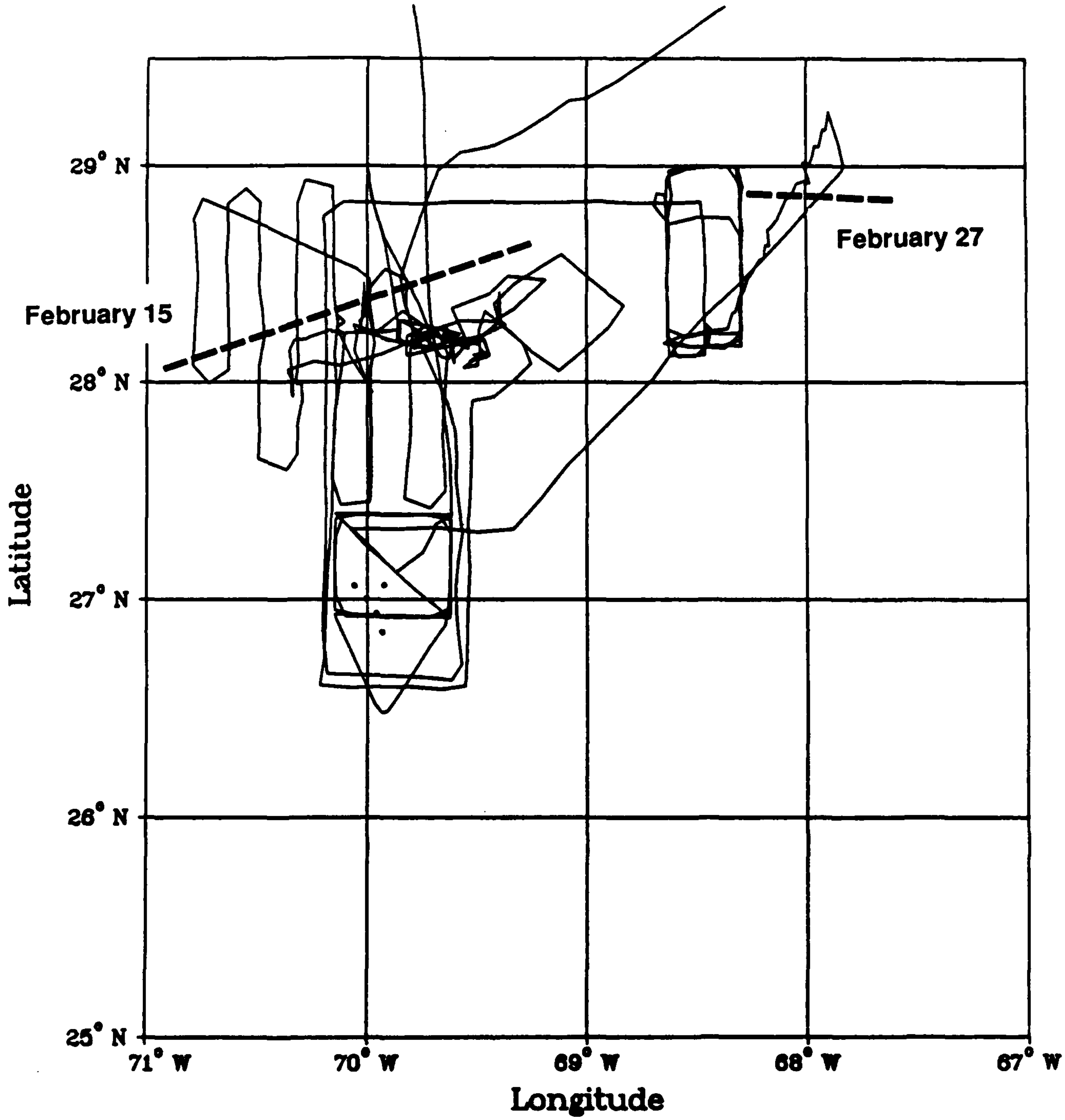


Figure 8. Phase Two OCEANUS ship track. (•) shows surface mooring anchor position and dashed line locates and dates the AVHRR frontal positions.

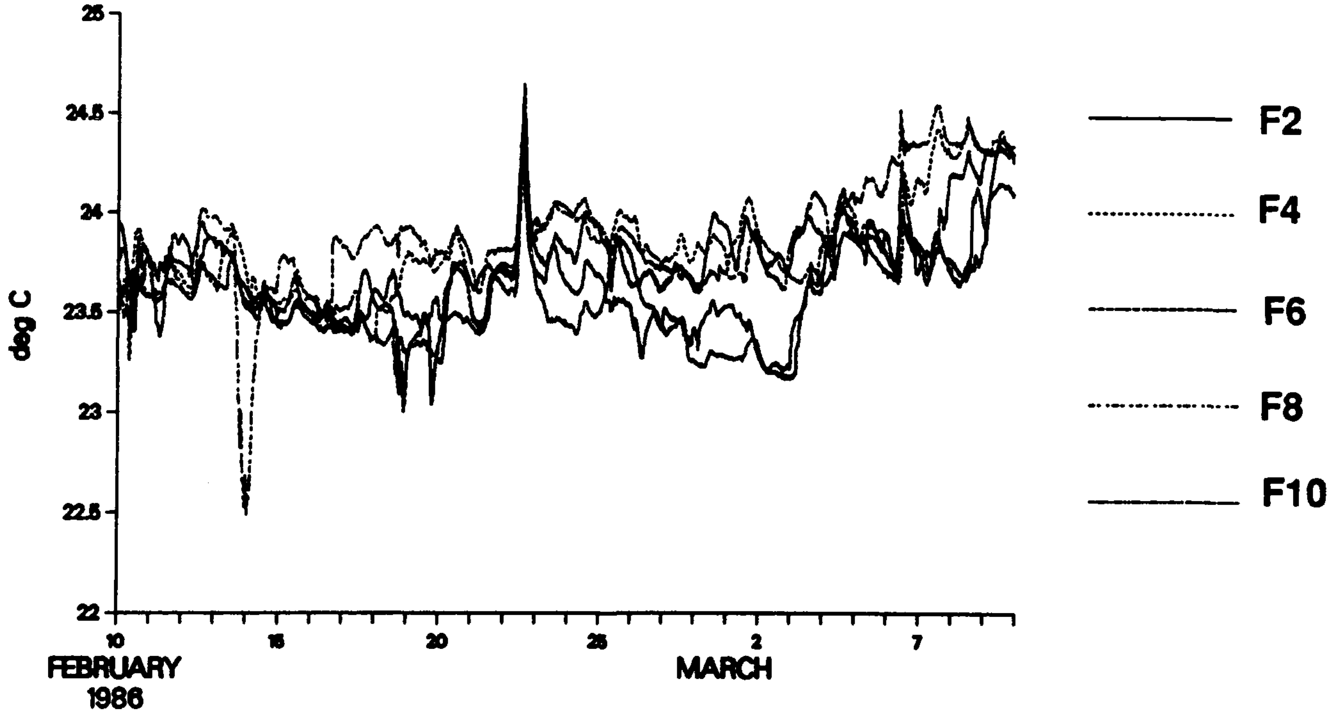


Figure 9. Phase Two SST composite plot.

Long Term Subsurface Moorings

The outlying moorings F1 and F12, in addition to being the large-scale, long term part of FASINEX, were part of a two year study titled "A Long Term Study of the Ocean's Response to Fluctuating Winds South of Bermuda". The objective of this study was to test the importance of the forcing of currents by fluctuating (1-100 day period) winds. Instrument depth choices were determined by the overall aims of characterizing spatial variablity in eddy properties and investigating meteorological forcing. The shallow instruments were placed to penetrate the thermocline and to resolve the surface intensified behavior of wind-driven currents.

(See Brink (1987) for details of the experiment.)

Section 9 contains plots of the first 16 months of data, collected prior to the six month period when the central mooring array was also in the water.

ARGOS Telemetered Data / Mooring Positions

Data were available for the moorings in near real time via Service ARGOS. Both meteorological and mooring location information was checked daily. This alerted us to the fact that the mooring line on F10 parted in mid-May. The telemetered data are shown in Section 10.

2. FASINEX Moorings

Three types of moorings were set for FASINEX: surface, subsurface and PCM. The surface and subsurface moorings were designed by the WHOI Ocean Engineering Department and were constructed and deployed by the WHOI Buoy Group. Draper Labs designed and constructed the PCM moorings for C. Eriksen and assisted in the deployment with the Buoy Group.

Surface and subsurface moorings are made of many of the same components. Both types of moorings have a upper flotation sphere or buoy, an acoustic release, a backup recovery system, anchor and scientific instrumentation. Surface moorings use chain and wire rope in the top 2000 m to guard against fishbite, and braided nylon beneath for compliance. The surface moorings are slightly longer than the water depth, but the presence of a current at the site prevents any slack and subsequent entanglement in the mooring line. The intermediate moorings are constructed entirely of chain and wire rope, except for a short length of braided nylon line directly under the acoustic release.

Two types of current meters were used in FASINEX, Vector Measuring Current Meters (VMCMs) and Vector Averaging Current Meters (VACMs) (Figure 10). They differ mainly in their flow-sensing elements: the VACM uses a Savonius rotor and a vane to give speed and direction which are resolved using an internal compass into East and North components, whereas the VMCM uses orthogonal cosine-response propellers that sense directly the flow components which are then rotated, relative to an internal compass. Both instruments provide continuous vector-averaging during a recording interval by sampling 8 (VACM) and 4 (VMCM) times per rotation of the sensor. Both current meters record on Phillips-type cassettes by means of Sea Data recorders. The cassettes are removed ashore and transcribed to a VAX computer for further processing (see Section 3 Data Processing). Temperature measurements are made by VACMs using a sensor embedded in the end cap and by the VMCMs using an external temperature pod.

The central array moorings were deployed during a month-long cruise on the R.V. KNORR. Two surface moorings and two PCM moorings were set spanning the front on Leg 1. When the ship returned to the site for Leg 2, a survey showed the frontal feature had moved northwest approximately 20 n.m. A decision was made to continue with the array design in the area around 27°N, 70°W, with the expectation that other fronts would move through the area throughout the six month experiment. Two more surface and the final two PCM moorings were set forming lines perpendicular to the orientation of the front. The final surface mooring was set forming a right triangle to the other surface moorings, providing a greater variety of spatial lags and more of a view of along-front variability. See Figure 11 for the separation and orientation of the central array moorings. The complete mooring array is shown in Figure 12. The mooring deployment, recovery and duration times are shown in Table 1. Table 2 shows anchor positions.

Specific information on each of the mooring types is contained in the following sections.

All the moorings remained on station gathering data through June 14, 1986, except for mooring F10, which broke free about May 14, 1986. When the R.V. KNORR sailed on the mooring recovery cruise, the first task was to locate and retrieve that buoy, which had been tracked using the ARGOS positions.

a. Surface Moorings

The five FASINEX surface moorings used three meter diameter discus buoys with aluminum hulls filled with syntactic foam giving them 10,000 pounds of buoyancy. Towers on the buoys were platforms for the meteorological sensors, and the 23 cubic foot covered instrument wells held some of the batteries and recording packages for the sensors. The mooring lines were made up of jacketed wire rope, in the upper 2000 m and 3000 m of nylon for the deeper part of the mooring line.

Each discus buoy was instrumented with two independent meteorological packages, the Vector Averaging Wind recorder (VAWR) and a Meteorological Recorder (MR). The VAWR is a modification of the VACM and has been used at WHOI for making high quality, long duration observations of meteorological parameters from moored oceanic buoys. The VAWR contains averaging and recording circuitry that computes vector-averaged wind velocity. The VAWR recorded wind speed and direction, air and sea temperatures, barometric pressure, relative humidity, and insolation. All the sensors were positioned on the discus buoy's tower so that effects such as shading and wind disturbance would be minimized. The MRs on the FASINEX surface buoys acted as a redundant system for the VAWR. They also telemetered via ARGOS meteorological and engineering parameters and the buoy's position. (See Section 10 for information and plots of the telemetered data.) Table 3 gives the sensor heights above the waterline; Table 4 presents meteorological sensor specifications which are and (mostly estimates) in the "system accuracy" category are due to environmental

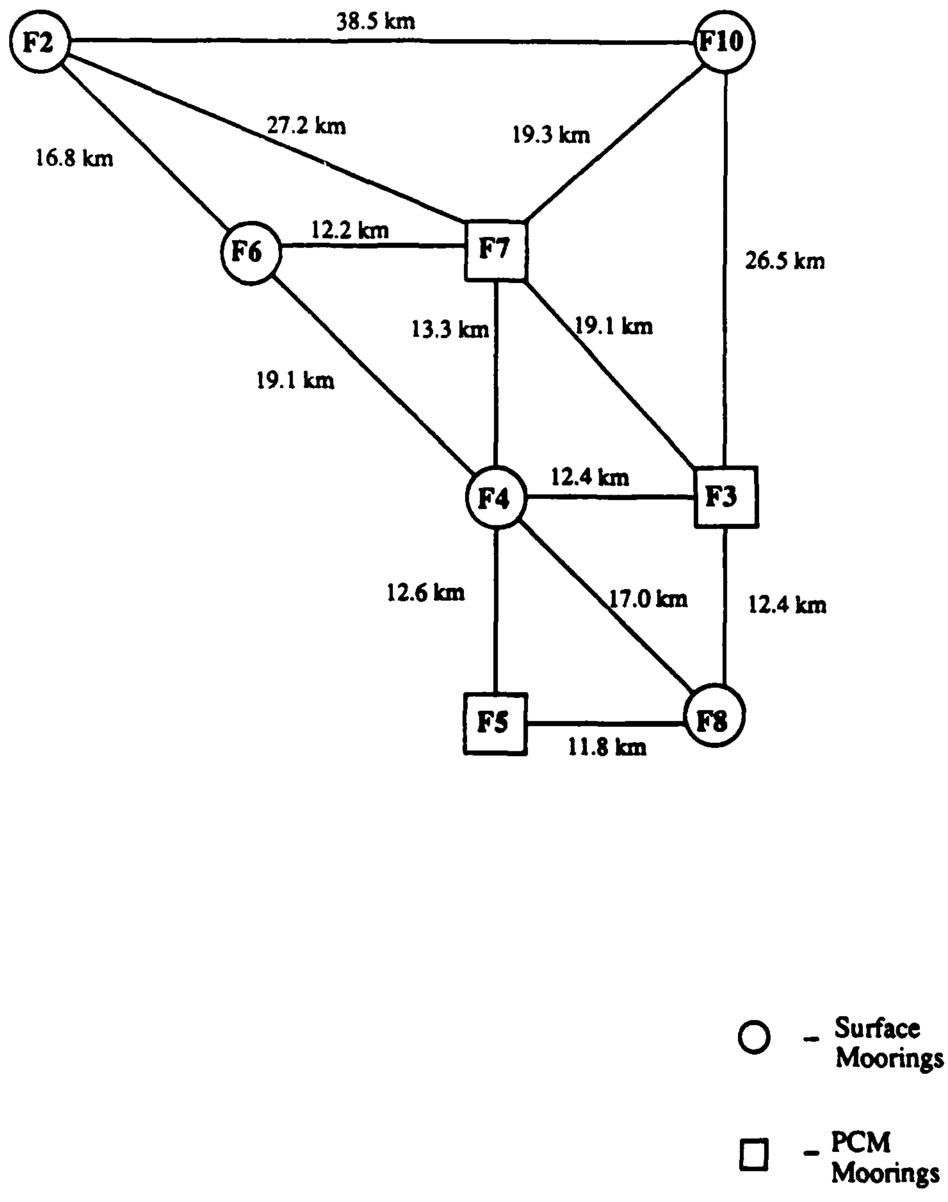


Figure 11. Separation in kilometers of moorings in FASINEX central array.

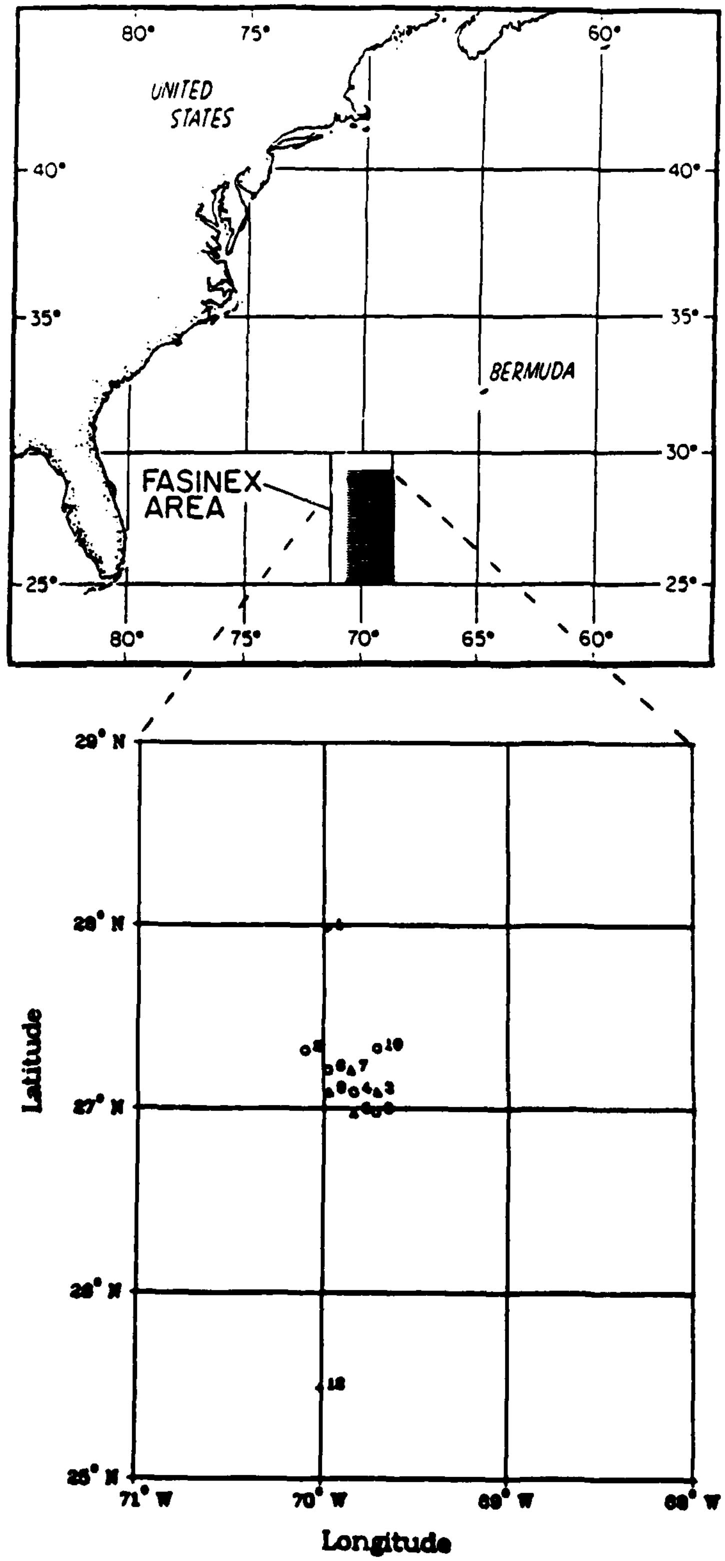


Figure 12. Geographic positioning of FASINEX moorings.

Table 1.
Mooring Deployment, Recovery and Duration Times

Mooring ID	Deployment Time (UTC)	Recovery Time (UTC)	Duration (days)
F2	15 January '86 2020	14 June '86 0950	150
F4	16 January '86 1947	15 June '86 2133	150
F6	26 January '86 1715	14 June '86 2151	139
F8	27 January '86 1748	15 June '86 1333	139
F10	01 February '86 1801	10 June '86 0545	103 on station[1] 129 total[2]
F3	17 January '86 1811	16 June '86 1352	150
F5	18 January '86 1840	16 June '86 2011	149
F7	28 January '86 1852	17 June '86 1108	140
F9	29 January '86 1806	Lost	
F1	28 October '84 2238	18 June '86 1721	598
F12	29 October '84 1724	13 June '86 1957	592

[1] - Days on station before mooring line parted.
[2] - Days in operation; recovered 10 June 1986 off San Salvador Island in the Bahamas.

Table 2.
GPS/LORAN C Positions of Mooring Anchors

GPS Positions FASINEX Identifier	Visible Number	Latitude/Longitude	WHOI Mooring Designation
F2	A	27°18.95N 70°05.86W	845
F3		27°05.34N 69°42.75W	PCM-1
F4	C	27°05.35N 69°50.30W	846
F5		26°58.58N 69°50.40W	PCM-2
F6	B	27°12.59N 69°58.48W	847
F7		27°12.53N 69°51.03W	PCM-3
F8	E	26°58.66N 69°43.19W	848
F9		27°05.45N 69°58.33W	PCM-4
F10	D	27°19.63N 69°42.52W	849
LORAN C positions			
F1		27°58.90N 69°58.80W	829
F12		25°29.10N 70°00.70W	830

Table 3.
FASINEX Meteorological Sensor Heights Above Buoy Waterline

		F2 845 Buoy A	F4 846 Buoy C	F6 847 Buoy B	F8 848 Buoy E	F10 849 Buoy D
VAWR						
	Air+	2.56	2.56	2.57	2.58	2.56
	RH+	2.91	2.91	2.93	2.96	2.86
	BP	2.17	2.13	2.15	2.16	2.15
	Solar	3.56	3.55	3.56	3.60	3.51
	Wind*	3.55	3.54	3.55	3.59	3.50
MR						
	Air+	2.66	2.63	2.64	2.67	2.65
	RH+	2.66	2.64	2.64	2.66	2.65
	BP	2.00	2.00	2.02	2.02	2.01
	Solar	3.56	3.55	3.56	3.60	3.51
	Wind	3.39	3.39	3.39	3.44	3.34

* Measurement to centerline of cups.
+ Measurement to mid-shield.
Units = meters above waterline. (41 cm below deck)

Table 4.
Estimates of the accuracy, precision, and resolution of each of the FASINEX meteorological sensors based on laboratory calibrations and intercomparisons.

Parameter	Instrument	Sensor	Accuracy, σ	Precision, δ	Resolution
Wind direction	VAWR	vane	3.0°	2.4°	2.8°
	MR	vane	2.8°	2.8°	2.8°
Wind speed	VAWR	Gill 3-cup	2%†	1%	0.375 m
	MR	propeller	2%†	1%	0.294 m
Sea temperature	VAWR	Thermistor	0.0038°C	0.0029°C	0.00012°C
	MR	Thermistor	0.039°C	0.032°C	0.010°C
Air temperature	VAWR	Thermistor	0.0084°C	0.0077°C	0.00010°C
	MR	Thermistor	0.02°C	0.01°C	0.001°C
Insolation	VAWR	Eppley 8-48	3%	3%	0.003 W m^{-2}
	MR	Eppley 8-48	3%	3%	0.05 W m^{-2}
Relative humidity	VAWR	Humicap	3–5% RH	1% RH	0.05% RH
	MR	Humicap	2% RH	0.4% RH	0.02% RH
Barometric pressure	VAWR	Digiquartz	0.26 mb	0.11 mb	0.1 mb
	MR	AIR	0.60 mb	0.11 mb	0.1 mb

† Achievable because wind tunnel calibrations were done.

effects on the sensor, and due to mechanical and electronic system effects. (See Weller et al., 1989 for more detail on the determination of these figures.) Figure 13 shows the sensor positioning on the buoy.

The sampling rate set for the VAWRs and MRs was 450 seconds. The VMCMs and VAWRs recorded data every 225 seconds, except for four VMCMs that were borrowed from Scripps Institution of Oceanography. These instruments recorded at 450 seconds.

Moorings F2, F4, and F10 carried 8 current meters at 10, 20, 30, 40, 80, 120, 160, and 700 m. Two of the five surface moorings, F6 and F8, carried 10 current meters, at 10, 20, 30, 40, 80, 120, 160, 700, 1000, and 4000 m. F8 also carried a WOTAN at 150 m for W. Large, University of British Columbia. Figure 14 shows mooring schematics for the five surface moorings, identifying the VACM and the VMCM depths. All the current meters measured current and temperature.

Subsurface Moorings

The long term subsurface moorings were simple intermediate moorings. The main upper flotation element was a three ball float, consisting of three glass balls in their protective hardhats within an aluminum frame with a radio and light, which are used for locating the mooring on recovery. Each mooring carried seven VACMs and a WOTAN. The current meters were at 160, 260, 485, 560, 635, 1060 and 4060 m. They measured current and temperature. The upper most current meter also measured pressure. The sampling rate was 1800 seconds. The time series were 22 months long. See Figure 15 for a diagram of the moorings.

PCM Moorings

The M.I.T.-Draper Profiling Current Meter (PCM) is a programmable moored upper ocean current and density profiler capable of making over 1000 repeated profiles from 20-200 m depth along the upper section of a barely subsurface mooring. It is free to move along the guideline portion of its mooring by adjusting its buoyancy

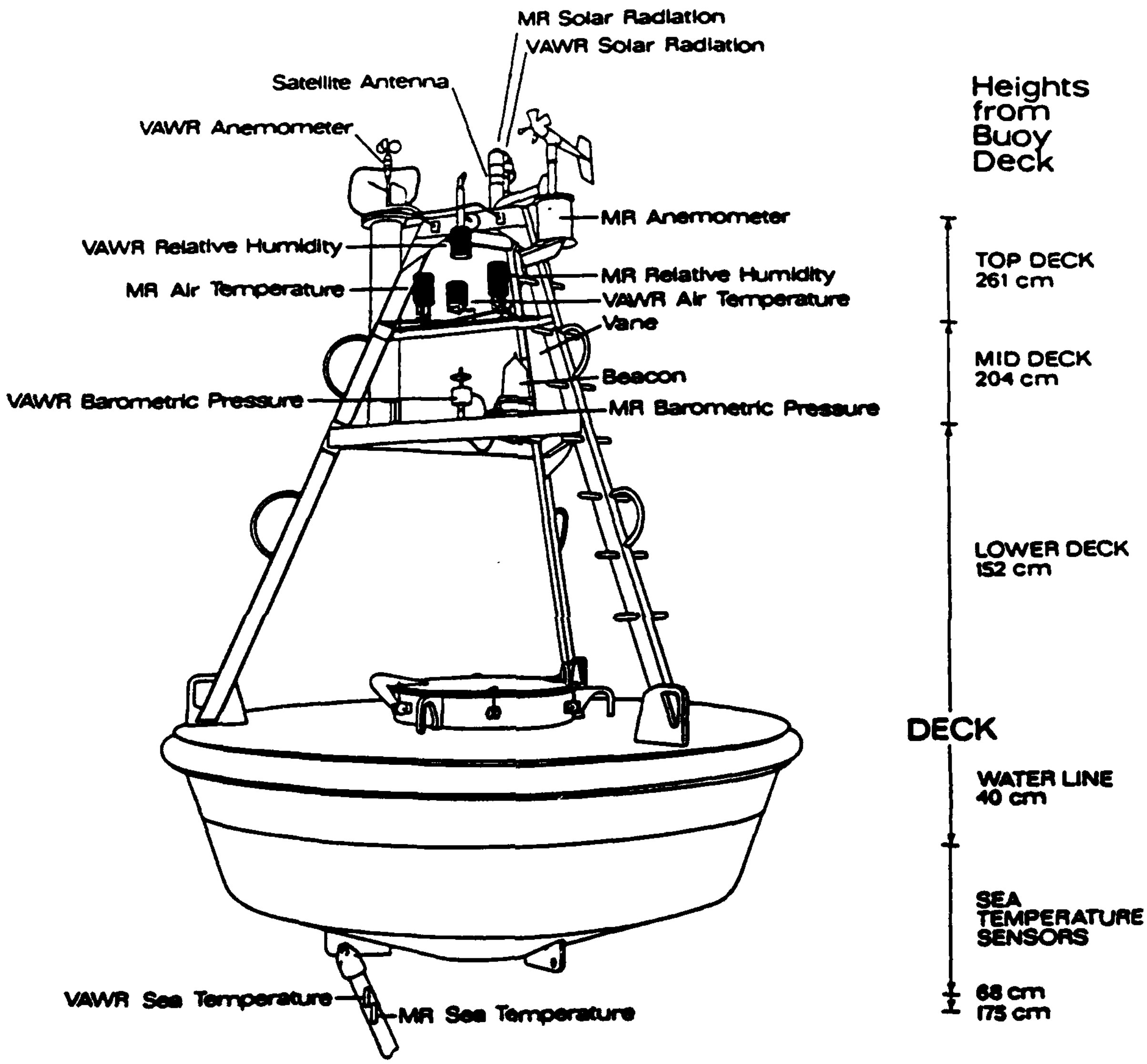


Figure 13. Meteorological sensors on FASINEX buoy.

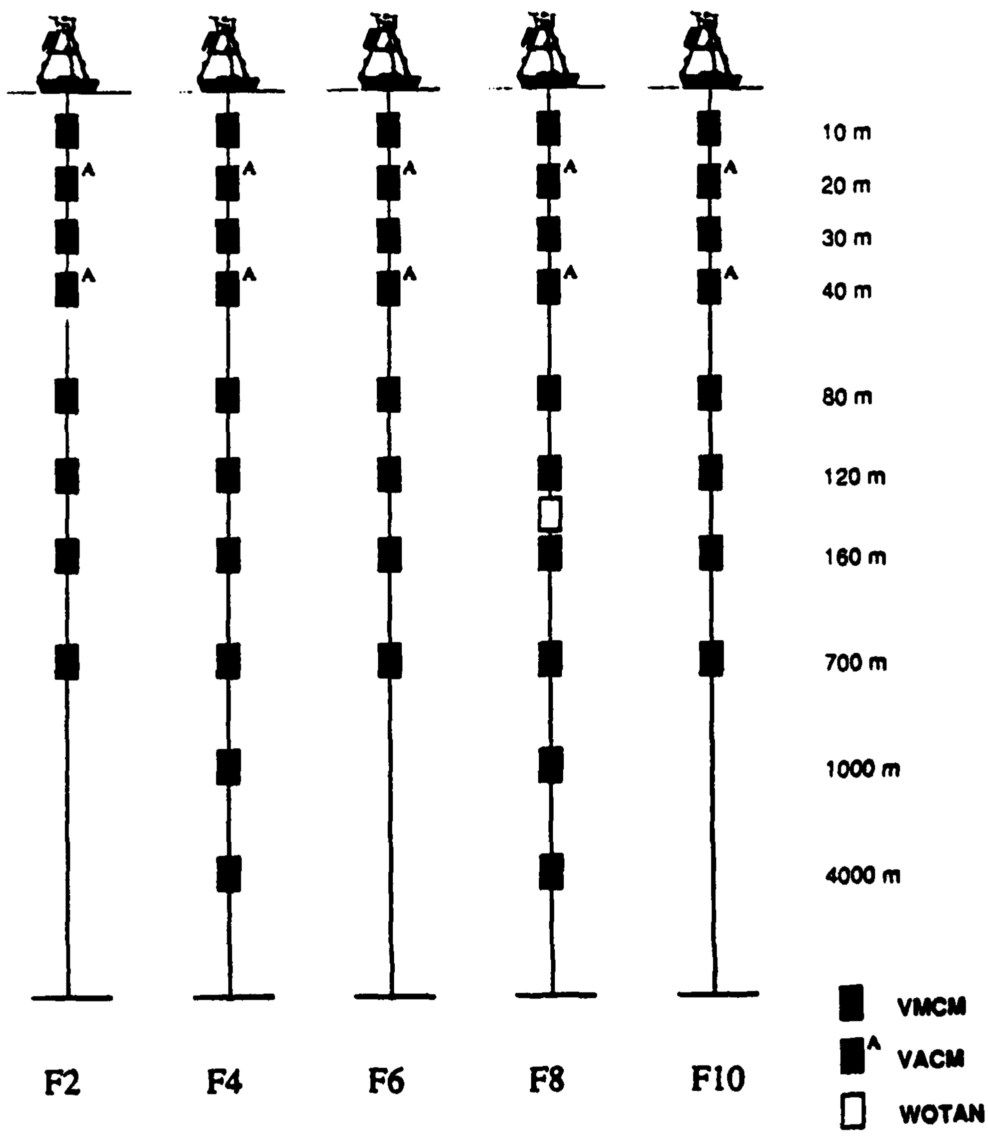


Figure 14. Mooring schematic for the FASINEX surface moorings.

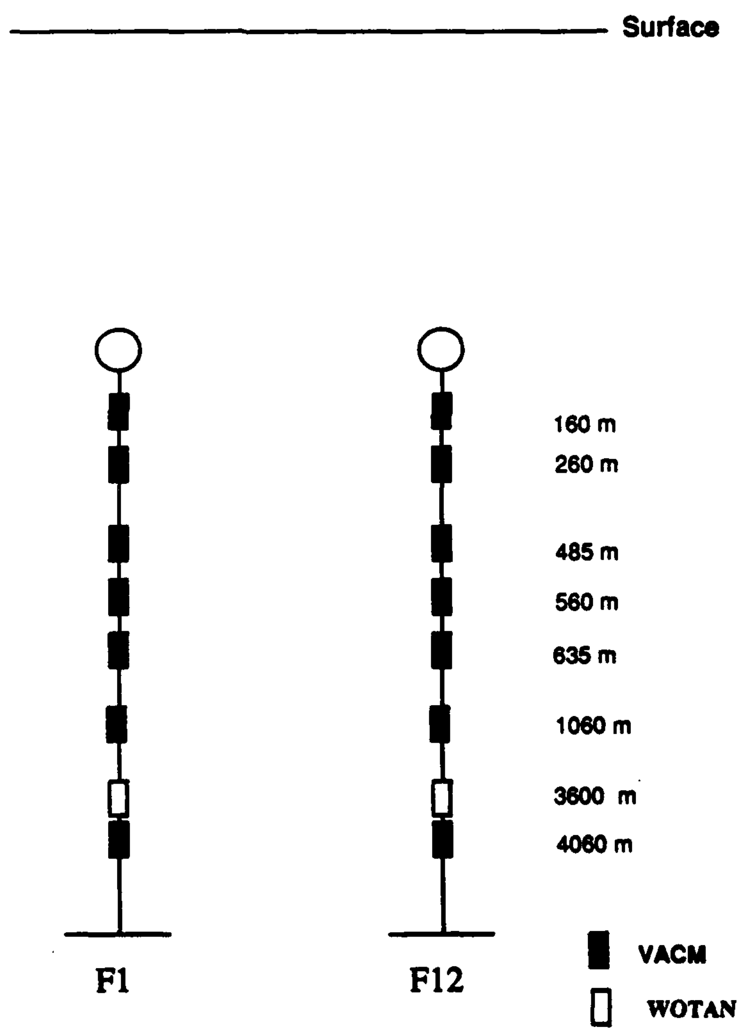


Figure 15. Mooring schematic for the FASINEX subsurface moorings.

under computer control of an electric oil pump/swim bladder assembly. As the instrument ascends, it measures current with a spherical 2-axis electromagnetic current probe, temperature with a thermister, electrical conductivity with an inductive cell, and pressure with a strain gauge. Samples are accumulated at 1 Hz and averaged into pre-programmed depth bins, typically 5 m thick. Magnetic field and tilt information are used to vector average horizontal current data. The instrument maintains a rise rate of 10-15 cm s^{-1} during ascents so that profiles can be repeated as often as 1 hour. The FASINEX sampling rate was set at 4 hours. Battery and tape recorder storage provide the principal limitations to the duration of PCM deployments. The instrument relies on computer software to manage finite resources efficiently. Figure 16 shows the configuration of a PCM mooring.

For information on the PCM data set, contact Dr. C.C. Eriksen, Department of Oceanography, University of Washington, Seattle, WA.

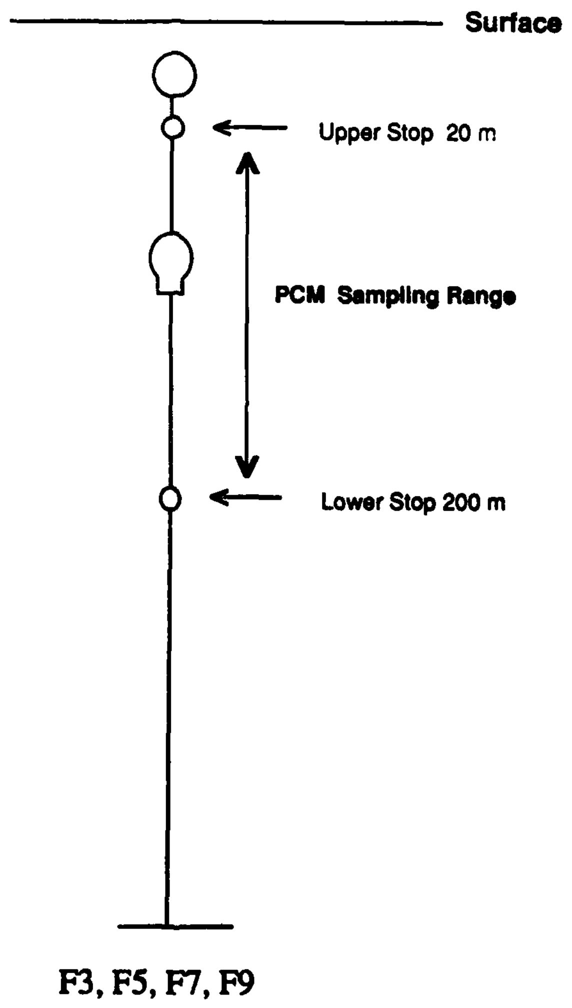


Figure 16. Mooring schematic for the PCM moorings.

3. Data Processing / Data Return

VAWRs, VMCMs and VACMs all record data to a Sea Data cassette housed inside the current meter pressure case. Basic processing, from the transcription of the cassette tape through to a calibrated, editted file is done within the WHOI Buoy Group system which consists of programs written by and run by Buoy Group personnel. The computers used are a LSI-11 and a Digital Equipment Corporation VAX 8800. The different versions of the processed data are stored on disk in binary format, along with programs and subroutines which allow for acquistion, processing and outputting, making the data accessible to all users. (See Tarbell et al., 1988 for a summary of the Buoy Group processing procedure.)

Extensive post-deployment calibrations and data intercomparisons were carried out to confirm the validity of the data. See Weller et al., 1989 and Dean et al., 1988 for information on the FASINEX Calibration procedures.

Table 5 , Table 6 and Table 7 list the days of good data from the six month surface meteorological, current meter time series and from the 22 month subsurface mooring series, respectively. If there is less than 100 perecent data return, a letter code describes the problem. Table 8 is a summary of the data return in percent showing the data return by mooring for both the meteorological data and the current meter data, which is broken down by velocity and temperature. The overall value for the surface mooring meteorological data set is based on one complete data set achieved by both the VAWR and MR. The oceanic velocity and temperature data are combined to show a return for all possible oceanic data.

The data are presented in five sections of this report. The meteorological data are first. The current meter data are second. Composite plots of the whole time period, including meteorological and oceanographic data are presented in Section 6. Phase Two plots are in Section 7. The long term subsurface data are broken up into four sections so the final segment matches the time scale of the FASINEX six-month project. (This total data set covers the time period from October 1984 up to January 15, 1986.) Table 8 shows the data return by mooring. There is a summary for the meteorological data and one for the current meter data, broken down to velocity and temperature data. An overall value for the surface mooring meteorological data set is based on one complete data set. The oceanic velocity and temperature data is combined to show a return for all possible oceanic data.

Table 5.
FASINEX Meteorological Data Return
(days of data)

	F2[J]	F4	F6	F8[K]	F10[L]
VAWR					
wind	150	150	139	139	129
sea temp	150	150[A]	139	139	129
air temp	150	150	139	139	129
bp	150	150	139	139	129
rh	150	150	139	139	0[B]
insolation	150	150	139	139	129
MR					
wind	5[C]	140[D]	30[E]	139	17[F]
sea temp	123	150	139	139	95
air temp	123	150	139	139	95
bp	123	150	139	139	95
rh	19[G]	0[H]	139	24[I]	95
insolation	123	150	139	139	95
Total Days on Station	150	150	139	139	129

[A] - sea temperature cable cut during deployment (WHOI ID 8461)
[B] - erratic behavior after deployment (8491)
[C] - sensor failure (8452)
[D] - sensor failure (8462)
[E] - sensor failure (8472)
[F] - sensor failure (8492)
[G] - sensor failure (8452)
[H] - sensor failure (8462)
[I] - sensor failure (8482)
[J] - MR record short 845 123/149 days
[K] - 5 records deleted from the time base (8481)
[L] - MR record short 849 95/128 days

Table 6.
FASINEX Current Meter Data Return
(days of data)

	F2	F4	F6	F8	F10
10 m	150/150	150/150	139/139	139/139	129/129
20	150/150	150/150[A]	139/139	139/139	129/129
30	150/150	150/150	139/139	139/139	129/129
40	150/150	150/150	100/100[B]	139/139	129/129
80	150/150	150/150	139/139	139/139	000/000[C]
120	000/150[D]	078/150[E]	139/139	018/139[F]	000/129[G]
160	150/150	150/150	139/139	139/139	129/129
700	150/150	150/150	139/139	139/139	000/000[H]
1000		150/150		139/139	
4000		150/150		139/139	
Total Days on Station	150	150	139	139	129

Velocity Days/Temperature Days

[A] - sticky rotor (8464)
[B] - cassette tape caught in pinch wheel (8476)
[C] - cassette tape snapped (8497)
[D] - no velocity (8458)
[E] - upper rotor died after high speed event at end of March (8468)
[F] - water in sting (8488)
[G] - no velocity (8498)
[H] - oscillator failure (84910)

Table 7.
Subsurface Current Meter Data Return.
(days of data)

	F1	F12
160 m	597/597	591/591
260	170/597[A]	002/59[B]
485	597/597	591/591
560	597/597	591/591
635	143/597[C]	591/591
1060	597/551[D]	591/591
4060	597/597	267/267[E]
Total Days on Station	597	591

Velocity Days/Temperature Days

[A] - rotor out of pivot (8292)
[B] - bad lithium battery (8302)
[C] - rotor out of pivot (8295)
[D] - temp counts at zero until Dec. 84, then starts up (8296)
[E] - tape drive problem (8308)

Table 8.
FASINEX Data Return
(%)

	F2	F4	F6	F8	F10
Meterological Data					
	100	100	100	100	96
Current Meter Data					
	87/100	95/100	97/97	92/100	63/75

Total Data Return Meteorological Data 99%
Total Data Return Current Meter Data 87%

	F1	F12
Current Meter Data		
	79/99	78/79

Total Data Return Current Meter Data 84%

Velocity %/Temperature %

4. Meteorological Data Plots

Each of the five surface buoys in FASINEX carried a VAWR and a MR. The plots presented in this section reflect the best complete meteorological data set. For the six month time series plots, one hour averaged time series are used. For the expanded scale met data, the basic sampling rate of 450 seconds were used. For the spectral plots, a 15 minutes average was used.

Information about the meteorological data set includes:

Sea temperature for F4 is taken from the MR on the same buoy.

Relative humidity for F10 is taken from the MR data for the first 95 days and patched with the last 34 days of F2, which was set at the same latitude as F10.

VAWR data are used for all the rest of the data set.

The plots are identified by W.H.O.I. mooring number, so F2=845, F4=846, F6=847, F8=848, F10=849.

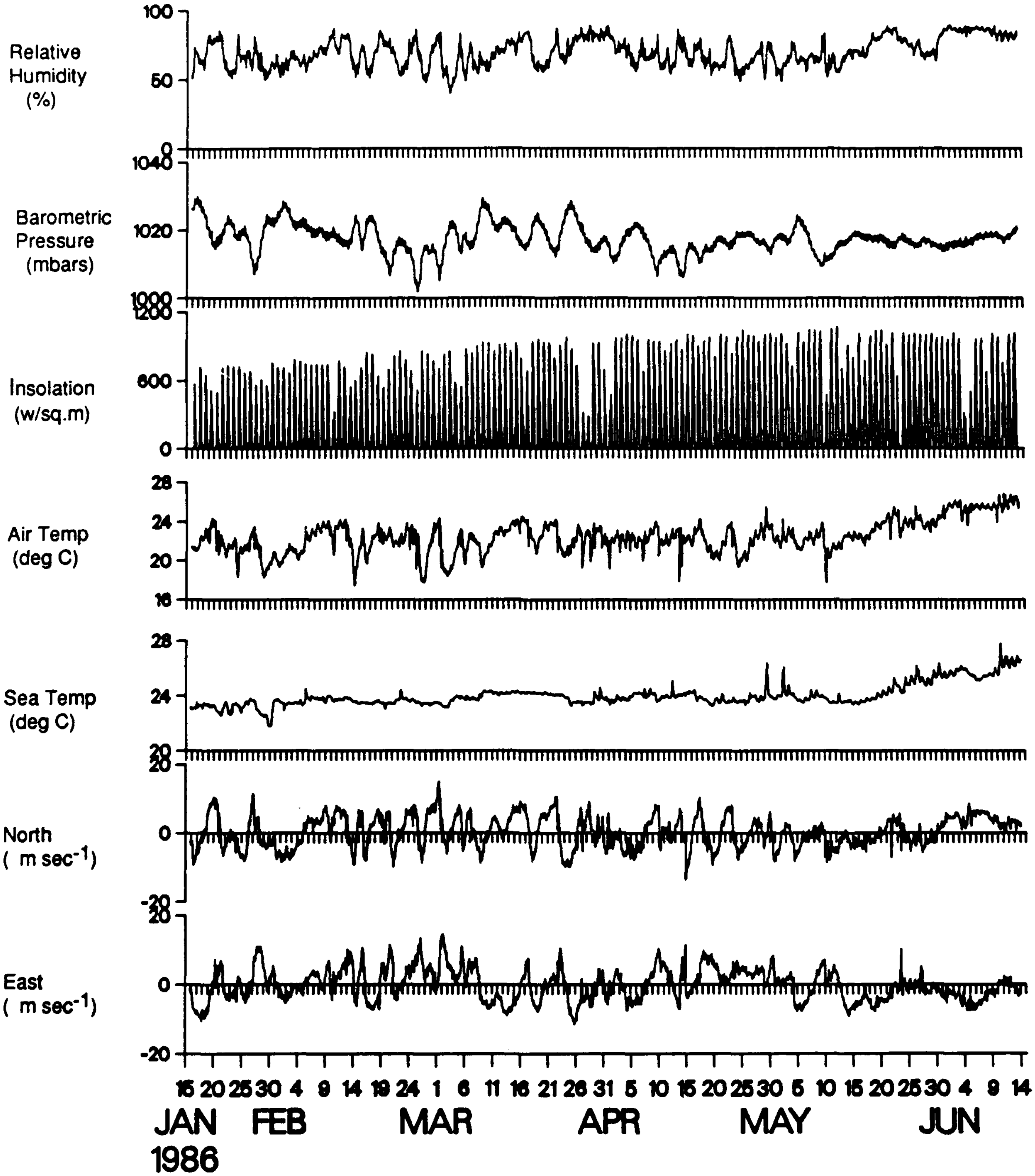
The winds are in oceanographic convention (toward which).

Mooring F10 was adrift from May 14, 1986 (see Figure 17 for drift track) until its recovery June 10, 1986.

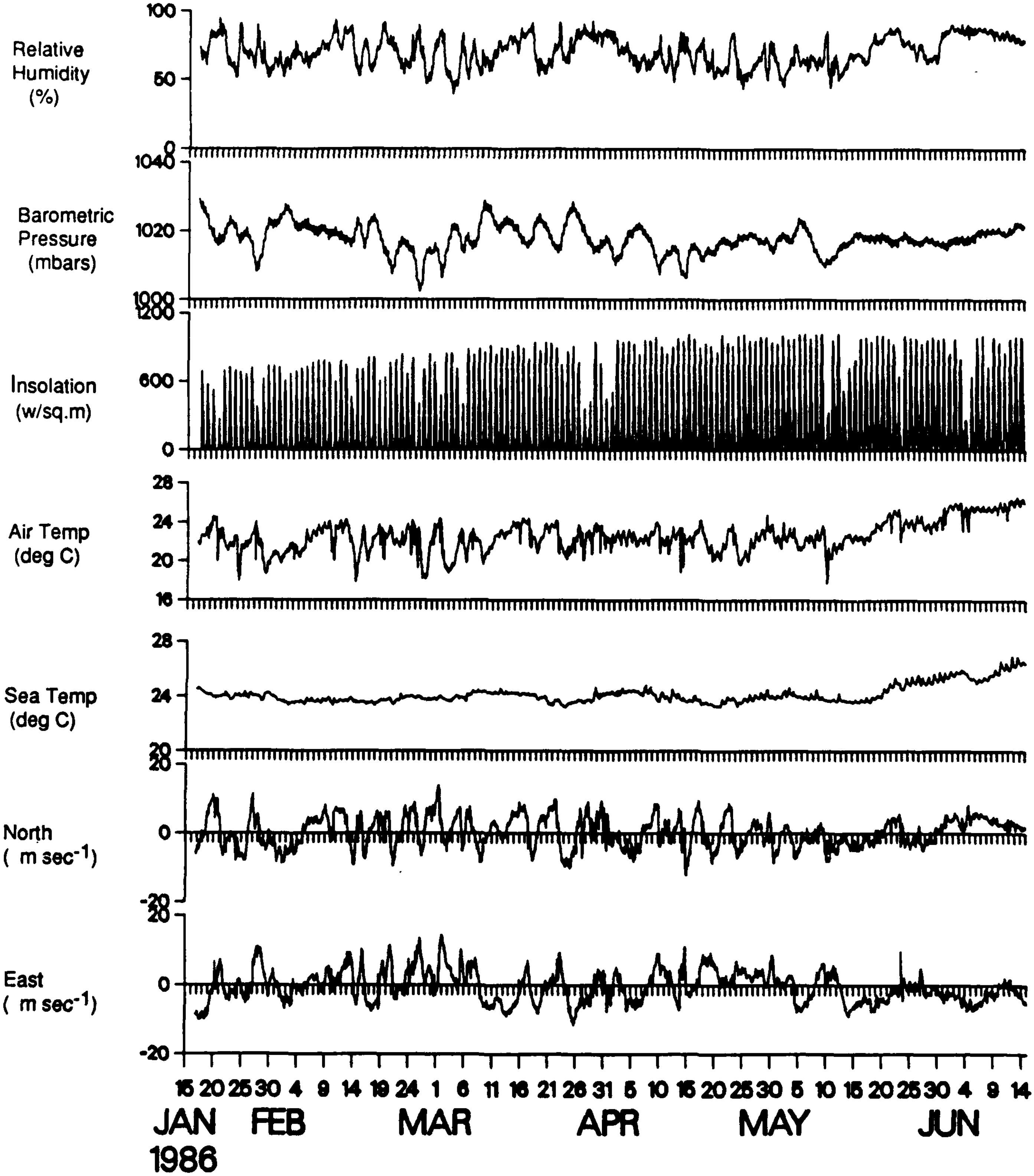
The plots in this section present time series for the meteorological variables. One plot covers the whole time period with all the variables and one plot is an expanded scale of each variable, broken into one month periods. A progressive vector plot of wind is also presented. (This plot places wind speed vectors tail to head to show the path that a particle in a perfectly homogenous flow would take.) The plot is ticked daily and annotated every 10 days. Wind speed and temperature spectra for each buoy, and time series of wind stress, long wave radiation, sensible, latent and total heat flux complete this section.

See Section 7 for expanded scale plots for the Phase Two time period. See Section 6 for composite plots.

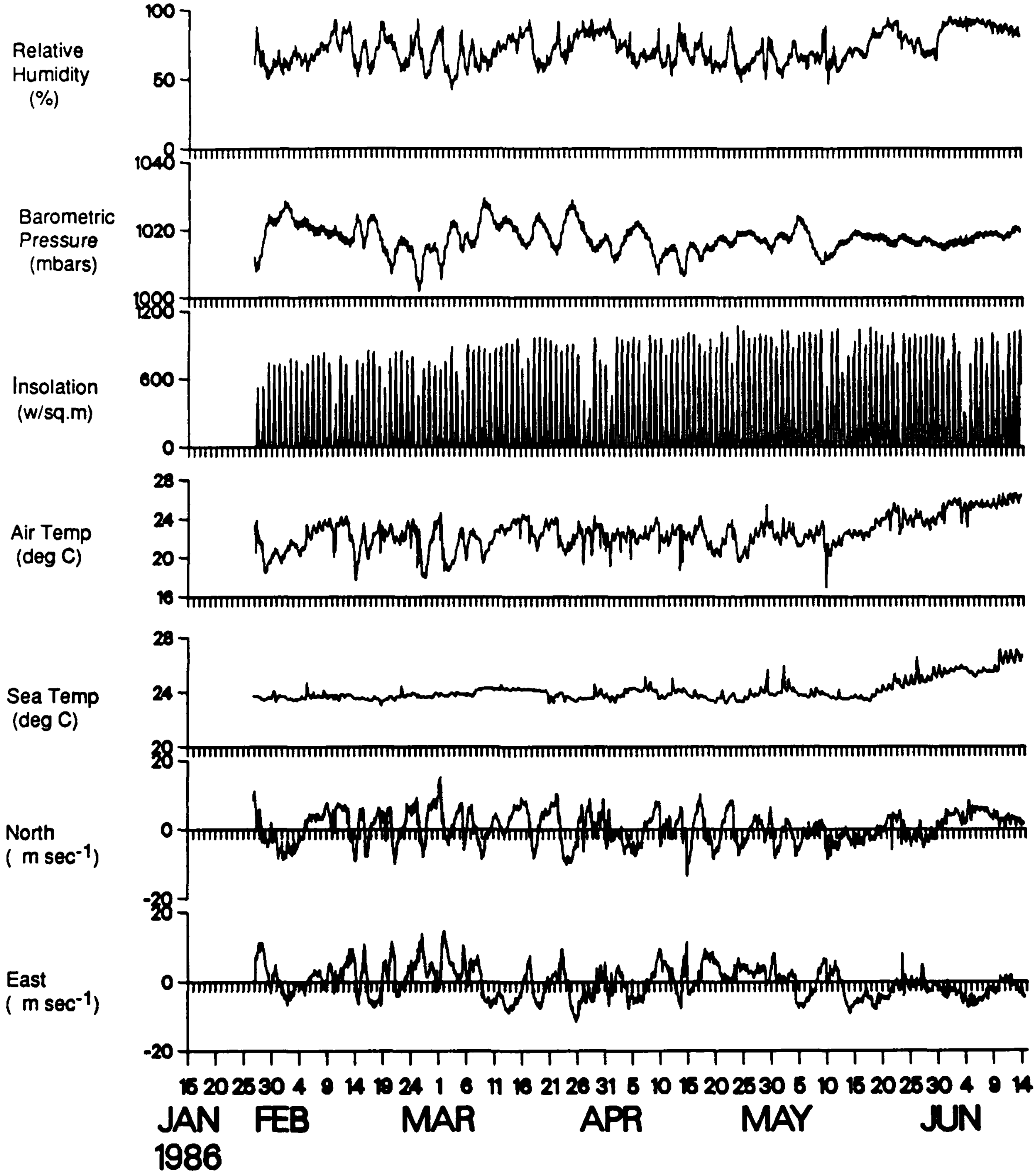
	pages
Time series of VAWR meteorological data by buoy.	35-39
Expanded scale meteorological data by buoy.	40-74
Wind progressive vector diagram by buoy.	75-79
Wind Speed and surface Temperature spectra by buoy.	80-84
Heat Flux and Wind Stress by buoy.	85-89



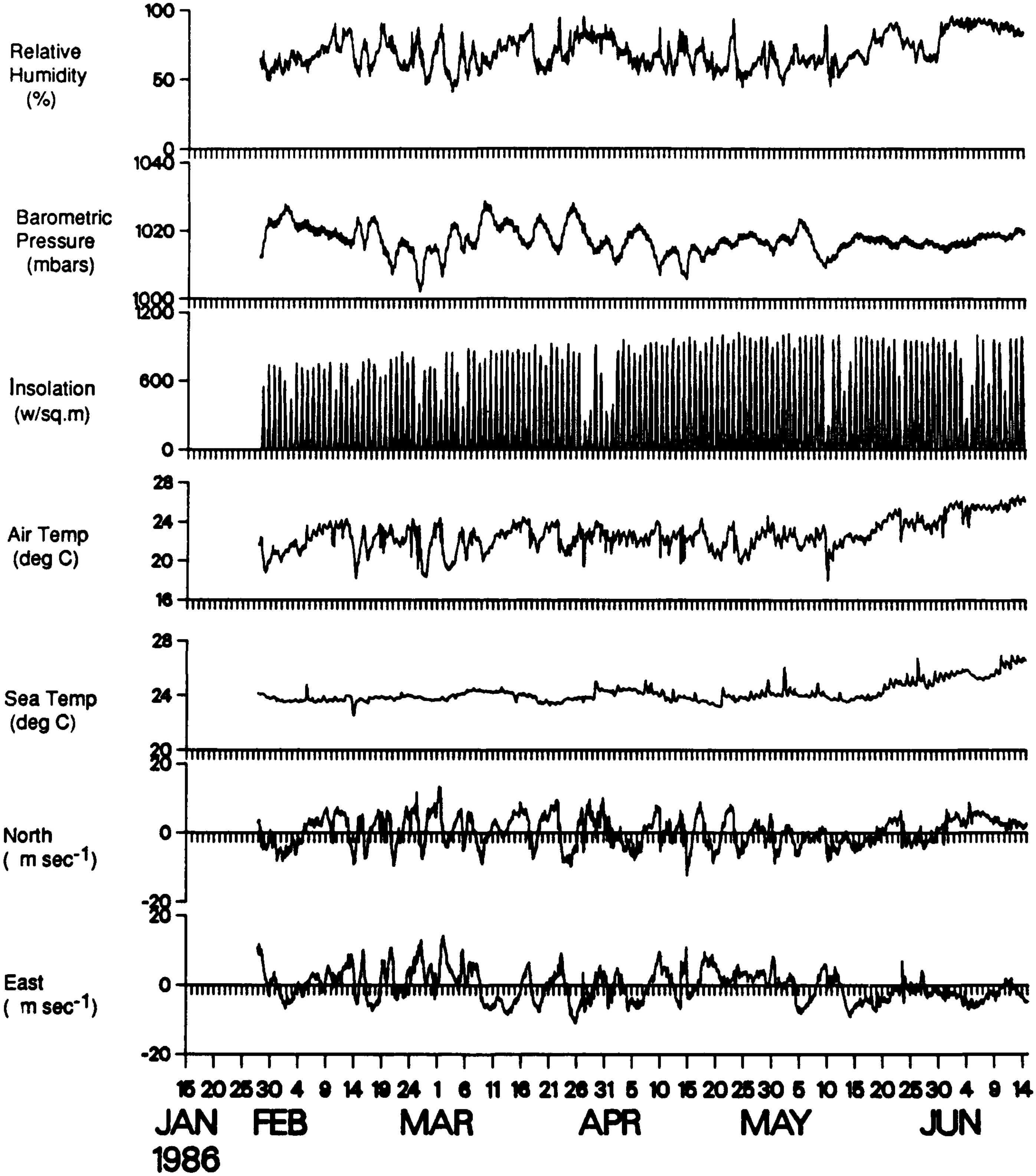
Surface mooring F2 meteorological data set.



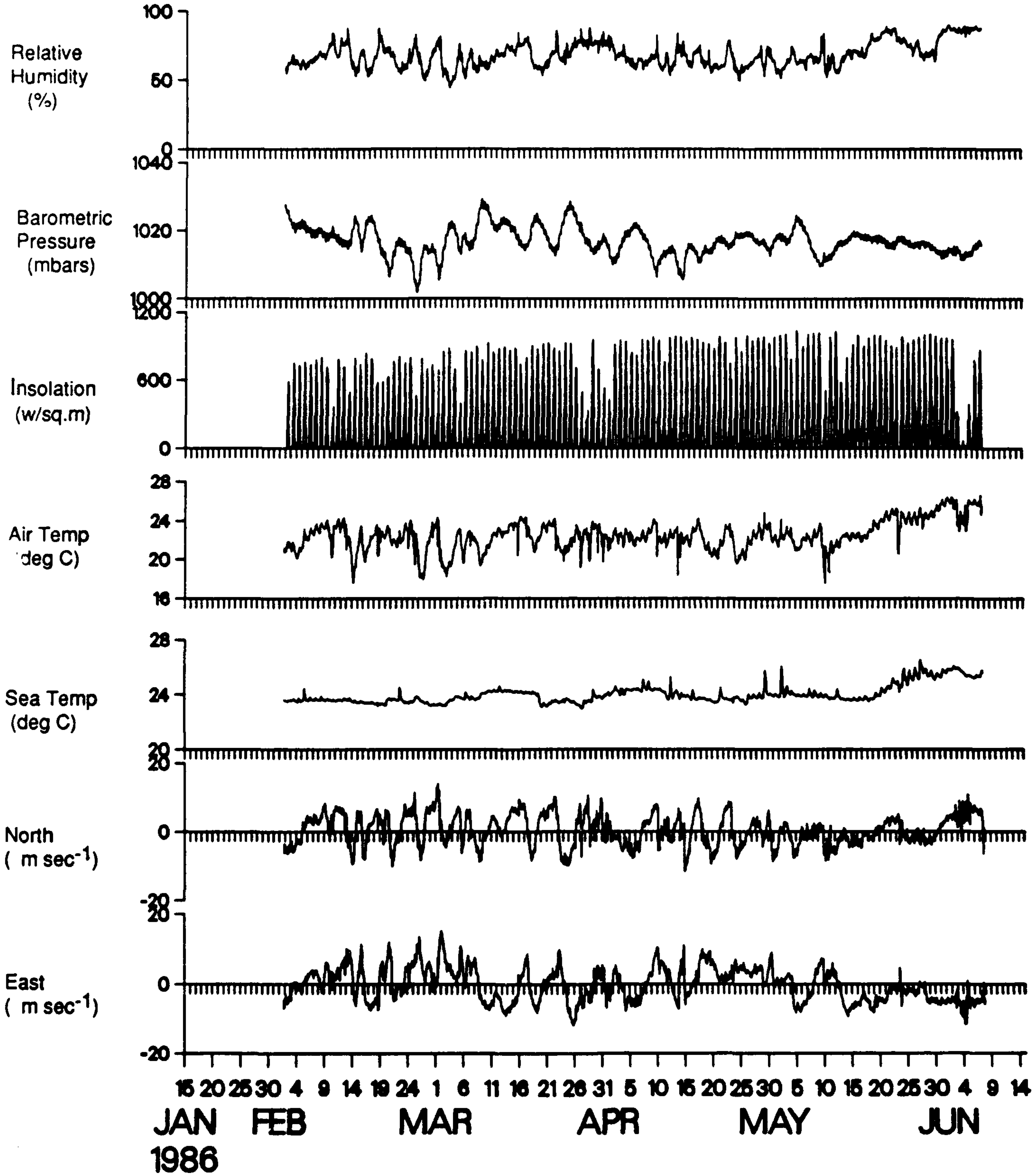
Surface mooring F4 meteorological data set.



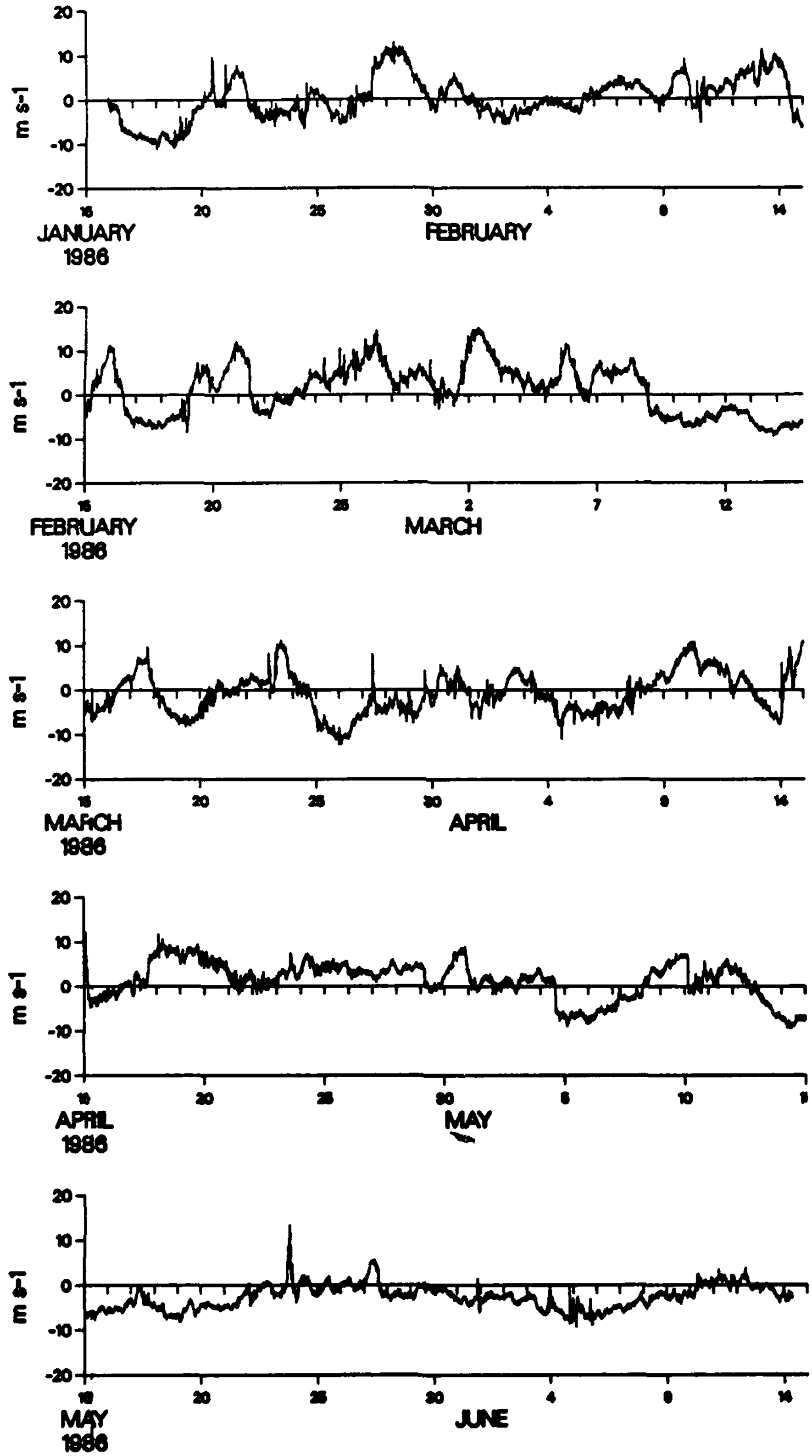
Surface mooring F6 meteorological data set.



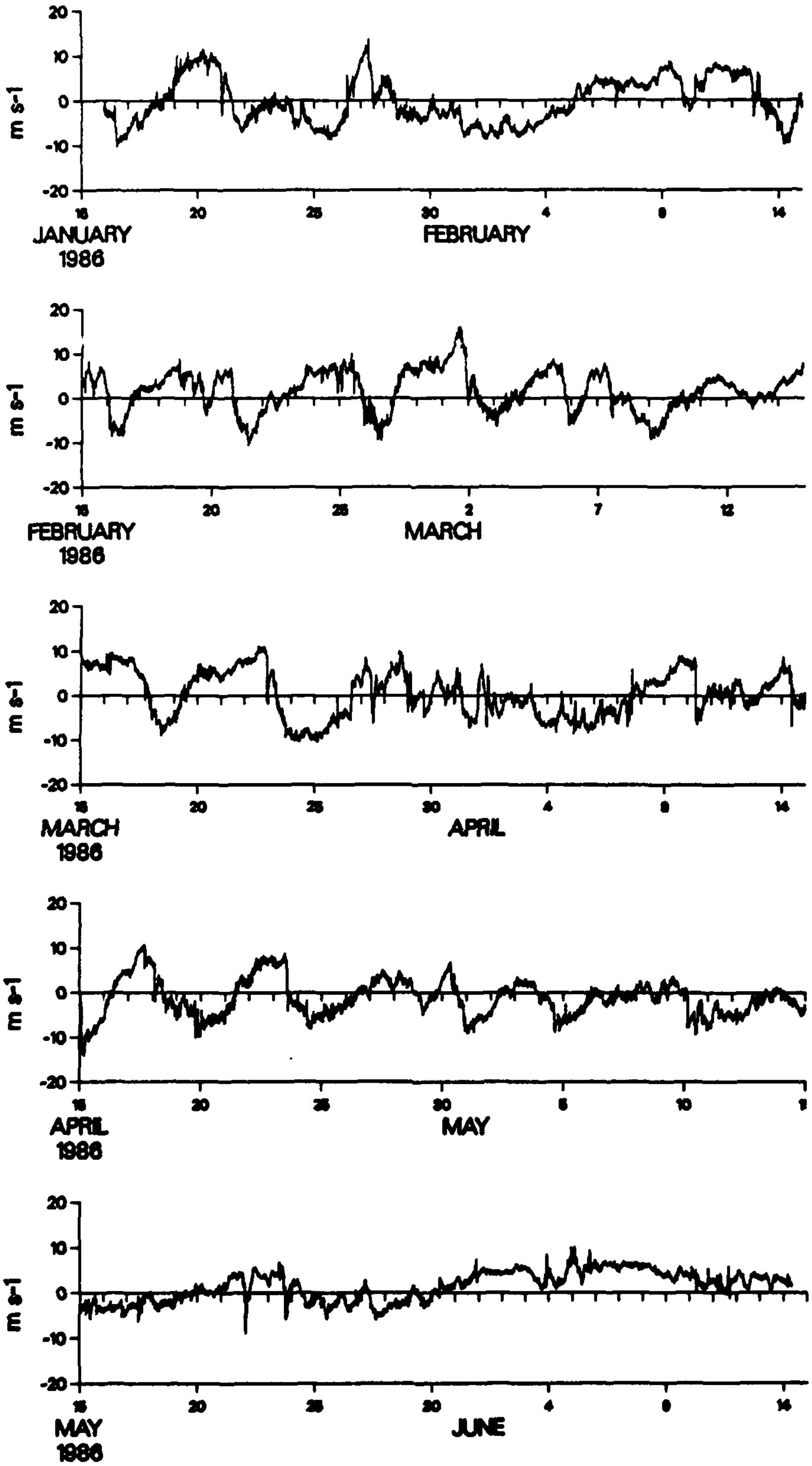
Surface mooring F8 meteorological data set.



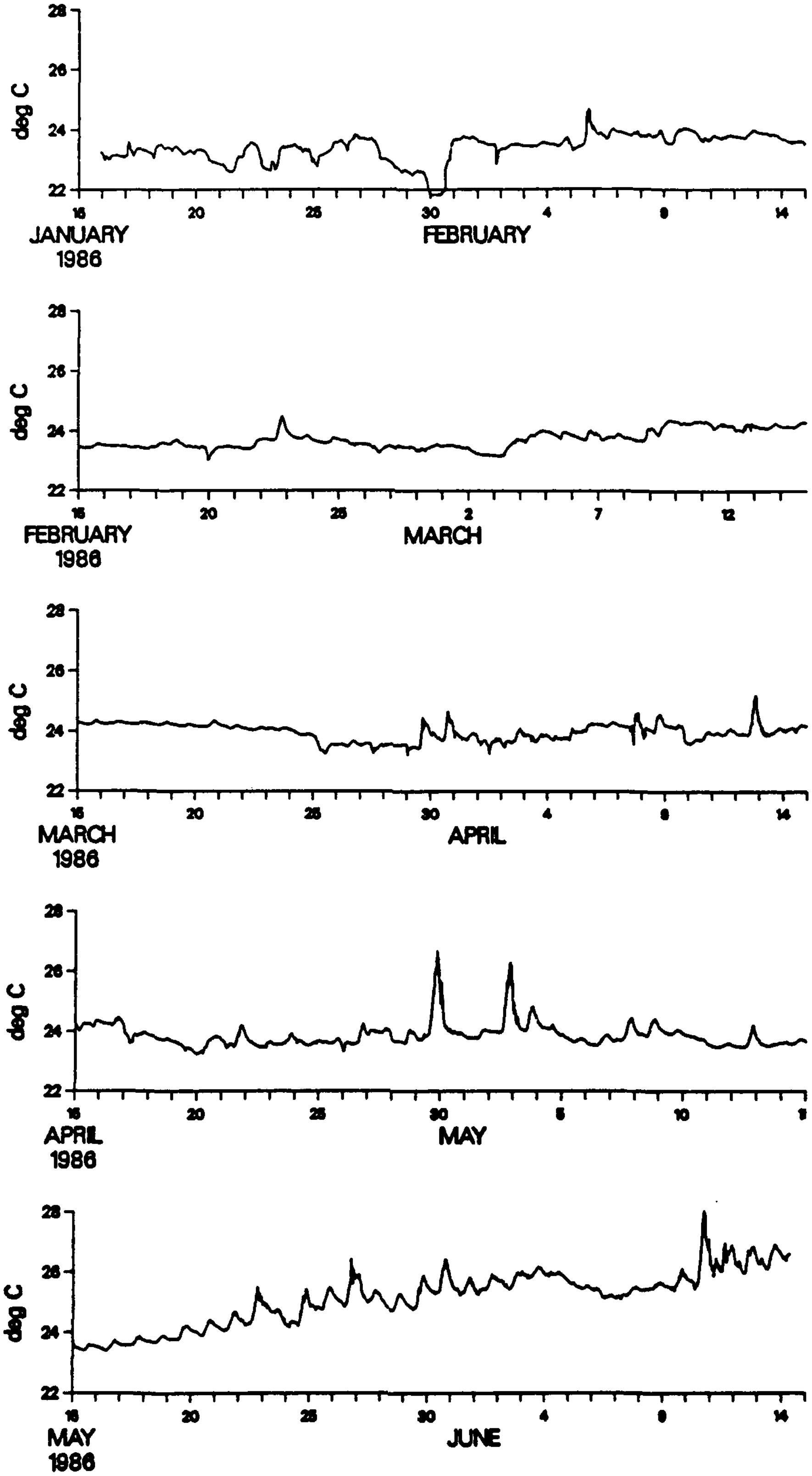
Surface mooring F10 meteorological data set.



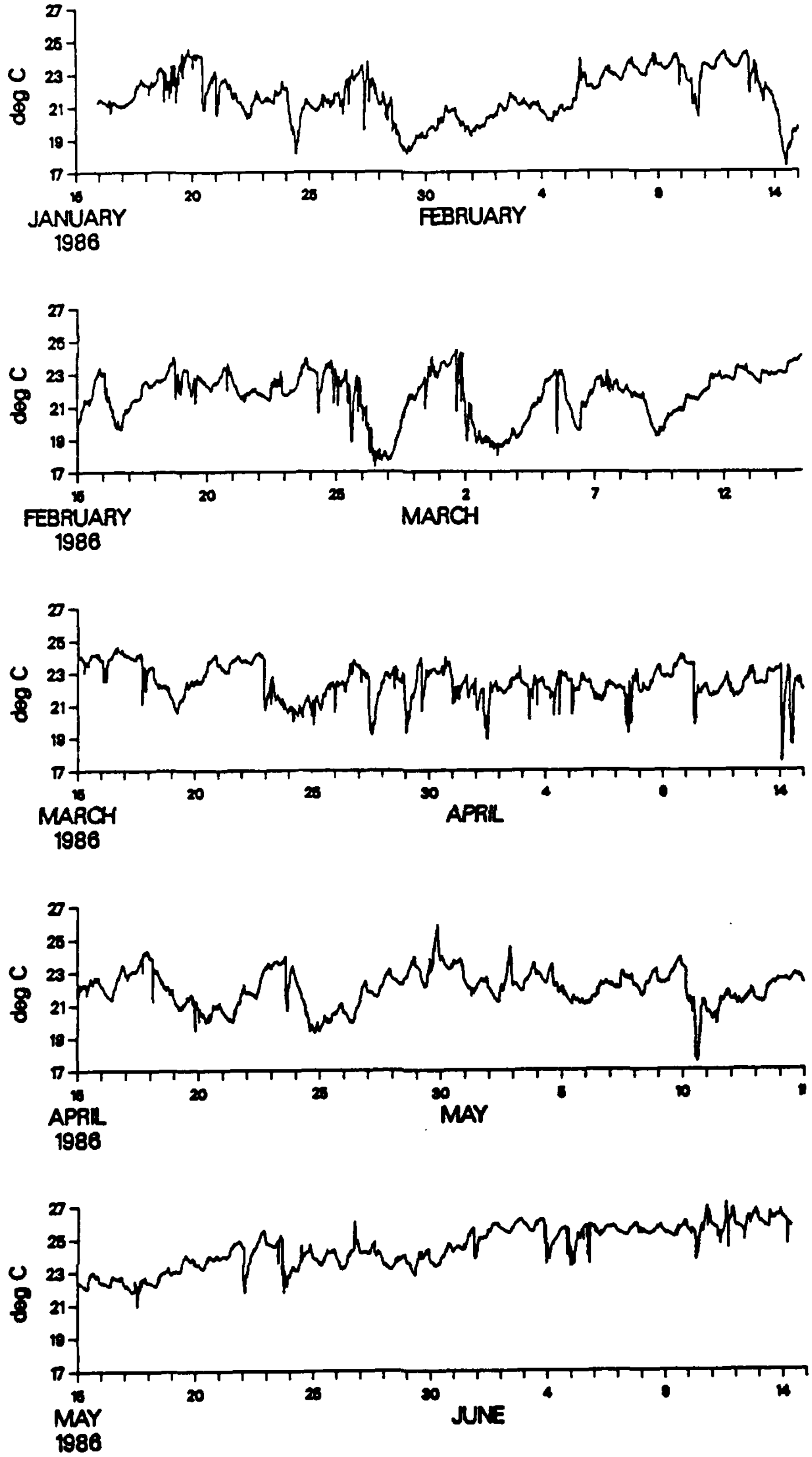
Surface mooring F2 expanded scale East.



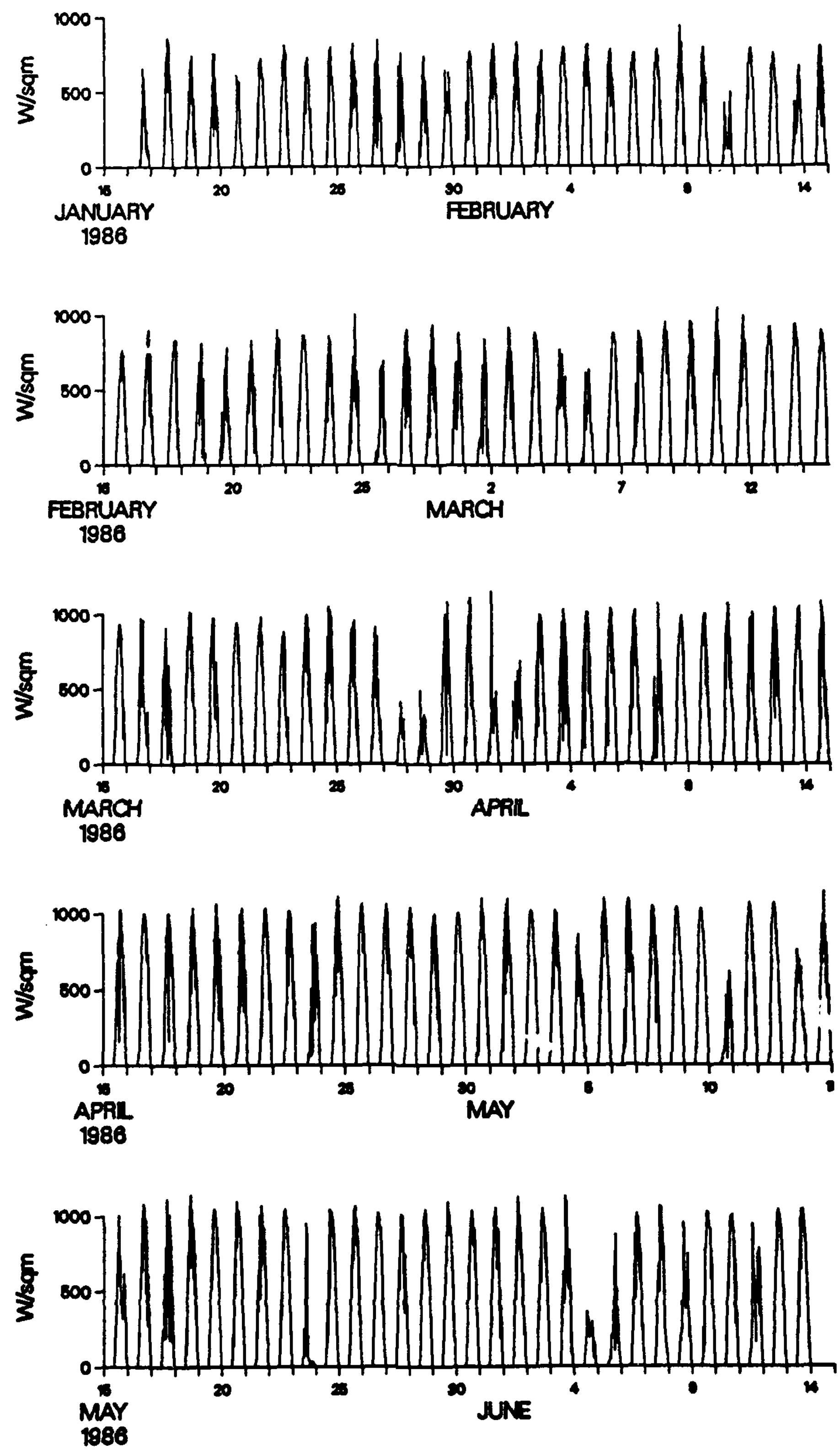
Surface mooring F2 expanded scale North.



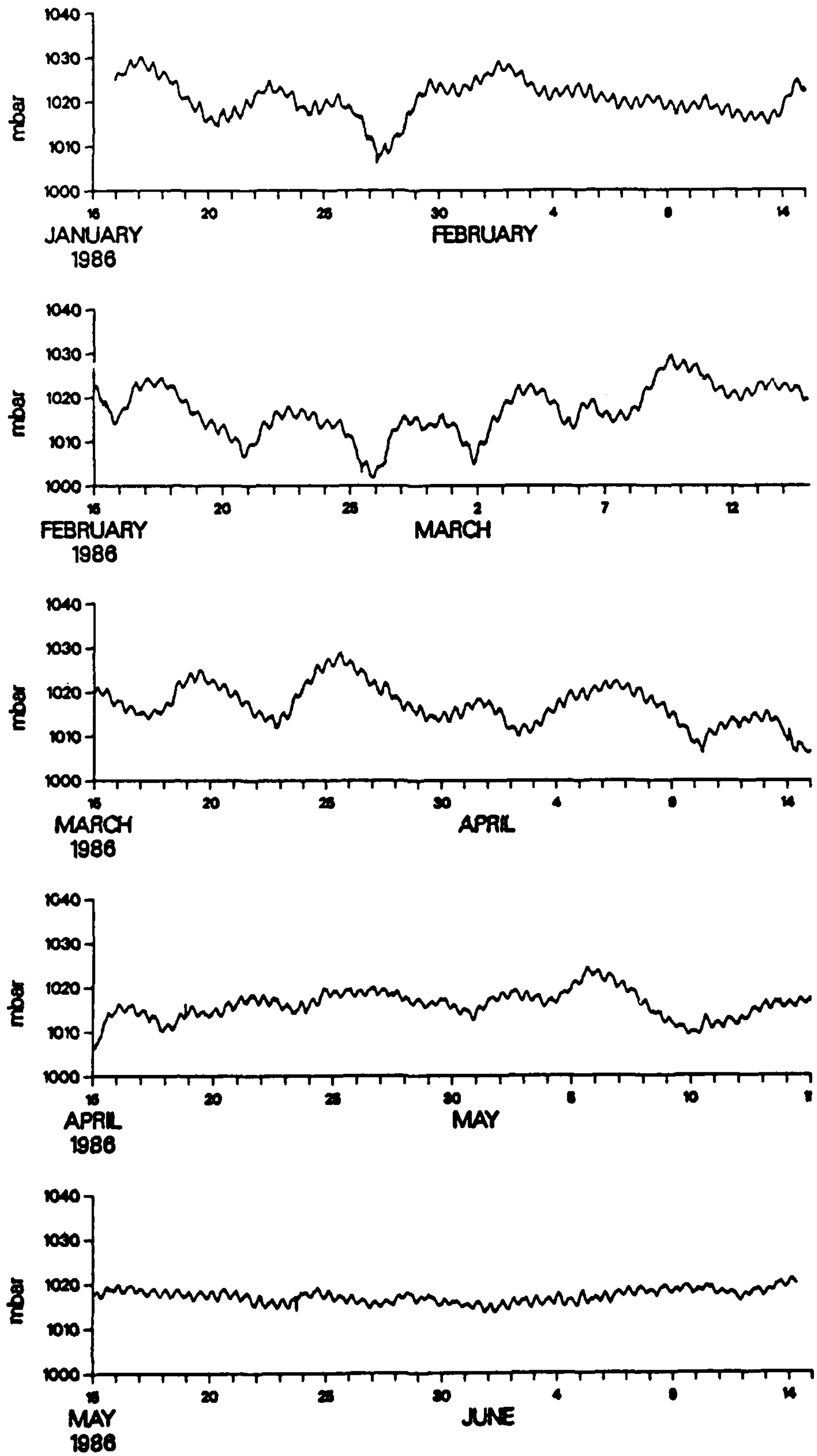
Surface mooring F2 expanded scale Sea Temperature.



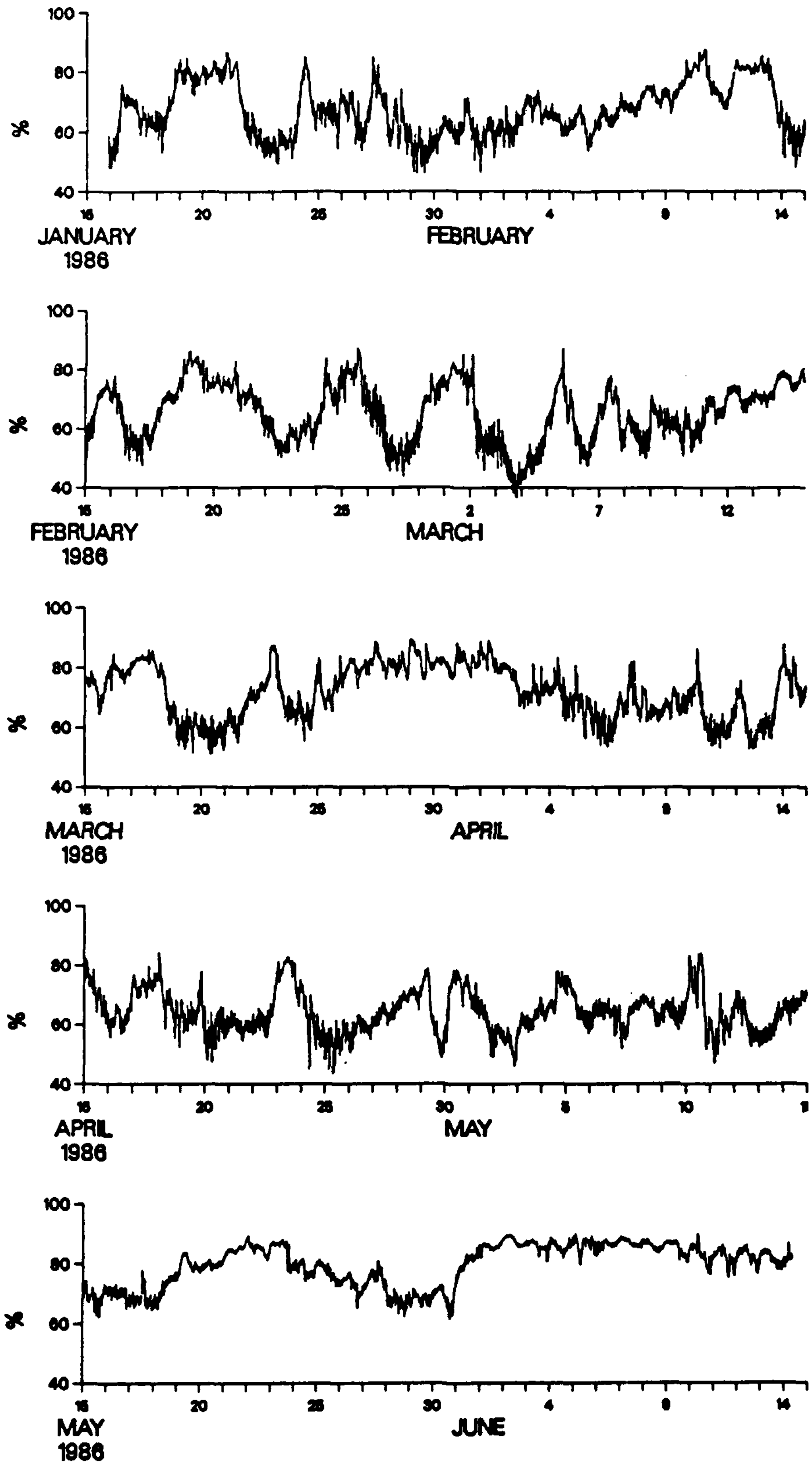
Surface mooring F2 expanded scale Air Temperature.



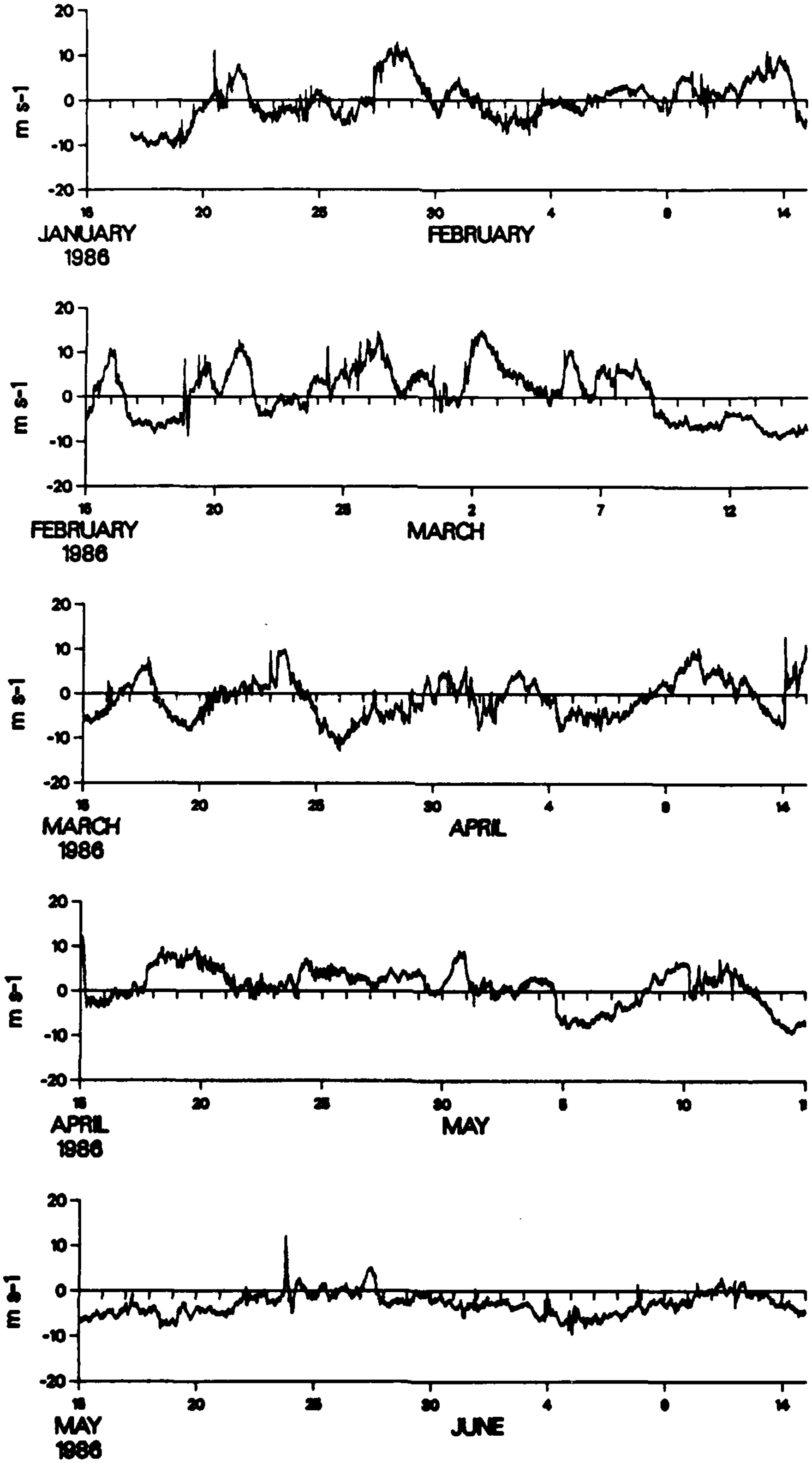
Surface mooring F2 expanded scale Insolation.



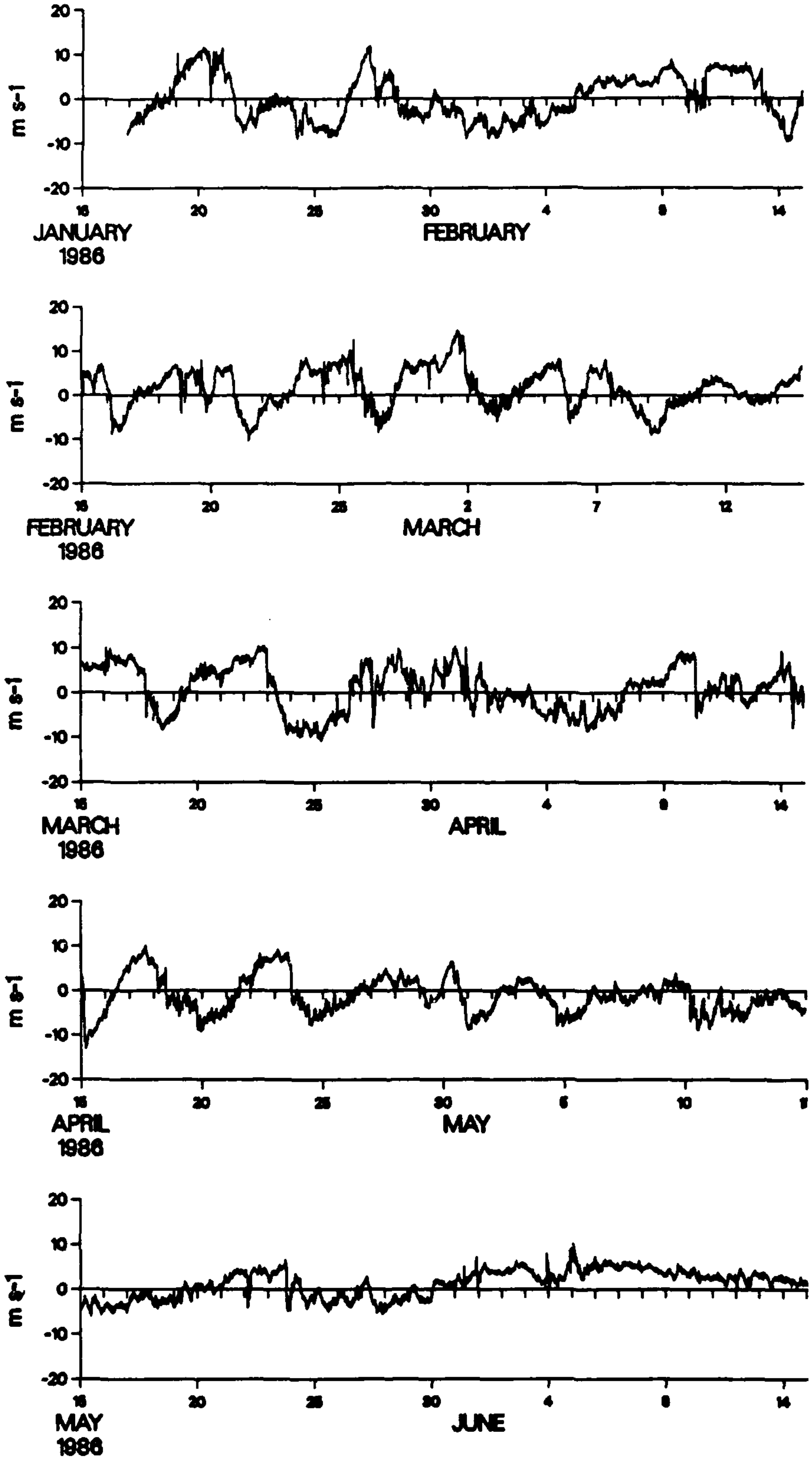
Surface mooring F2 expanded scale Barometric Pressure.



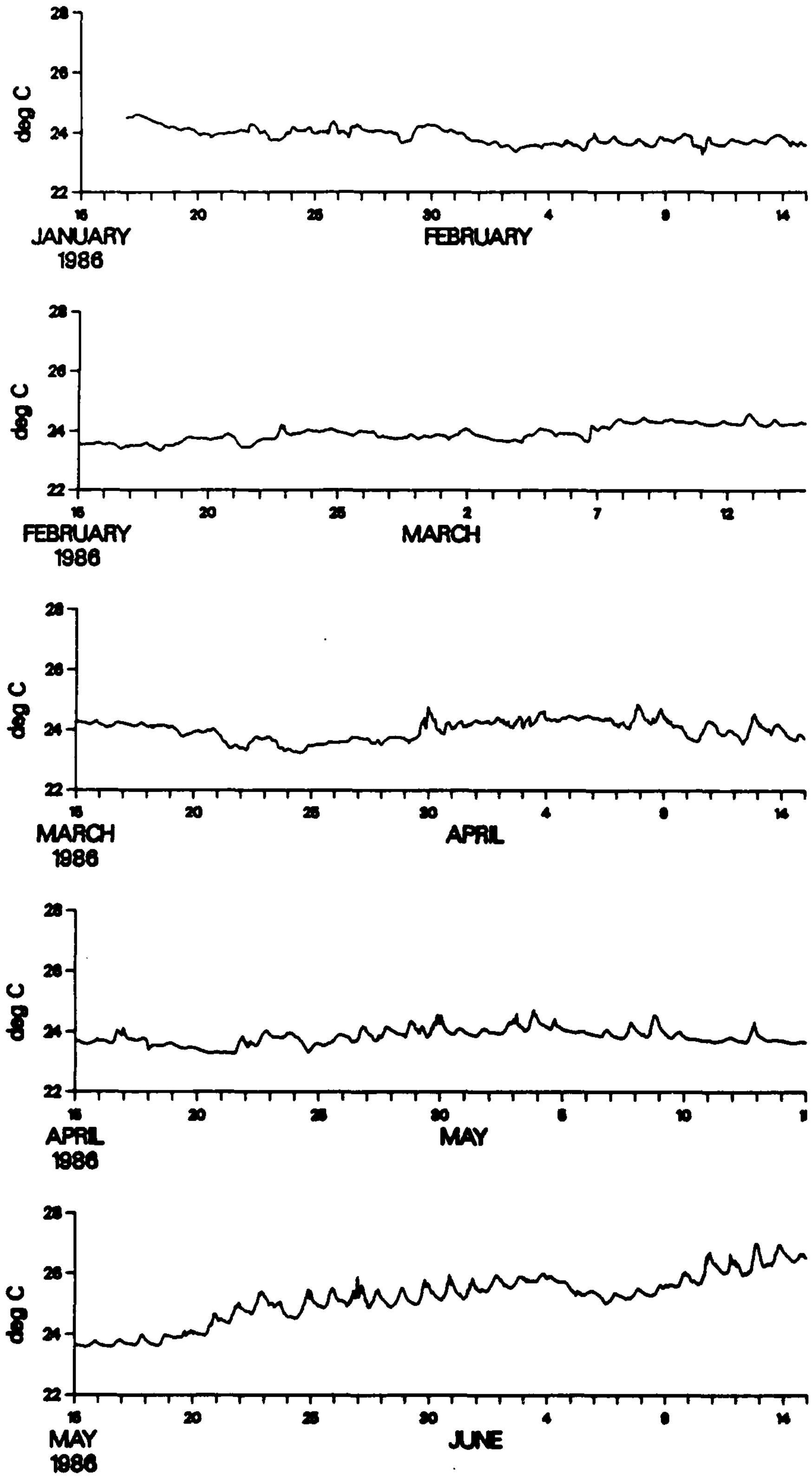
Surface mooring F2 expanded scale Relative Humidity.



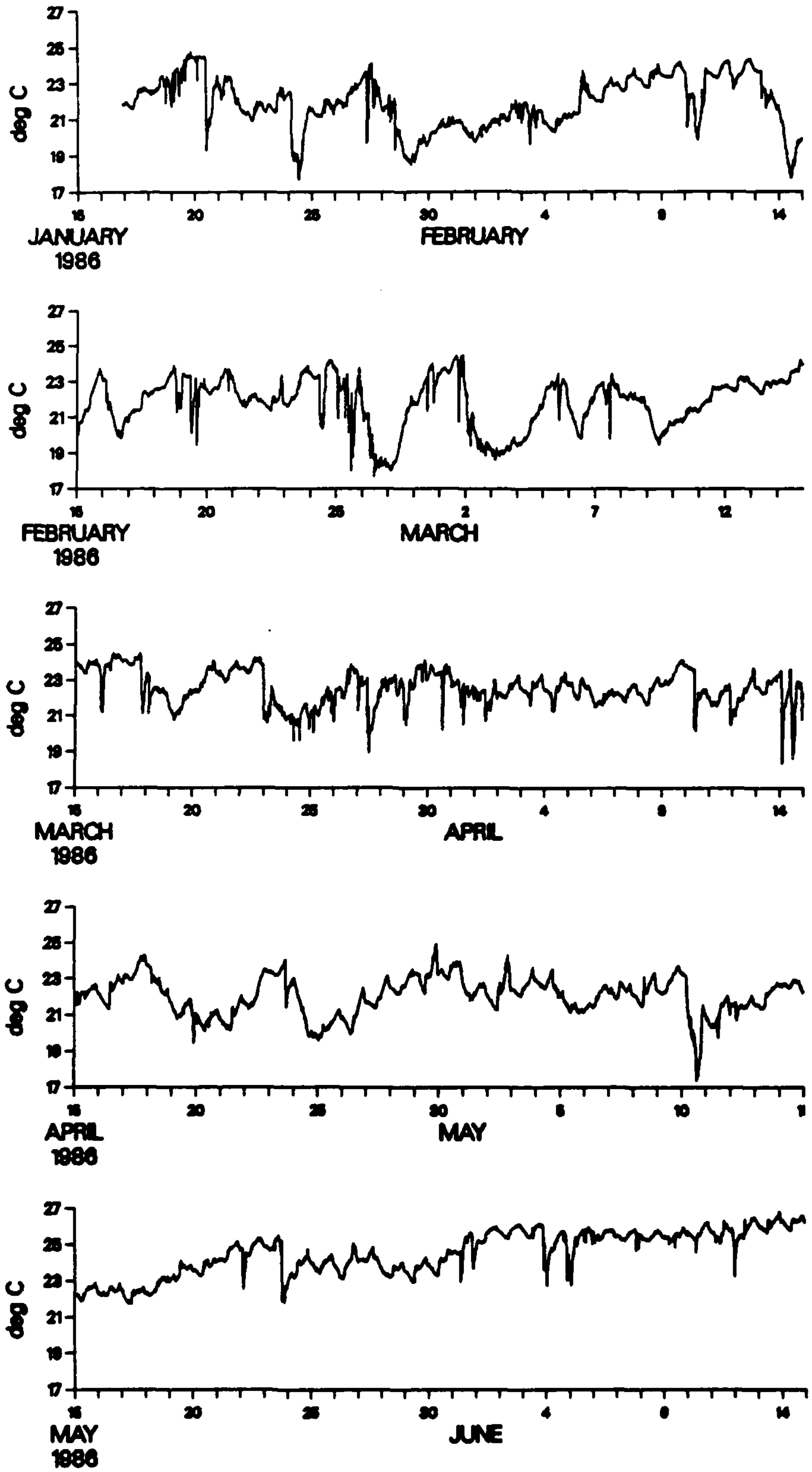
Surface mooring F4 expanded scale East.



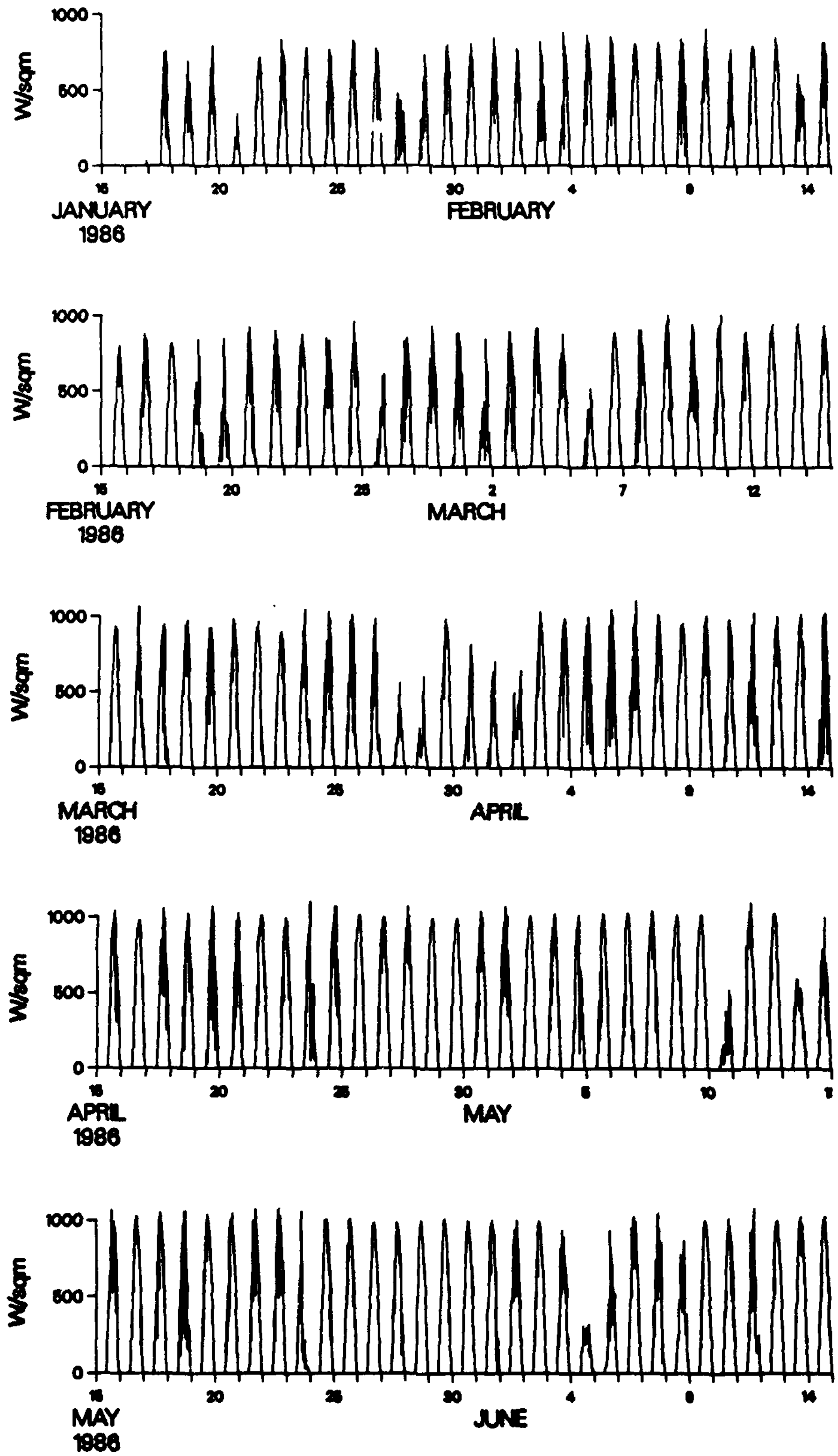
Surface mooring F4 expanded scale North.



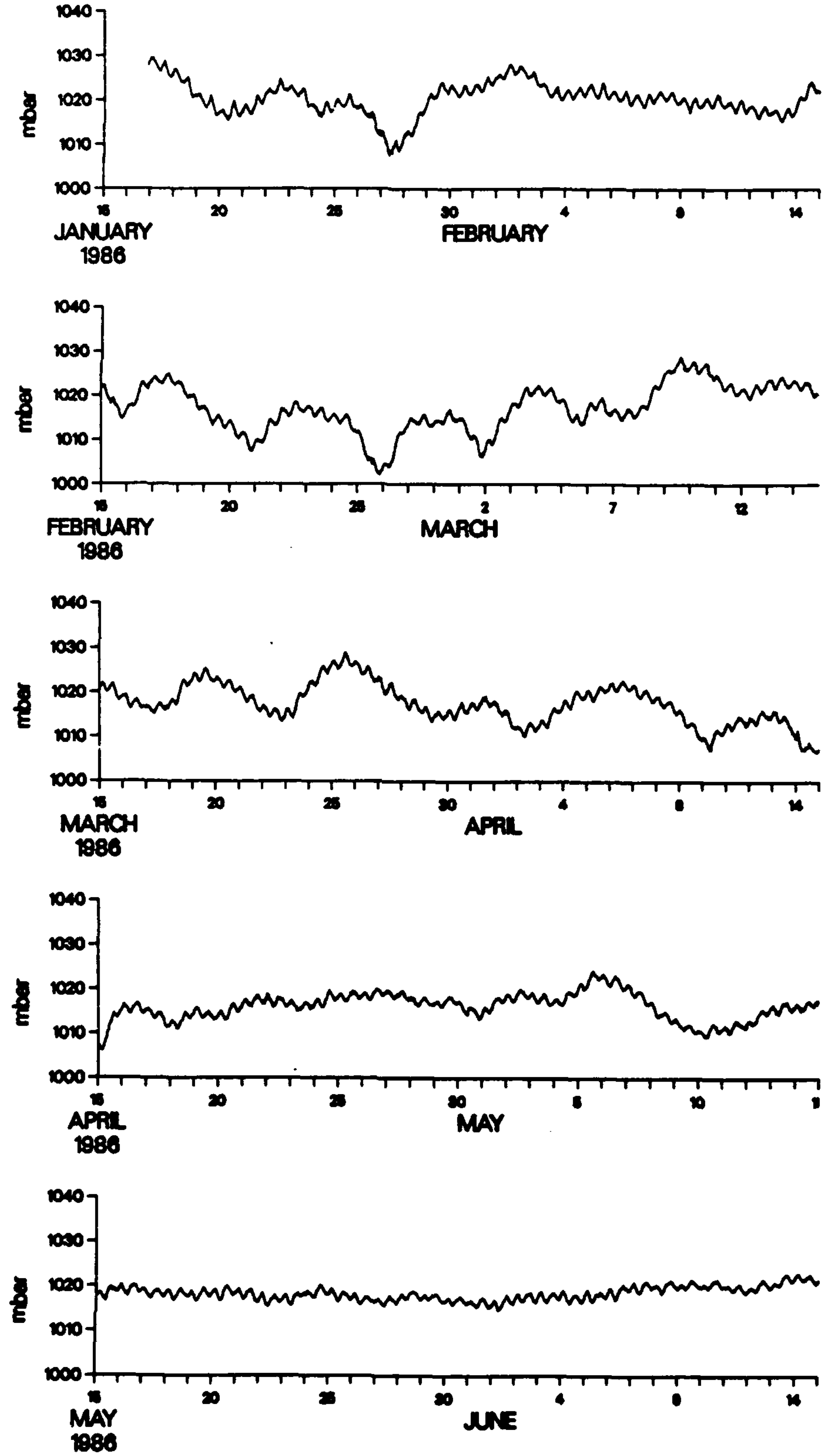
Surface mooring F4 expanded scale Sea Temperature.



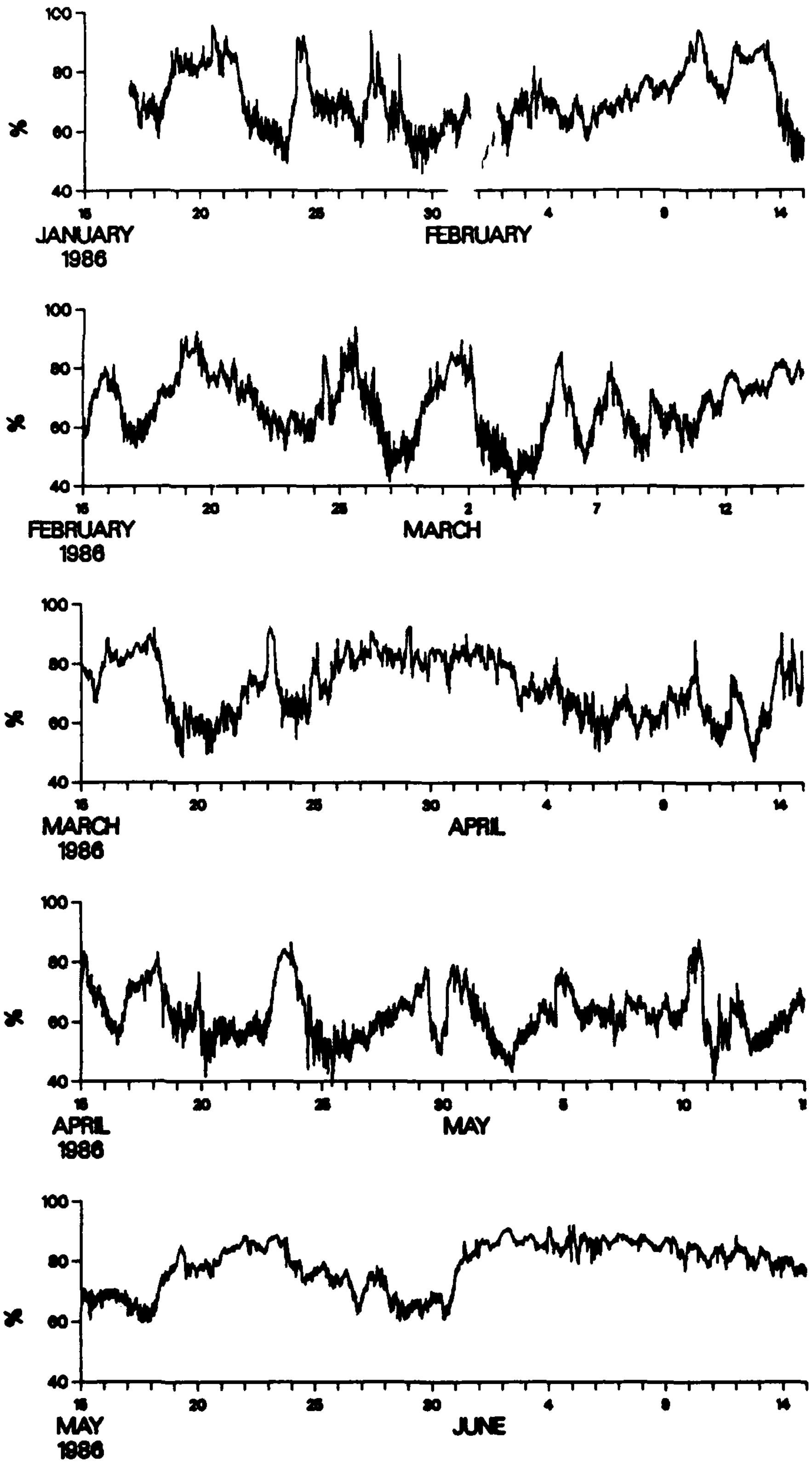
Surface mooring F4 expanded scale Air Temperature.



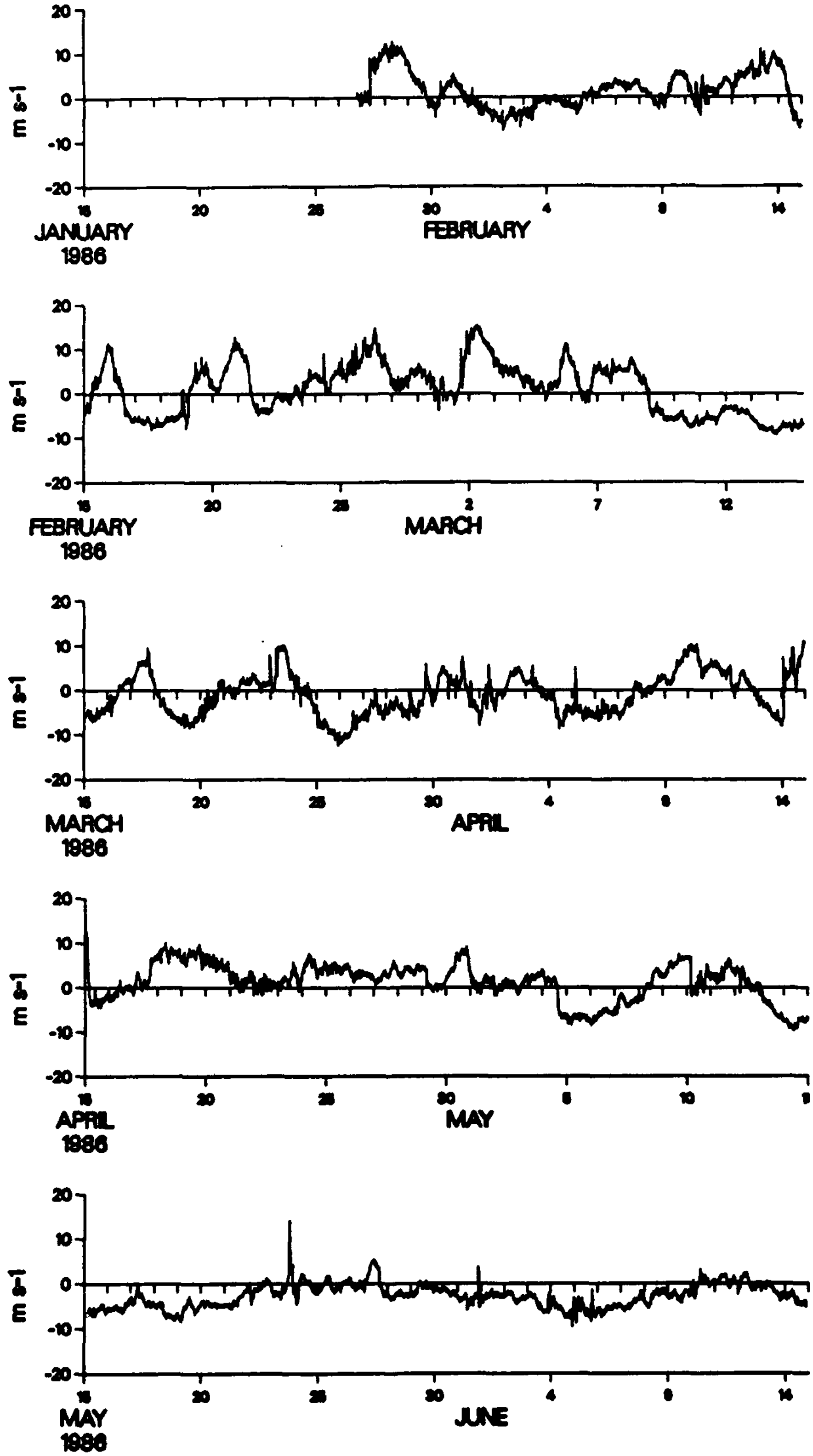
Surface mooring F4 expanded scale Insolation.



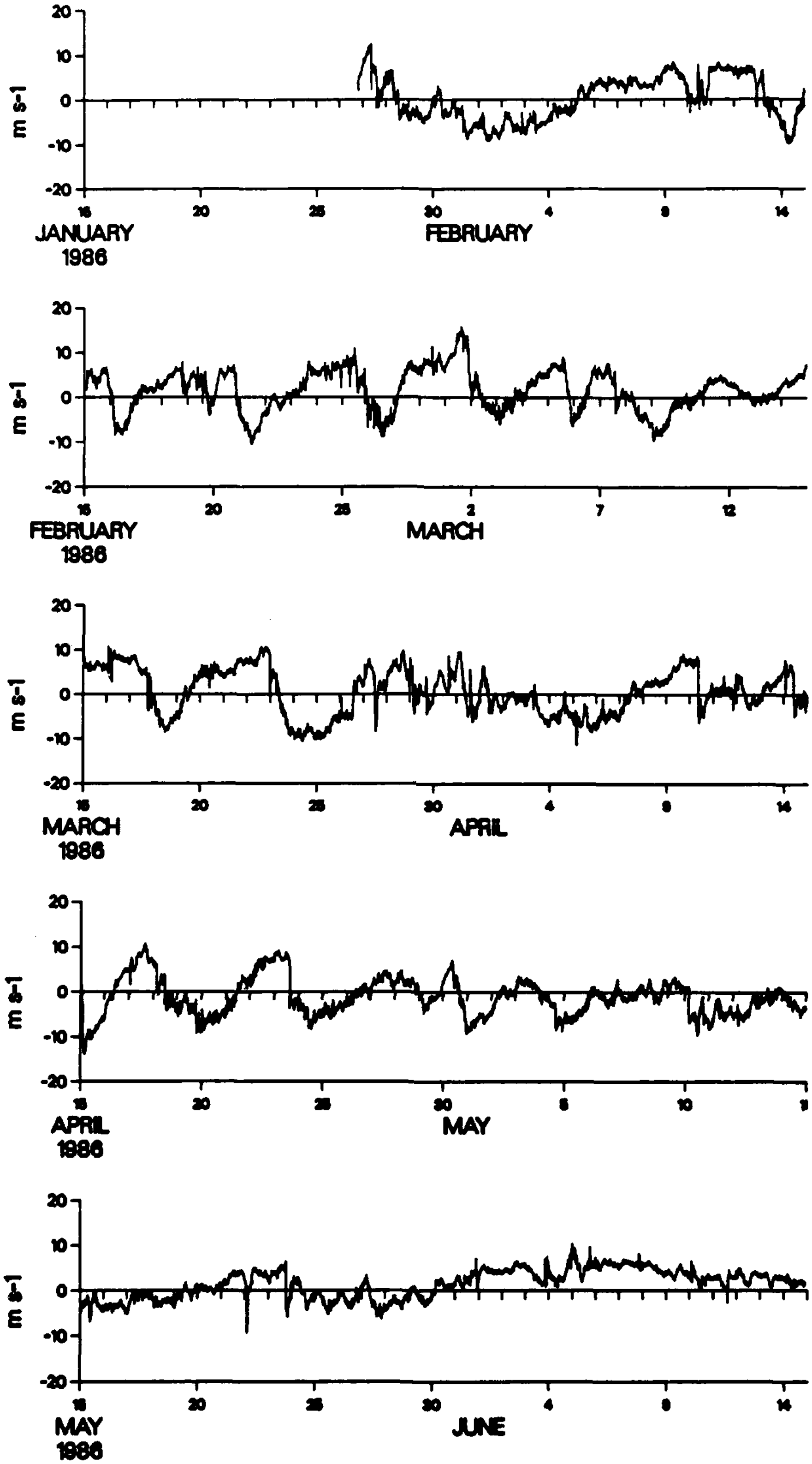
Surface mooring F4 expanded scale Barometric Pressure.



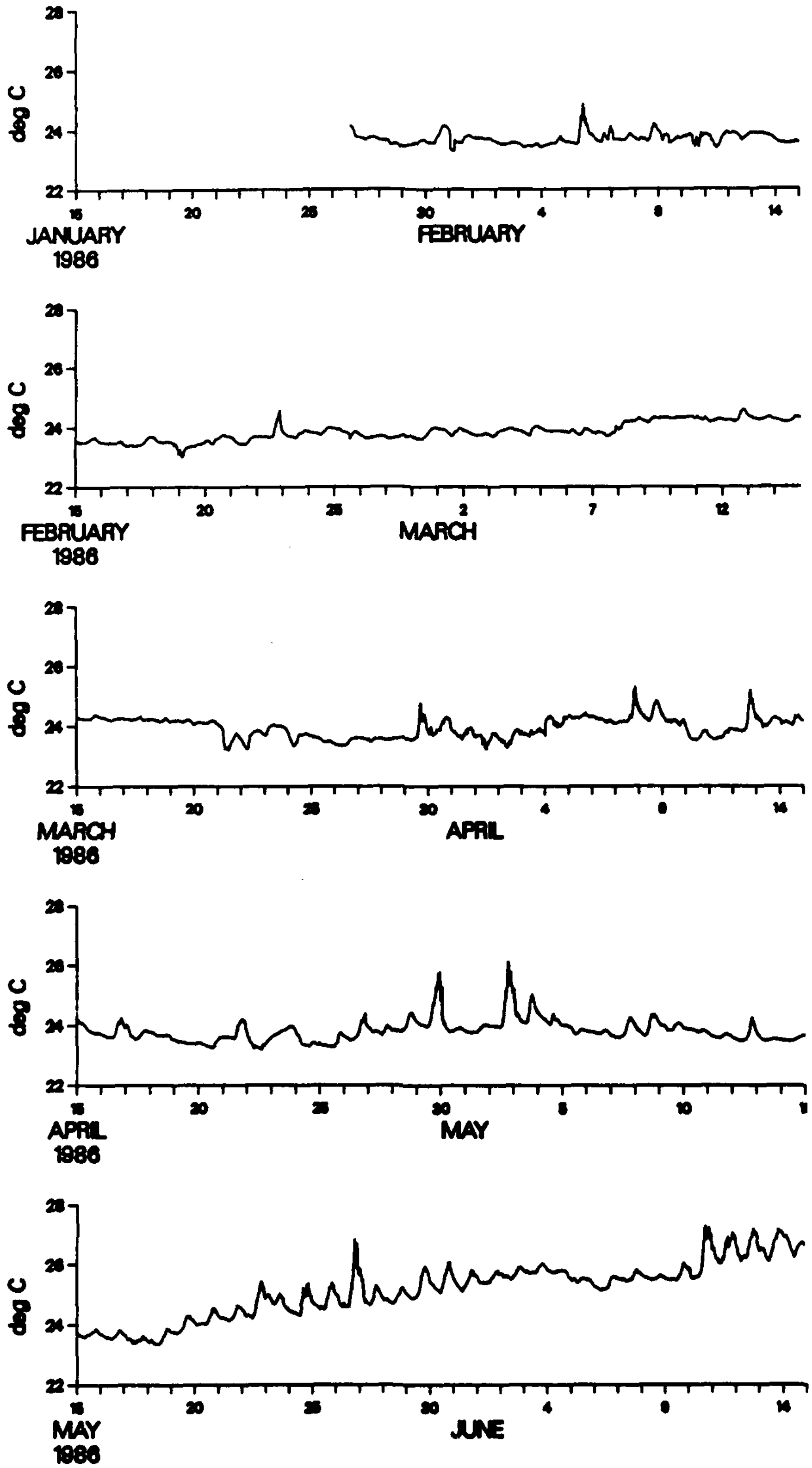
Surface mooring F4 expanded scale Relative Humidity.



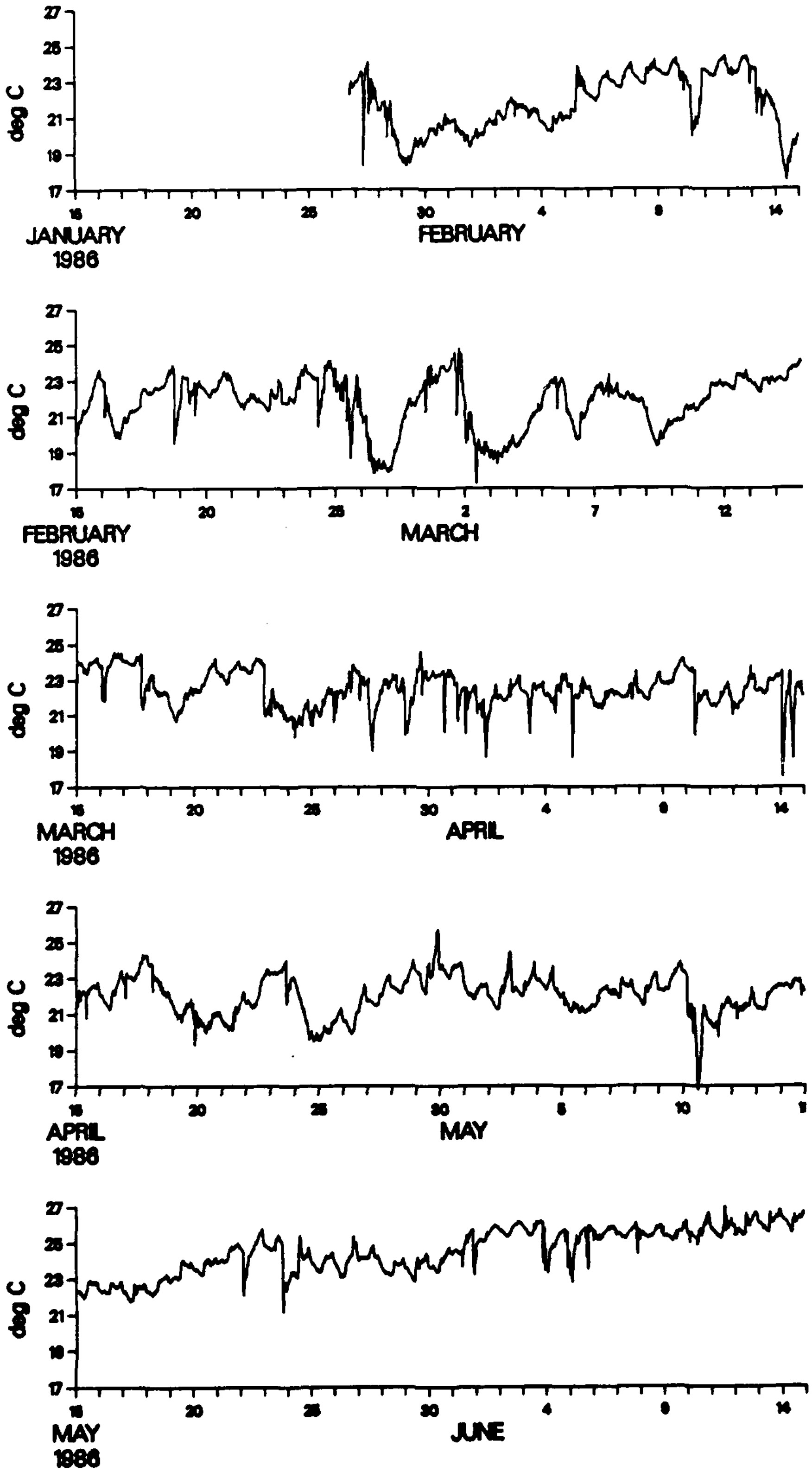
Surface mooring F6 expanded scale East.



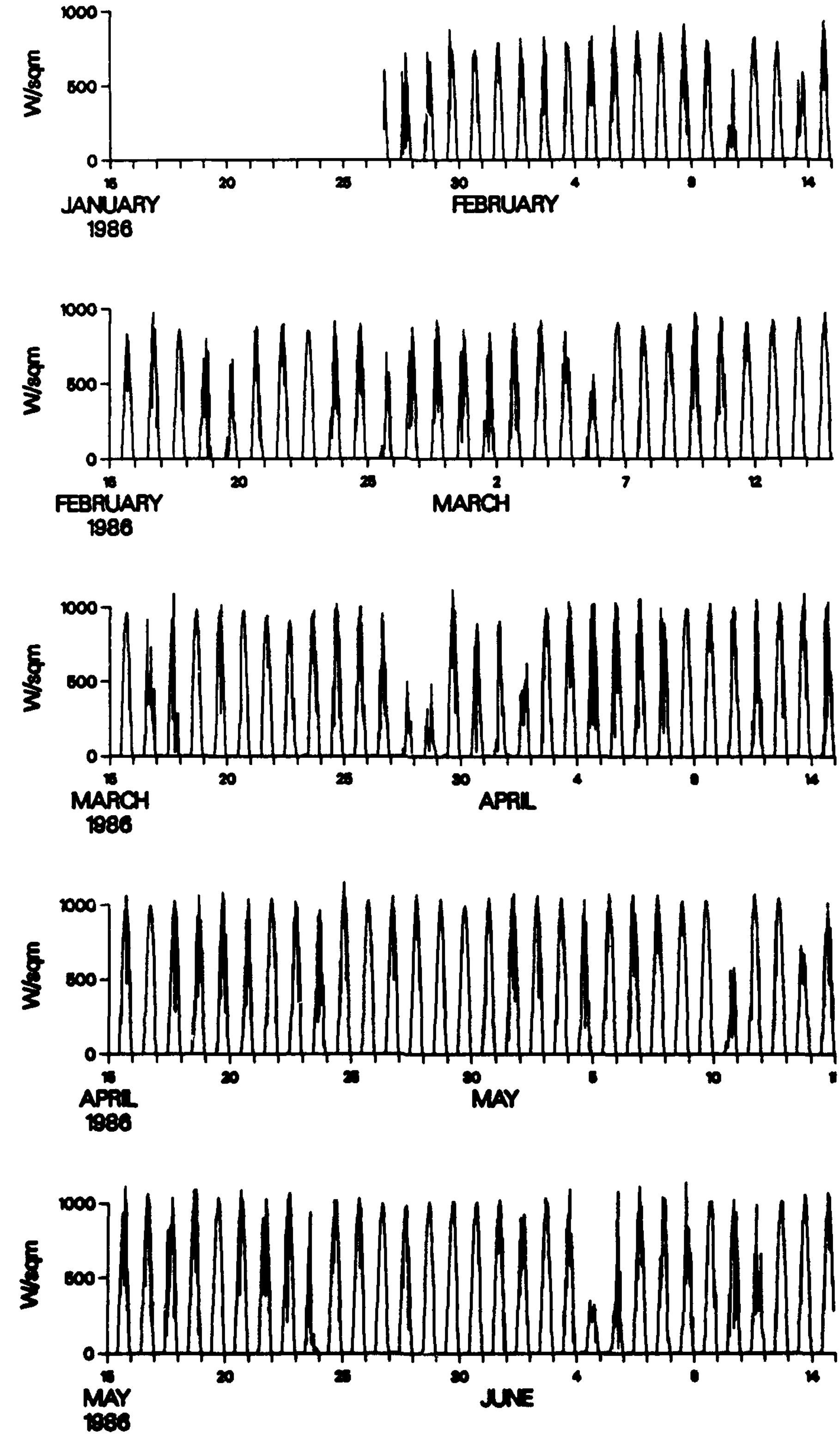
Surface mooring F6 expanded scale North.



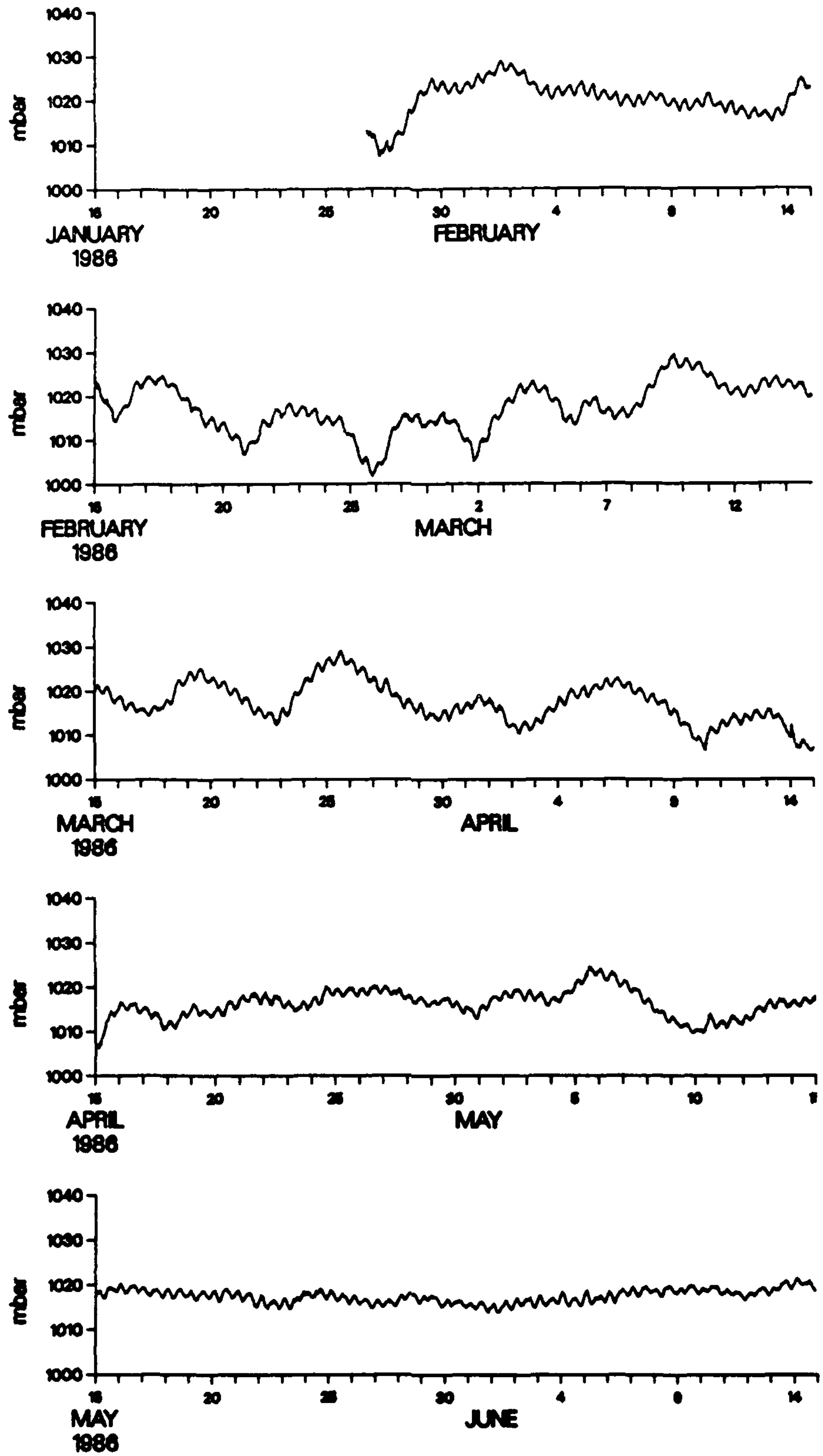
Surface mooring F6 expanded scale Sea Temperature.



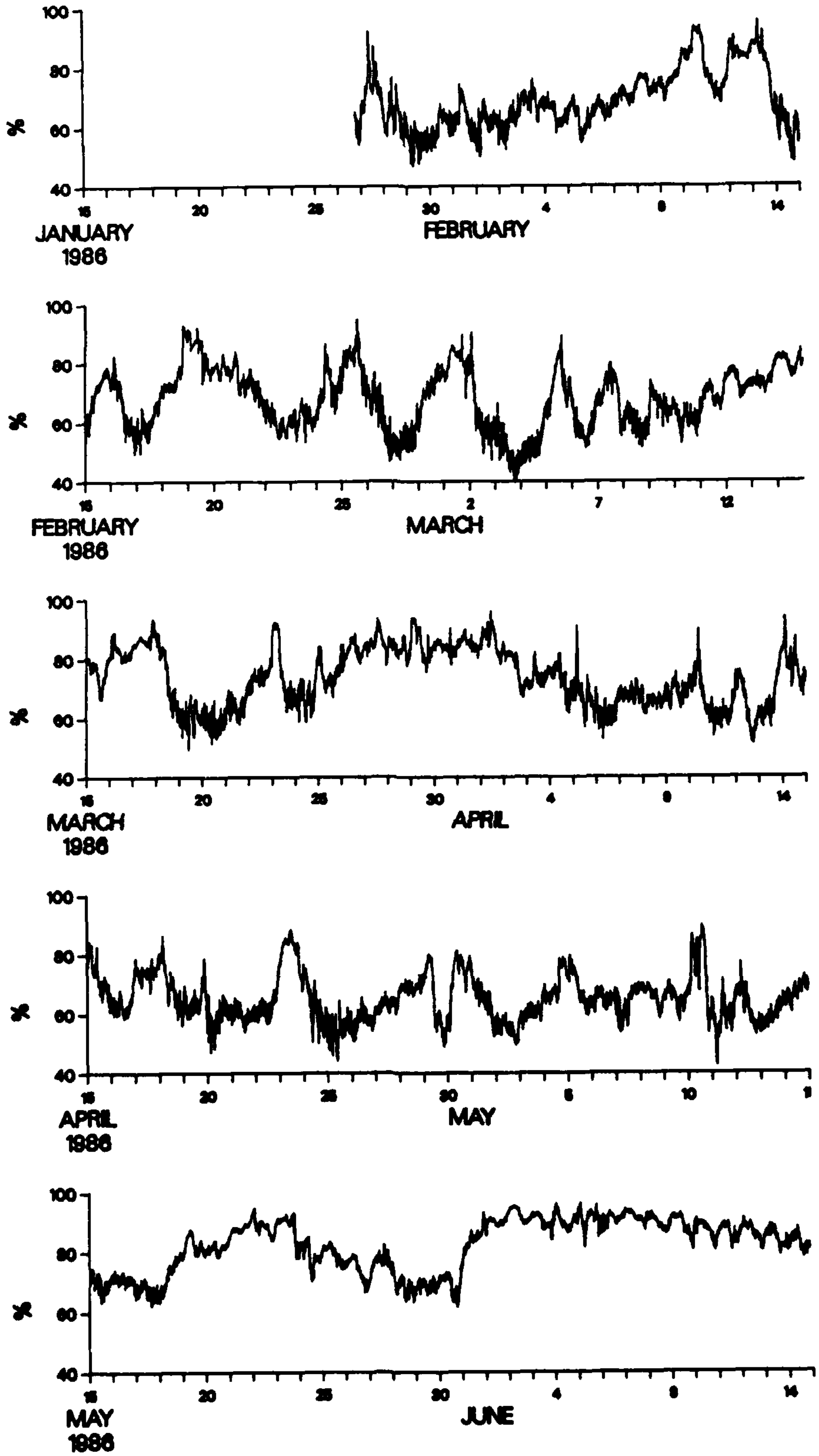
Surface mooring F6 expanded scale Air Temperature.



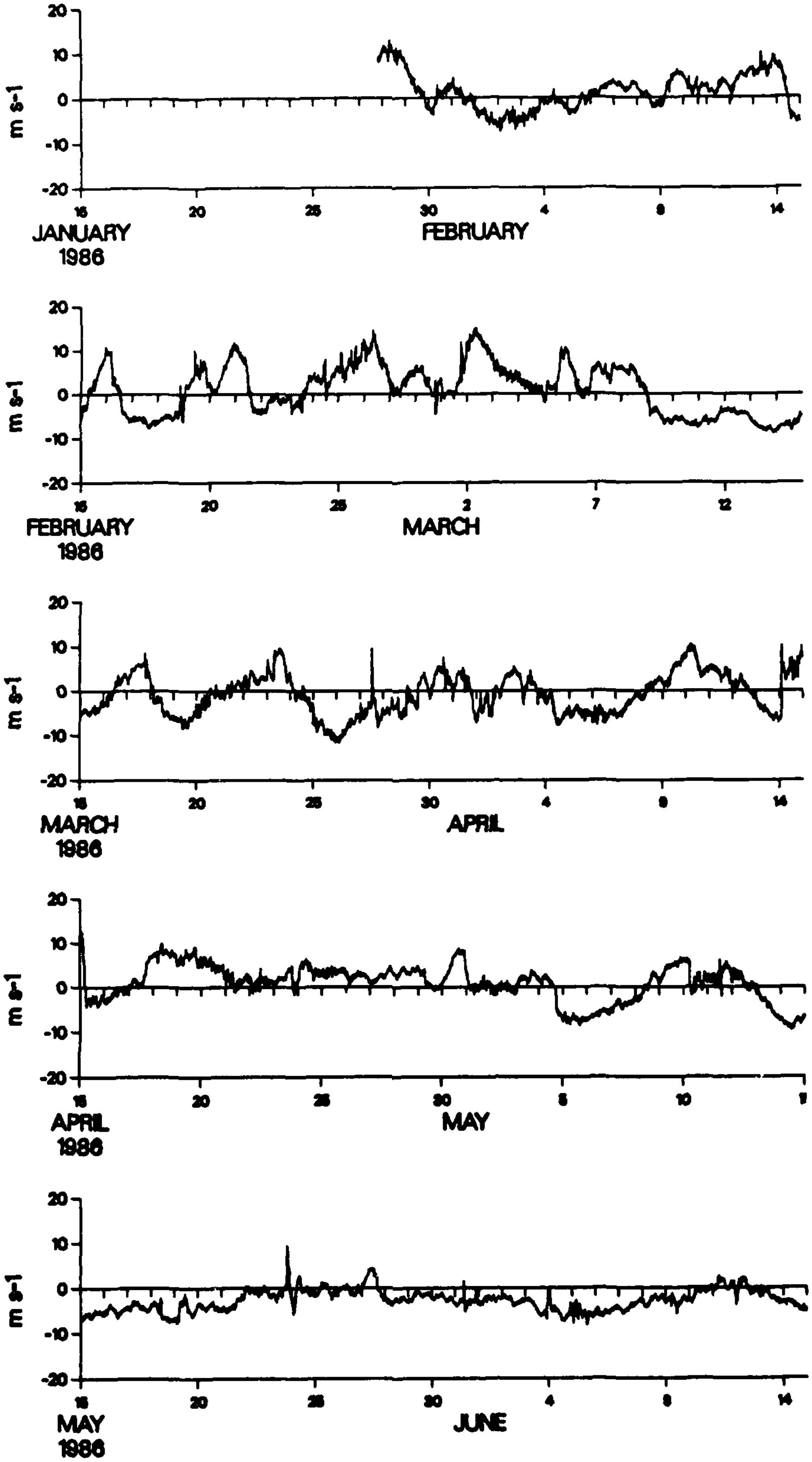
Surface mooring F6 expanded scale Insolation.



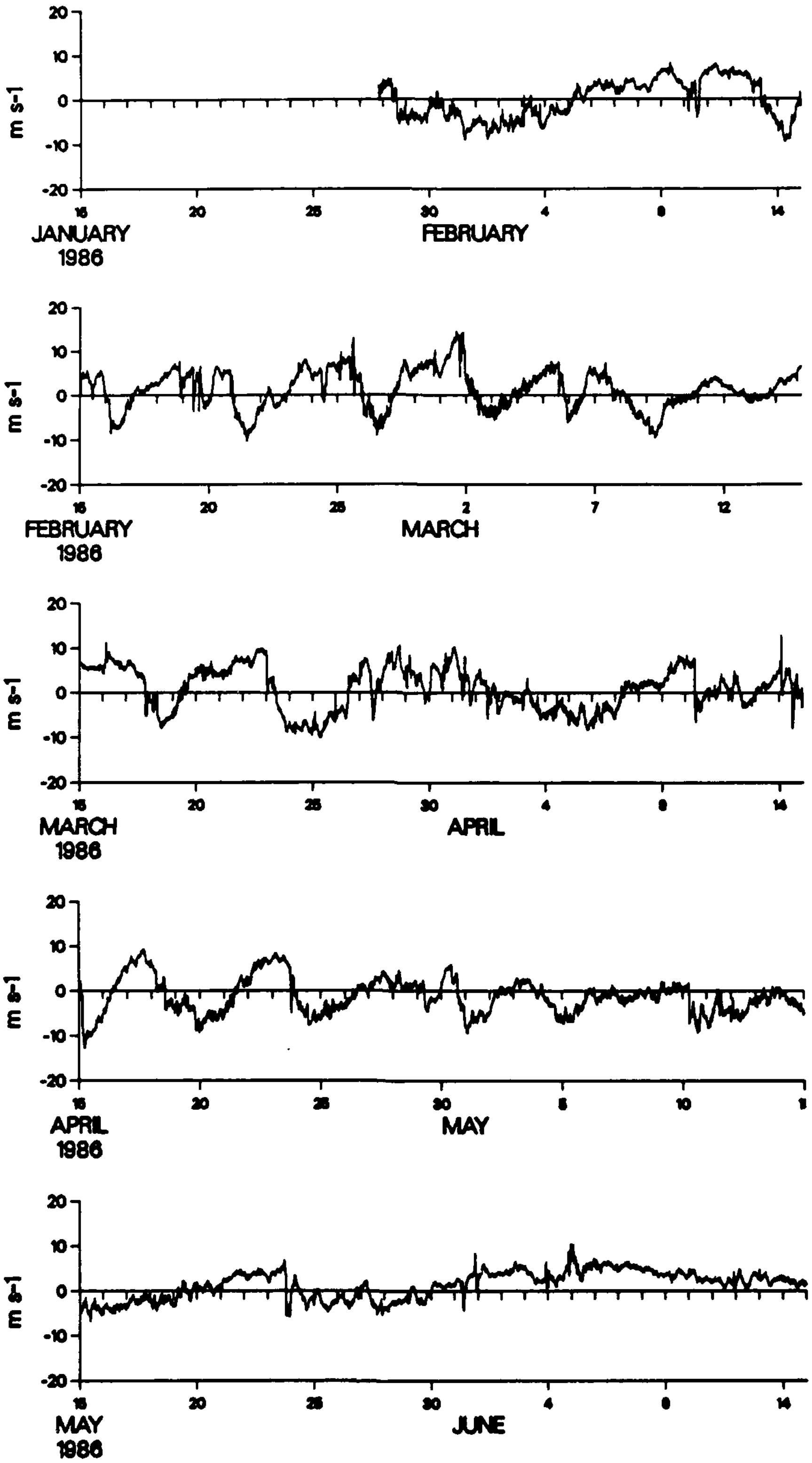
Surface mooring F6 expanded scale Barometric Pressure.



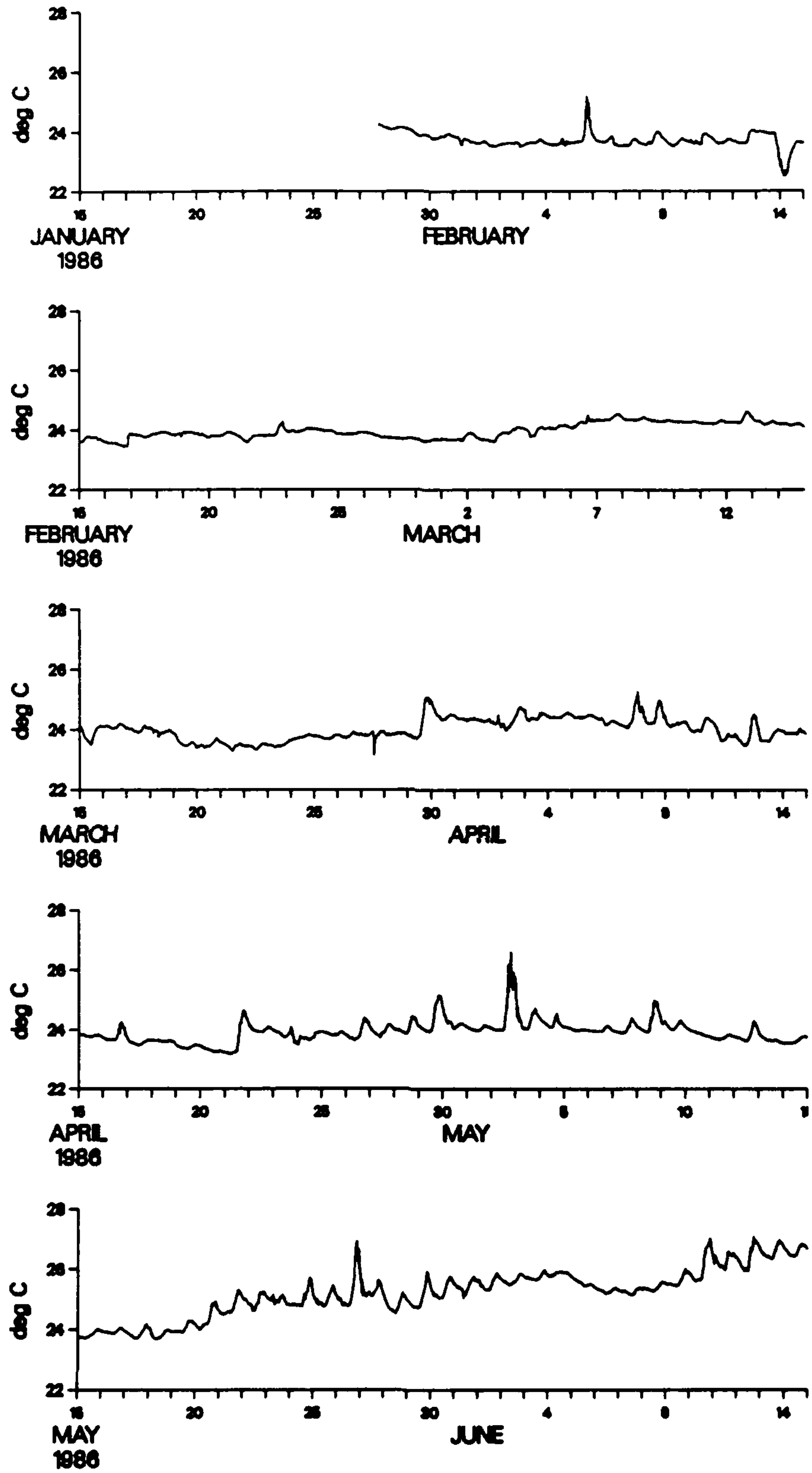
Surface mooring F6 expanded scale Relative Humidity.



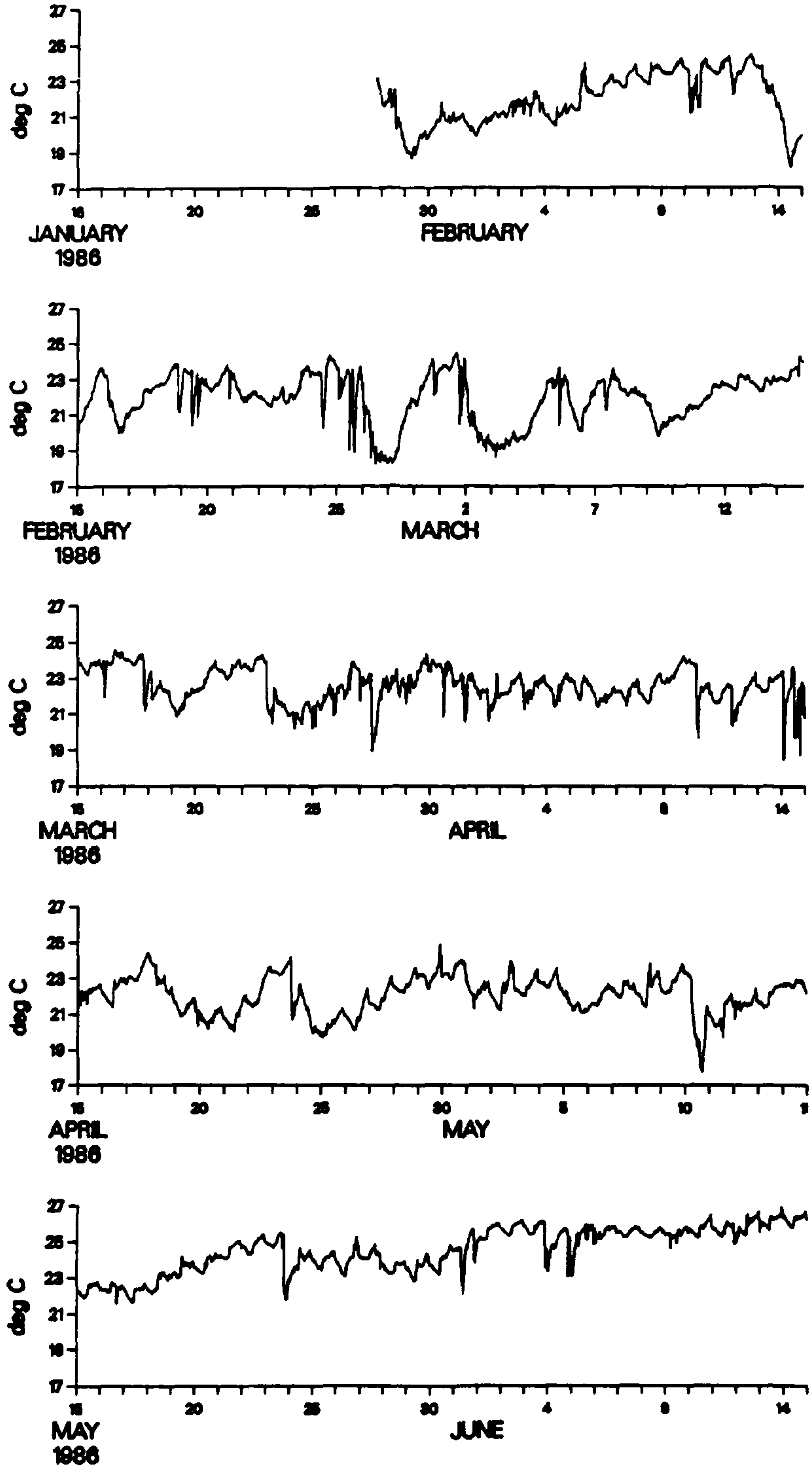
Surface mooring F8 expanded scale East.



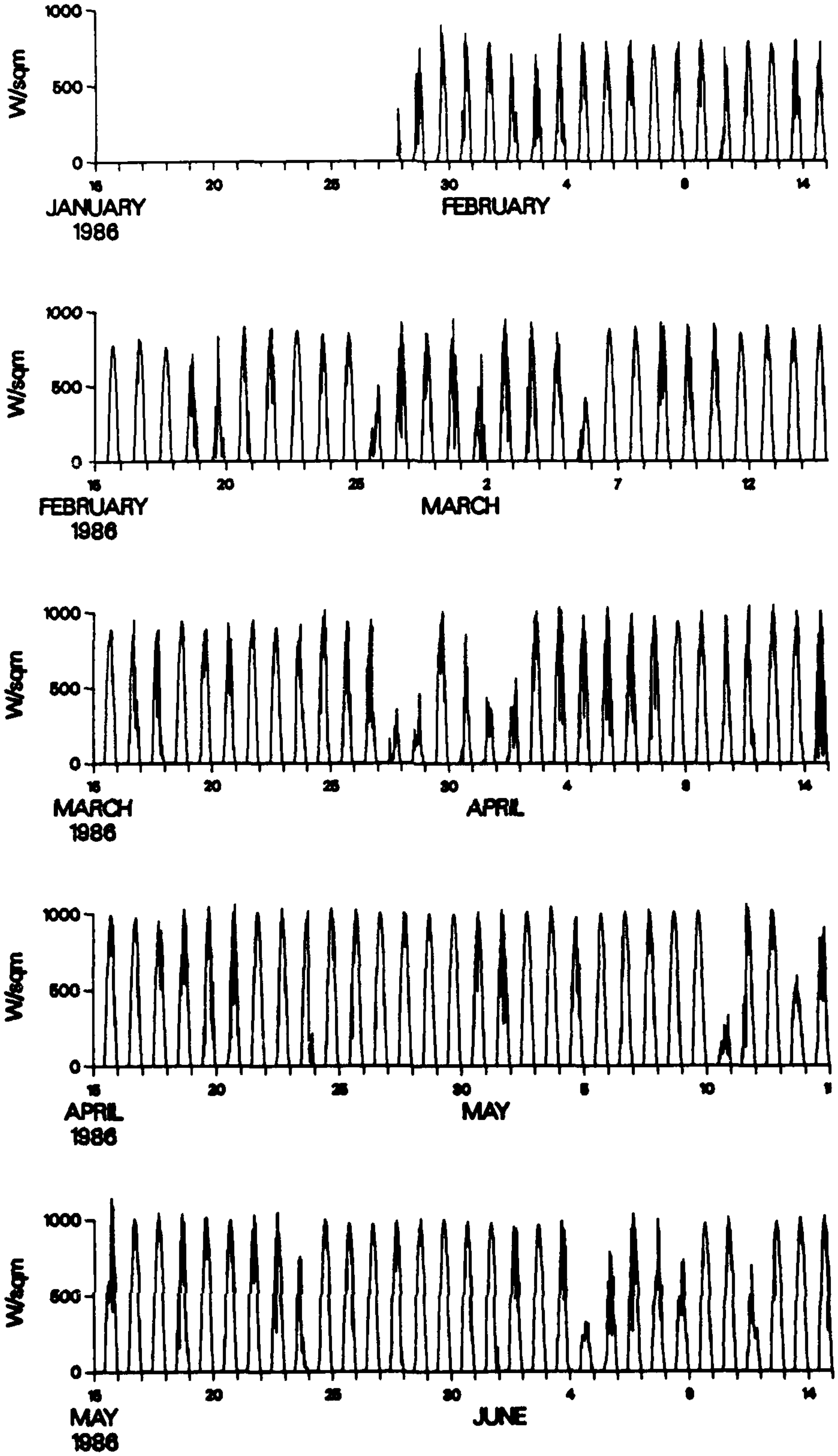
Surface mooring F8 expanded scale North.



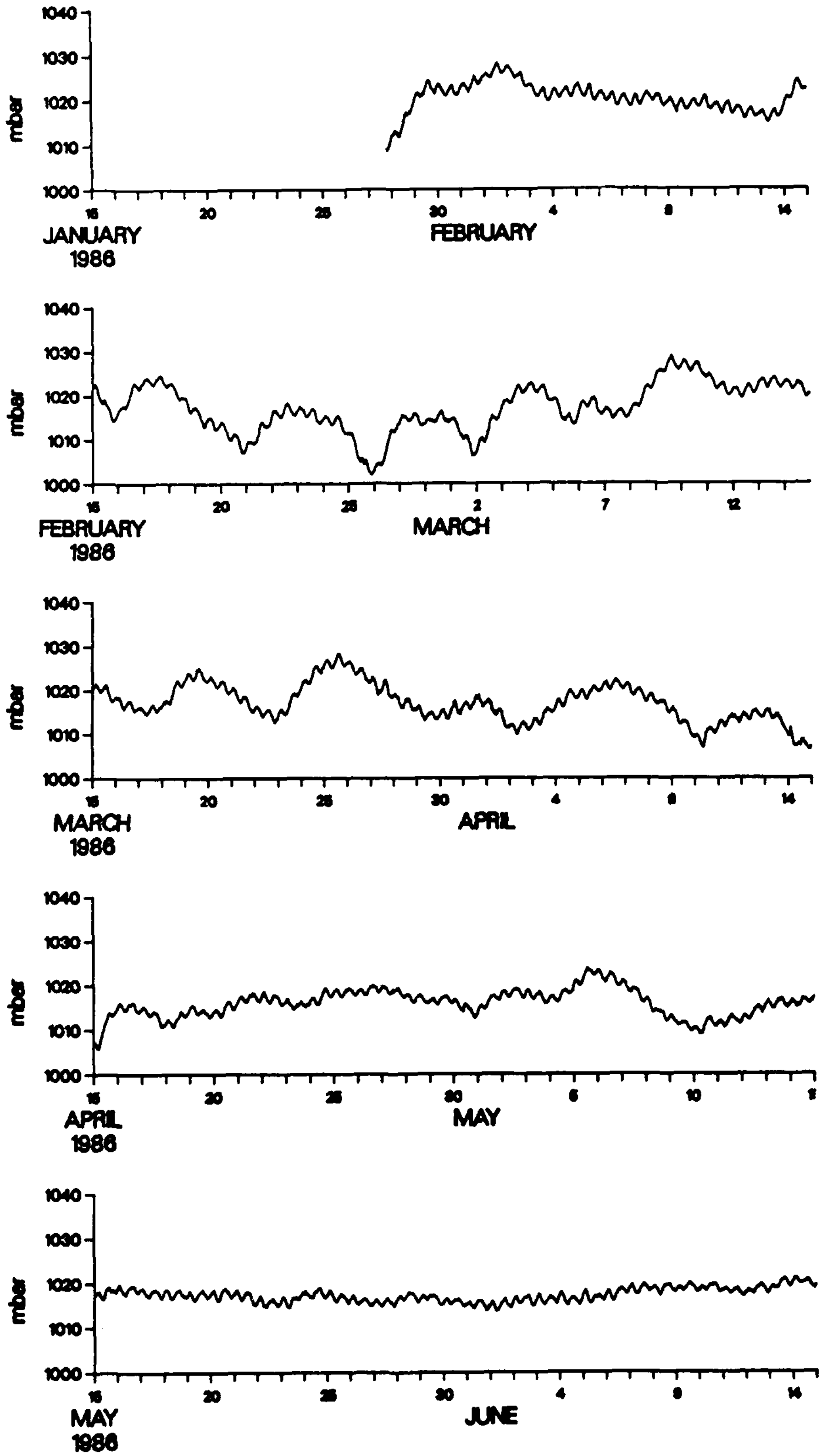
Surface mooring F8 expanded scale Sea Temperature.



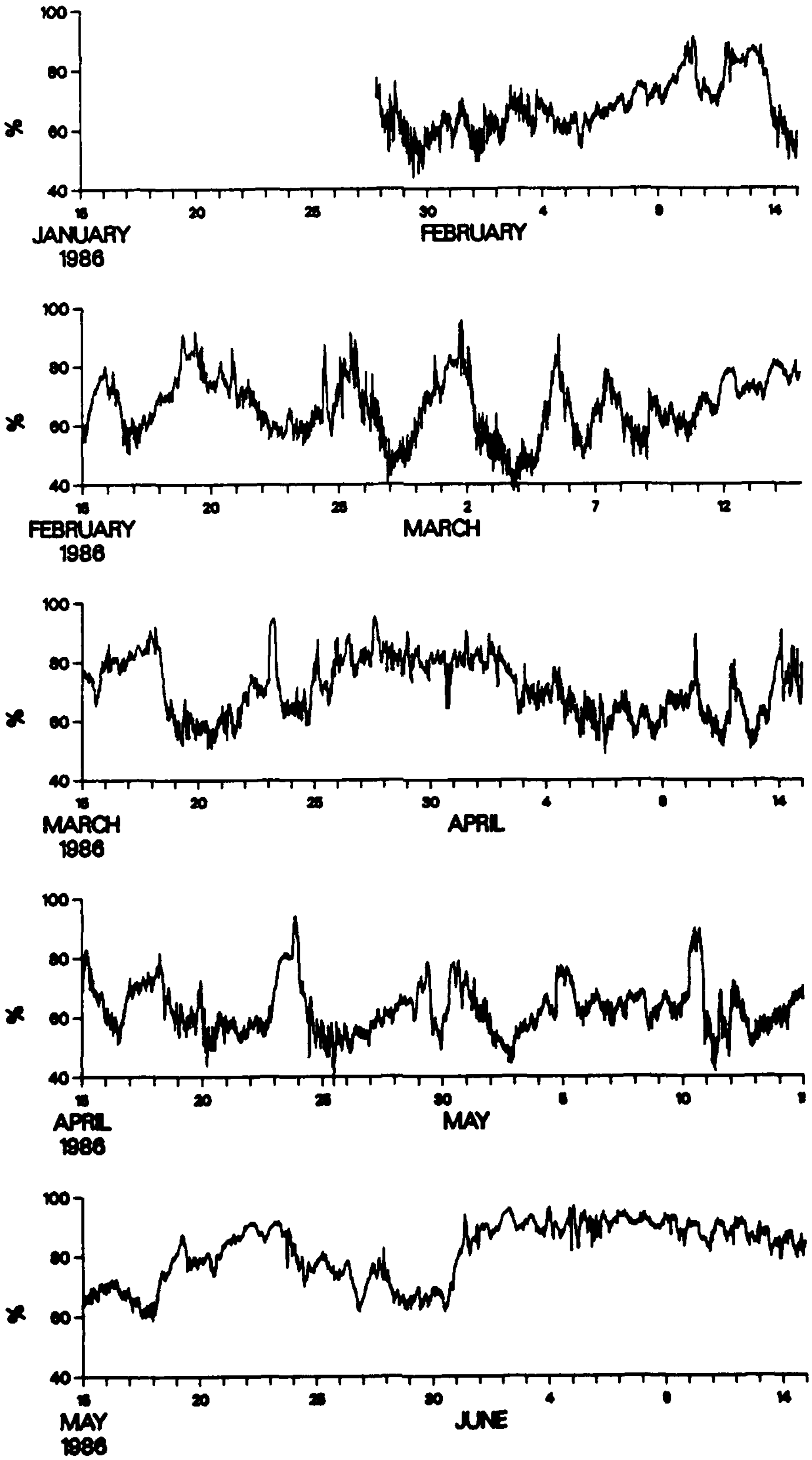
Surface mooring F8 expanded scale Air Temperature.



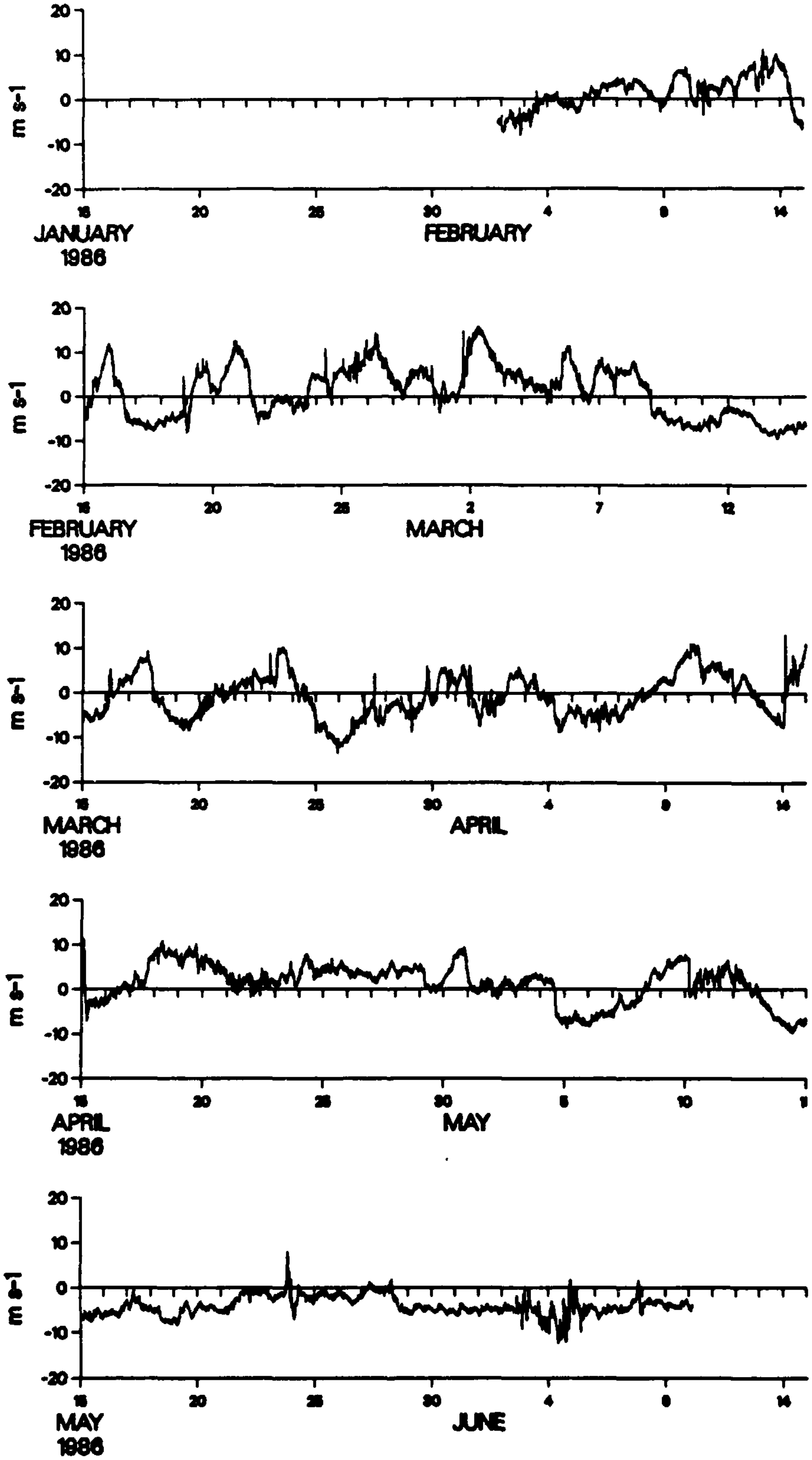
Surface mooring F8 expanded scale Insolation.



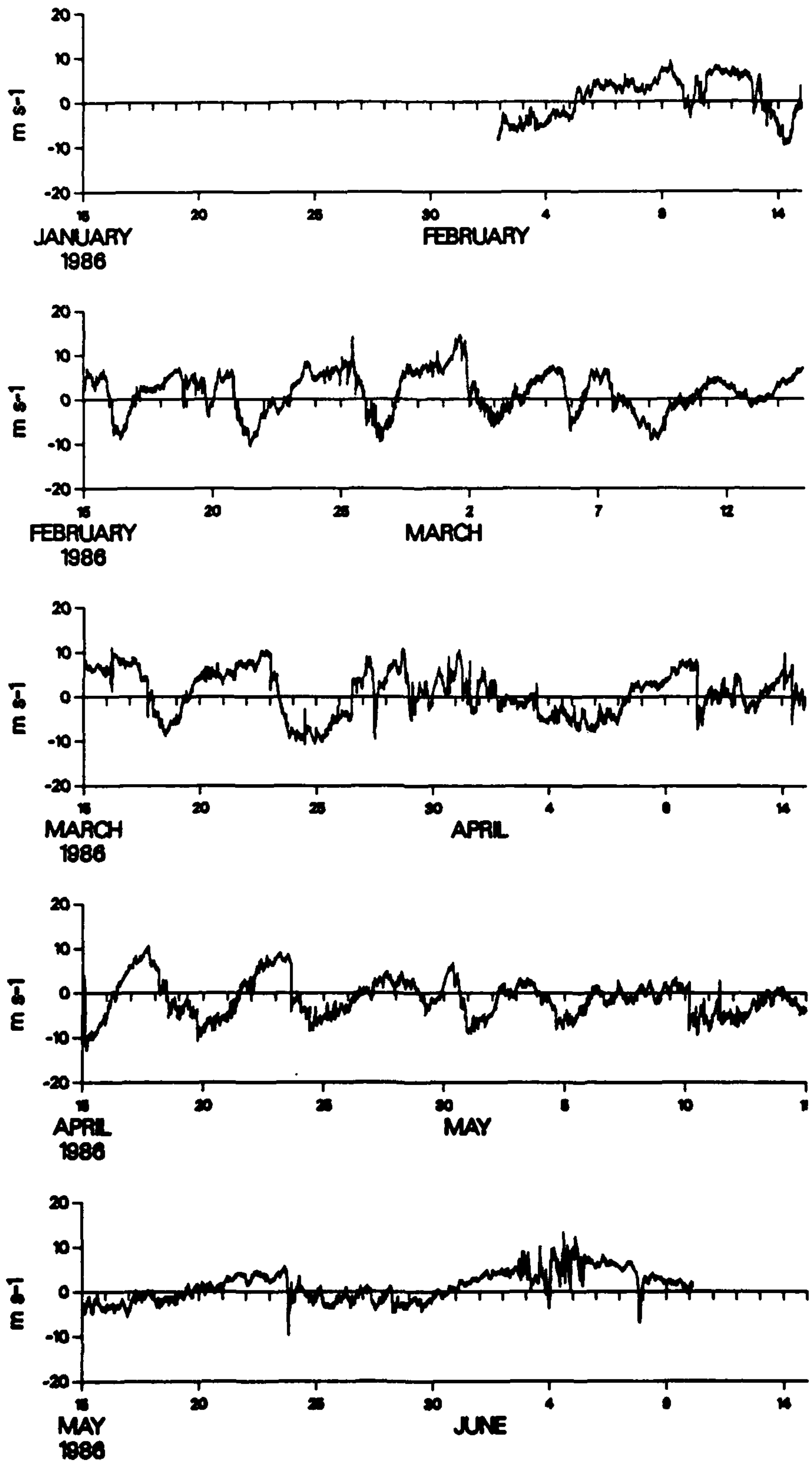
Surface mooring F8 expanded scale Barometric Pressure.



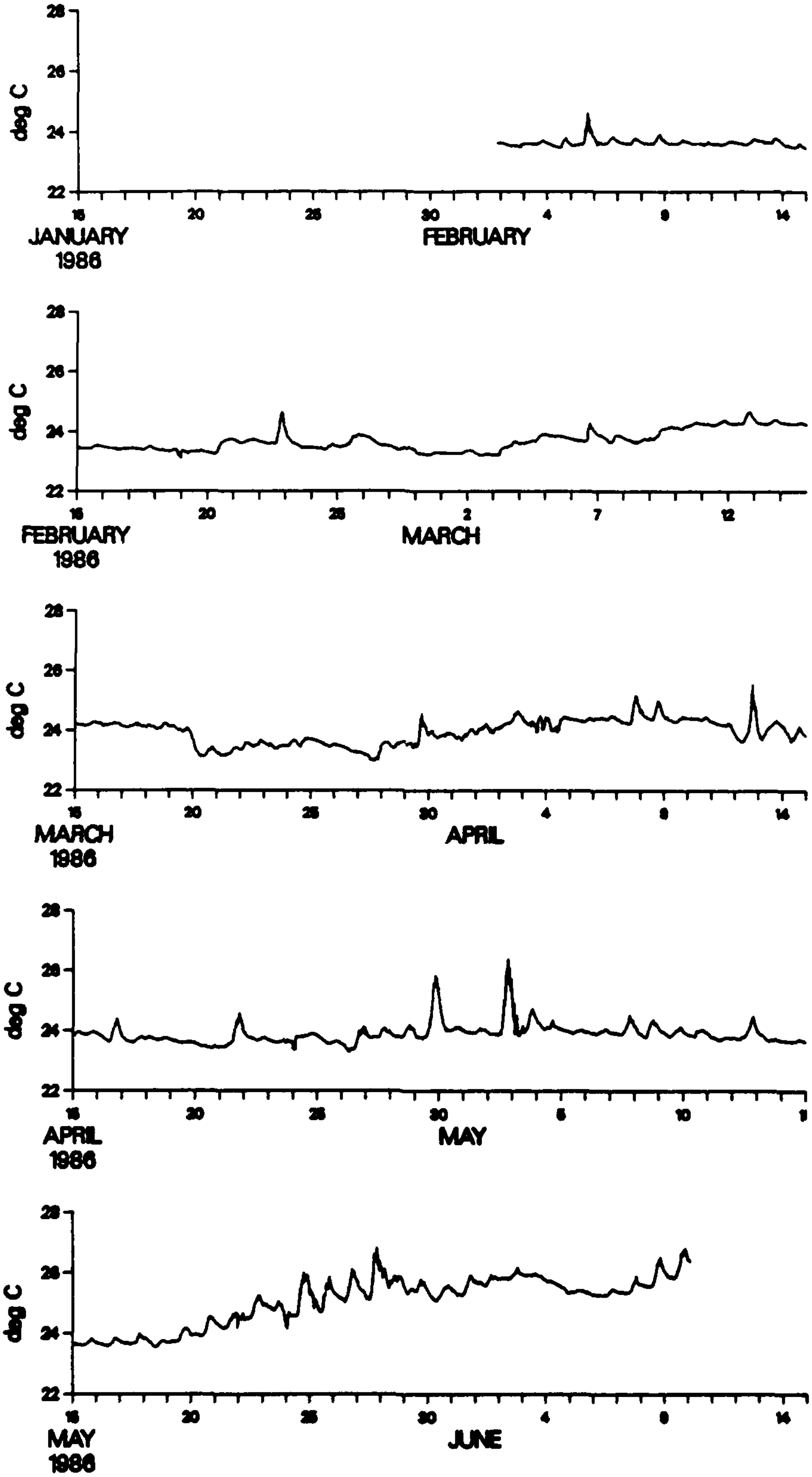
Surface mooring F8 expanded scale Relative Humidity.



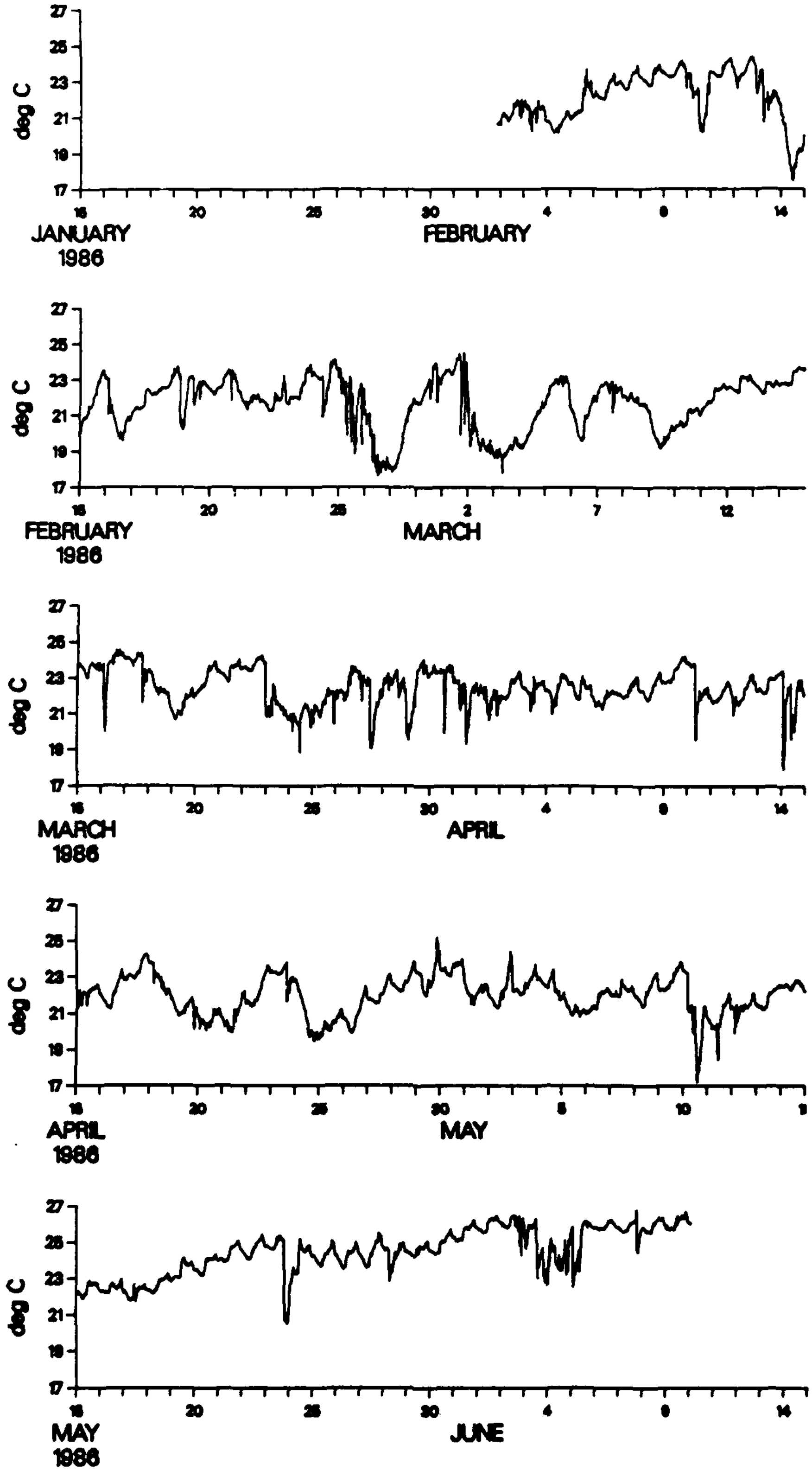
Surface mooring F10 expanded scale East.



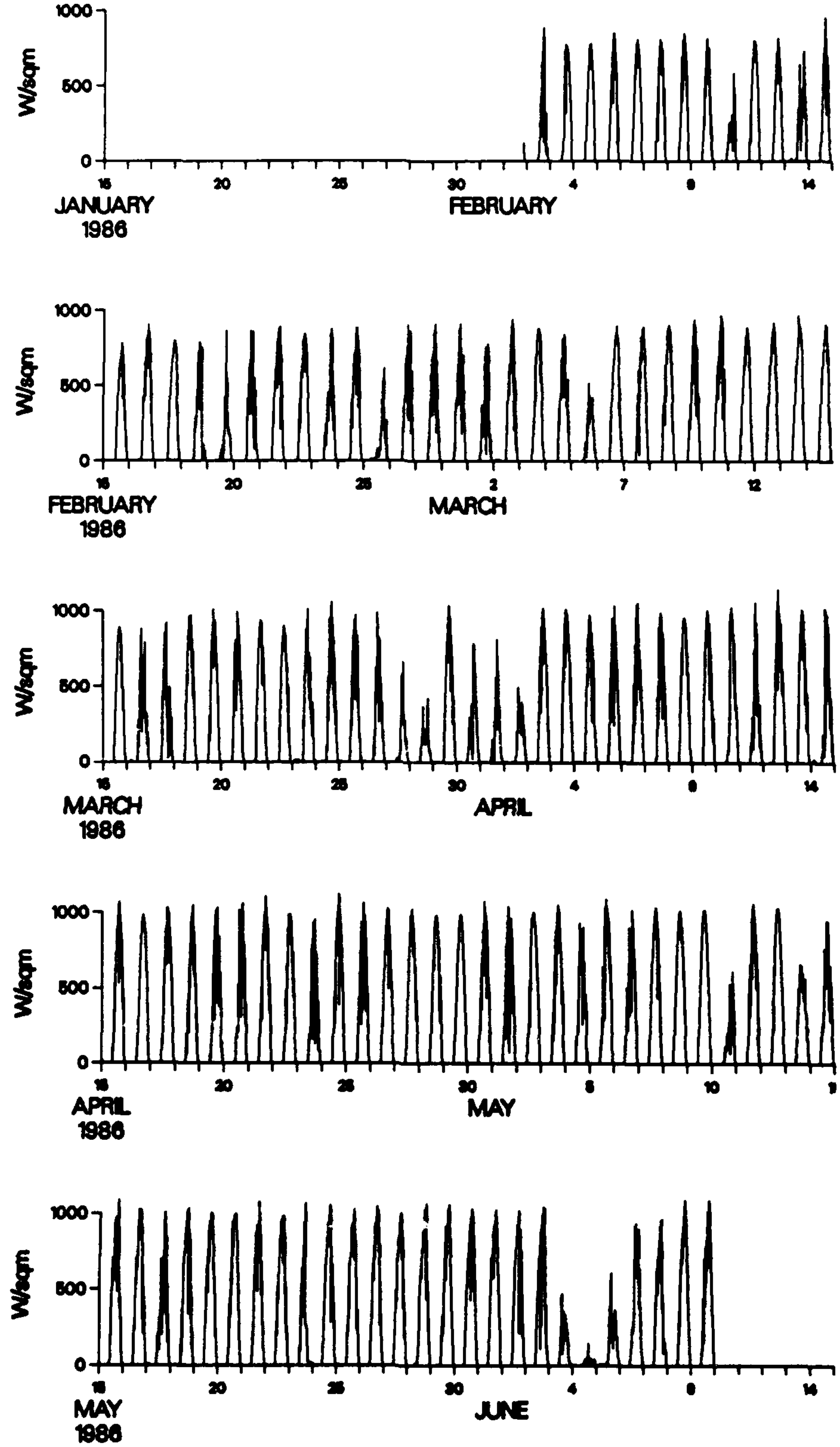
Surface mooring F10 expanded scale North.



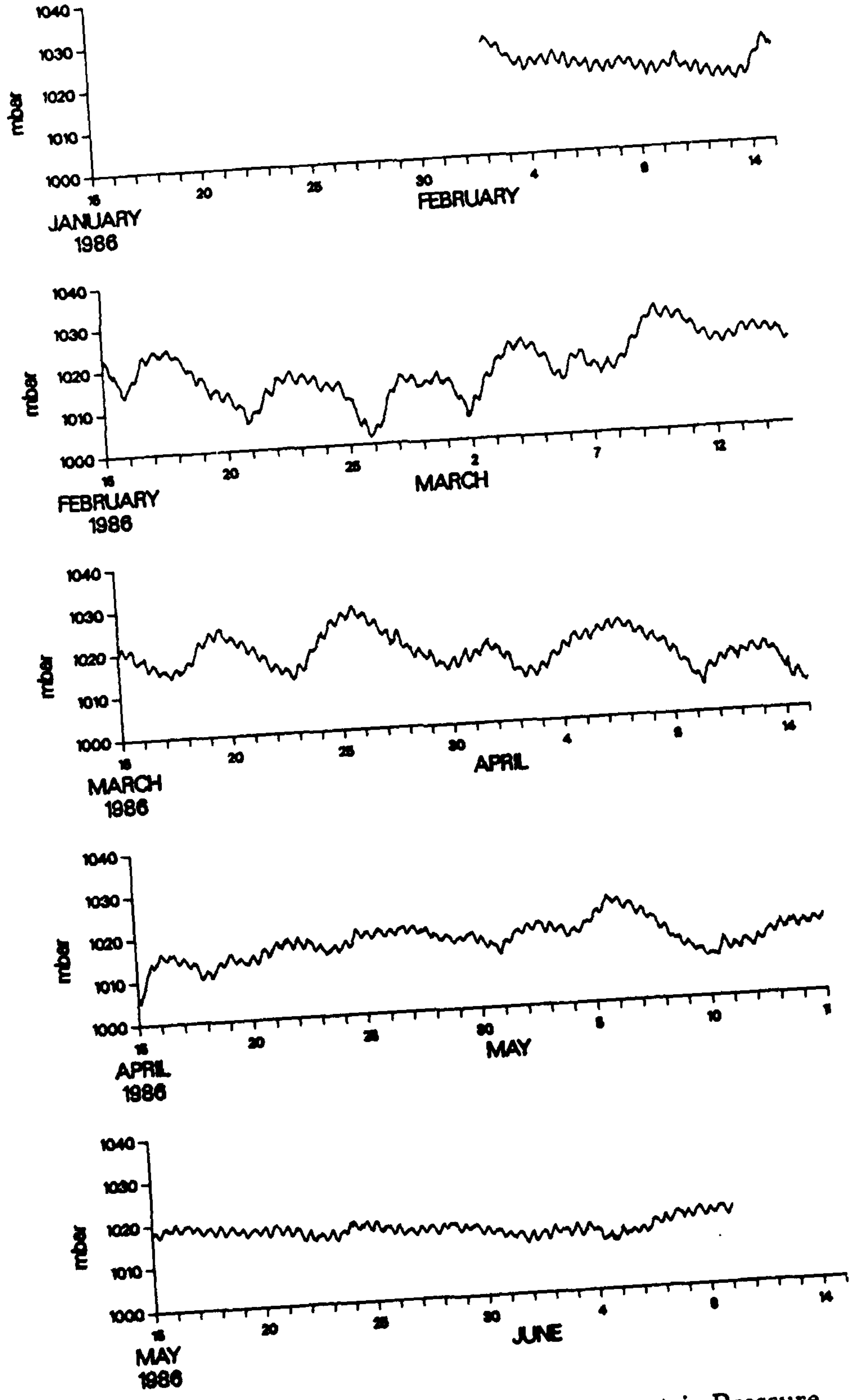
Surface mooring F10 expanded scale Sea Temperature.



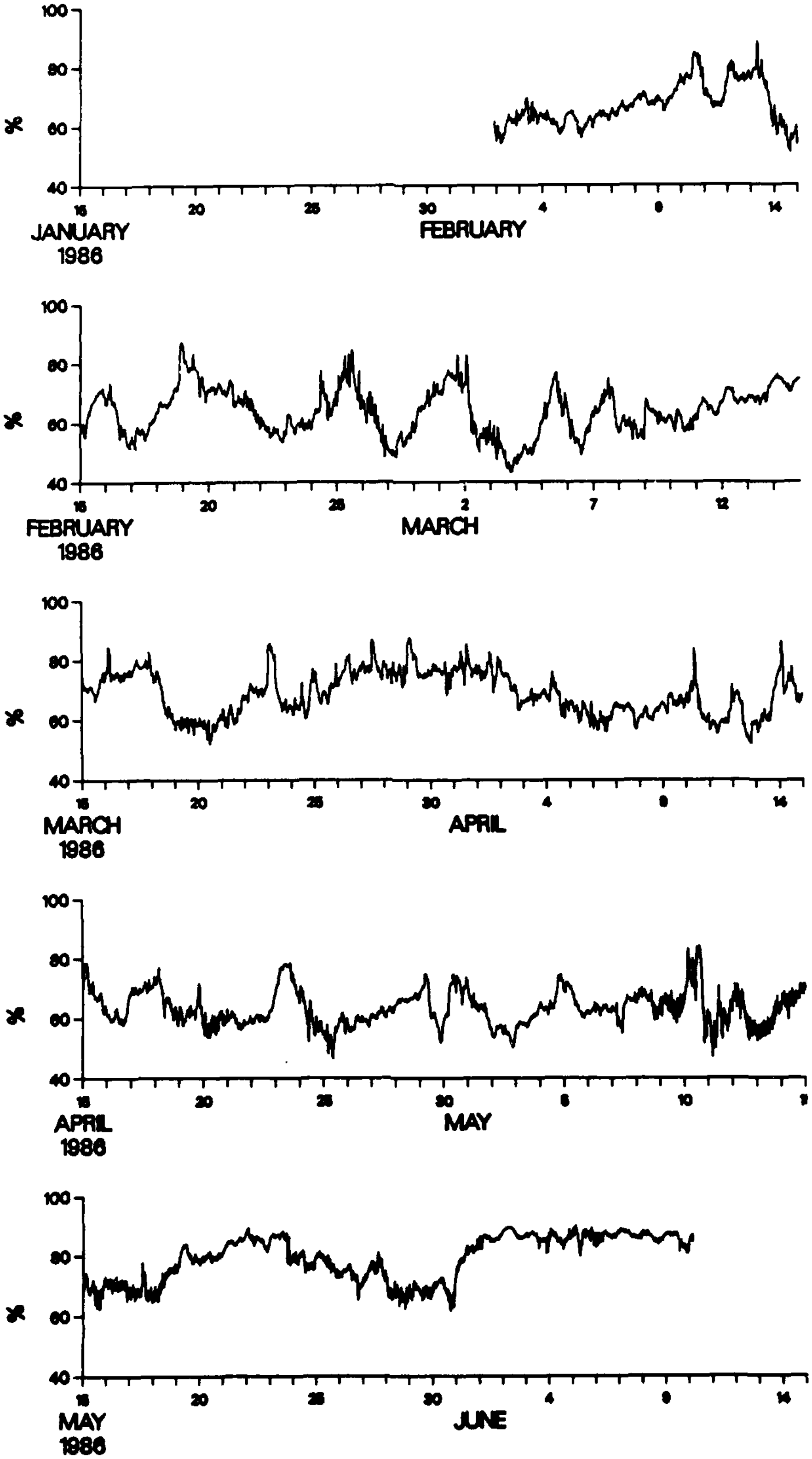
Surface mooring F10 expanded scale Air Temperature.



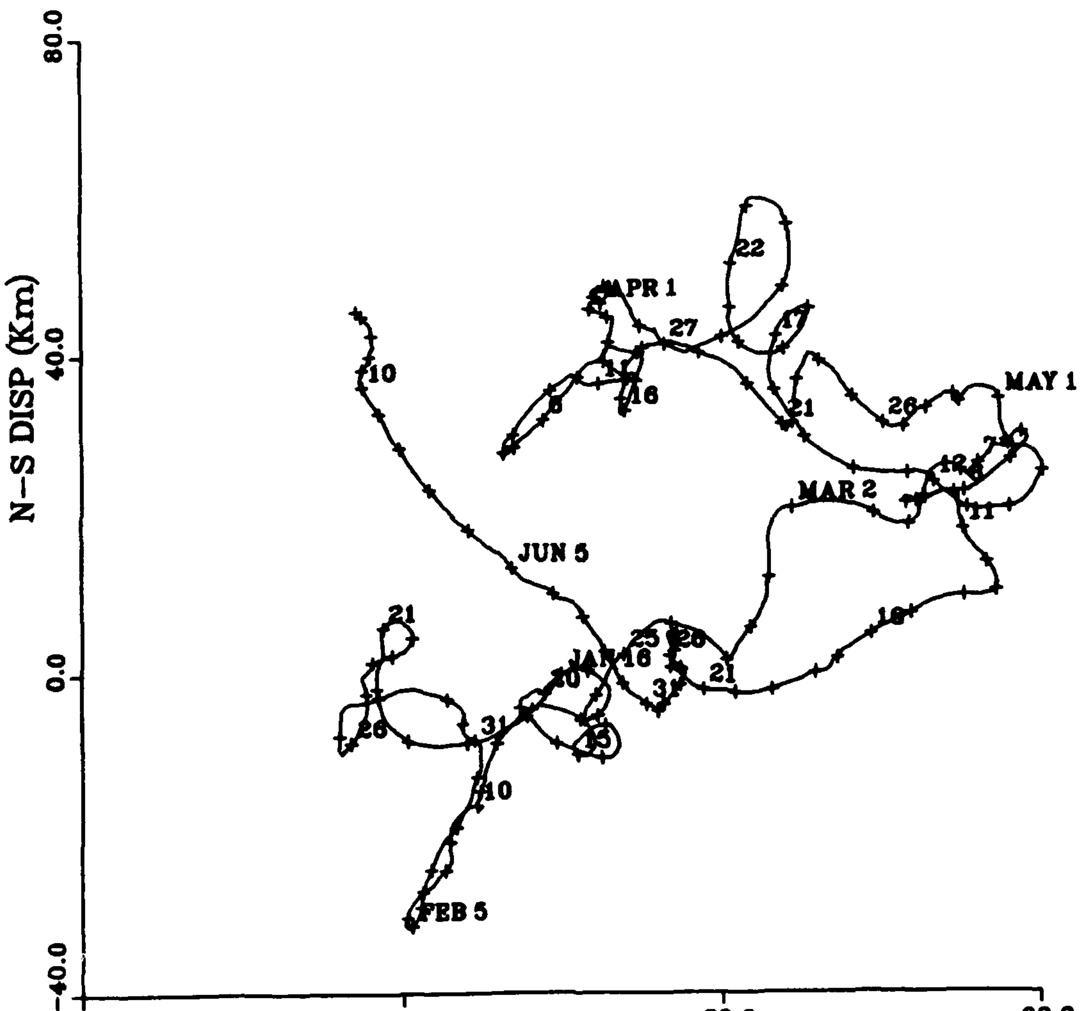
Surface mooring F10 expanded scale Insolation.



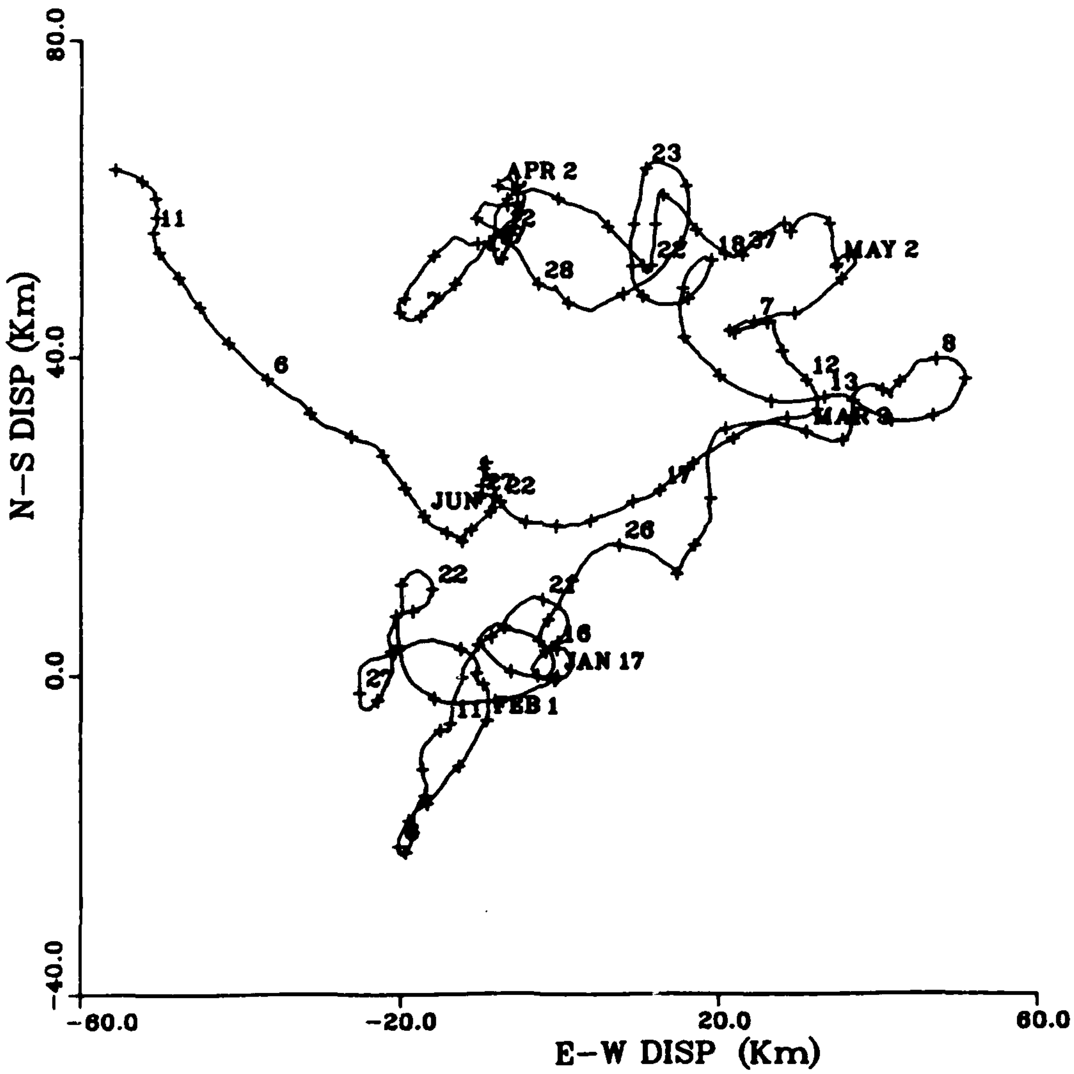
Surface mooring F10 expanded scale Barometric Pressure.



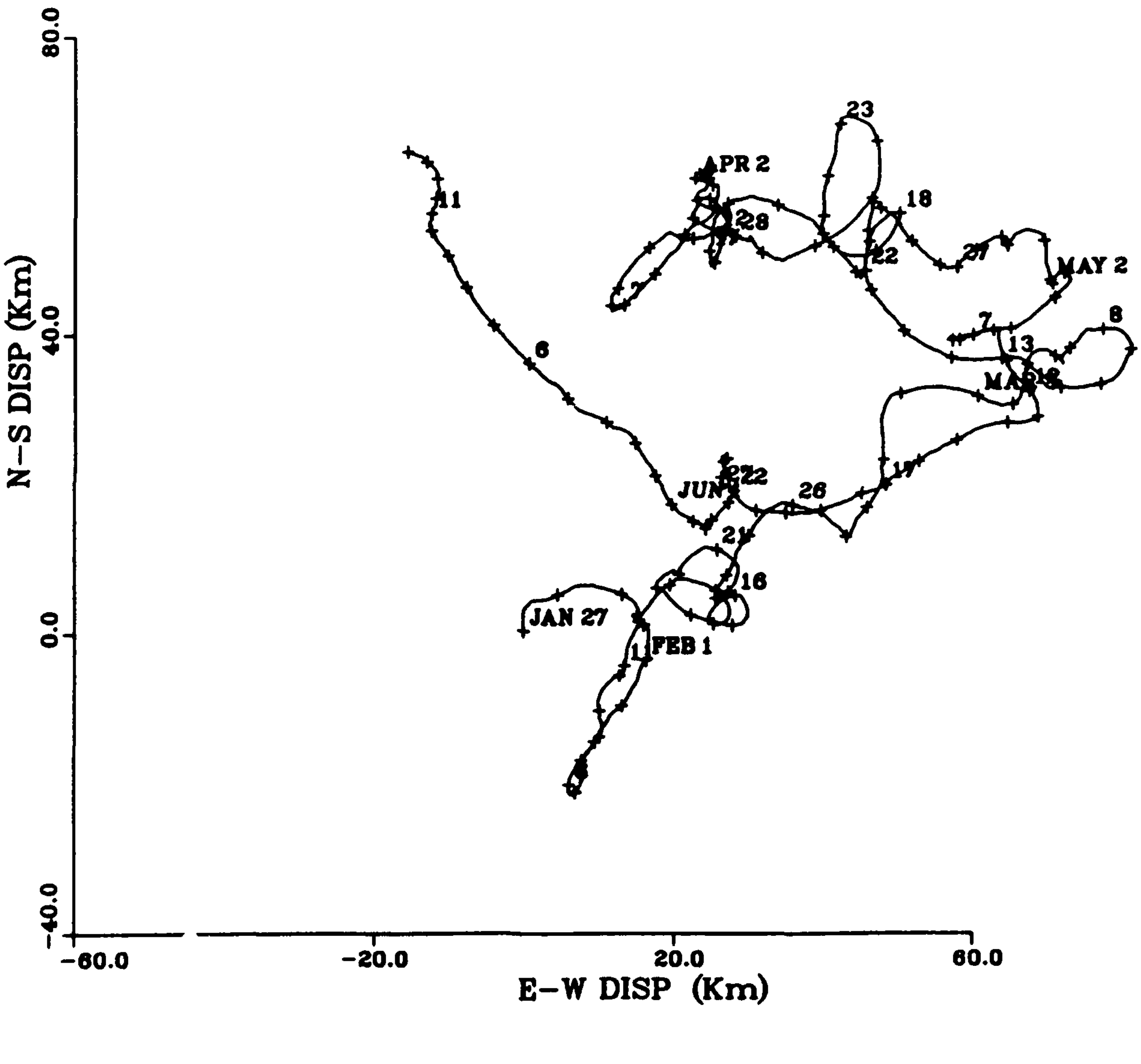
Surface mooring F10 expanded scale Relative Humidity. MR data used from February 1, 1986 to May 7, 1986.
F2 VAWR Relative Humidity used to pad until June 10, 1986.



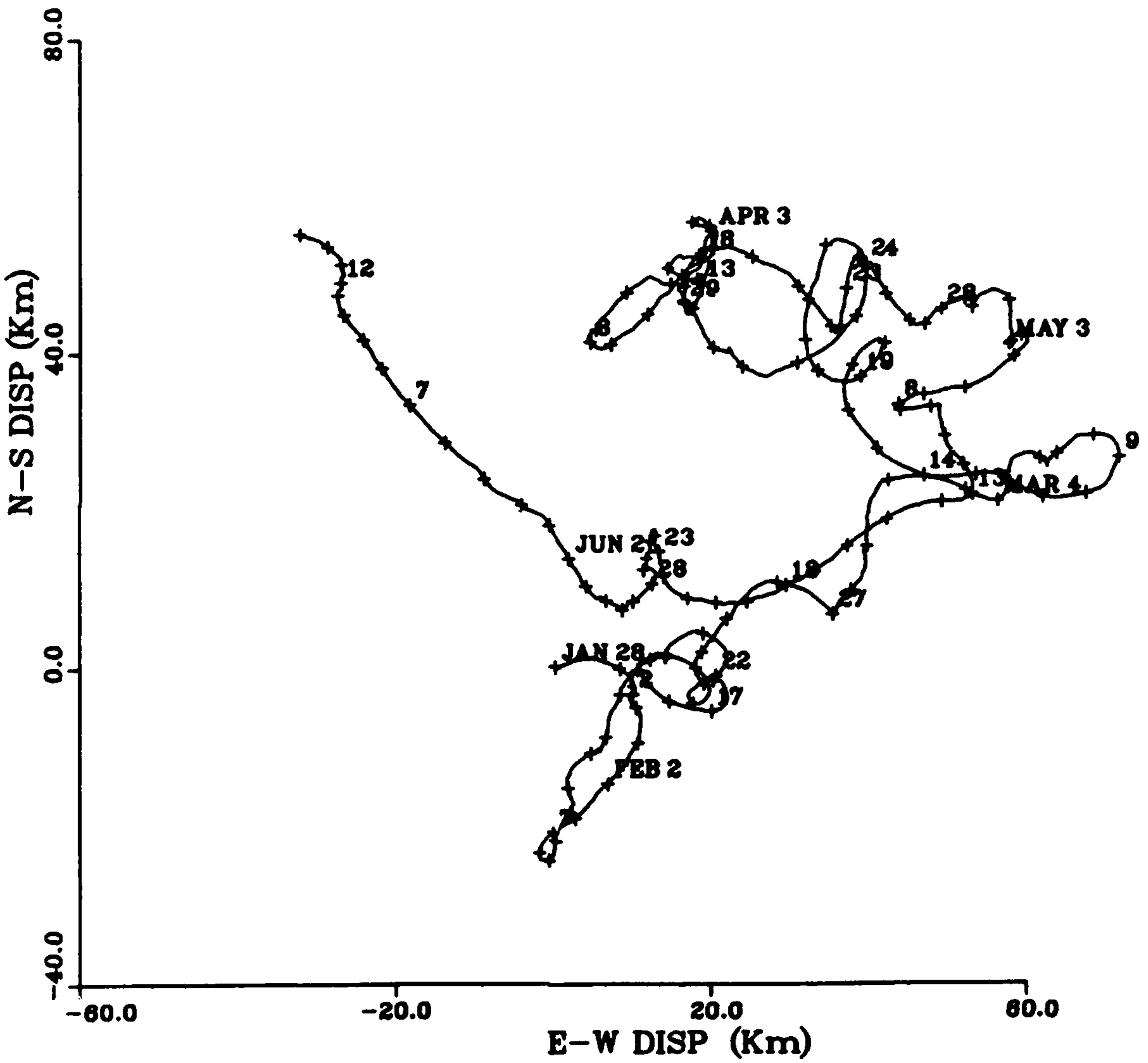
Mooring F2 Wind progressive vector diagram.



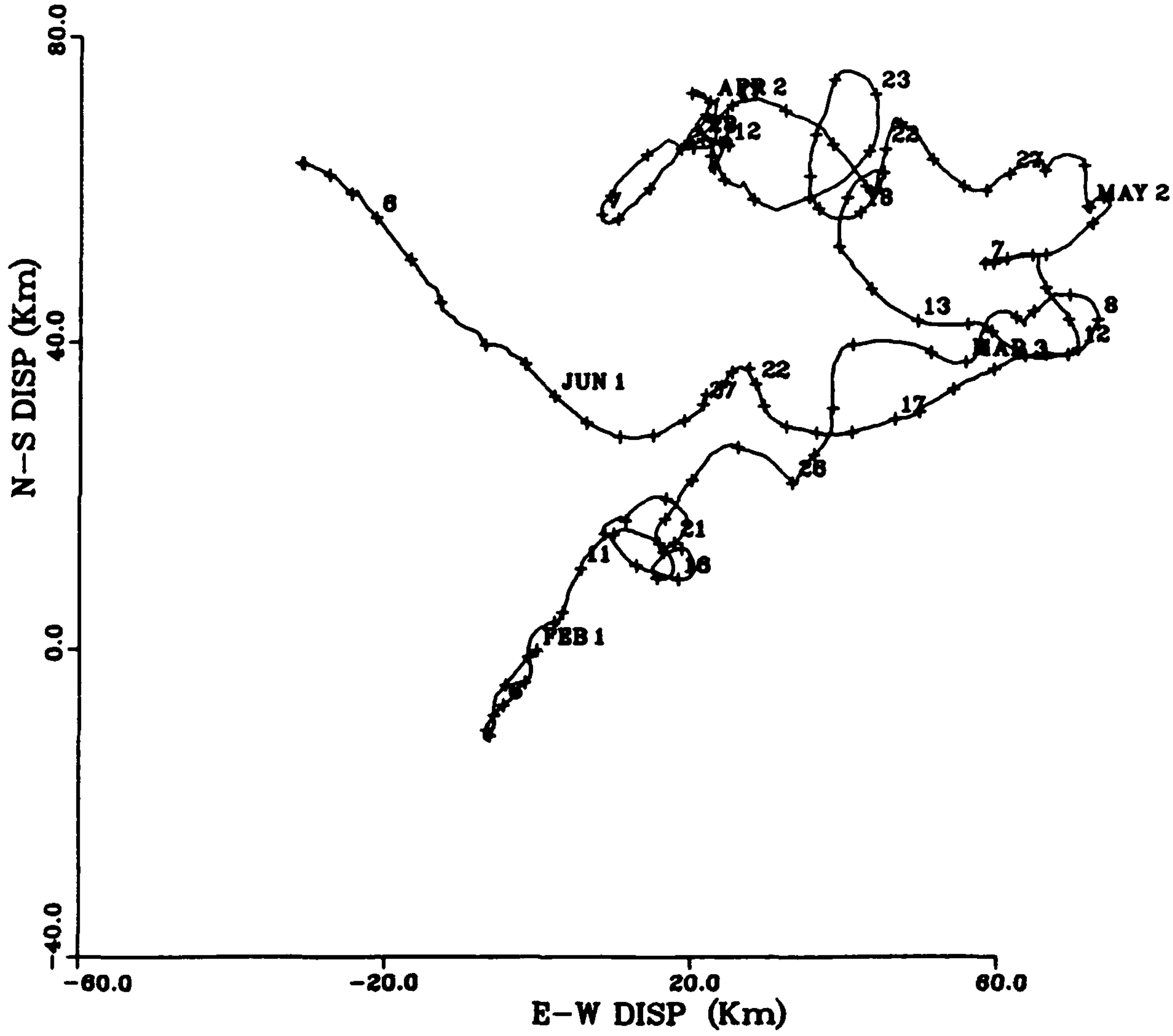
Mooring F4 Wind progressive vector diagram.



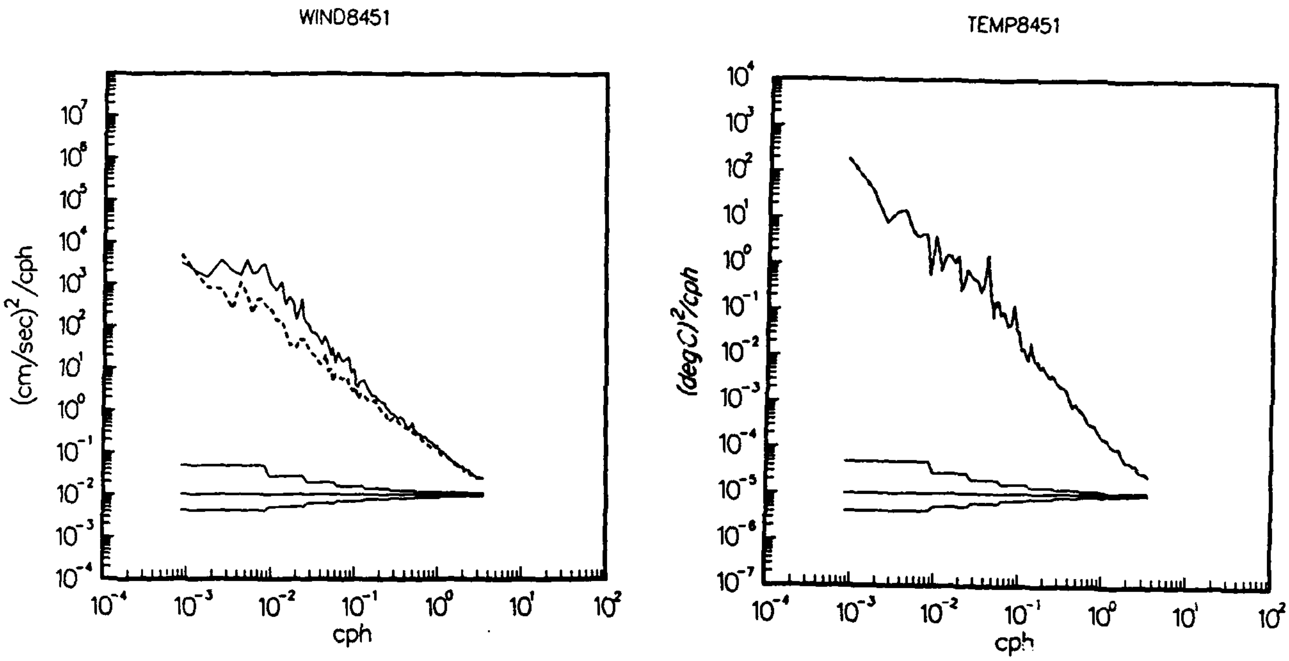
Mooring F6 Wind progressive vector diagram.



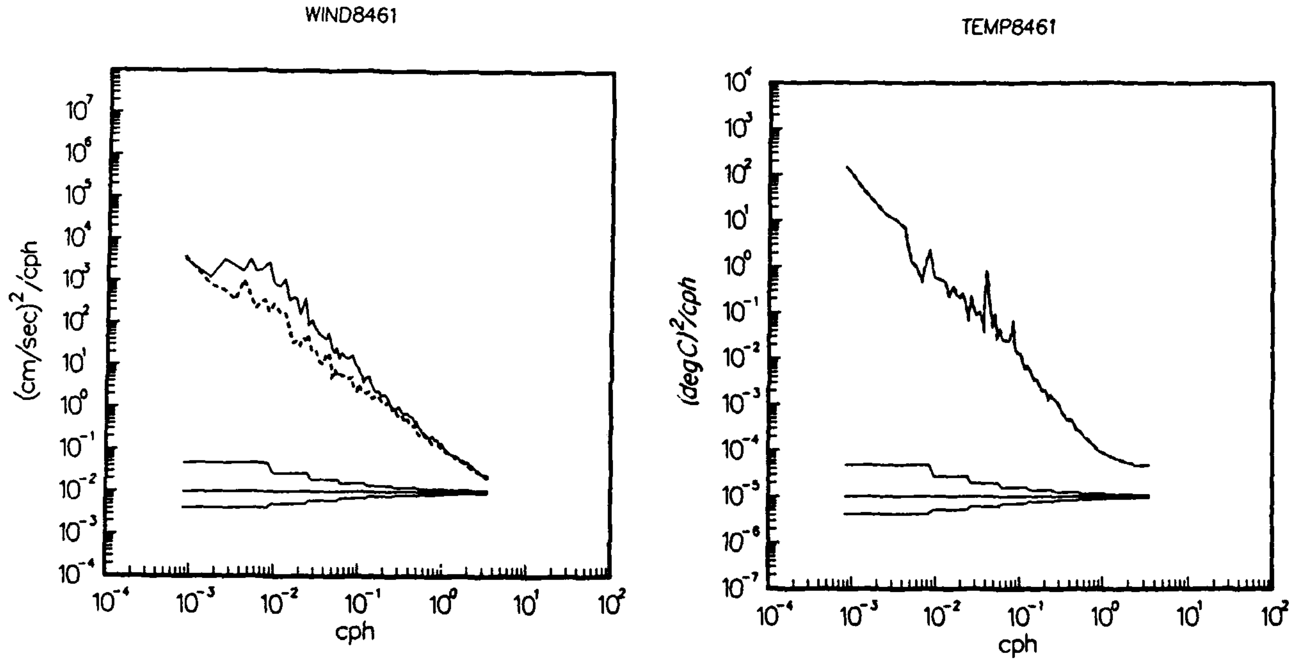
Mooring F8 Wind progressive vector diagram.



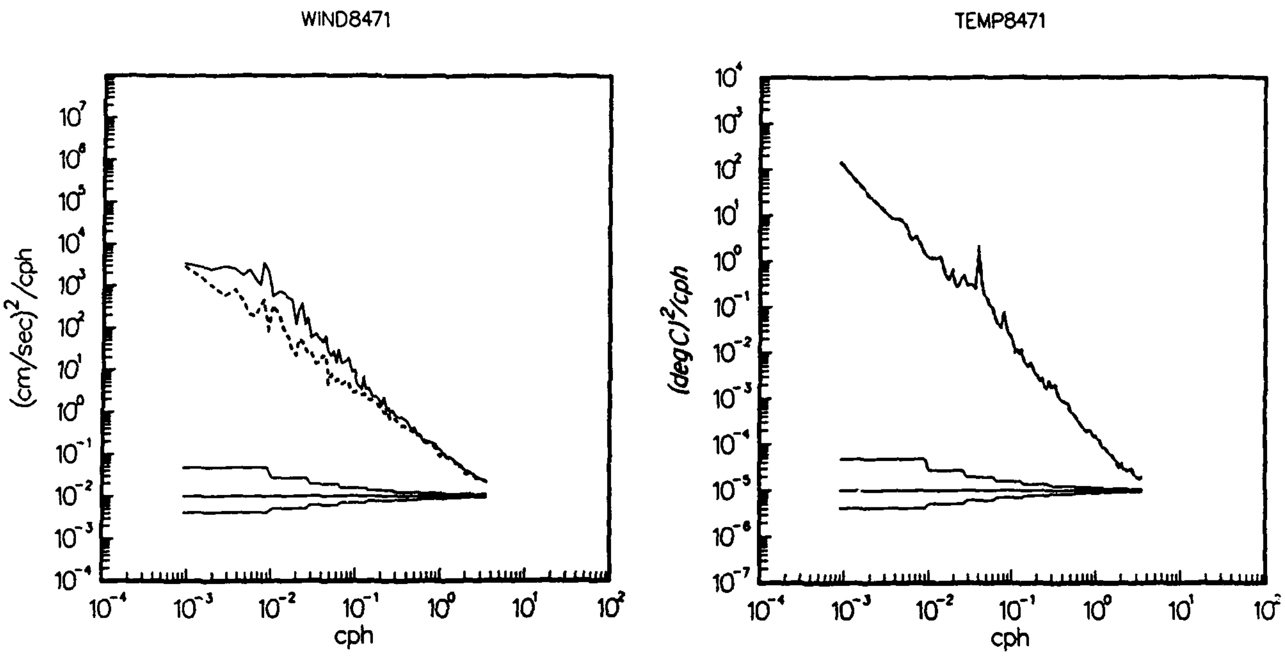
Mooring F10 Wind progressive vector diagram.



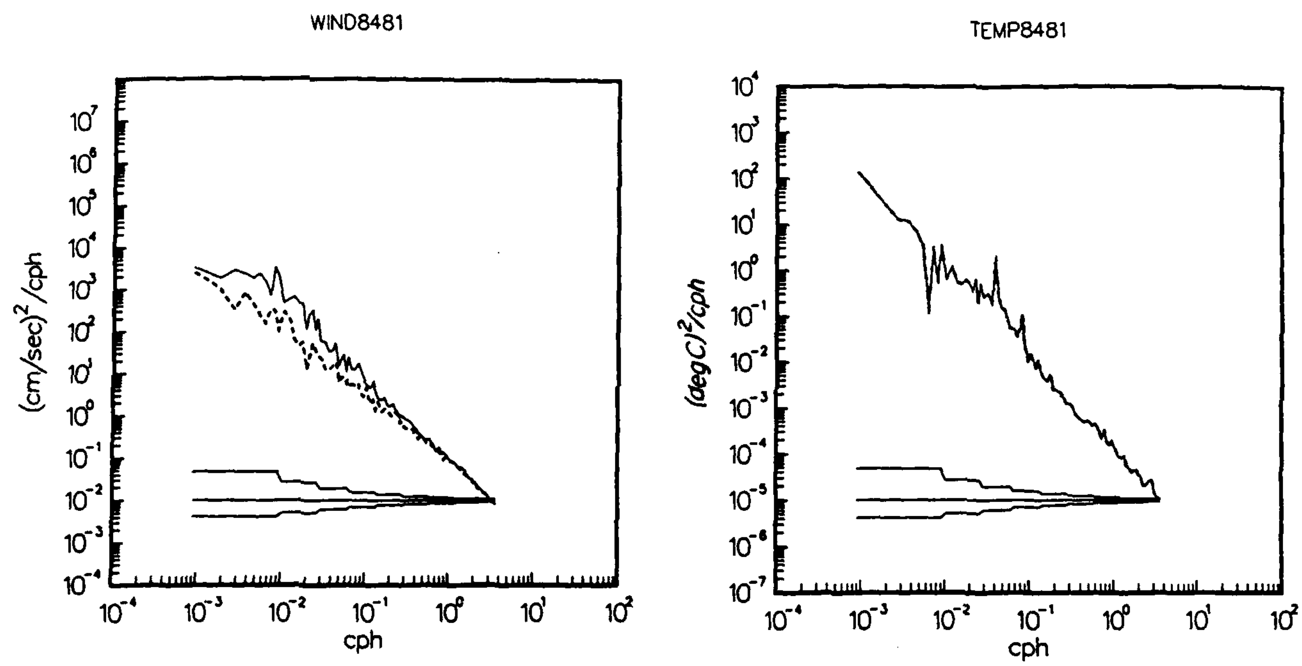
Mooring F2 Wind Speed and surface Temperature spectra.



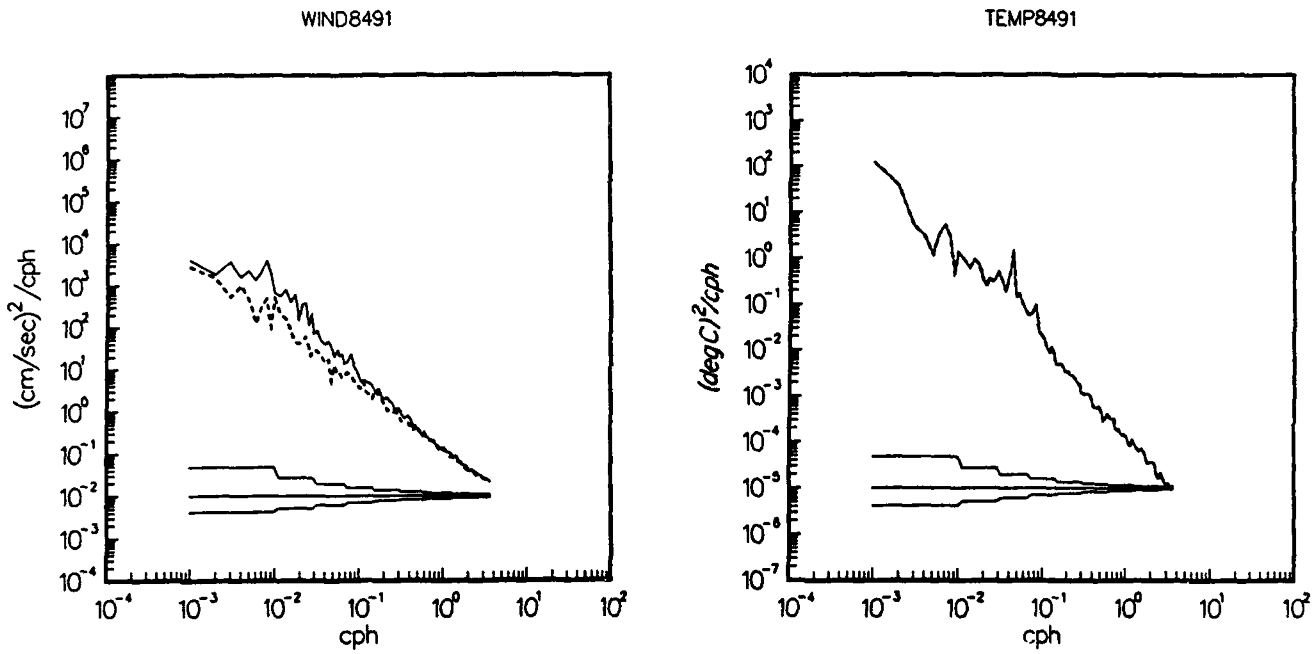
Mooring F4 Wind Speed and surface Temperature spectra.



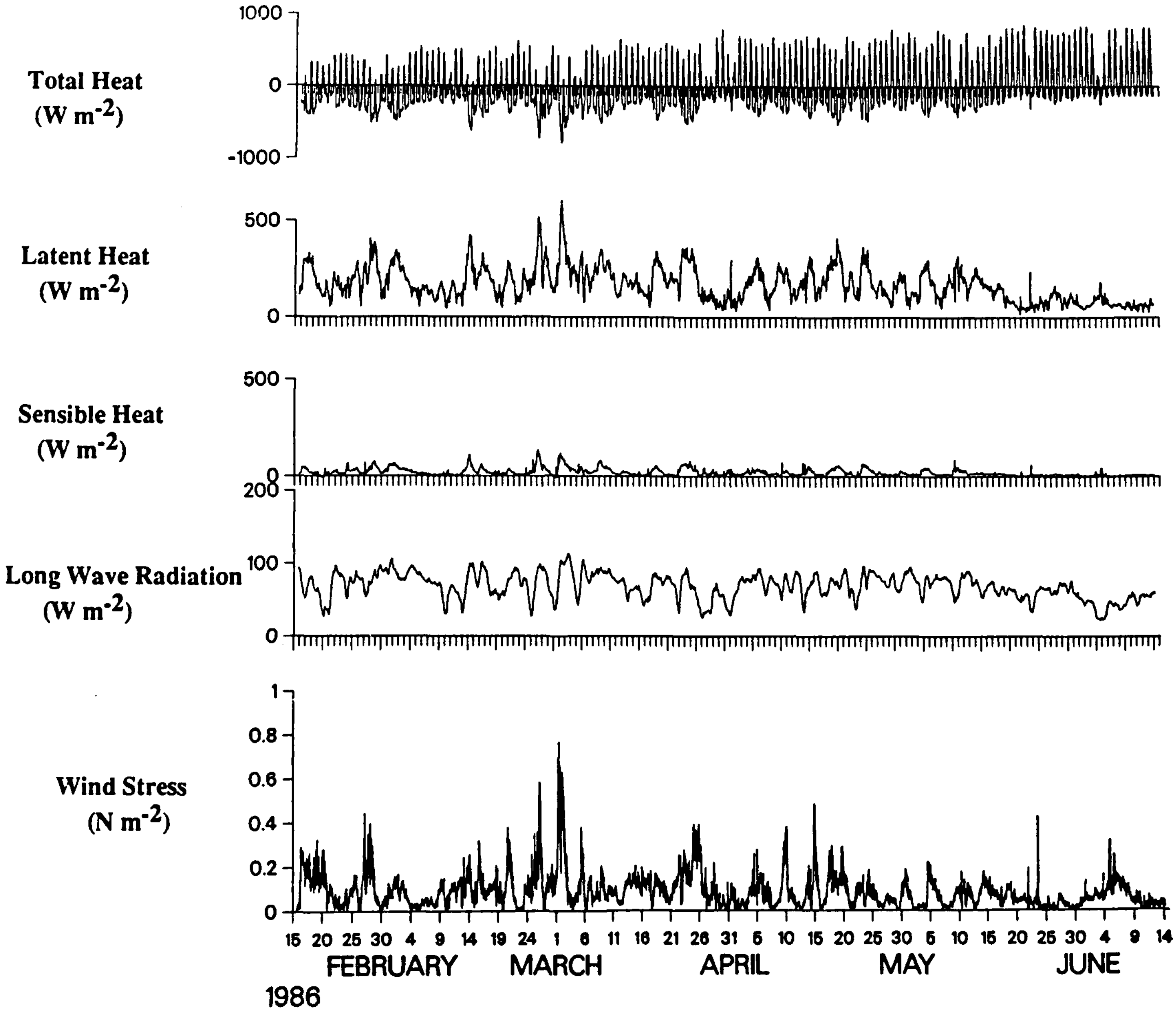
Mooring F6 Wind Speed and surface Temperature spectra.



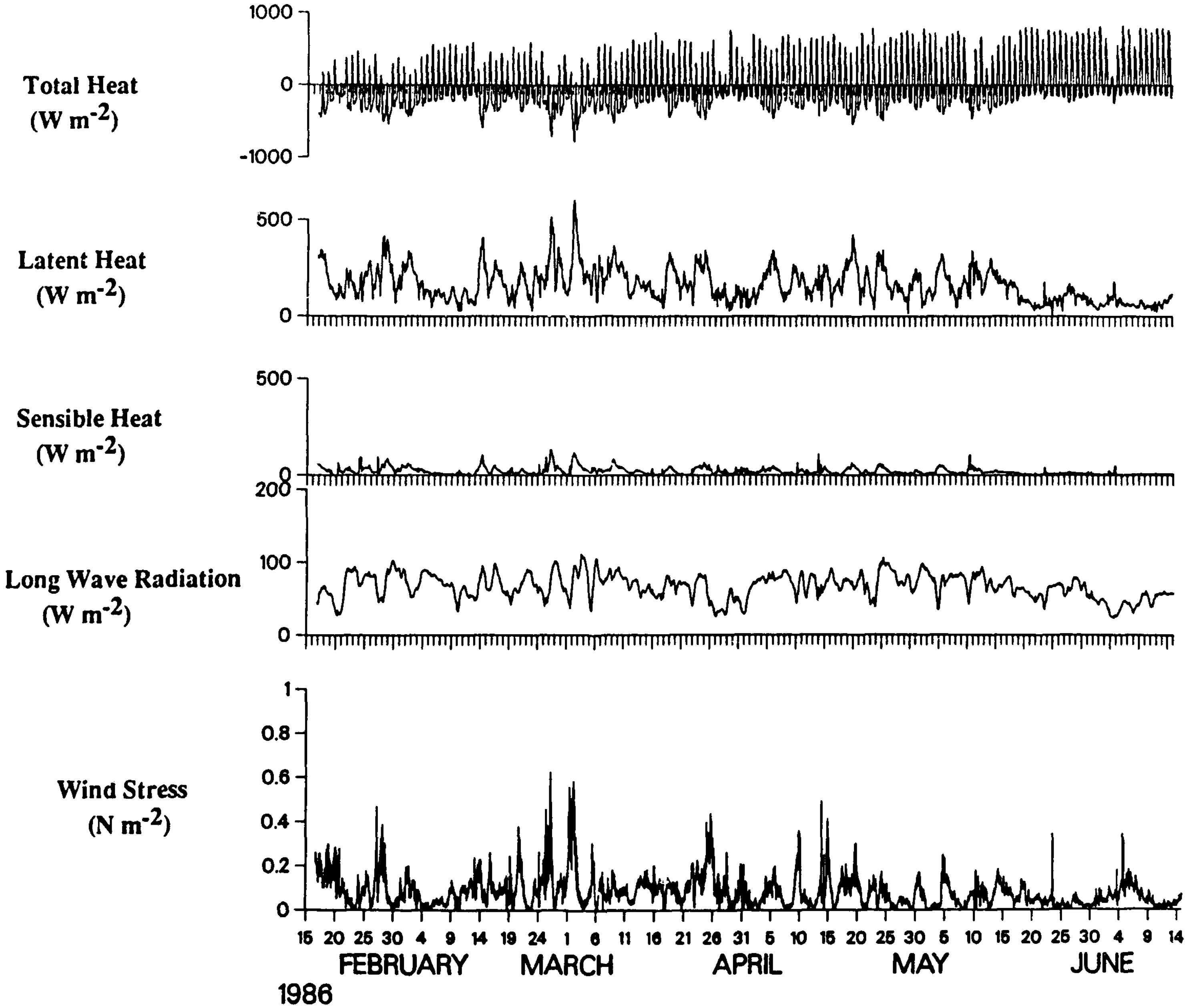
Mooring F8 Wind Speed and surface Temperature spectra.



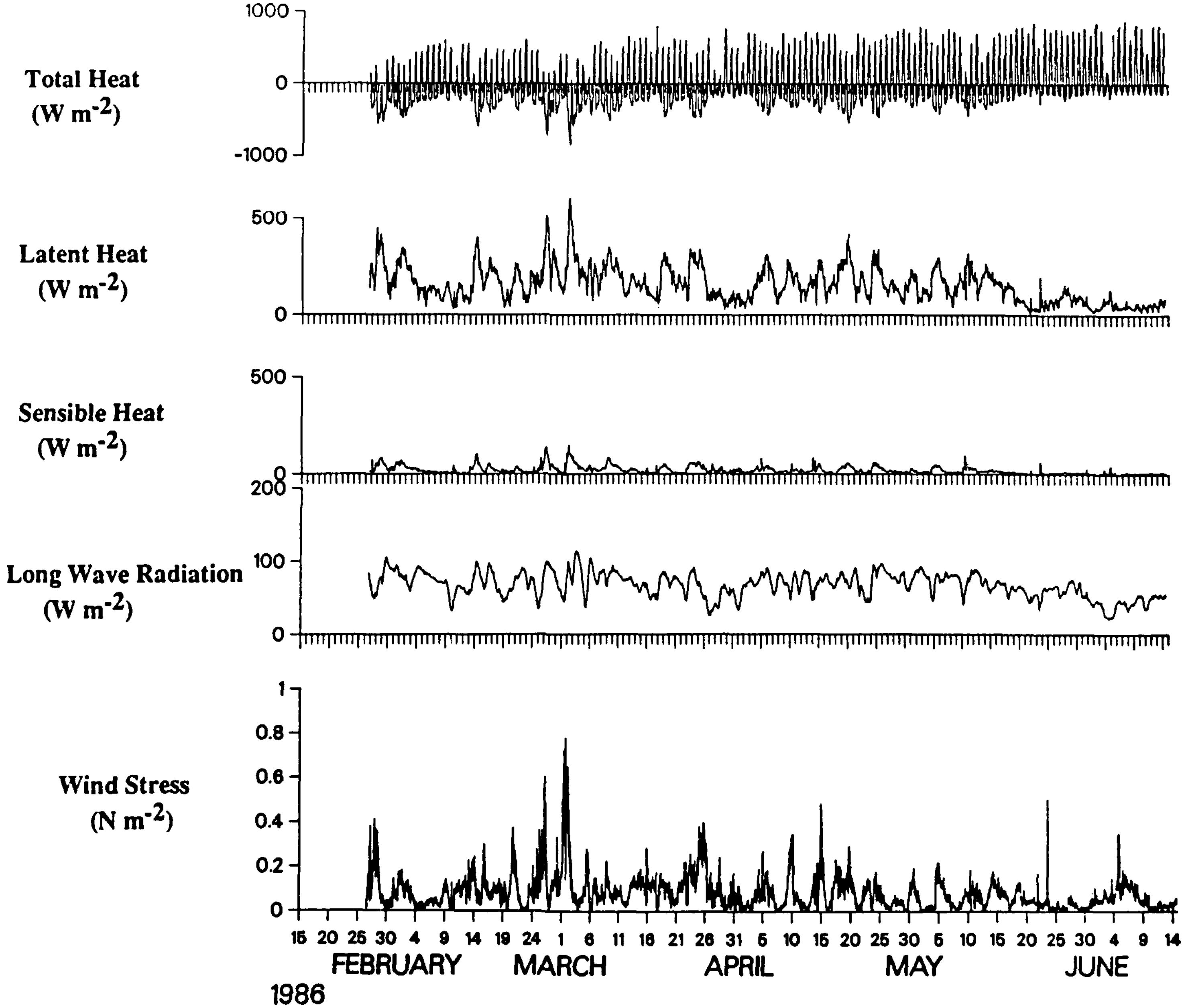
Mooring F10 Wind Speed and surface Temperature spectra.



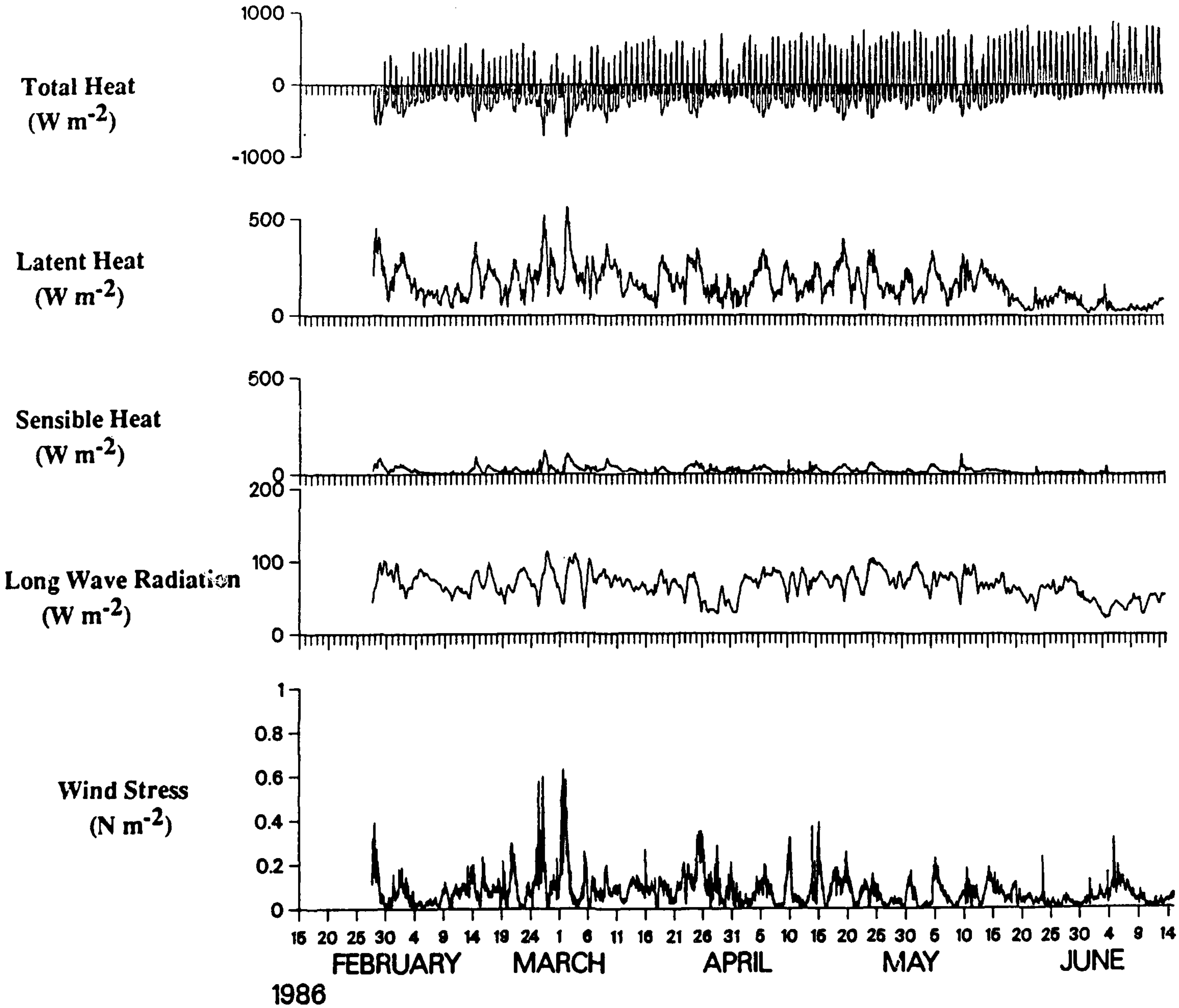
Surface mooring F2 Heat Flux and Wind Stress (magnitude) data set.



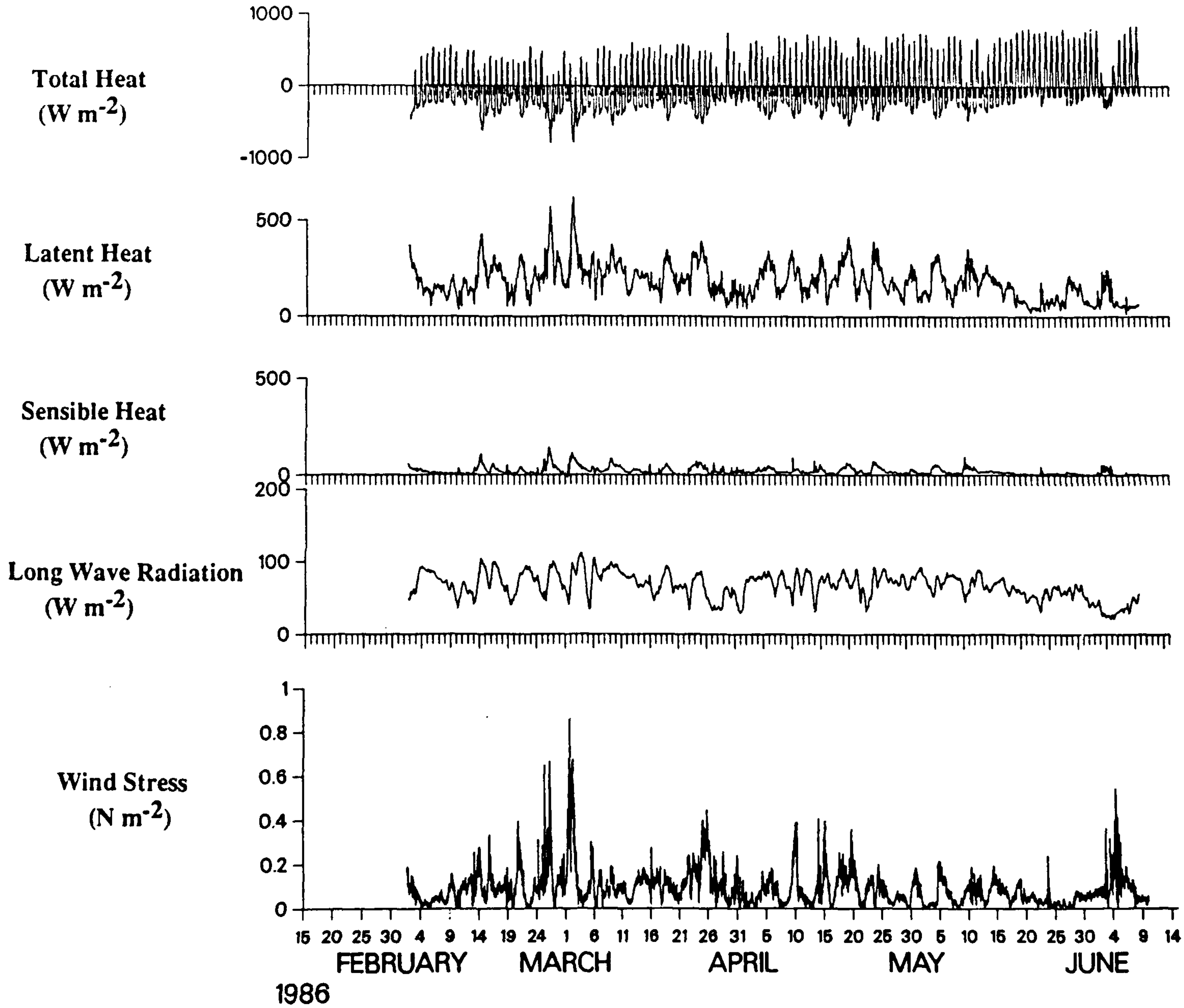
Surface mooring F4 Heat Flux and Wind Stress (magnitude) data set.



Surface mooring F6 Heat Flux and Wind Stress (magnitude) data set.



Surface mooring F8 Heat Flux and Wind Stress (magnitude) data set.



Surface mooring F10 Heat Flux and Wind Stress (magnitude) data set.

5. Current Meter Data Plots

Forty four VMCMs and VACMs were set on the five FASINEX surface moorings. A schematic with the current meter type and depth is shown in Figures 17. Tables 6 and 7 give the number of days of data by instrument and an explanation if there is less than 100 percent data return.

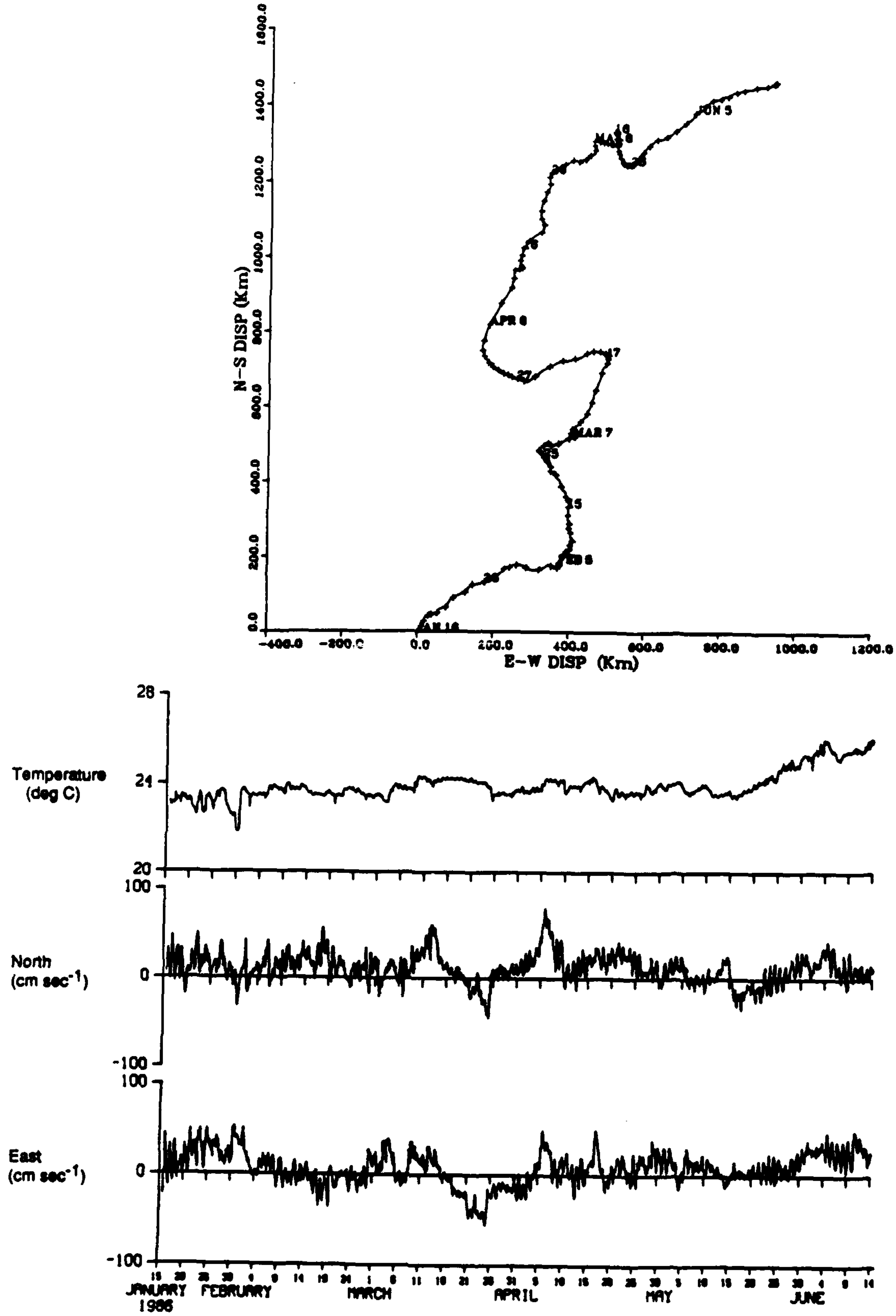
The common depths of the current meters on the five surface moorings were 10, 20, 30, 40, 80, 120, 160 and 700 meters. Two moorings (F6-847, F8-848) also had VMCMs at 1000 and 4000 meters.

The plots in this section present time series of east and north velocity components and of temperature and also progressive vector diagrams. The files are identified by WHOI mooring number and depth is given. All the current meters at a given depth are presented together, working from shallow to deep. The current speeds all range from -100 to +100 cm s^{-1}, and the temperature range is set at 4° C on the vertical axis. The progressive vector diagrams for the deeper current meters (greater than 700 m) are expanded to twice the scale as the shallower instruments. A one hour averaged series was used for the plots in this section.

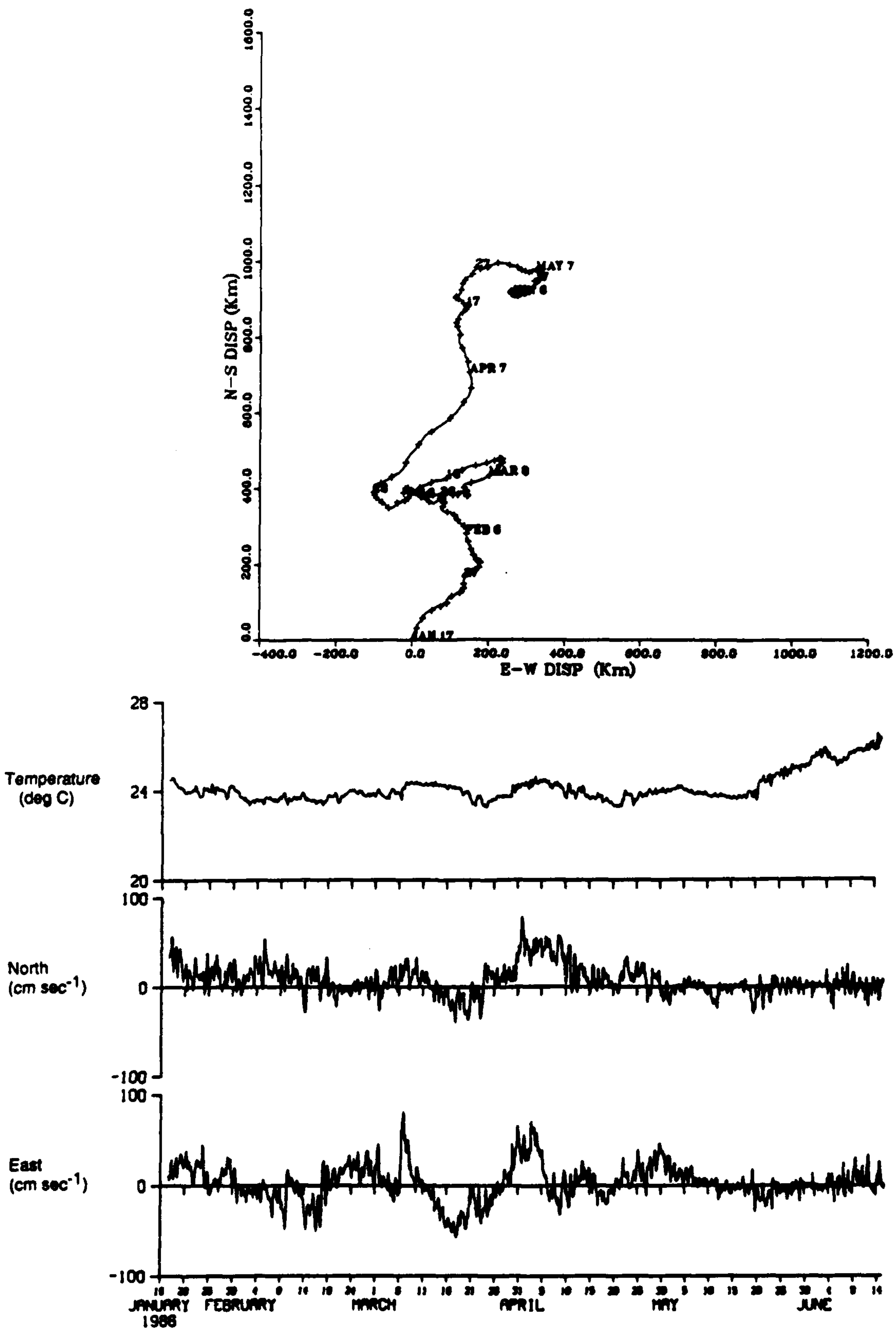
(Progressive vector diagrams show the VACMs at 20 and 40 m over-responded relative to the VMCMs (see Weller et al., 1989)).

Fourteen VACMs were set on the two subsurface moorings. A schematic with the depths is shown in Figure 18. Table 8 gives the number of days of data by instrument and an explanation is there is less than 100 percent. The depths for these plots are 160, 260, 485, 560, 635, 1060 and 4060 meters. The plots present time series of east, north and temperature and a progressive vector diagram, and on the shallowest instrument, pressure is also included. The scales for the subsurface current meters range from -50 to +50 cm $^{-1}$ and the temperature plots cover a 6° C range. The shallow progressive vector diagrams from 156 to 635 m are plotted full scale and the deeper instruments at 1080 and 4060 m are plotted at twice the scale. The subsurface plots (F1-829, F12-830) only cover the FASINEX time period in this section. The complete series are shown in Section 9. One hour averaged files were used for the plots in this section.

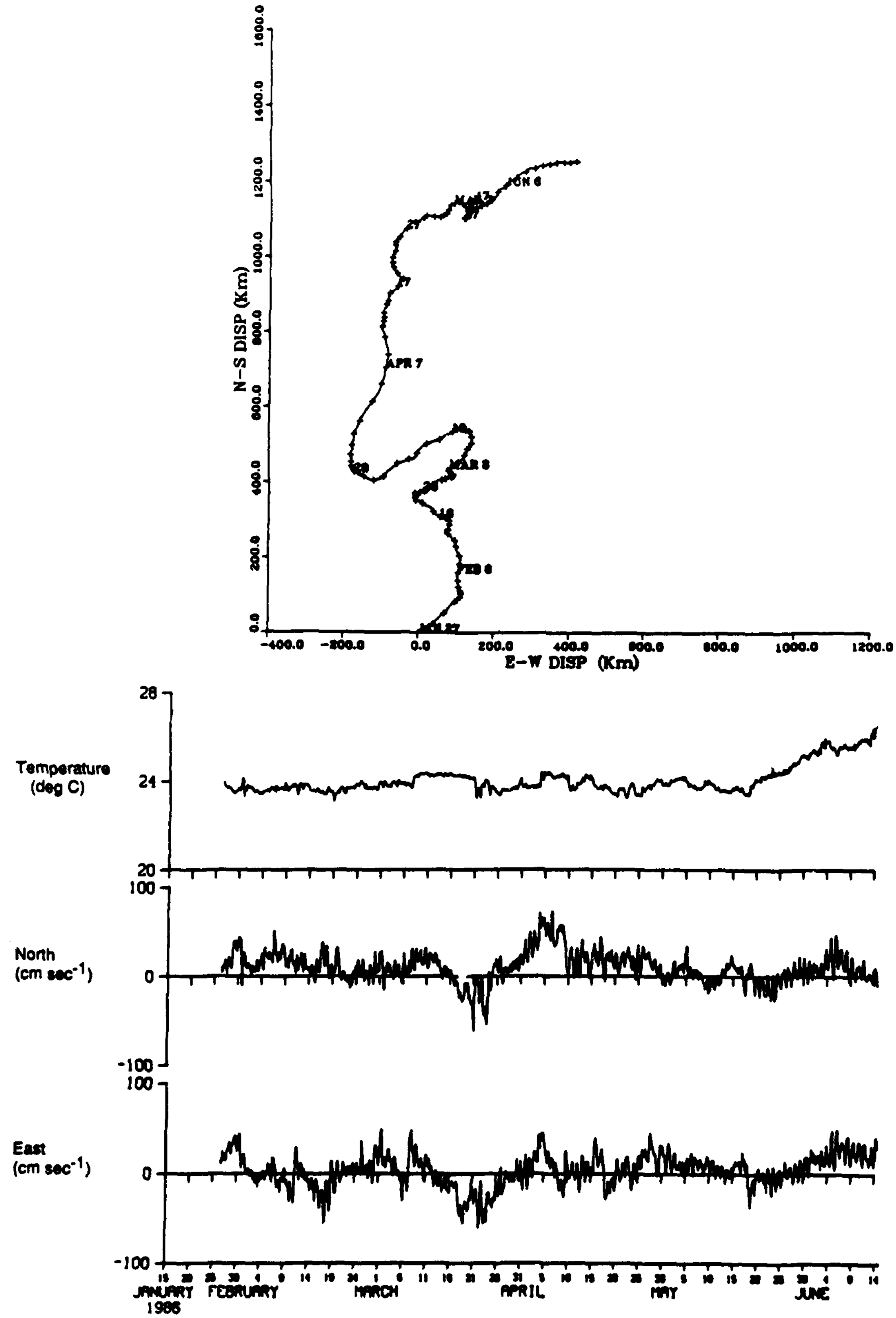
	pages
Current meter time series and progressive vector diagrams for the surface moorings.	91-132
Current meter time series and progressive vector diagrams for the subsurface moorings	133-144



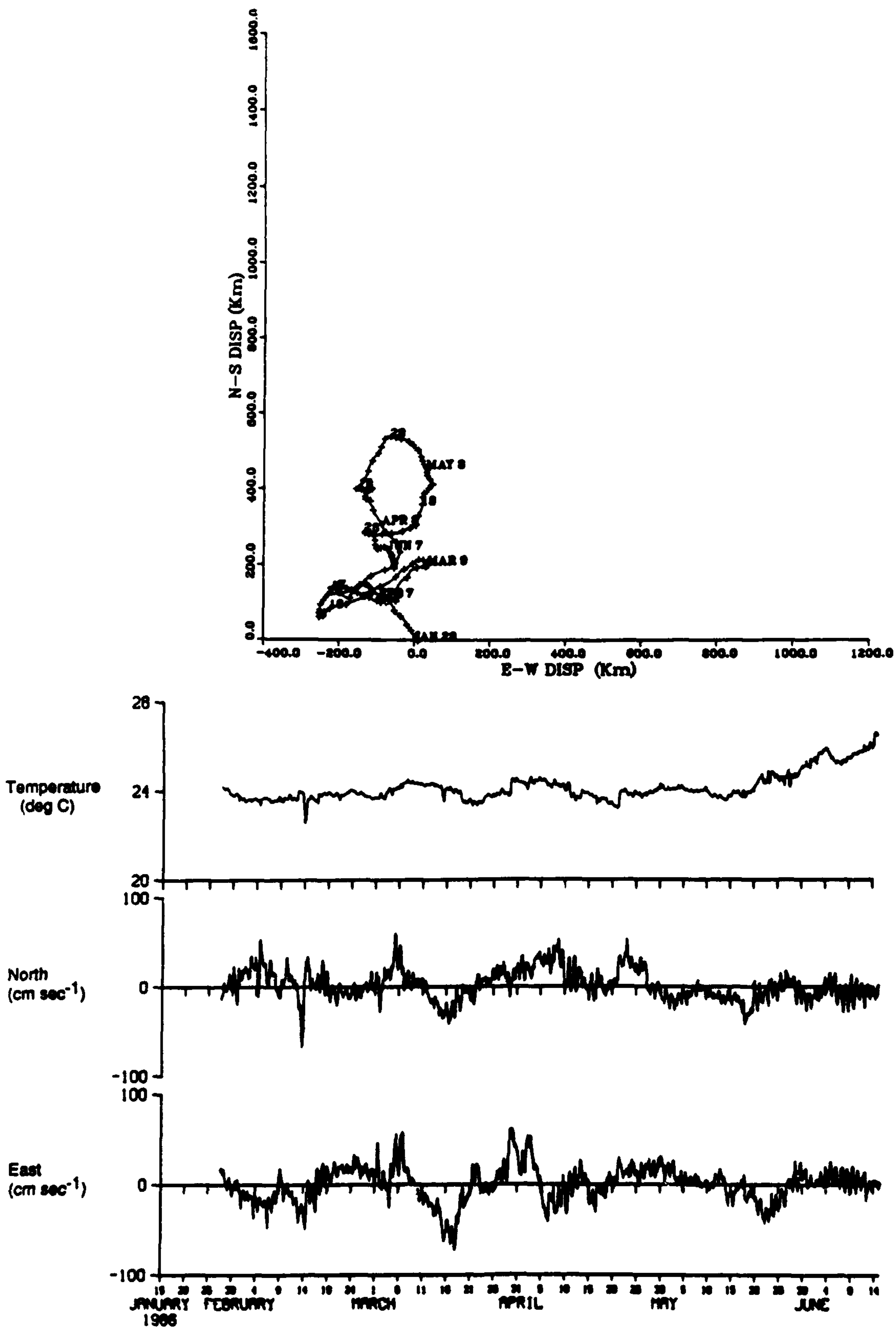
East, North, Temperature and progressive vector diagram for Mooring F2 10m.



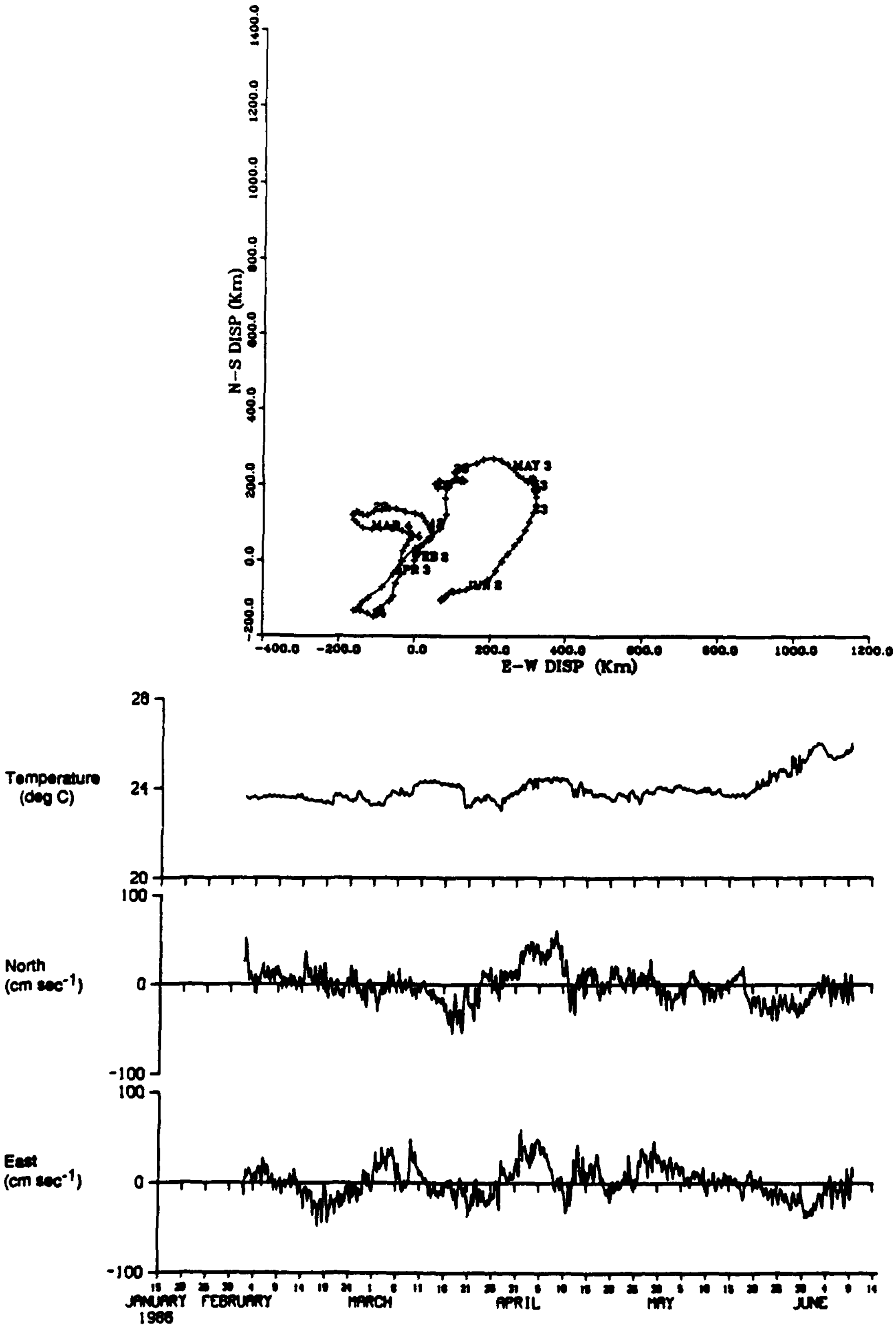
East, North, Temperature and progressive vector diagram for Mooring F4 10m.



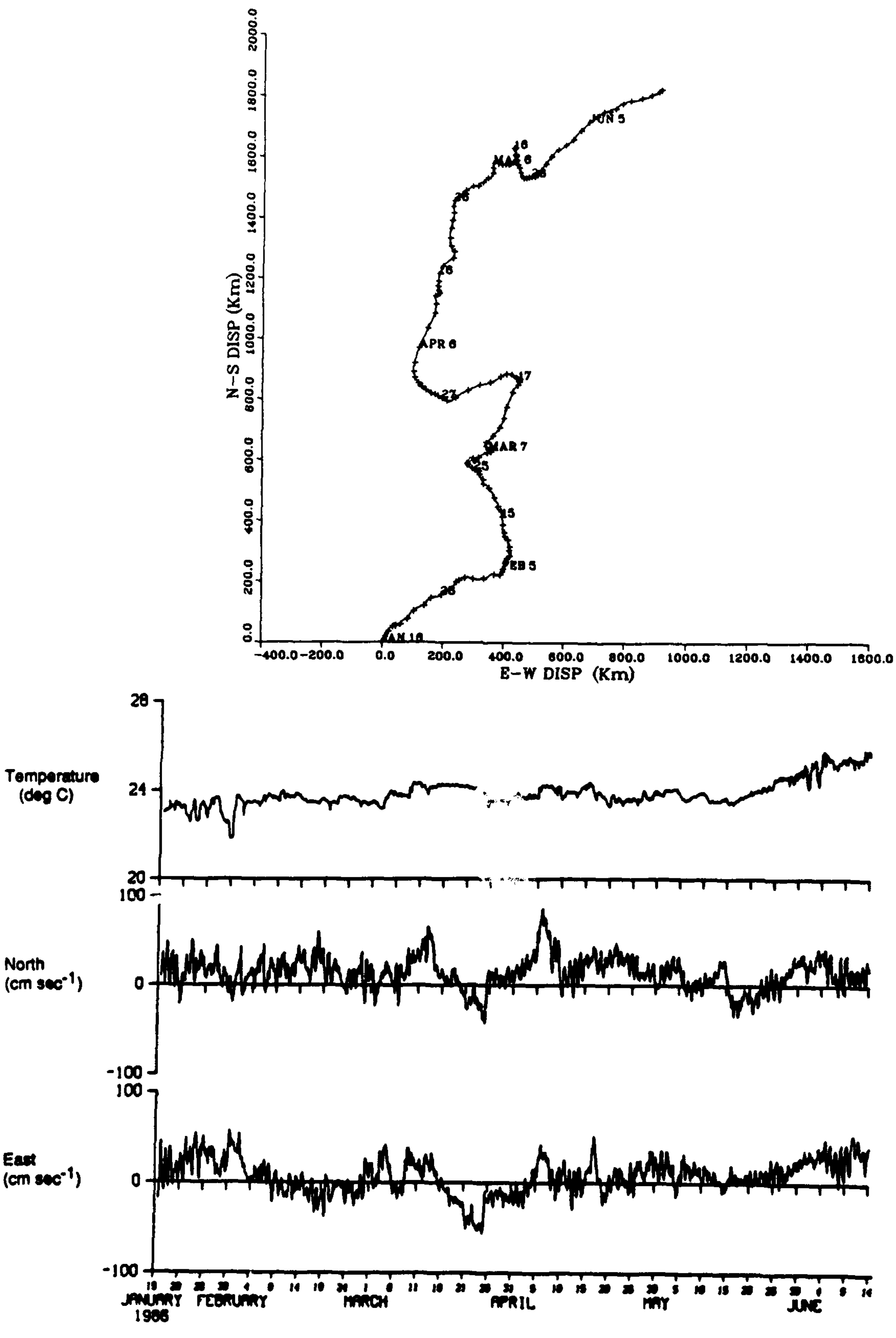
East, North, Temperature and progressive vector diagram for Mooring F6 10m.



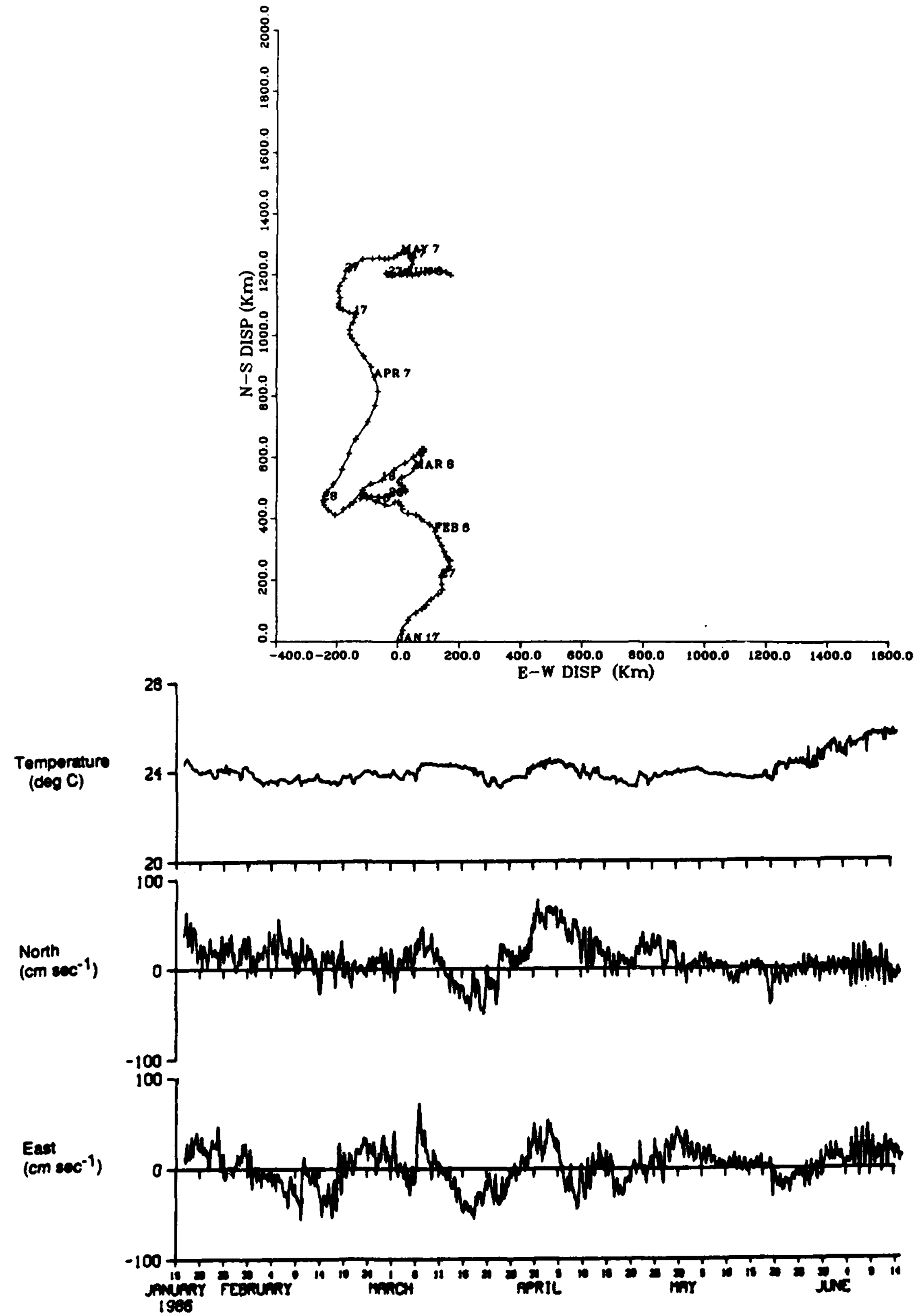
East, North, Temperature and progressive vector diagram for Mooring F8 10m.



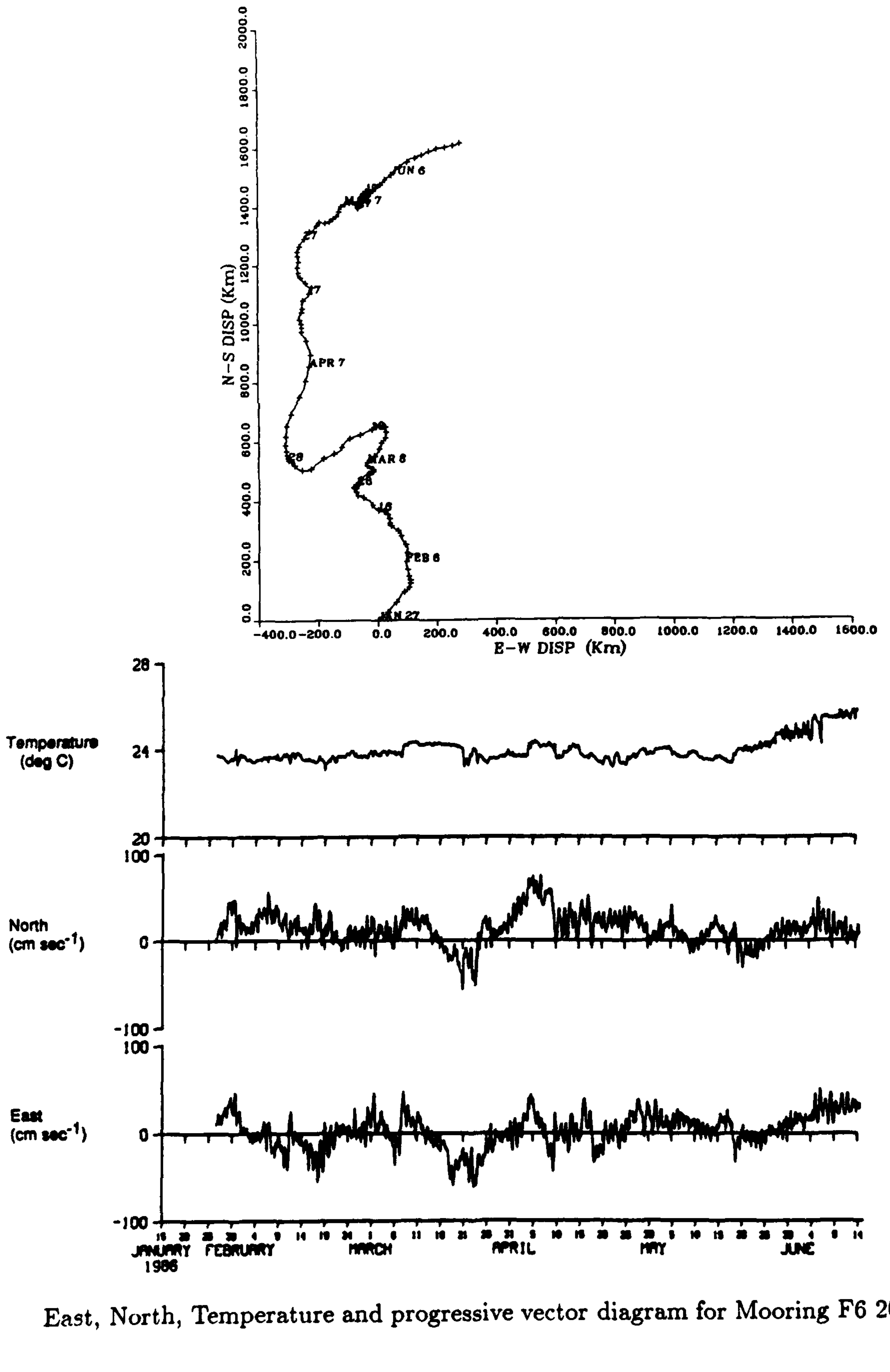
East, North, Temperature and progressive vector diagram for Mooring F10 10m.



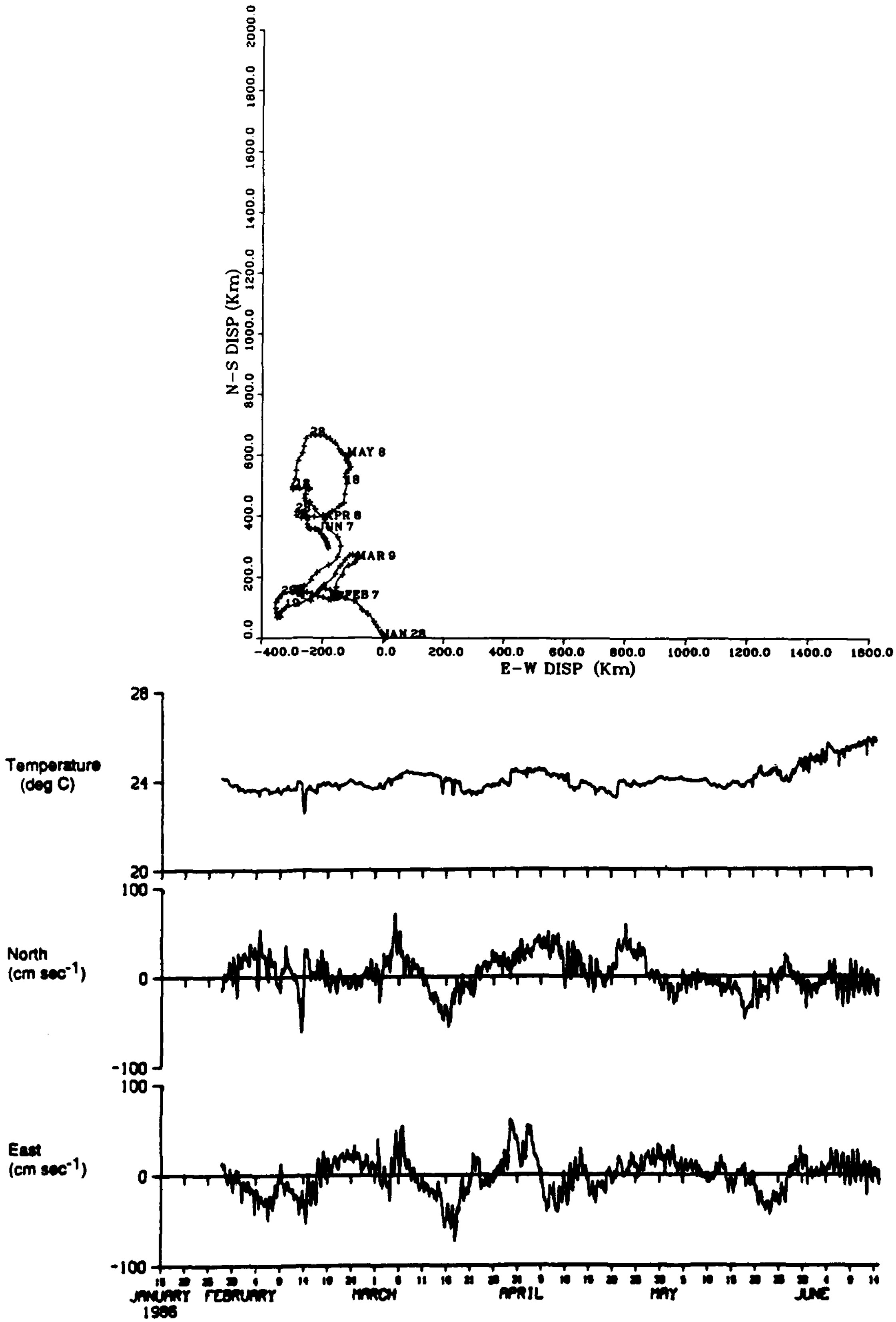
East, North, Temperature and progressive vector diagram for Mooring F2 20m.



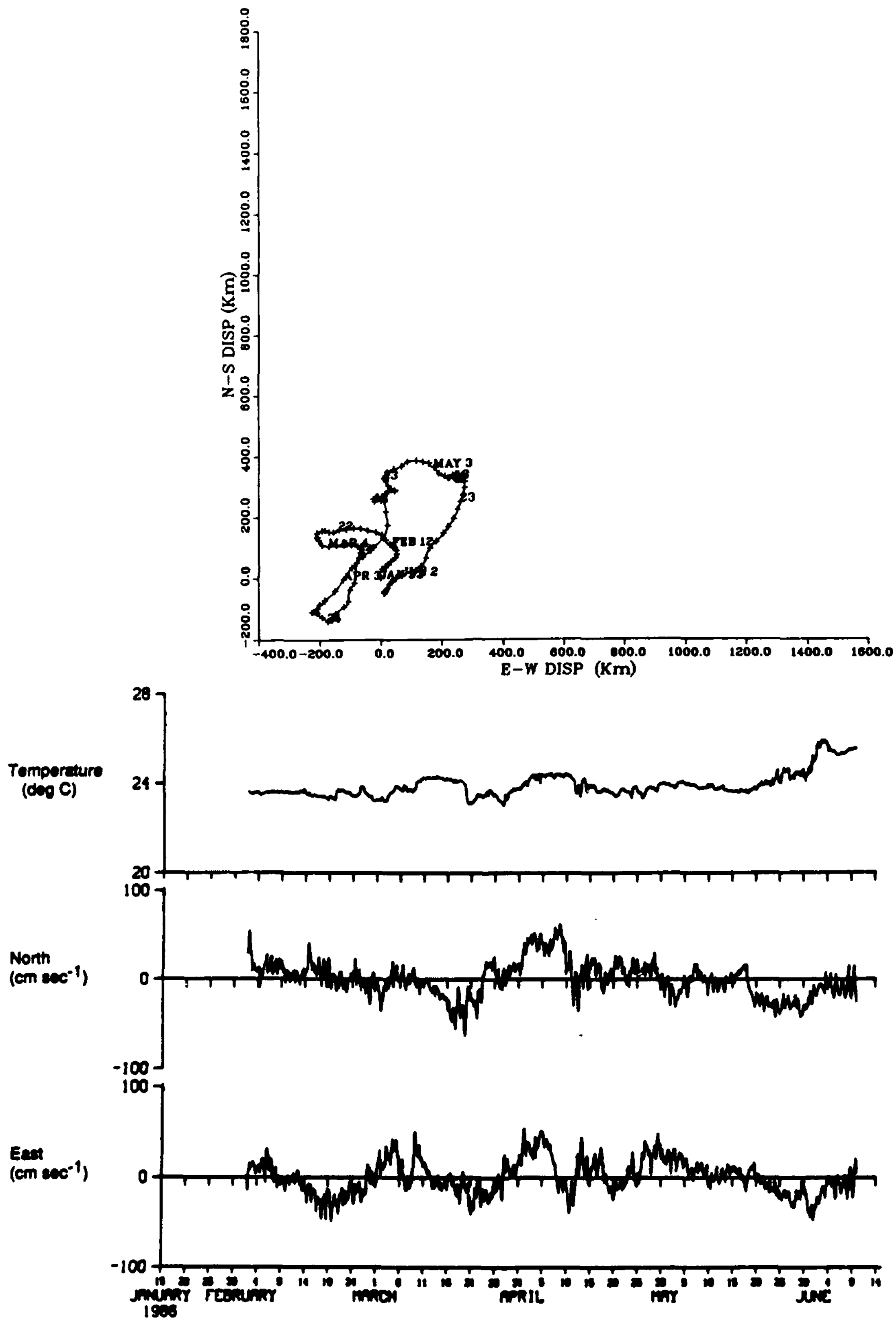
East, North, Temperature and progressive vector diagram for Mooring F4 20m.



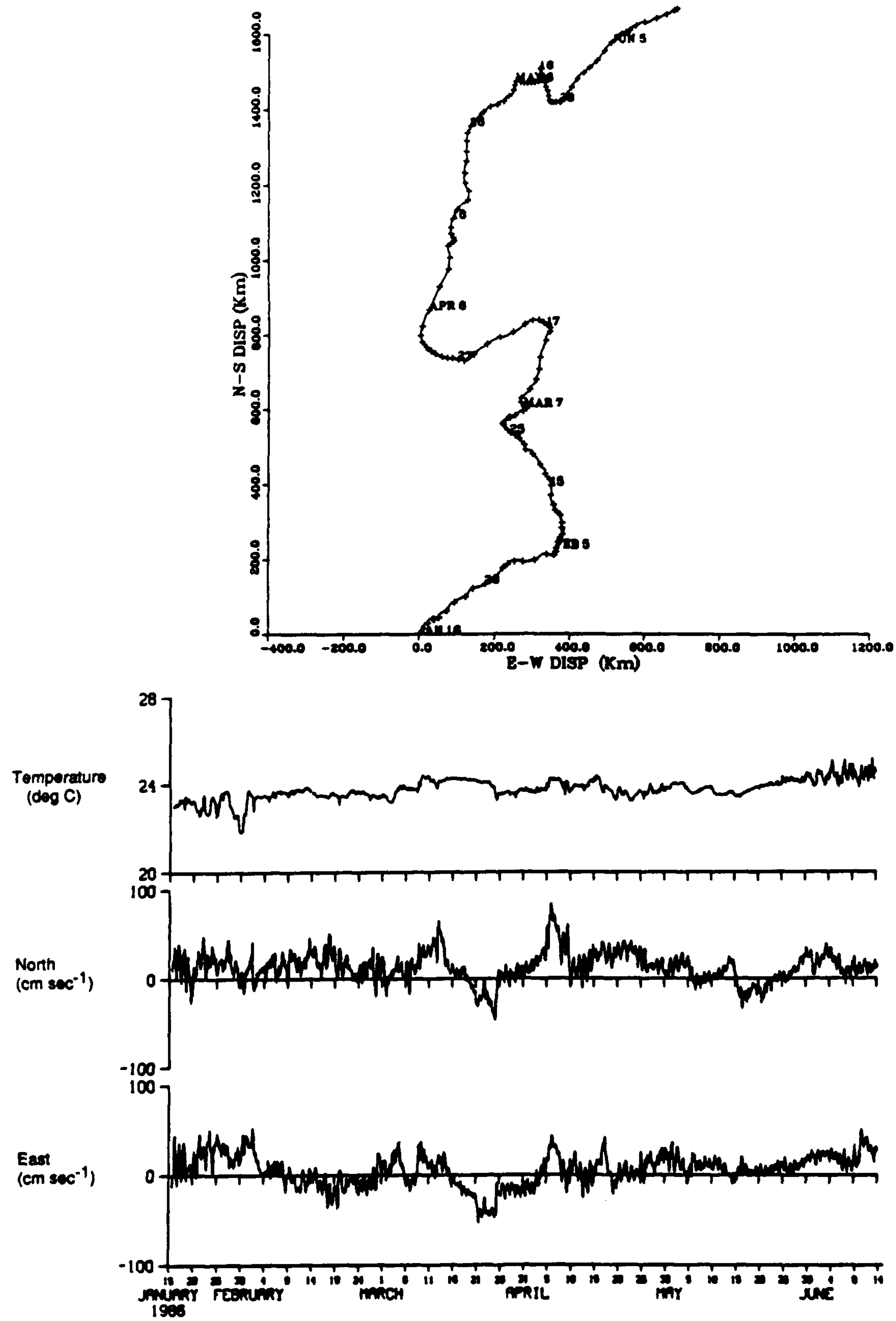
East, North, Temperature and progressive vector diagram for Mooring F6 20m.



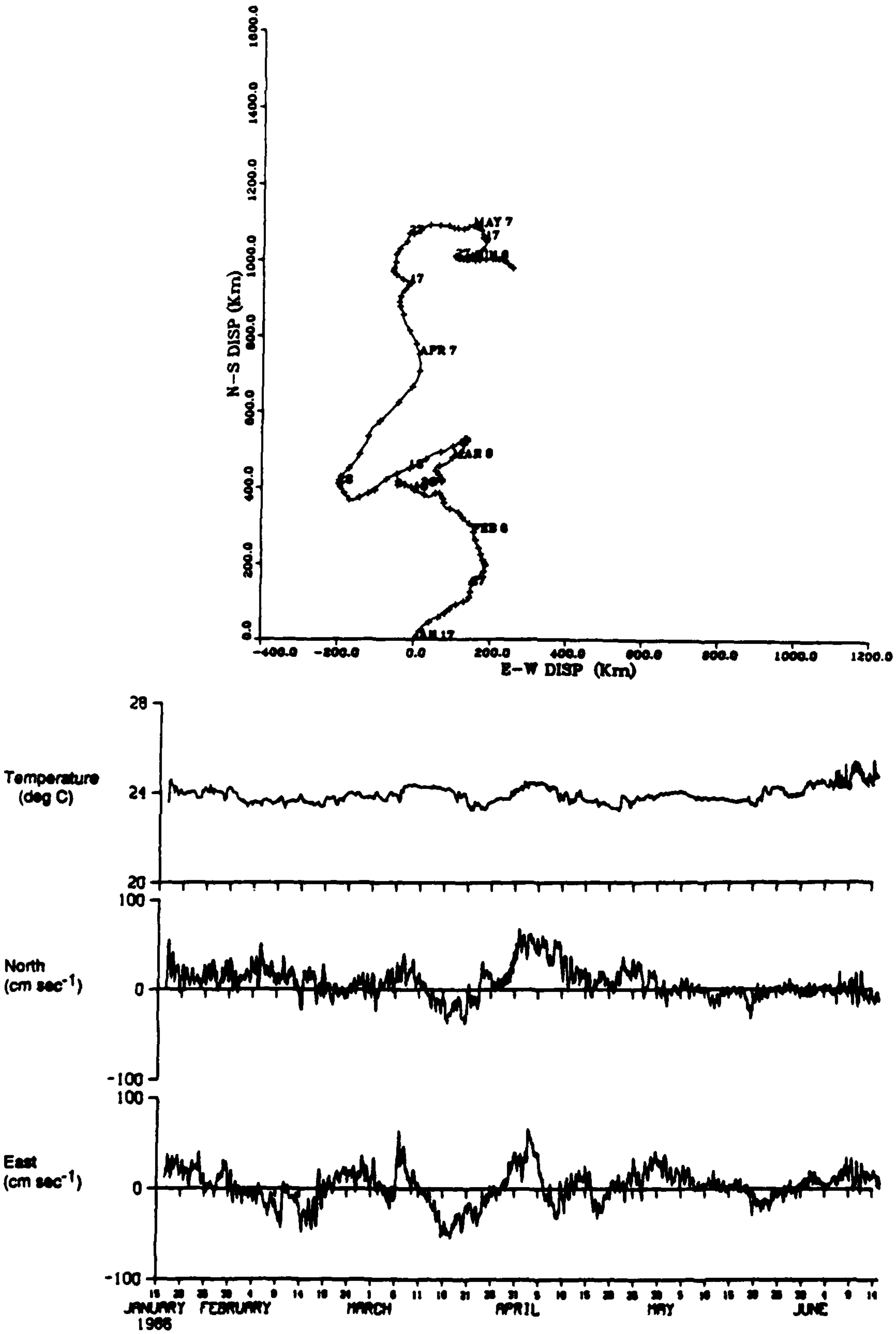
East, North, Temperature and progressive vector diagram for Mooring F8 20m.



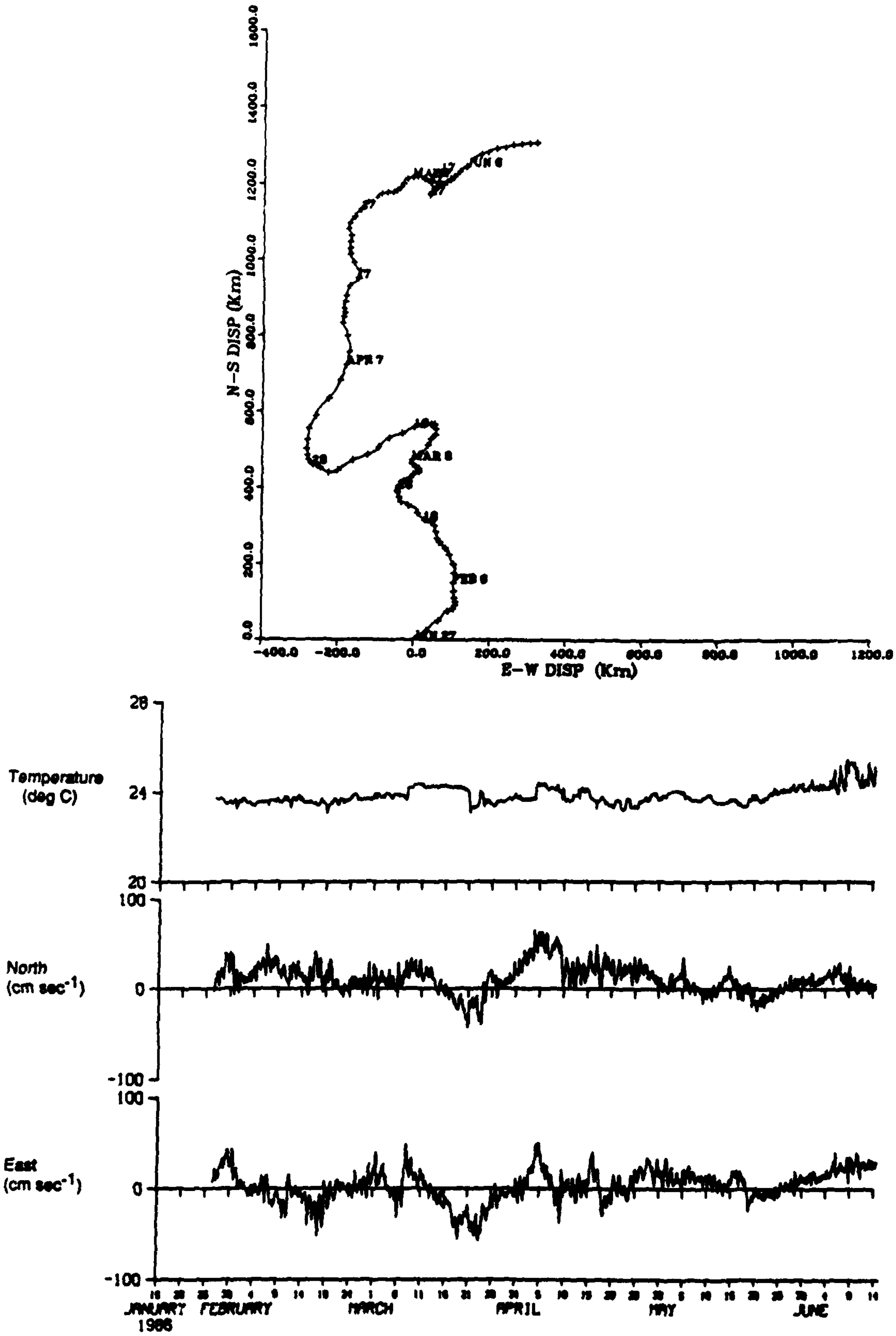
East, North, Temperature and progressive vector diagram for Mooring F10 20m.



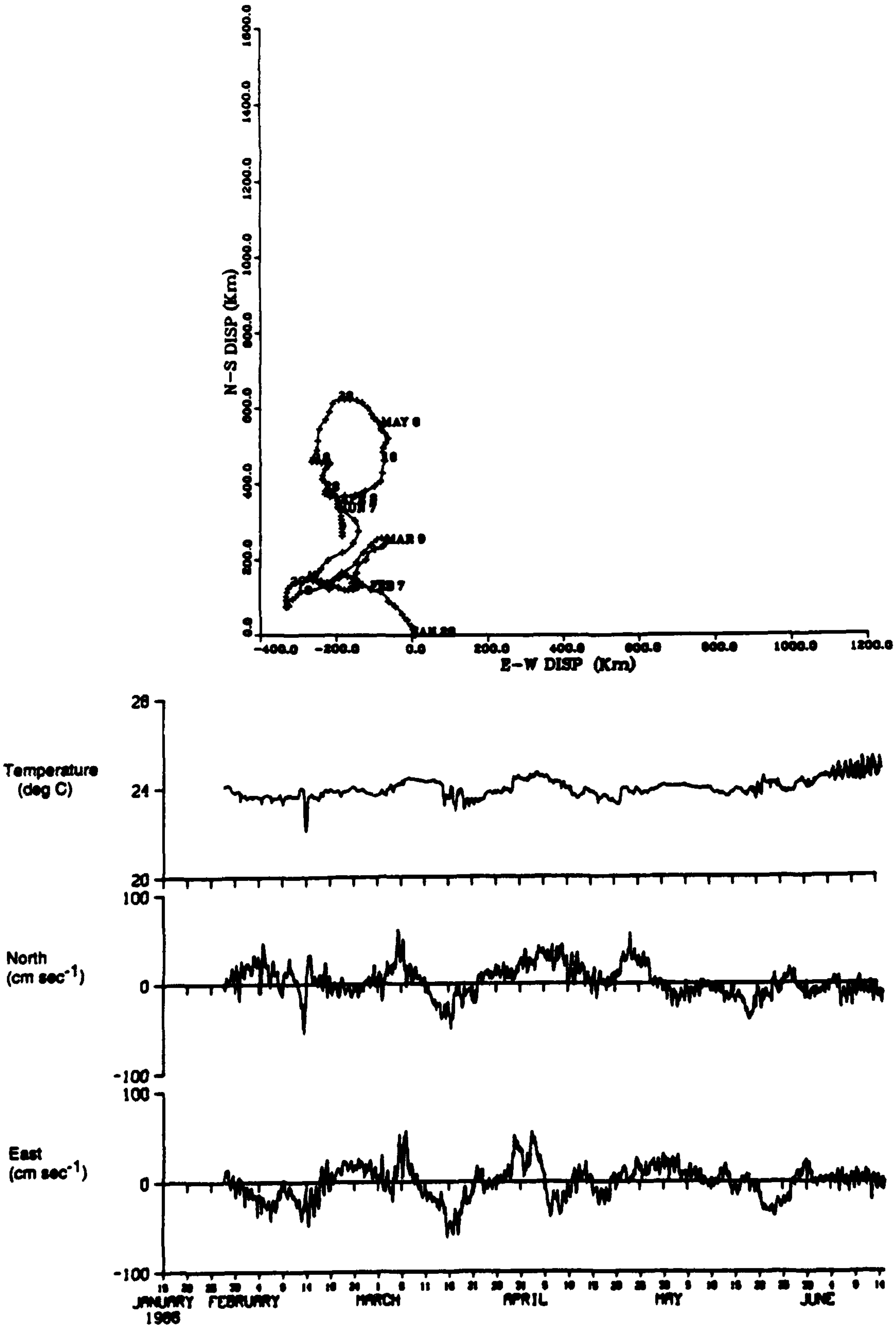
East, North, Temperature and progressive vector diagram for Mooring F2 30m.



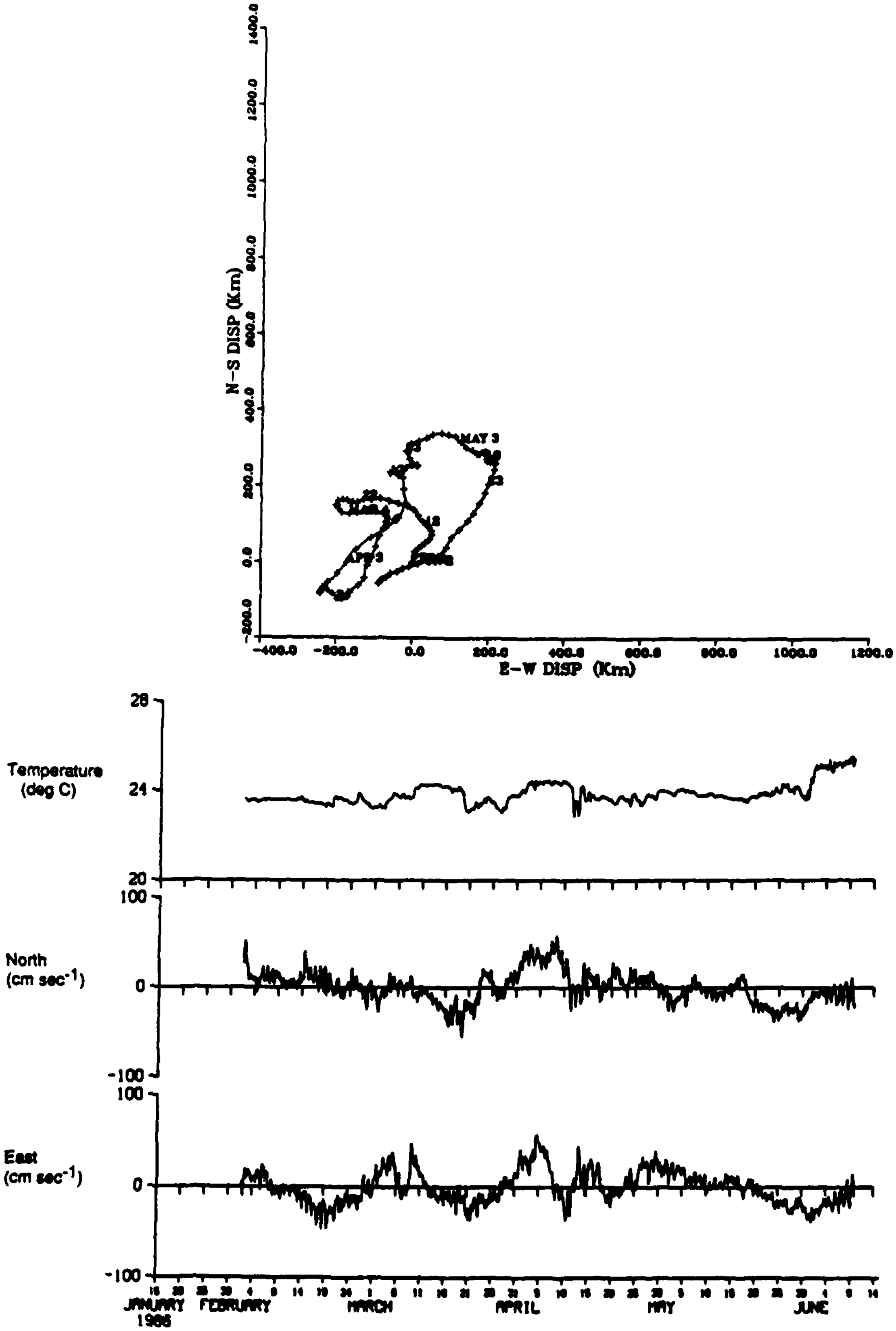
East, North, Temperature and progressive vector diagram for Mooring F4 30m.



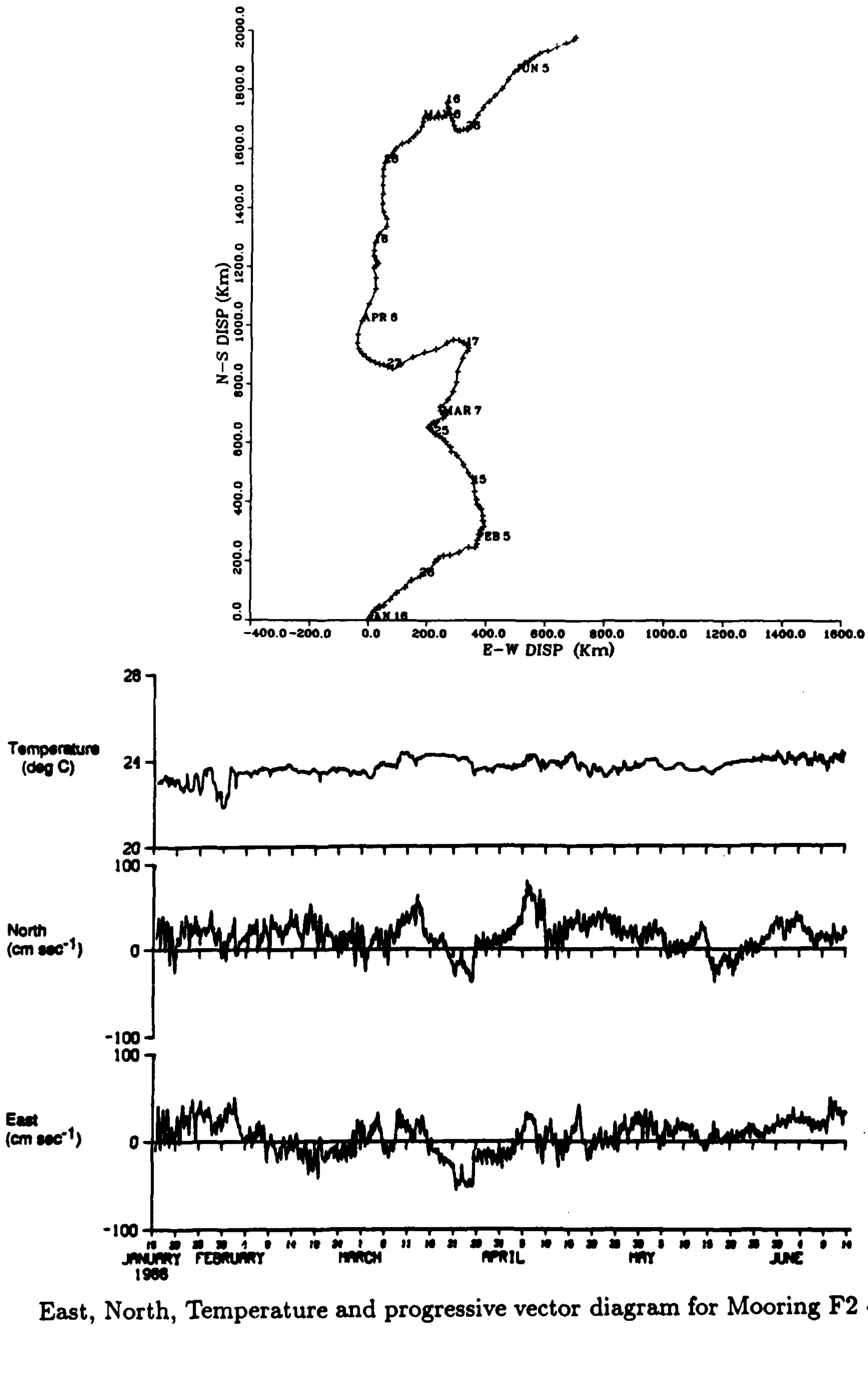
East, North, Temperature and progressive vector diagram for Mooring F6 30m.



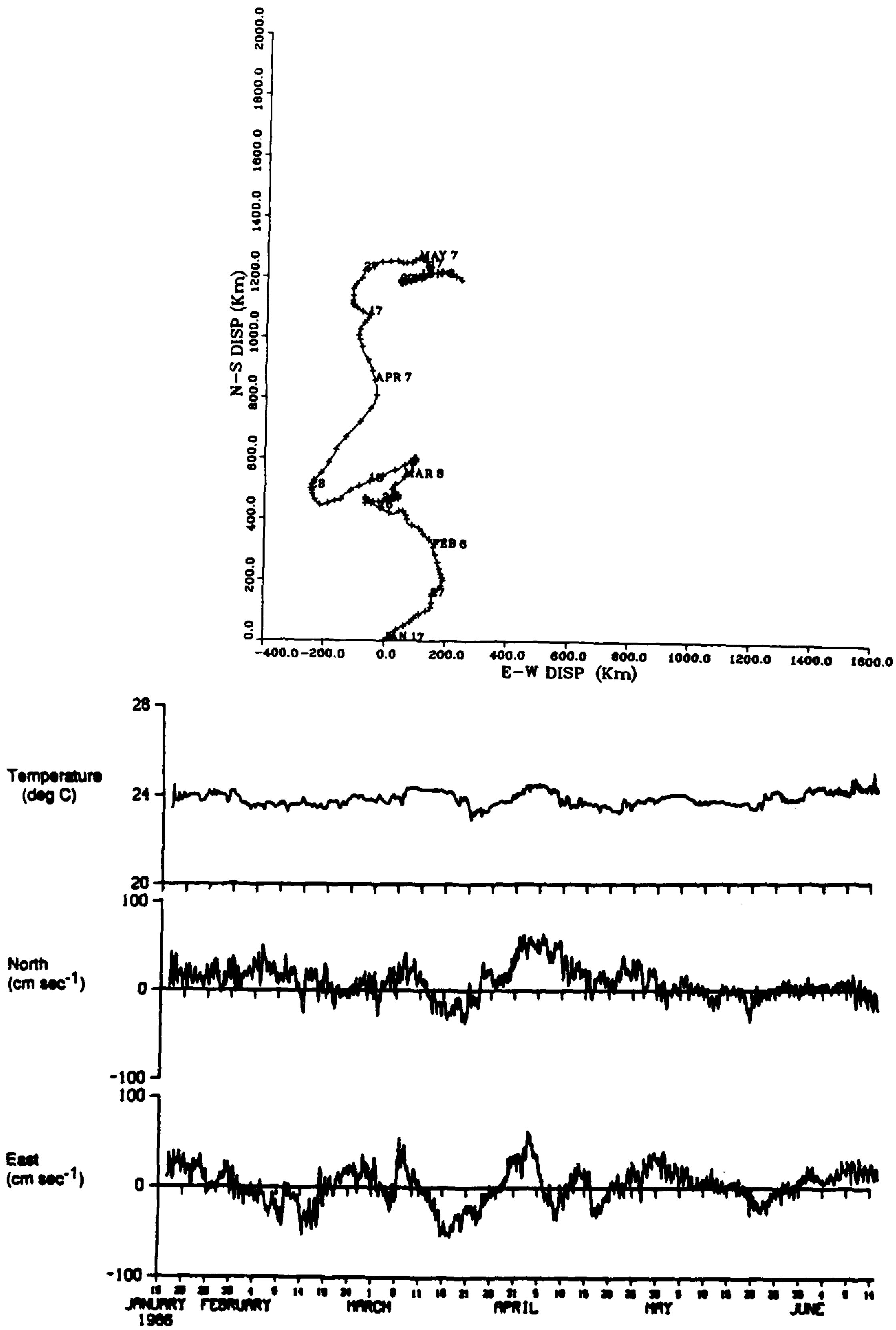
East, North, Temperature and progressive vector diagram for Mooring F8 30m.



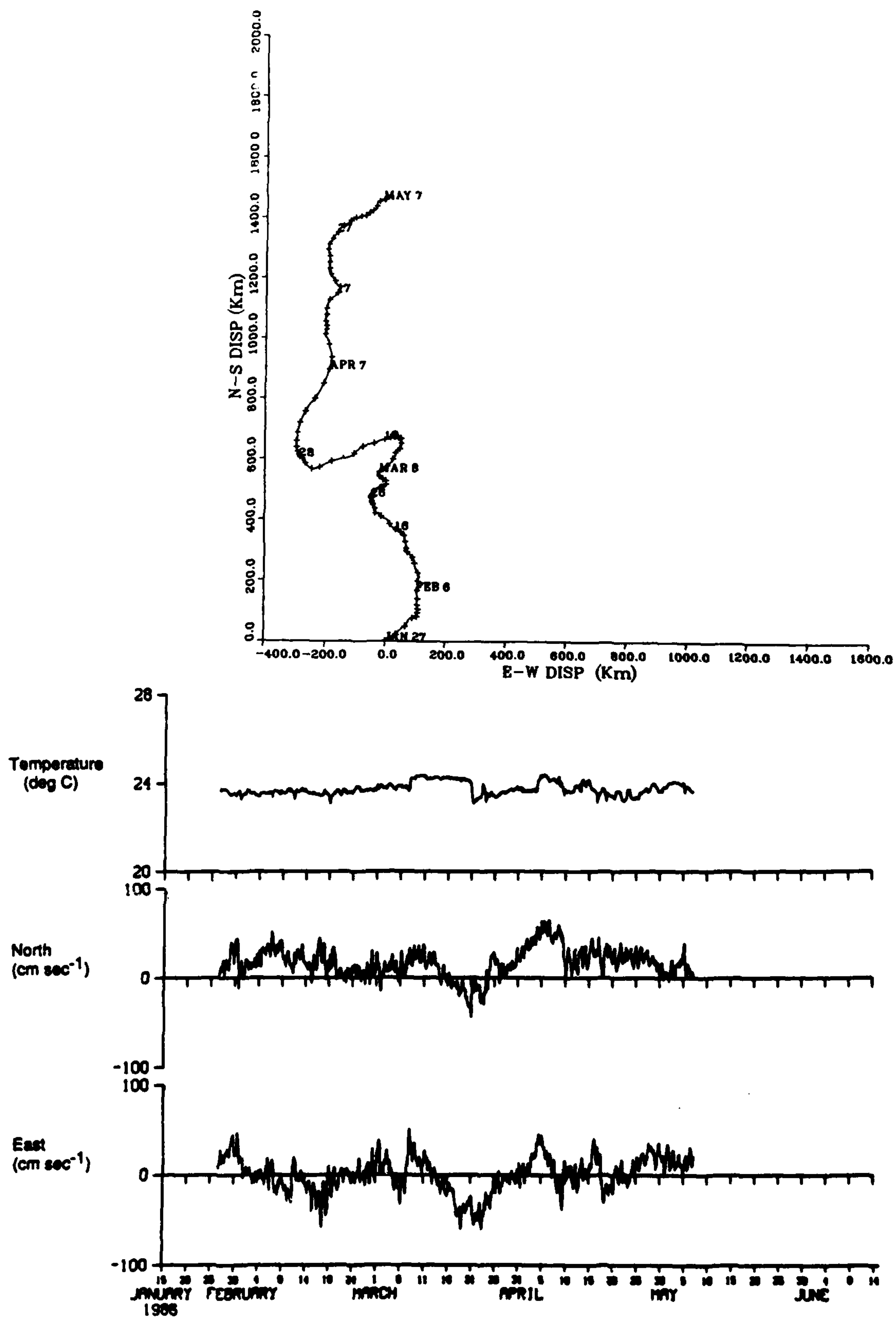
East, North, Temperature and progressive vector diagram for Mooring F10 30m.



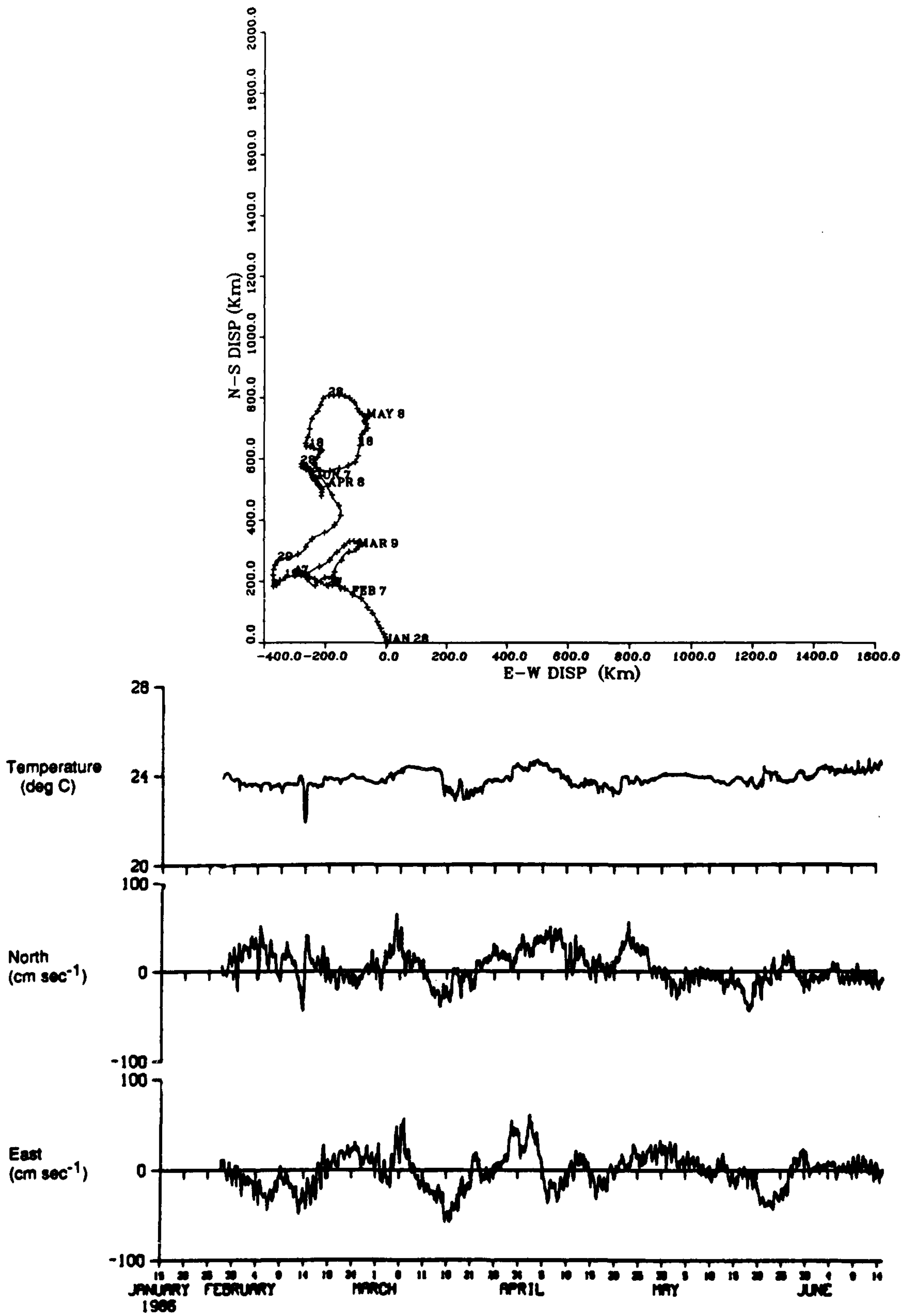
East, North, Temperature and progressive vector diagram for Mooring F2 40m.



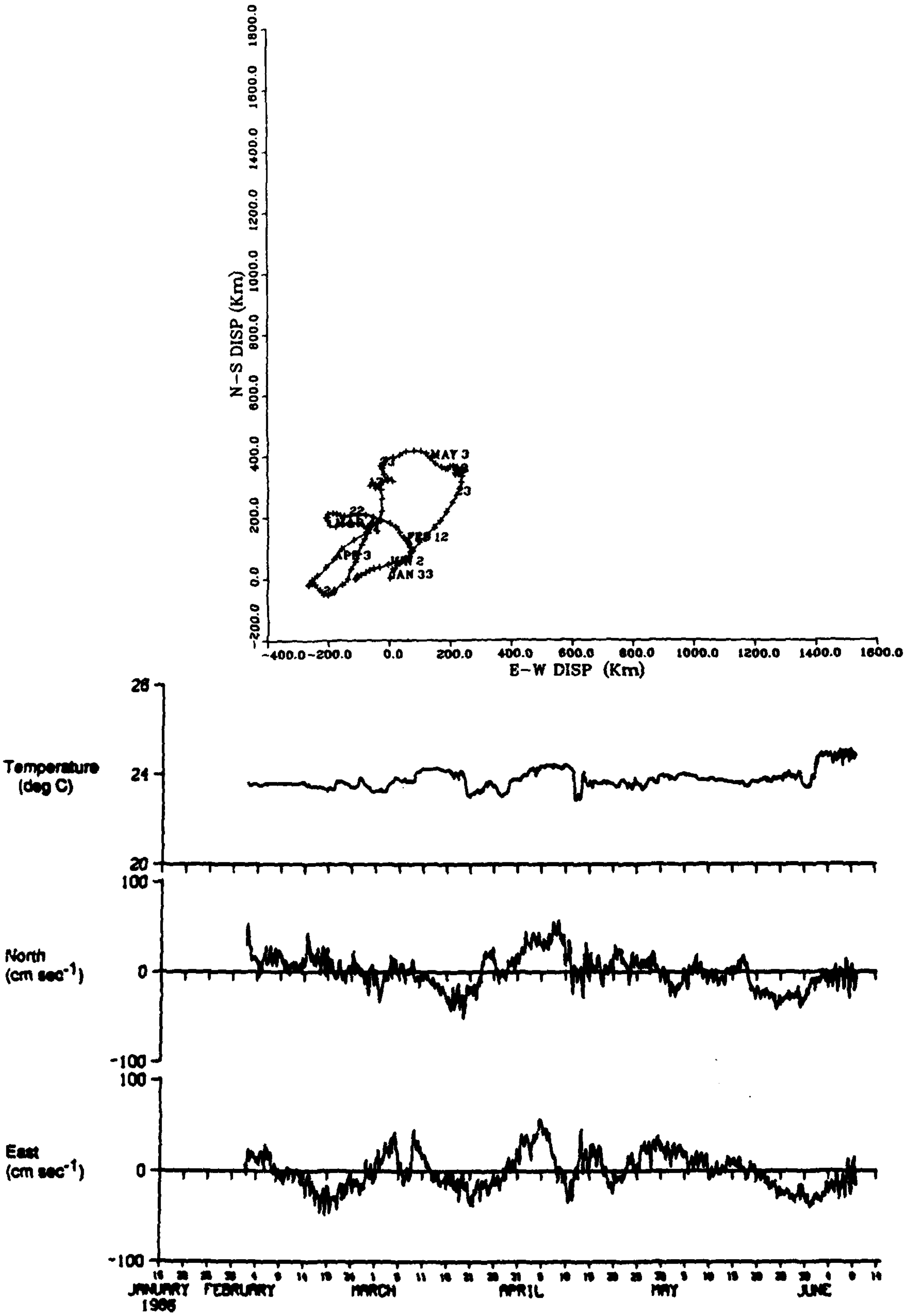
East, North, Temperature and progressive vector diagram for Mooring F4 40m.



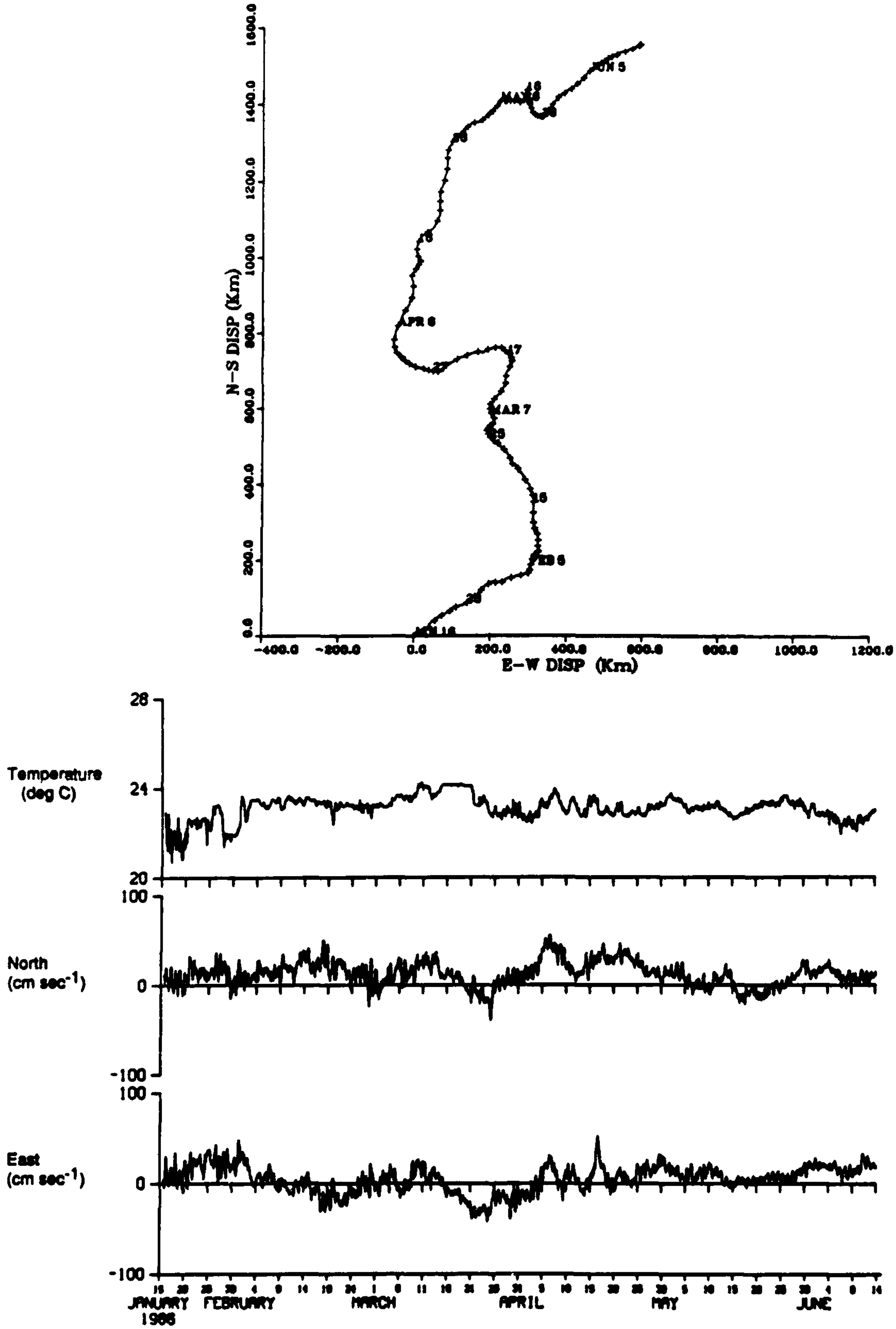
East, North, Temperature and progressive vector diagram for Mooring F6 40m.



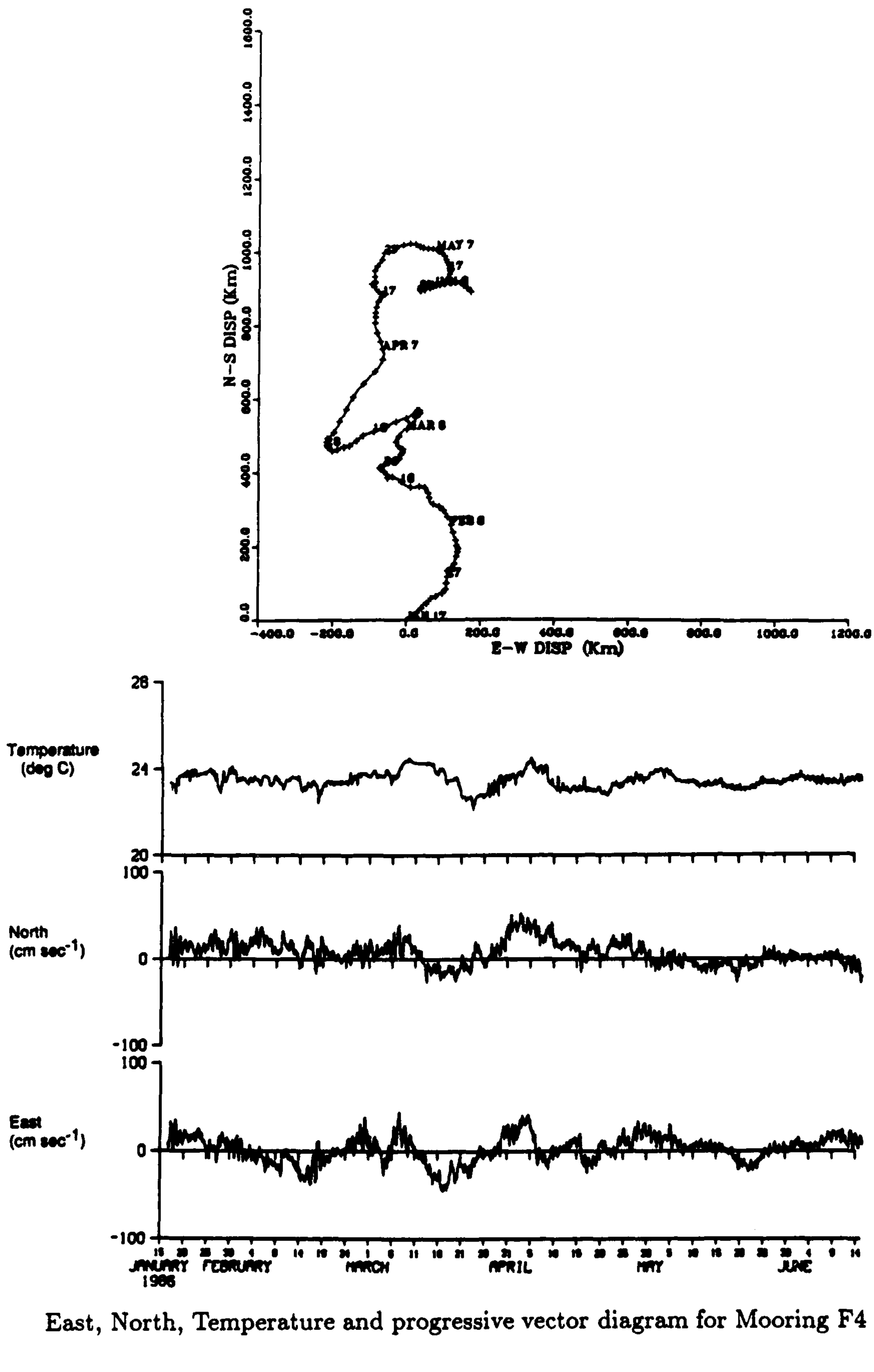
East, North, Temperature and progressive vector diagram for Mooring F8 40m.



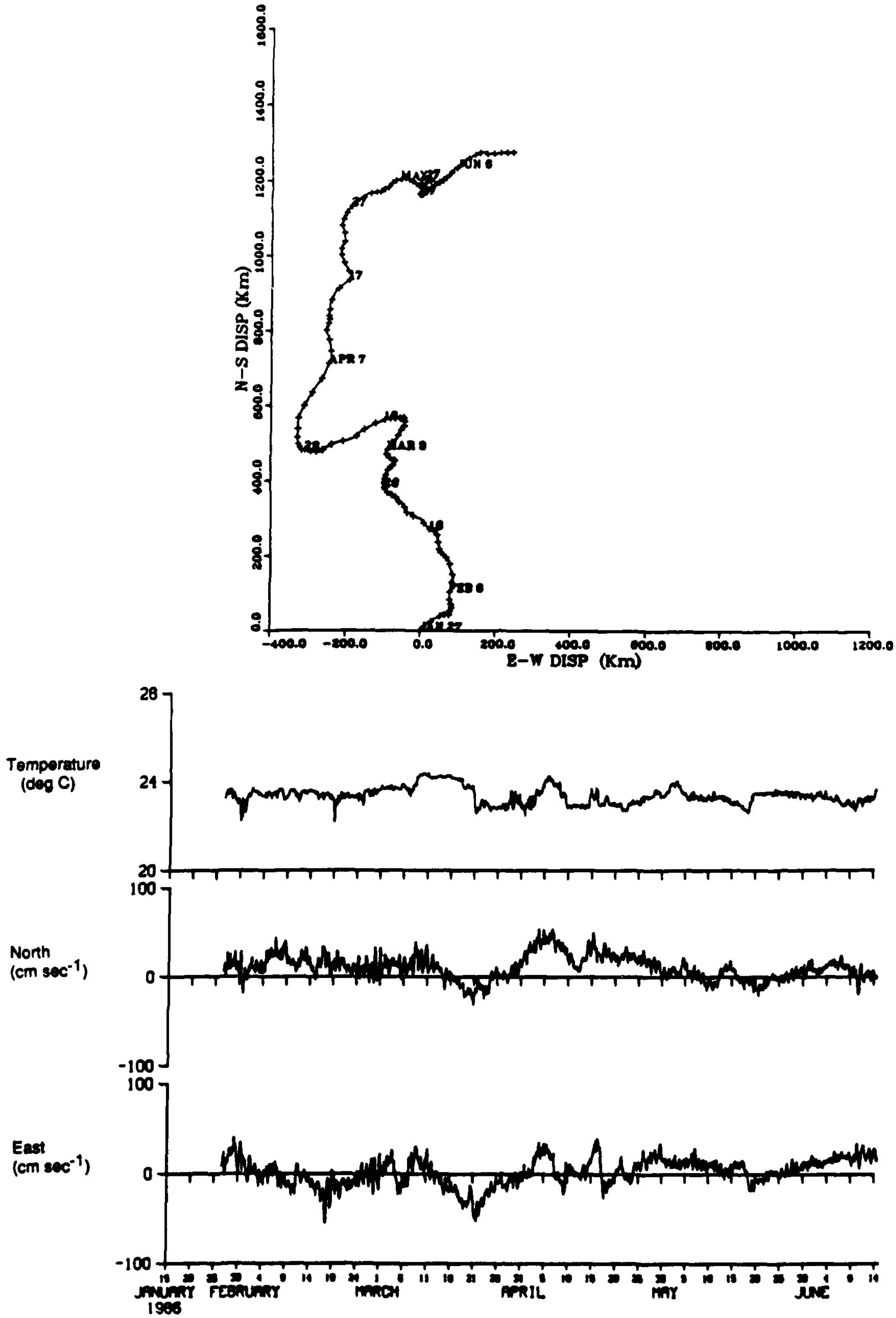
East, North, Temperature and progressive vector diagram for Mooring F10 40m.



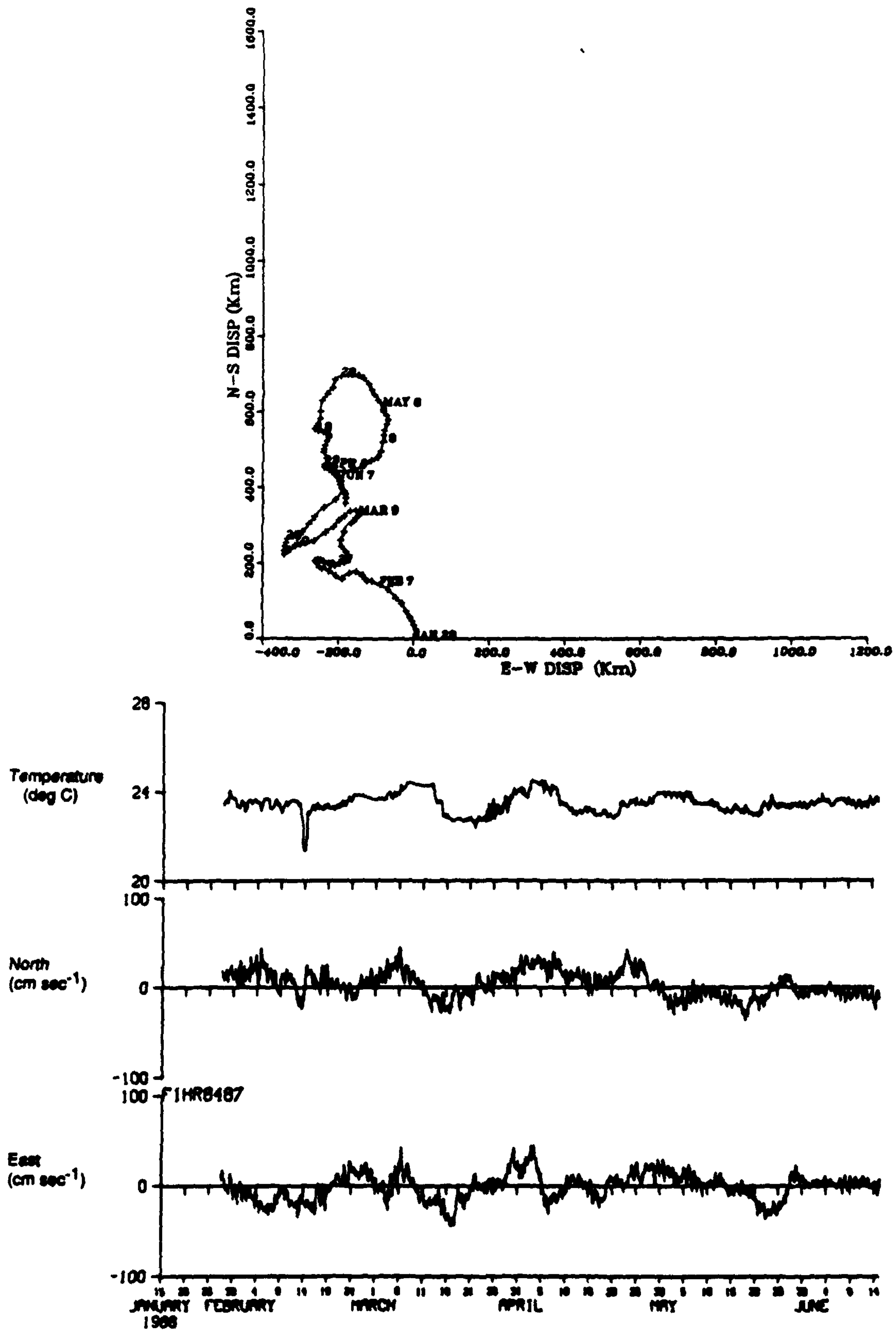
East, North, Temperature and progressive vector diagram for Mooring F2 80m.



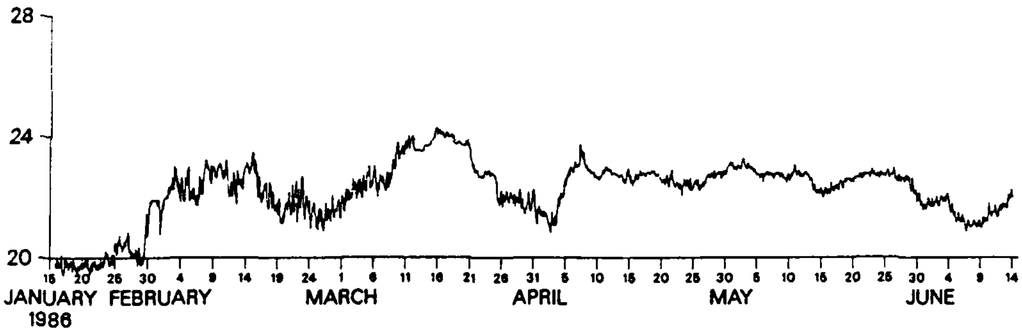
East, North, Temperature and progressive vector diagram for Mooring F4 80m.



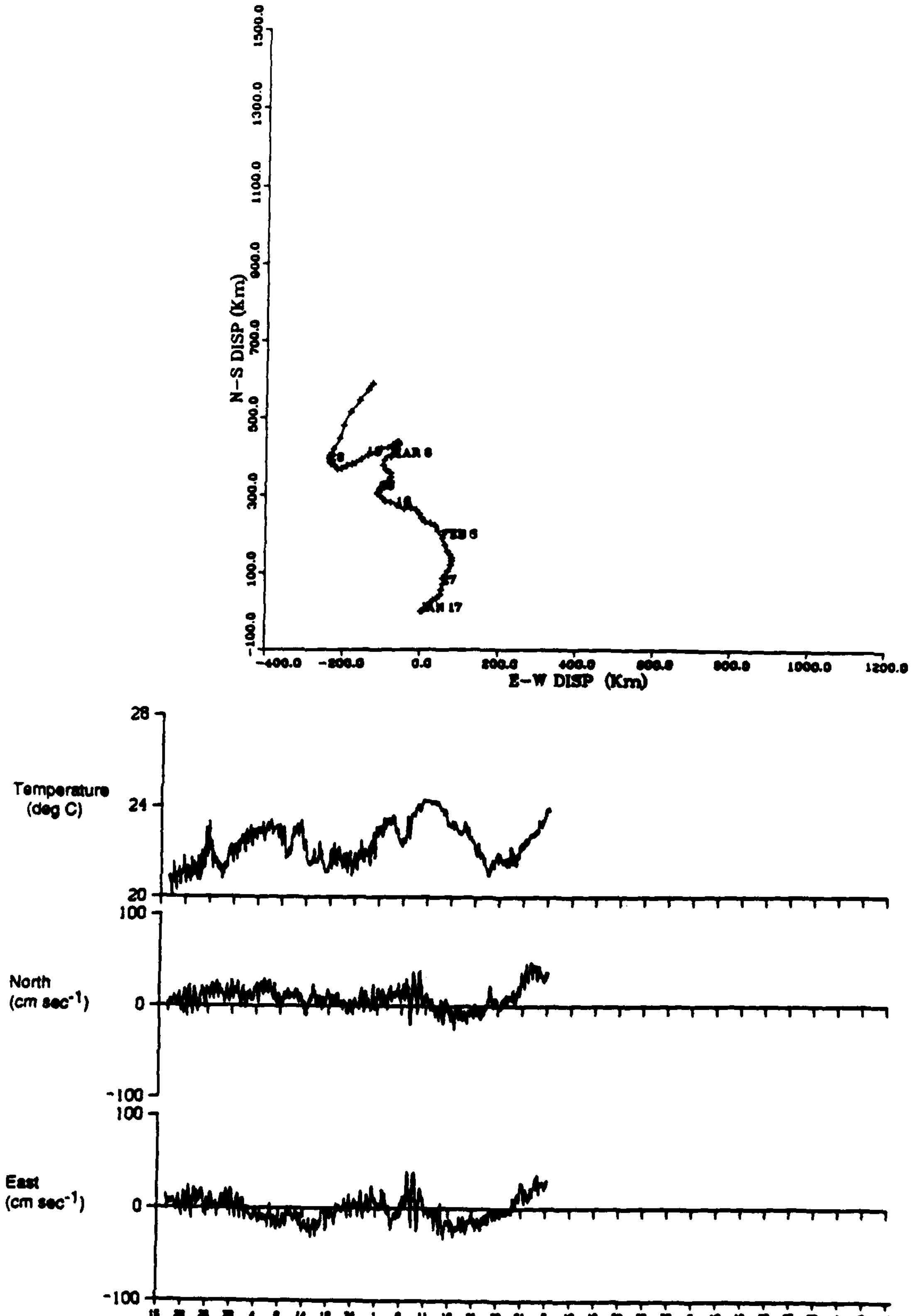
East, North, Temperature and progressive vector diagram for Mooring F6 80m.



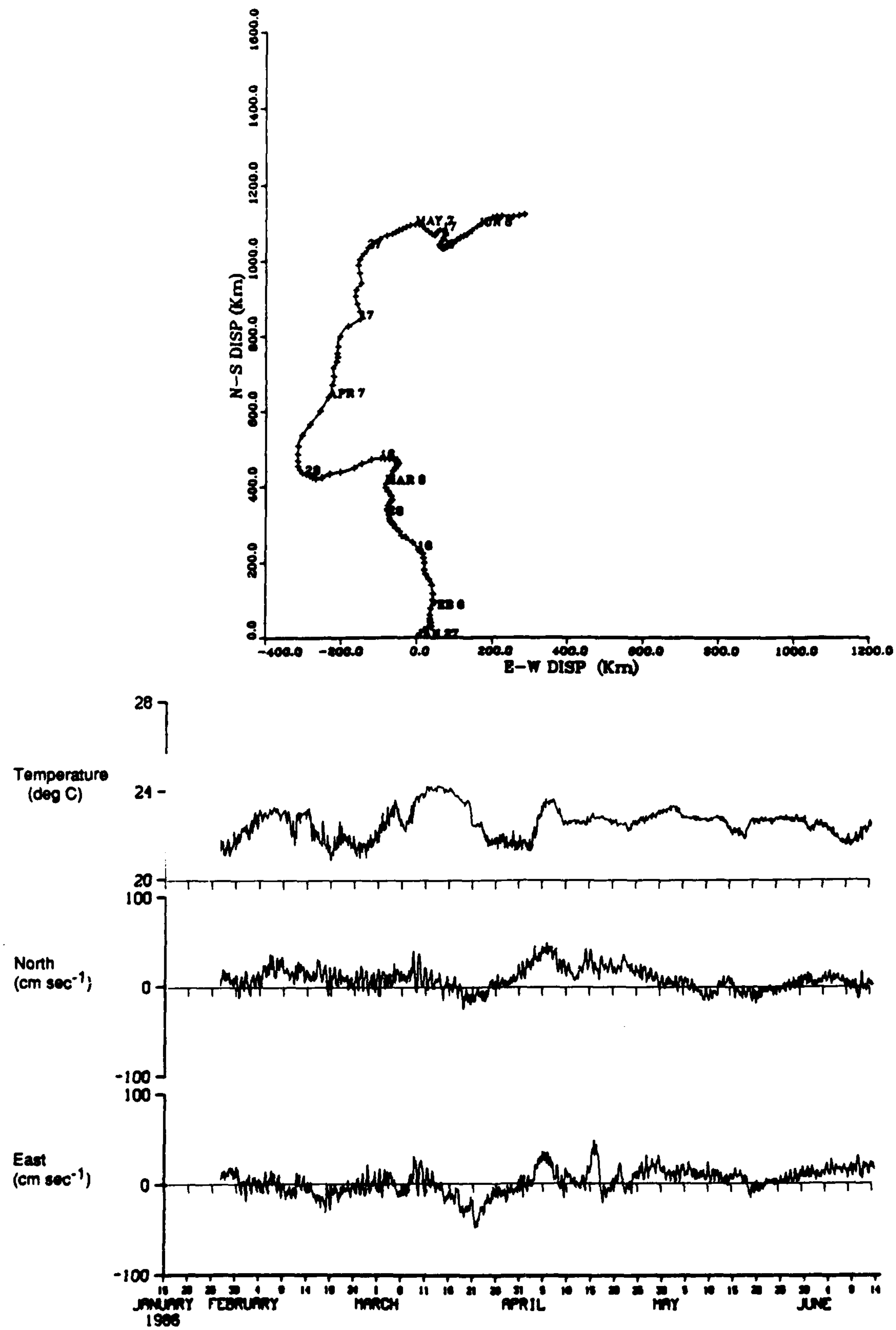
East, North, Temperature and progressive vector diagram for Mooring F8 80m.



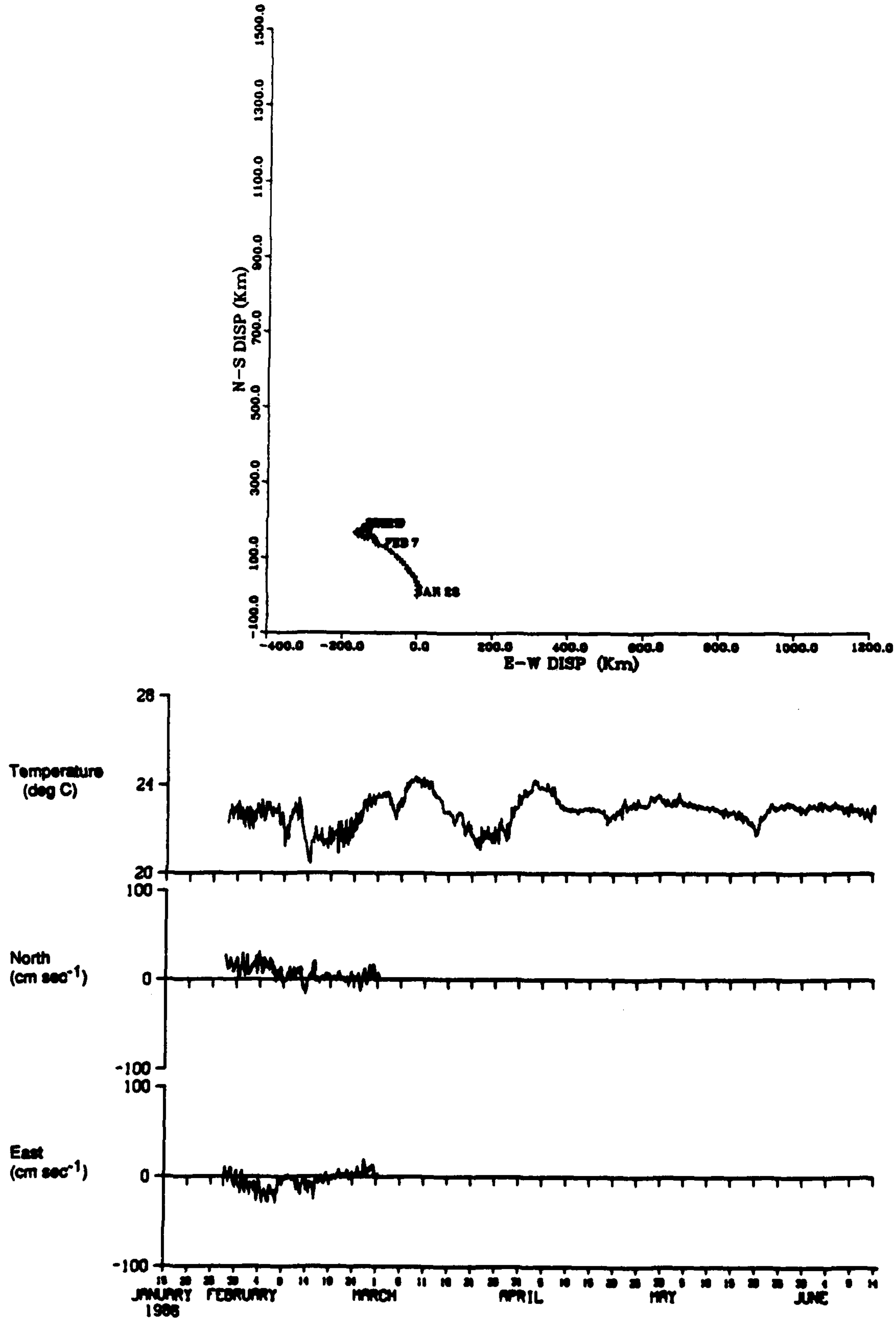
Temperature for Mooring F2 120m.



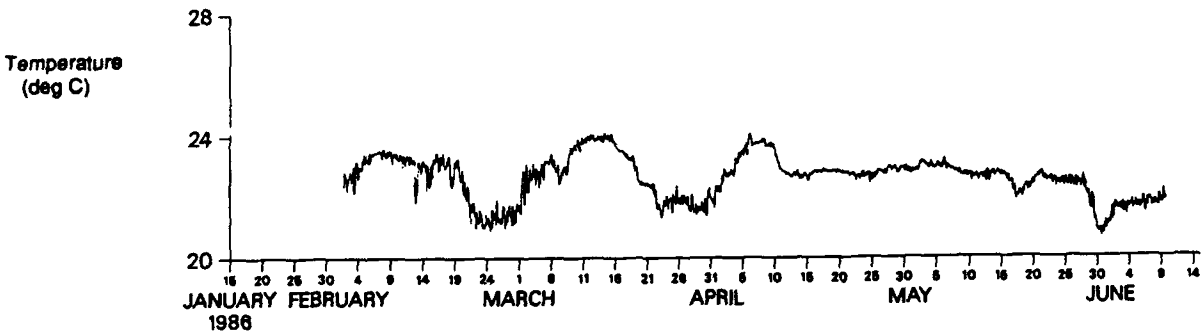
East, North, Temperature and progressive vector diagram for Mooring F4 120m.



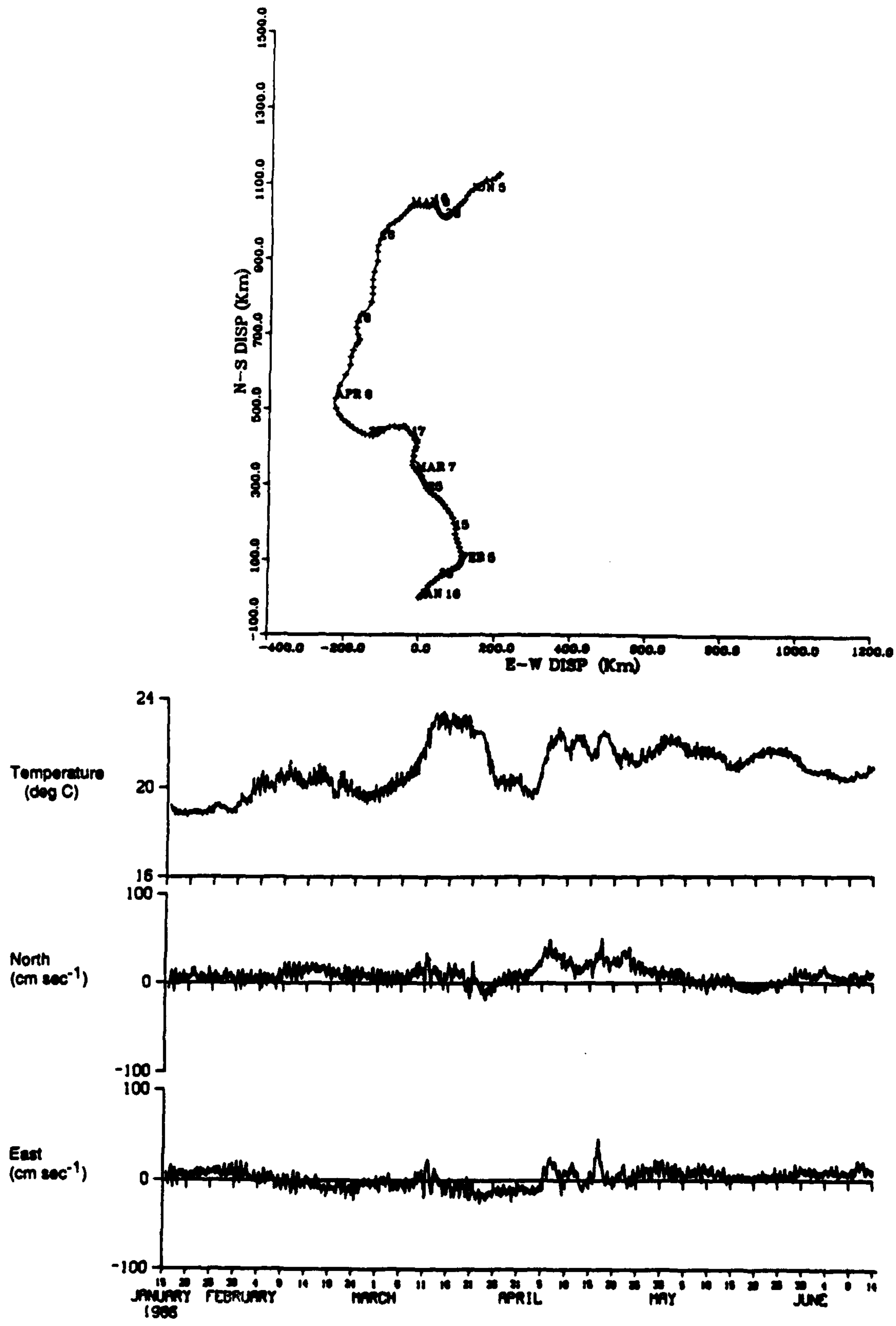
East, North, Temperature and progressive vector diagram for Mooring F6 120m.



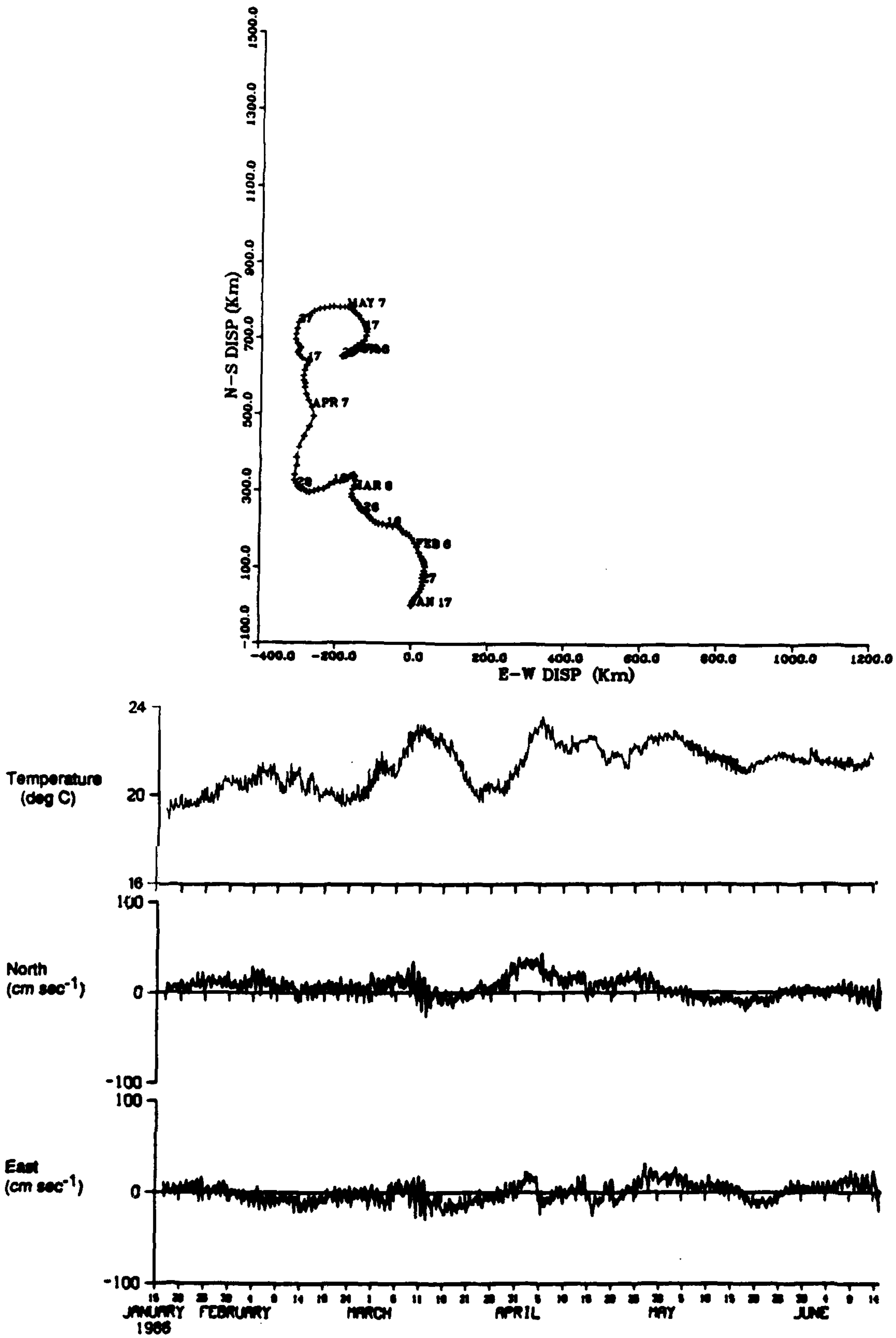
East, North, Temperature and progressive vector diagram for Mooring F8 120m.



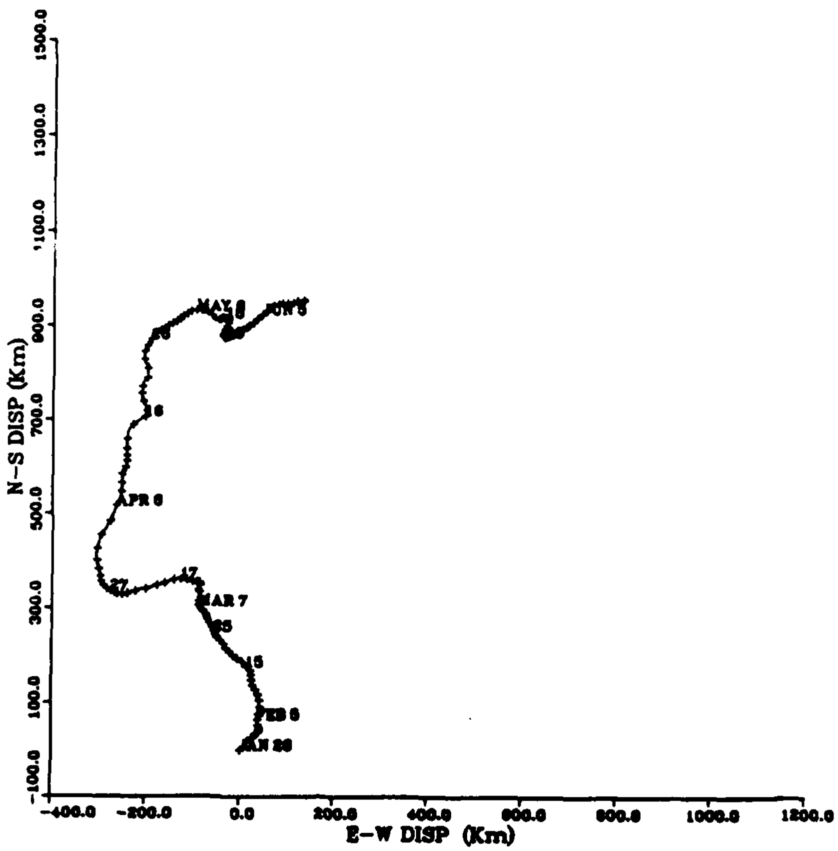
Temperature for Mooring F10 120m.

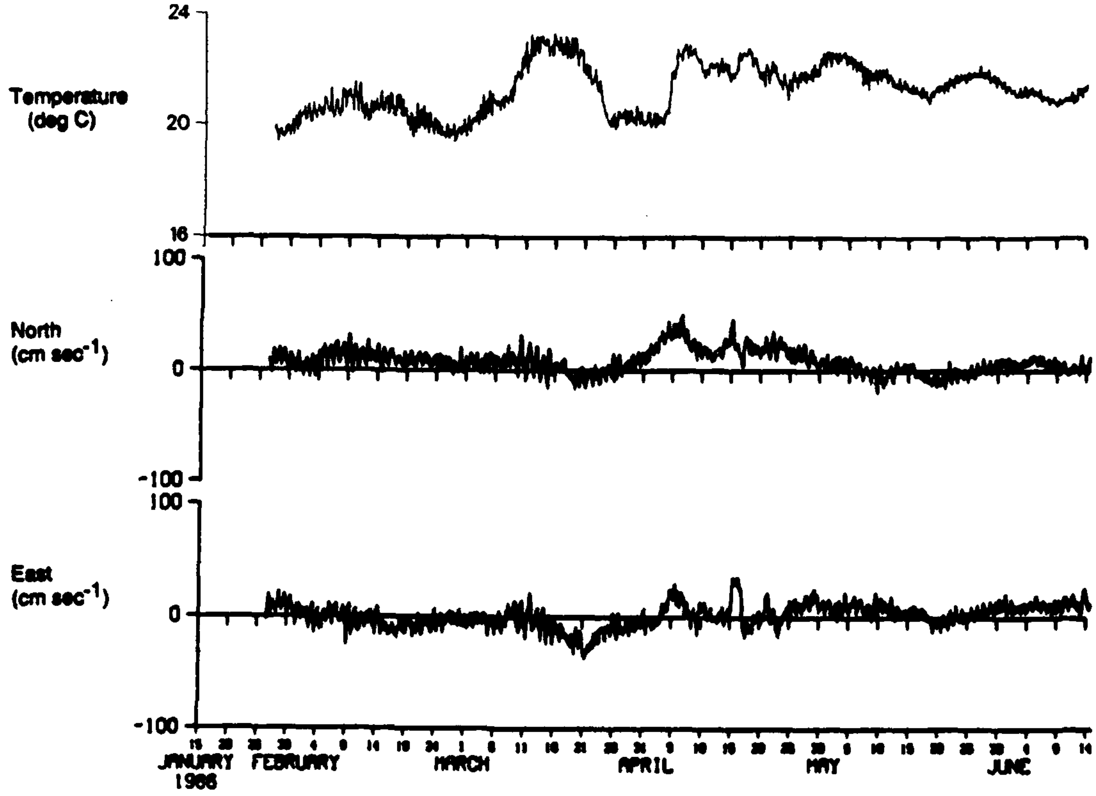


East, North, Temperature and progressive vector diagram for Mooring F2 160m.

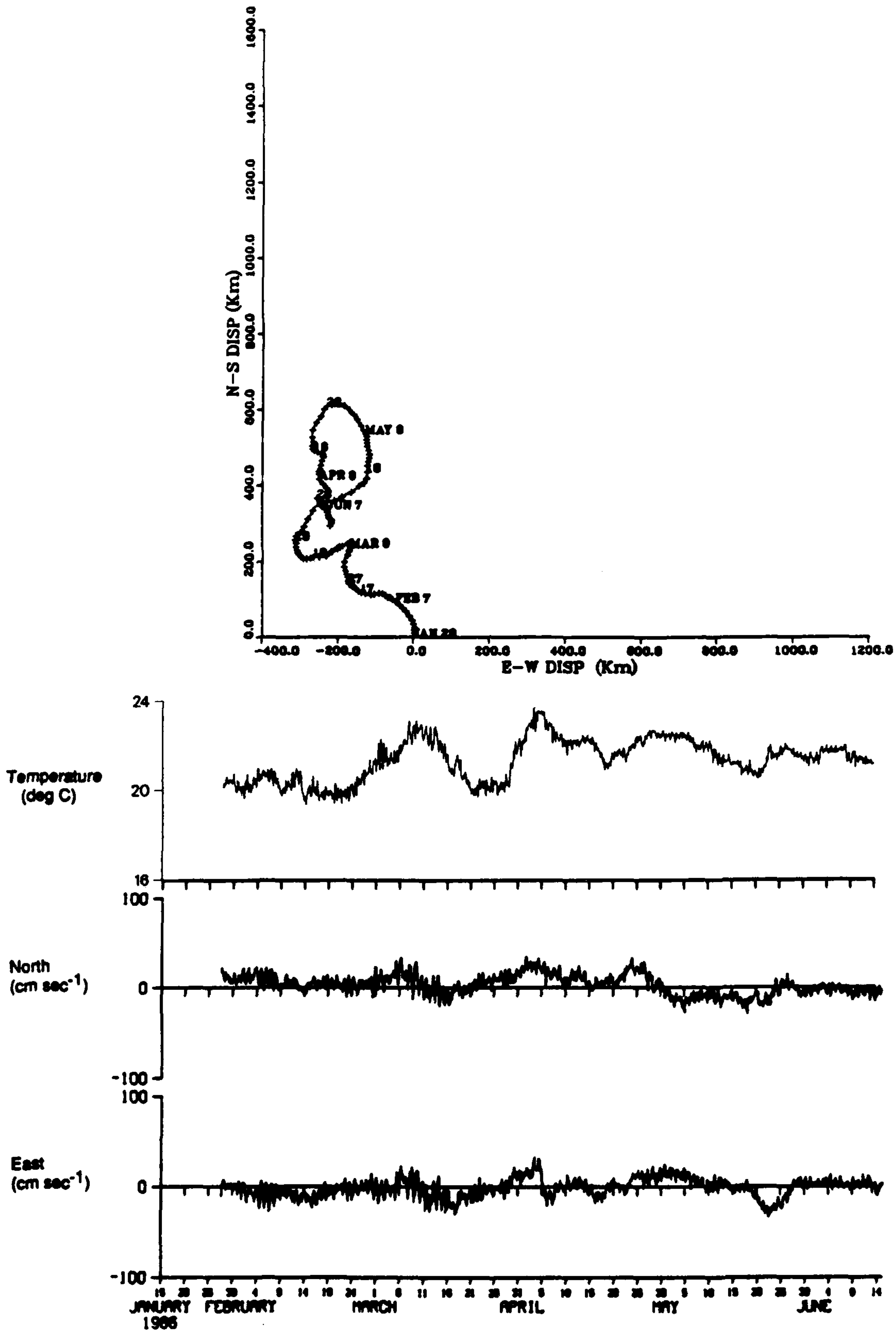


East, North, Temperature and progressive vector diagram for Mooring F4 160m.

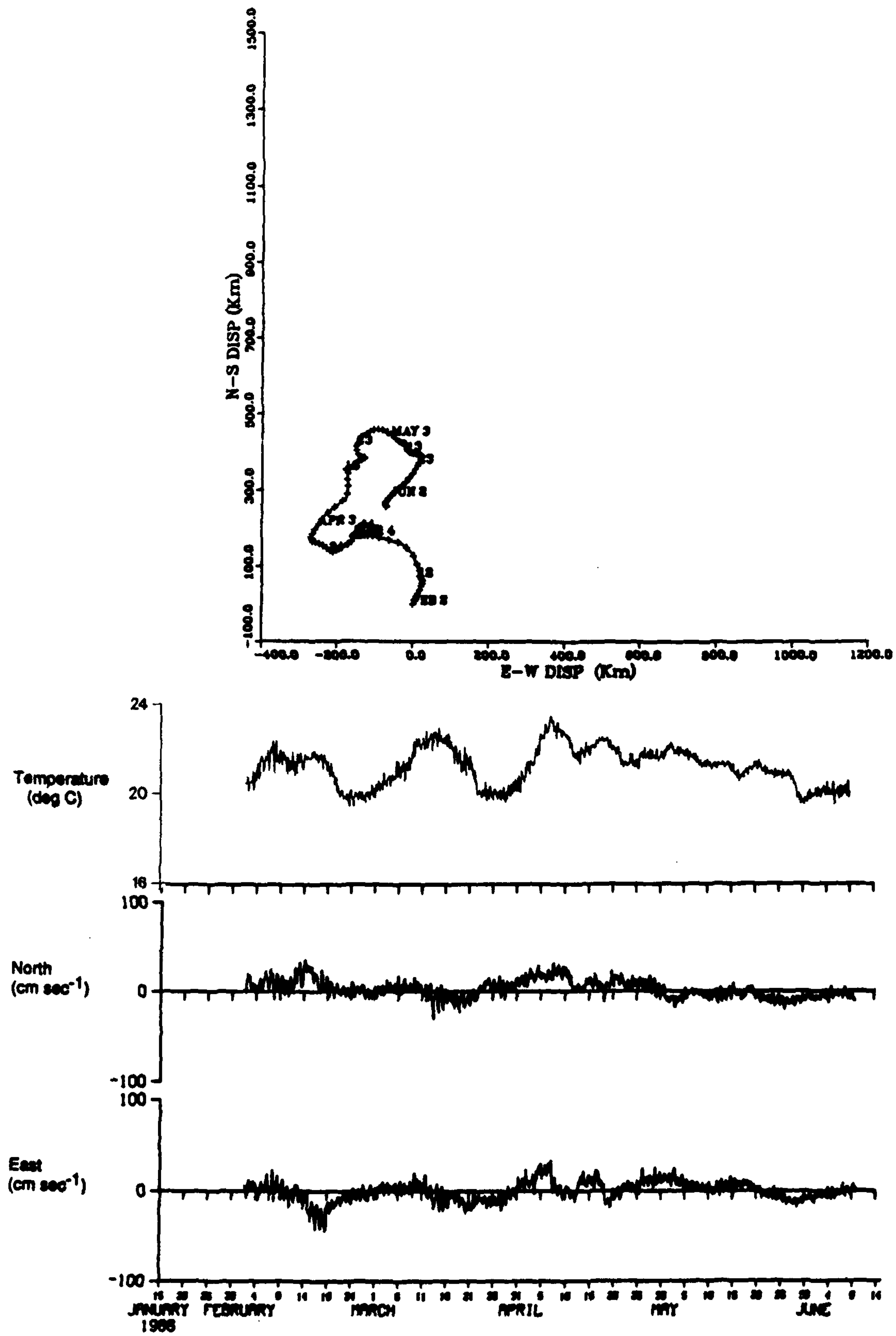




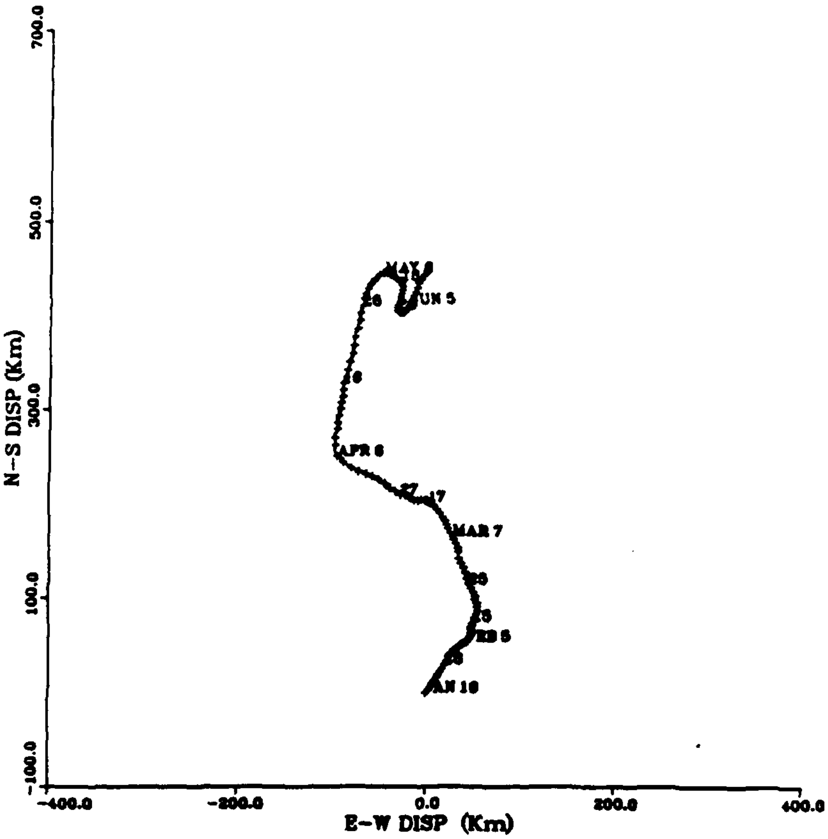
East, North, Temperature and progressive vector diagram for Mooring F6 160m.

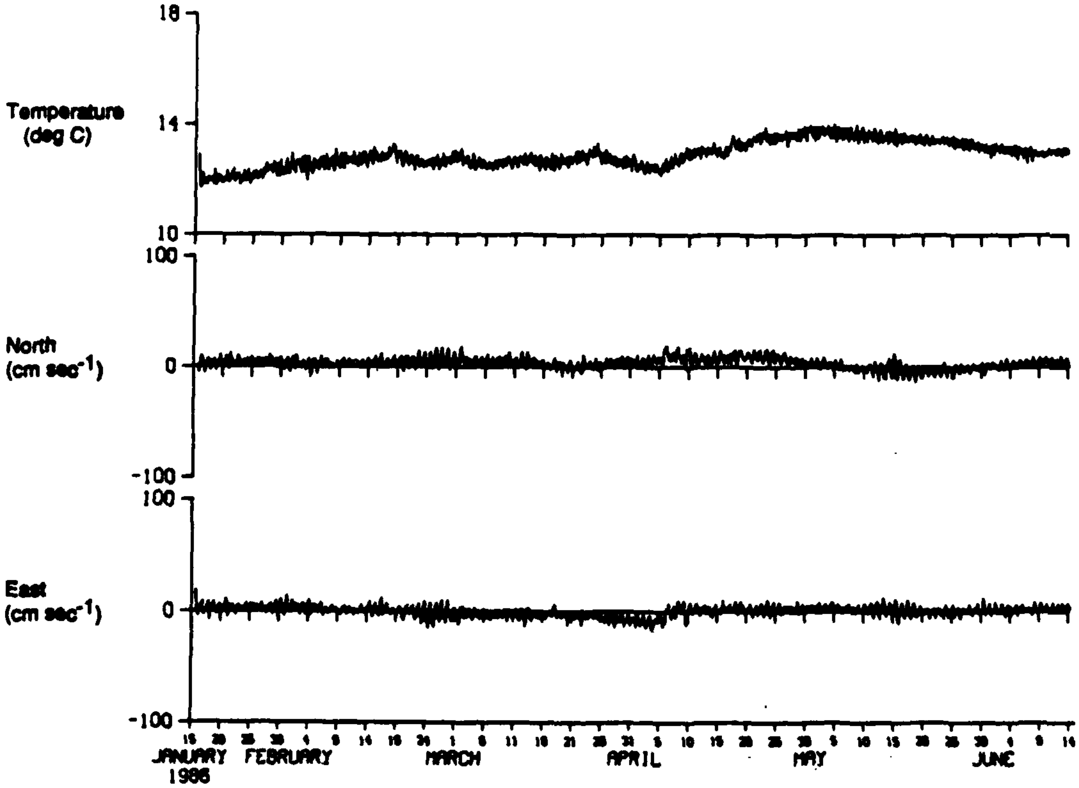


East, North, Temperature and progressive vector diagram for Mooring F8 160m.

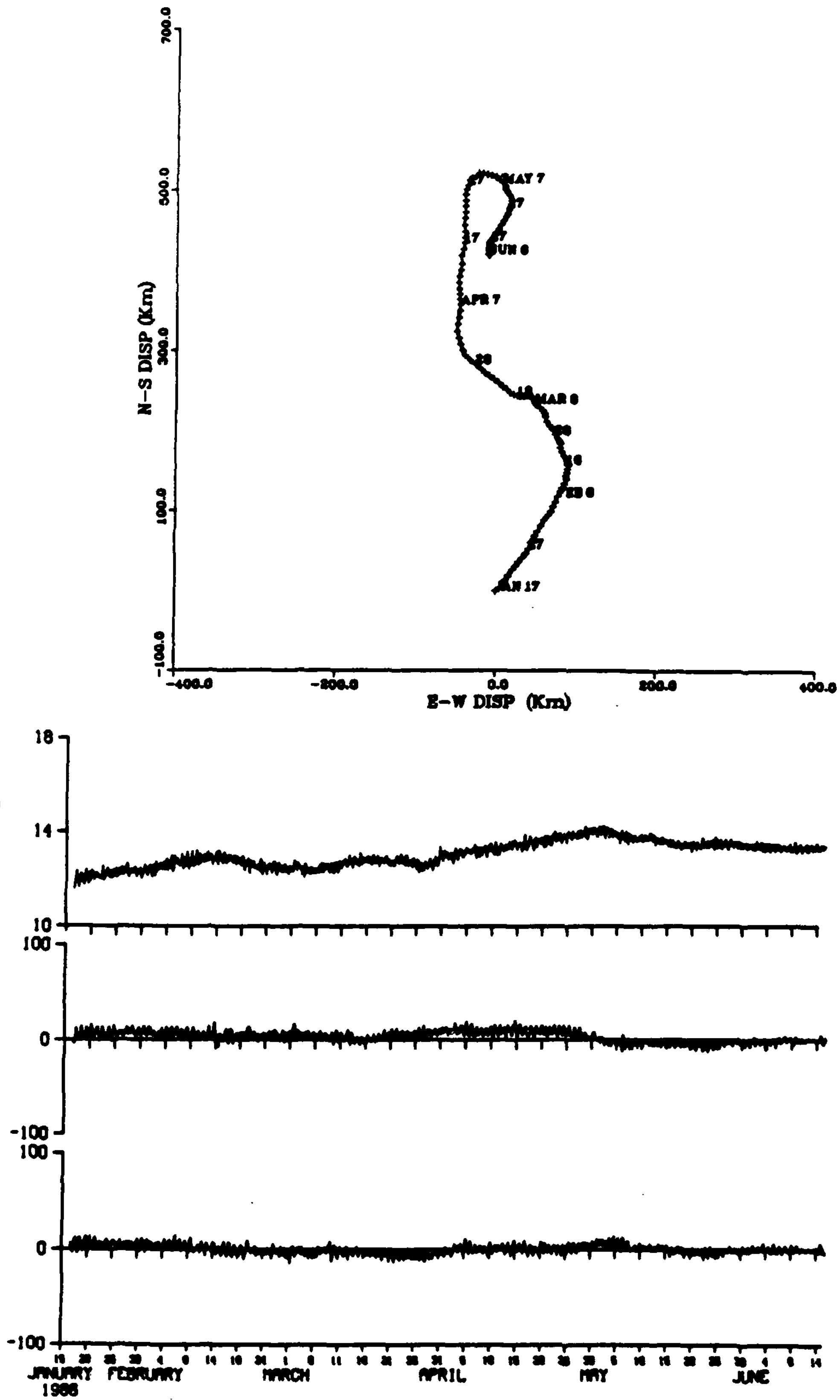


East, North, Temperature and progressive vector diagram for Mooring F10 160m.

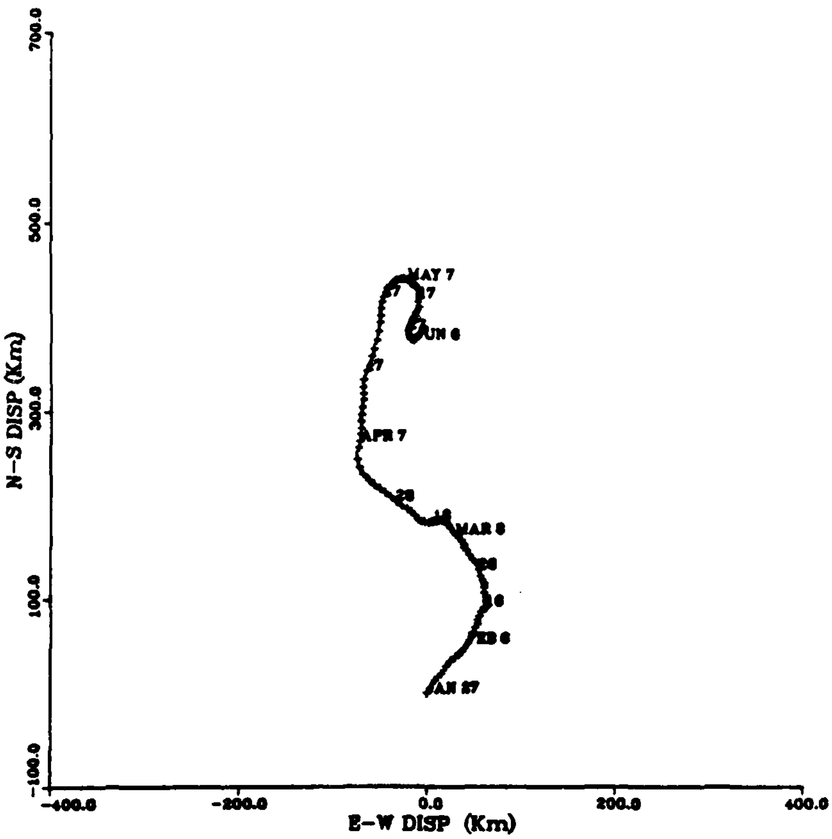


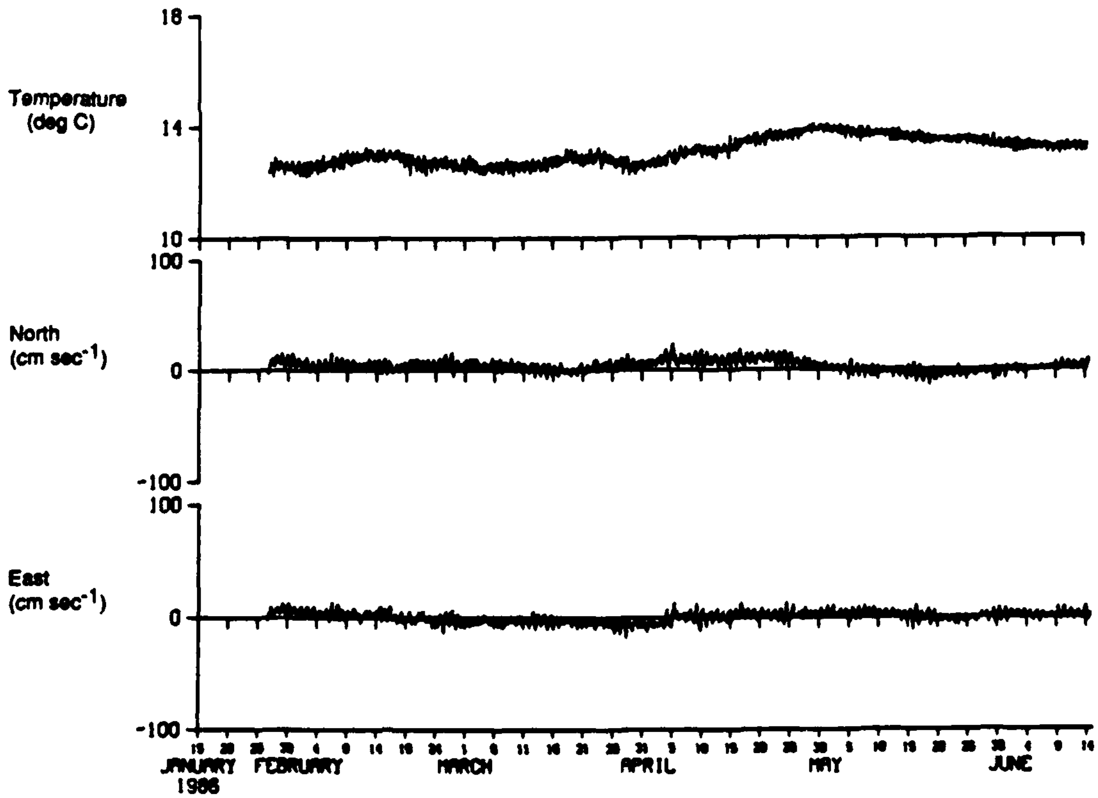


East, North, Temperature and progressive vector diagram for Mooring F2 700m.

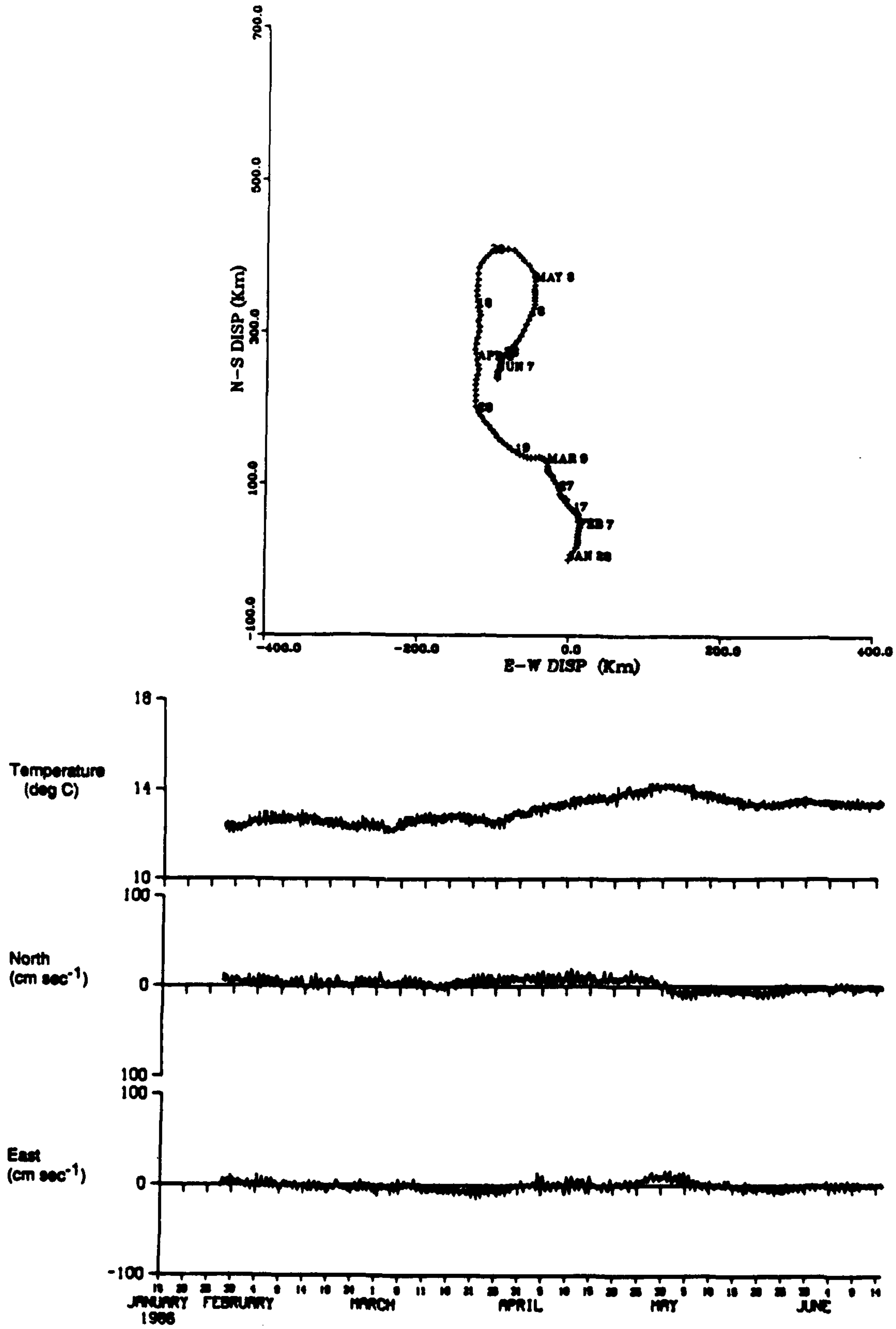


East, North, Temperature and progressive vector diagram for Mooring F4 700m.

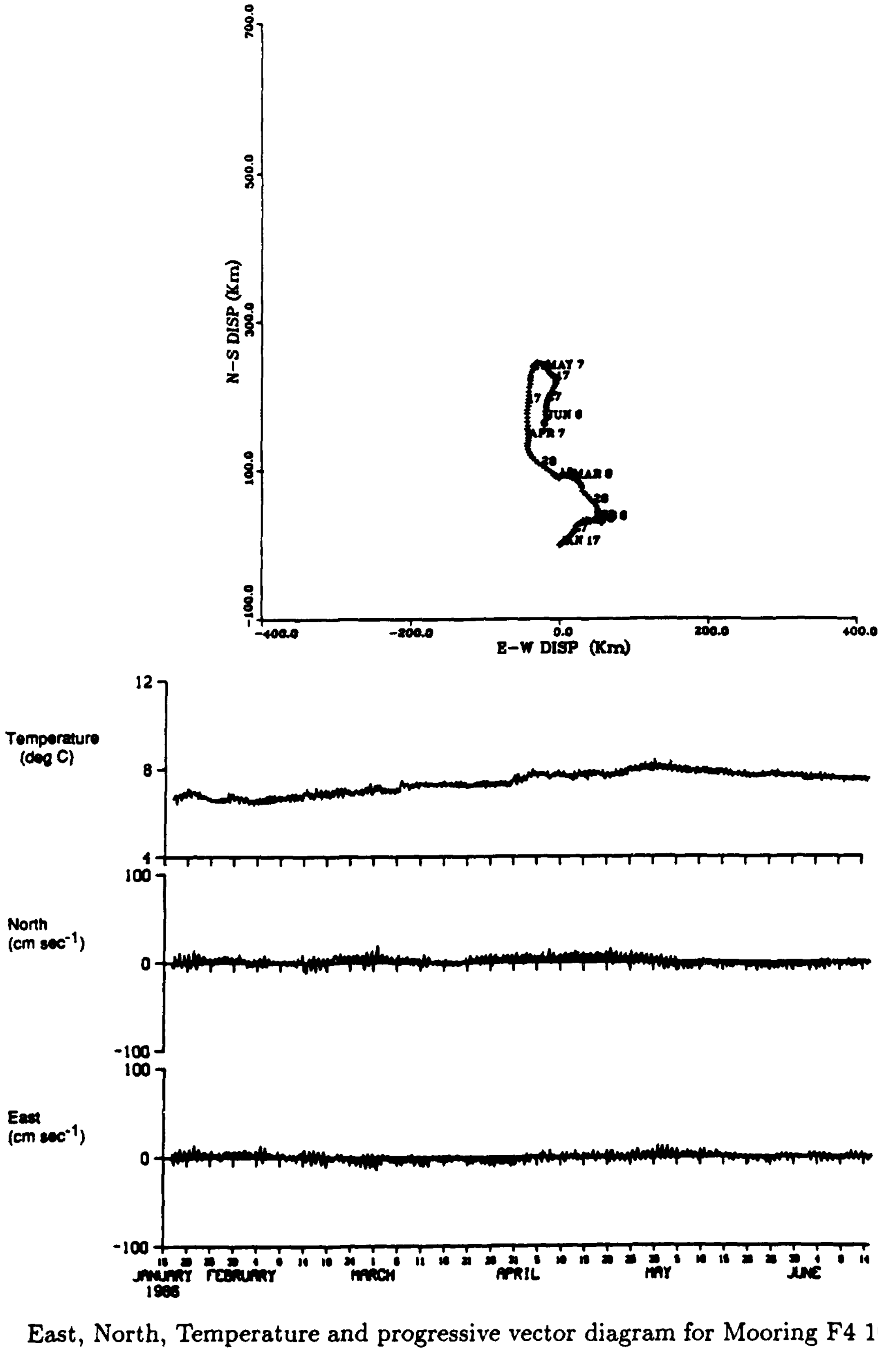




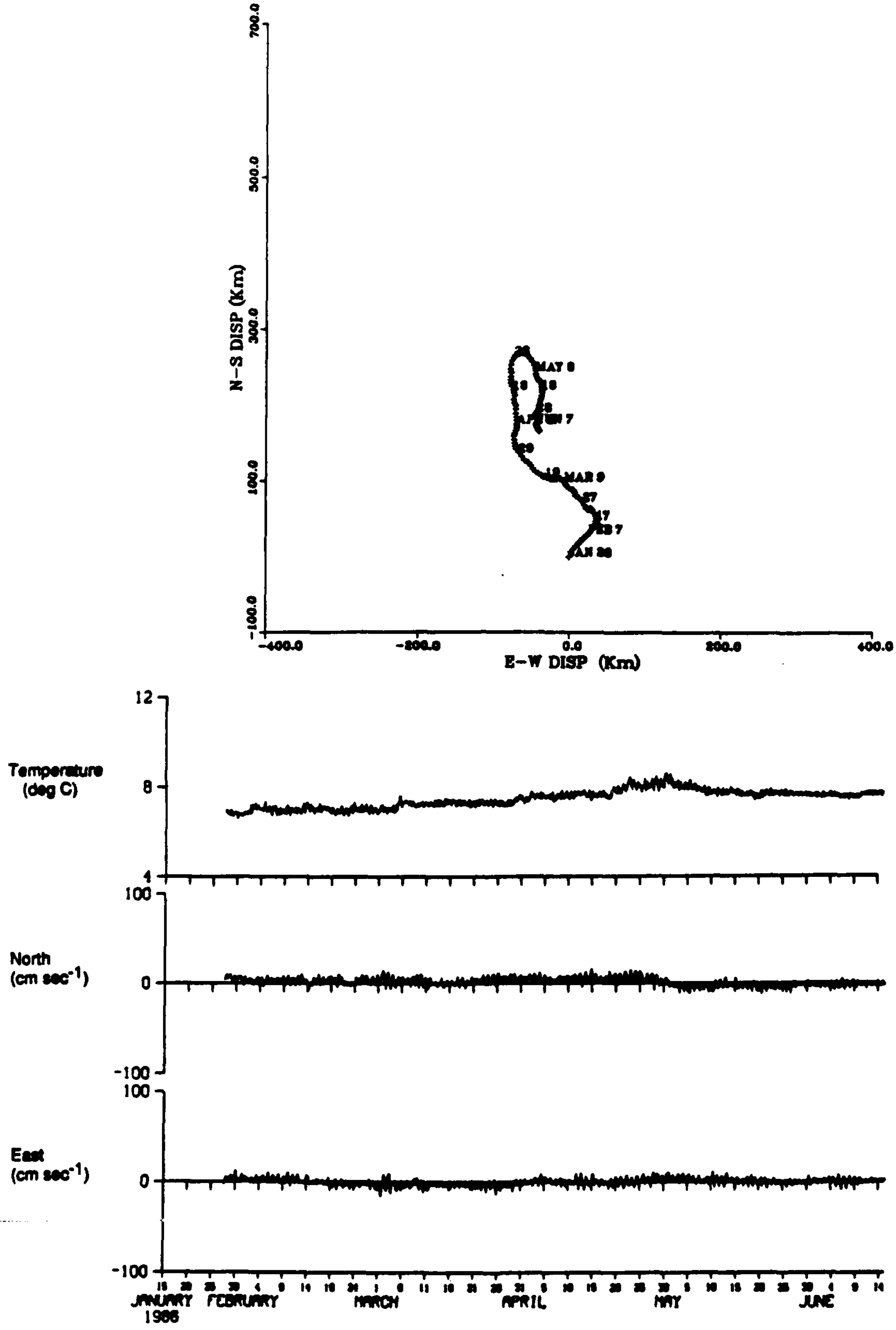
East, North, Temperature and progressive vector diagram for Mooring F6 700m.



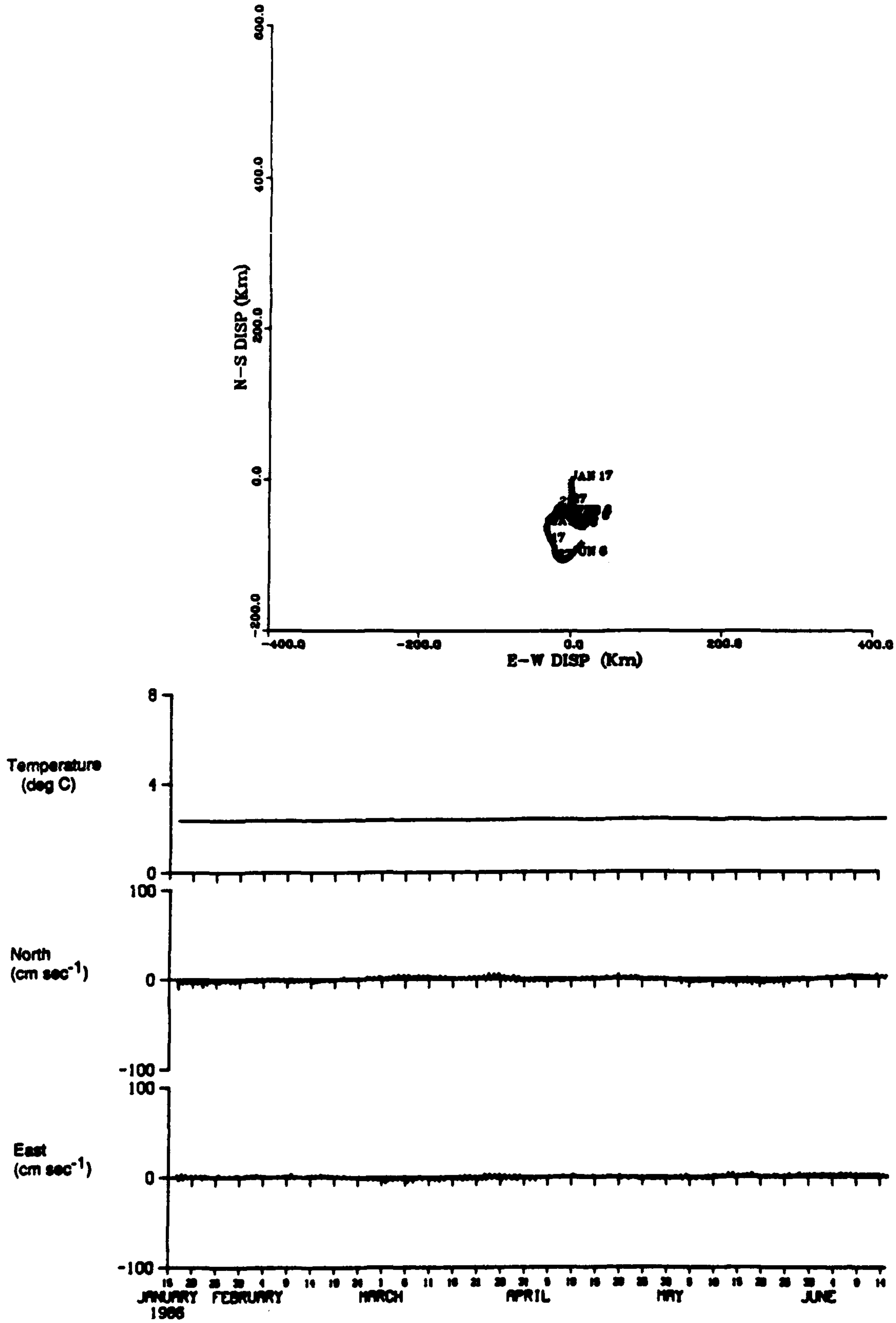
East, North, Temperature and progressive vector diagram for Mooring F8 700m.



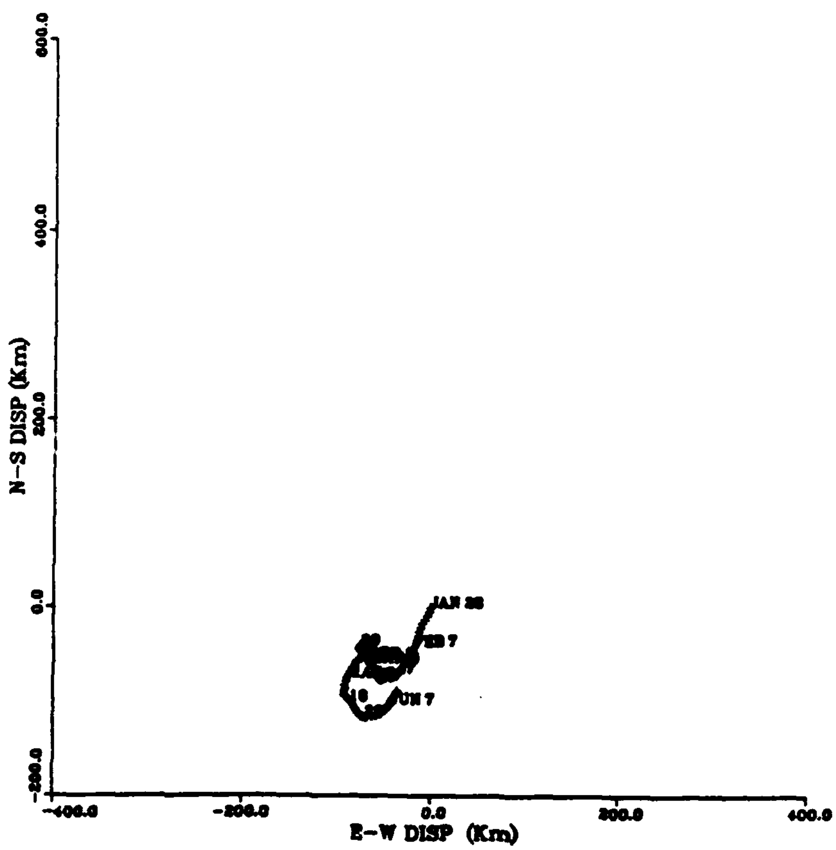
East, North, Temperature and progressive vector diagram for Mooring F4 1000m.

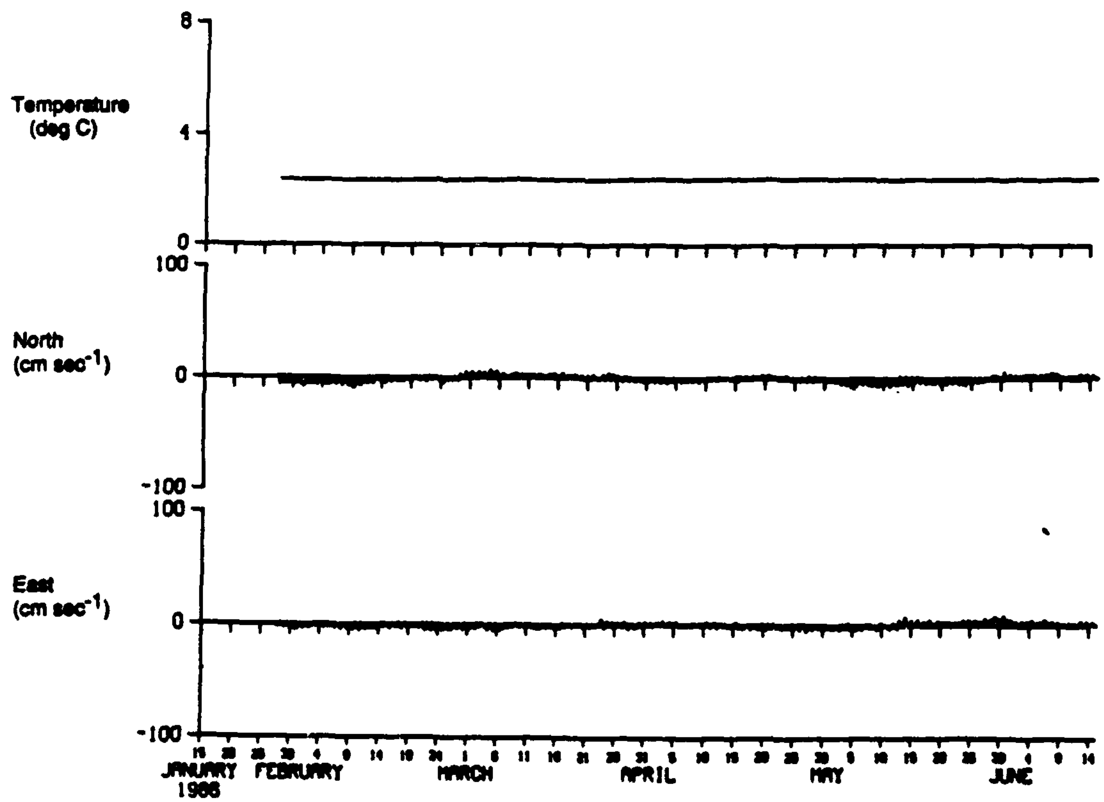


East, North, Temperature and progressive vector diagram for Mooring F8 1000m.

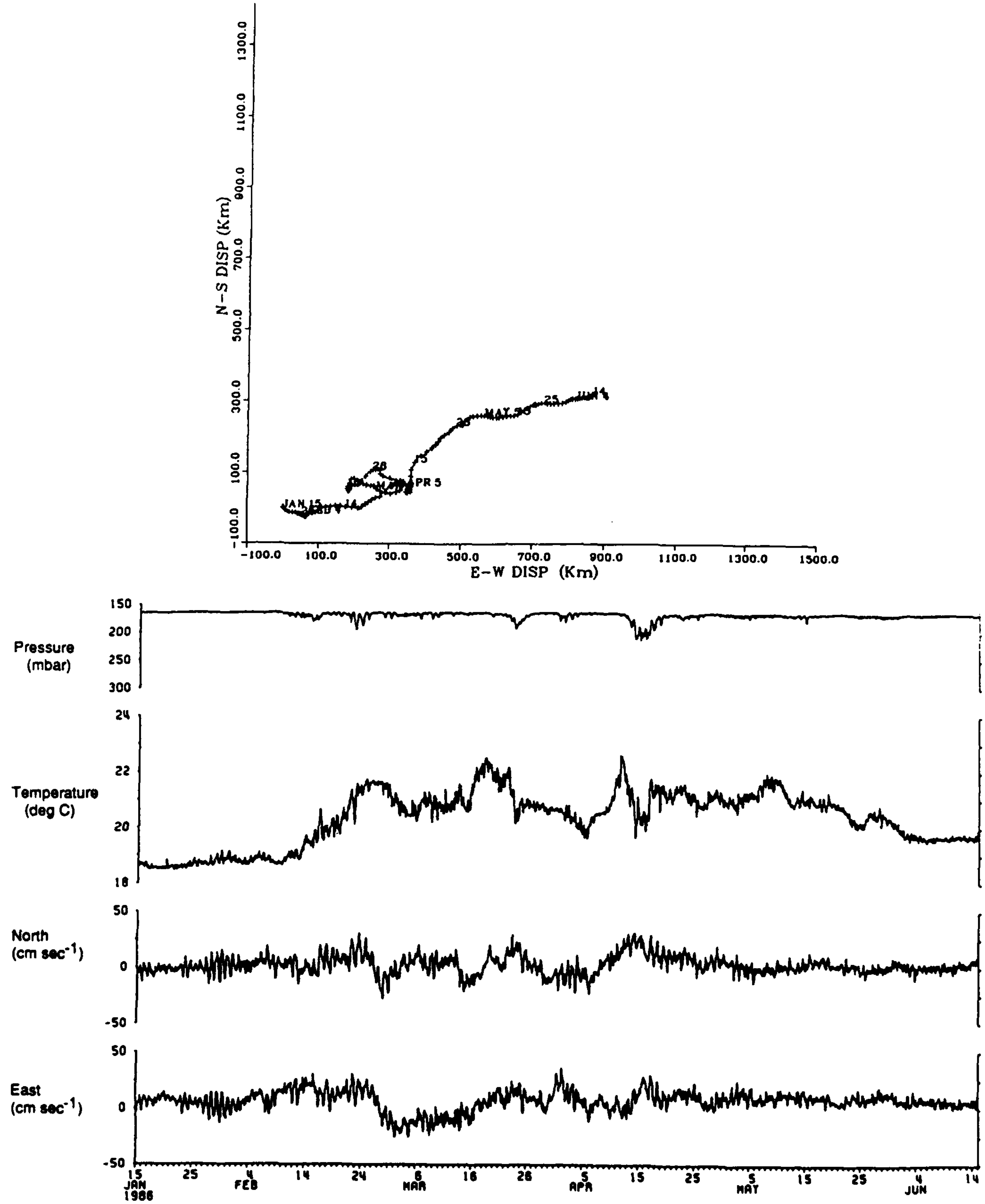


East, North, Temperature and progressive vector diagram for Mooring F4 4000m.

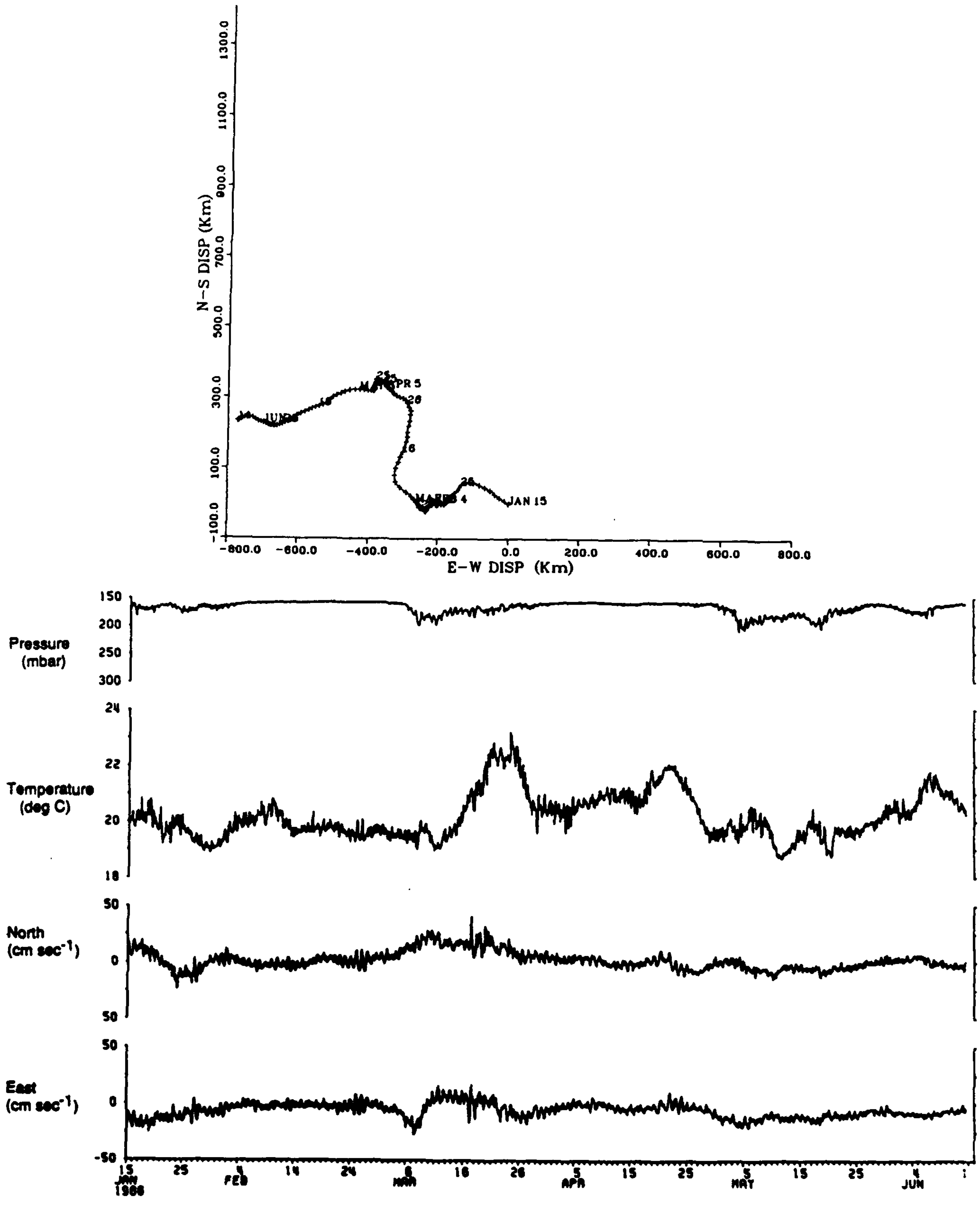




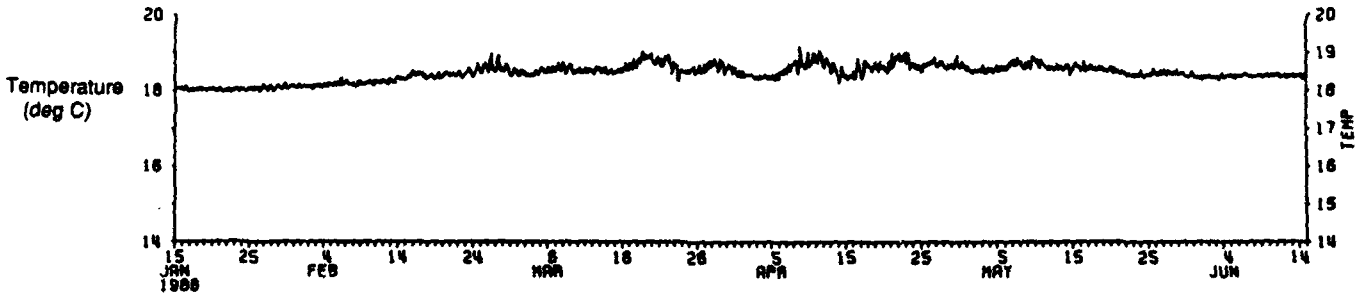
East, North, Temperature and progressive vector diagram for Mooring F8 4000m.



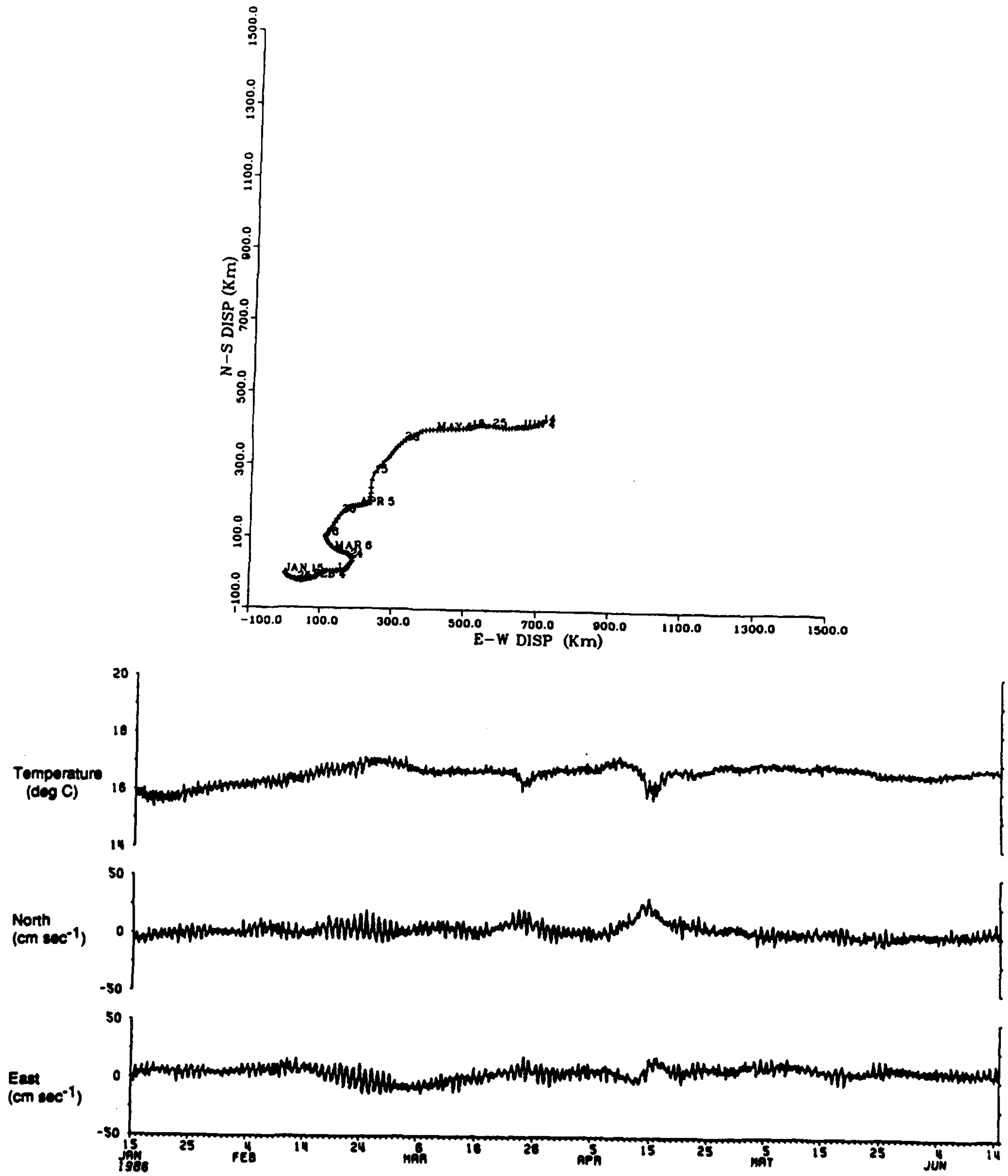
East, North, Temperature, Pressure and progressive vector diagram for Mooring F1 162m.



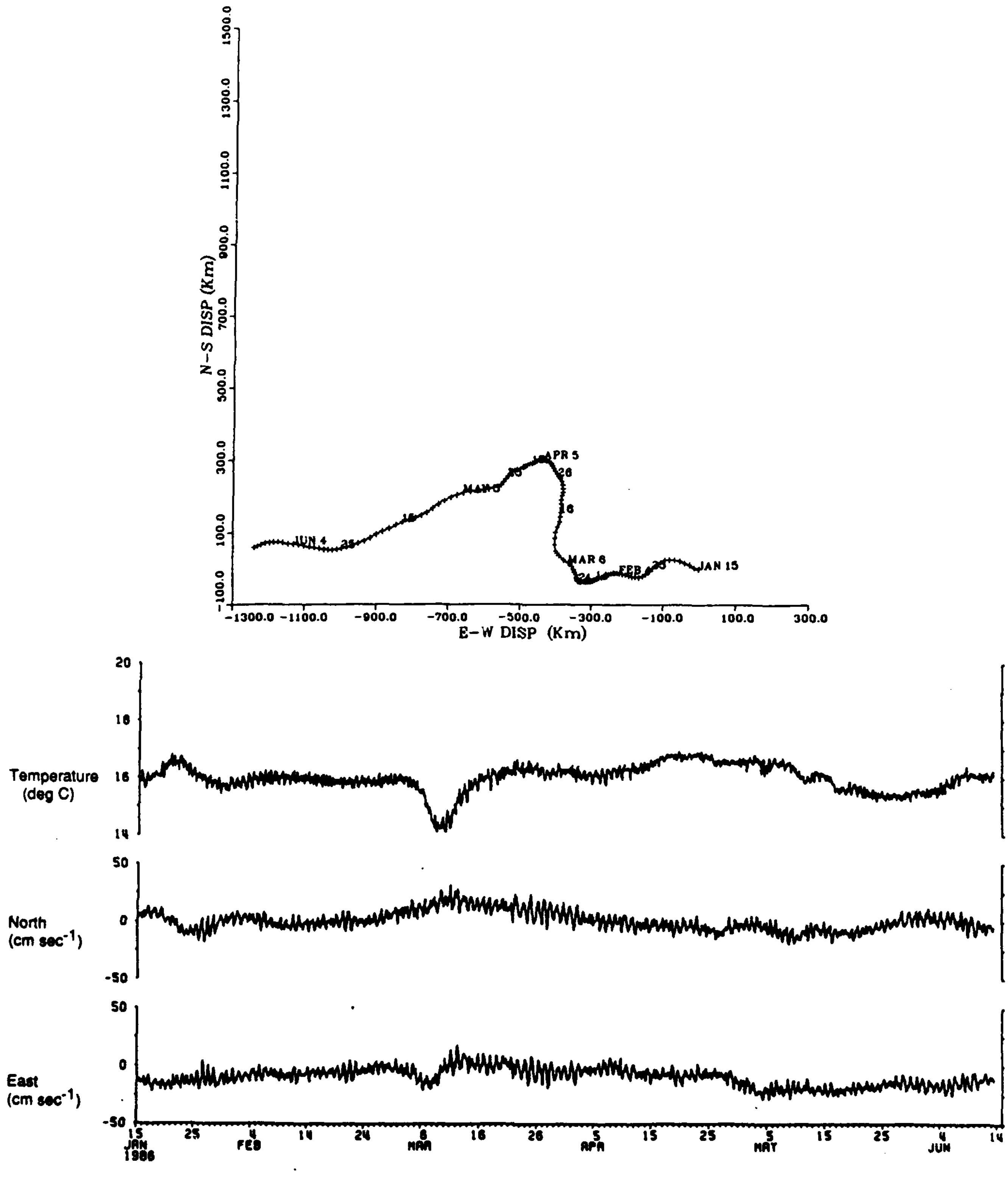
East, North, Temperature, Pressure and progressive vector diagram for Mooring F12 159m.



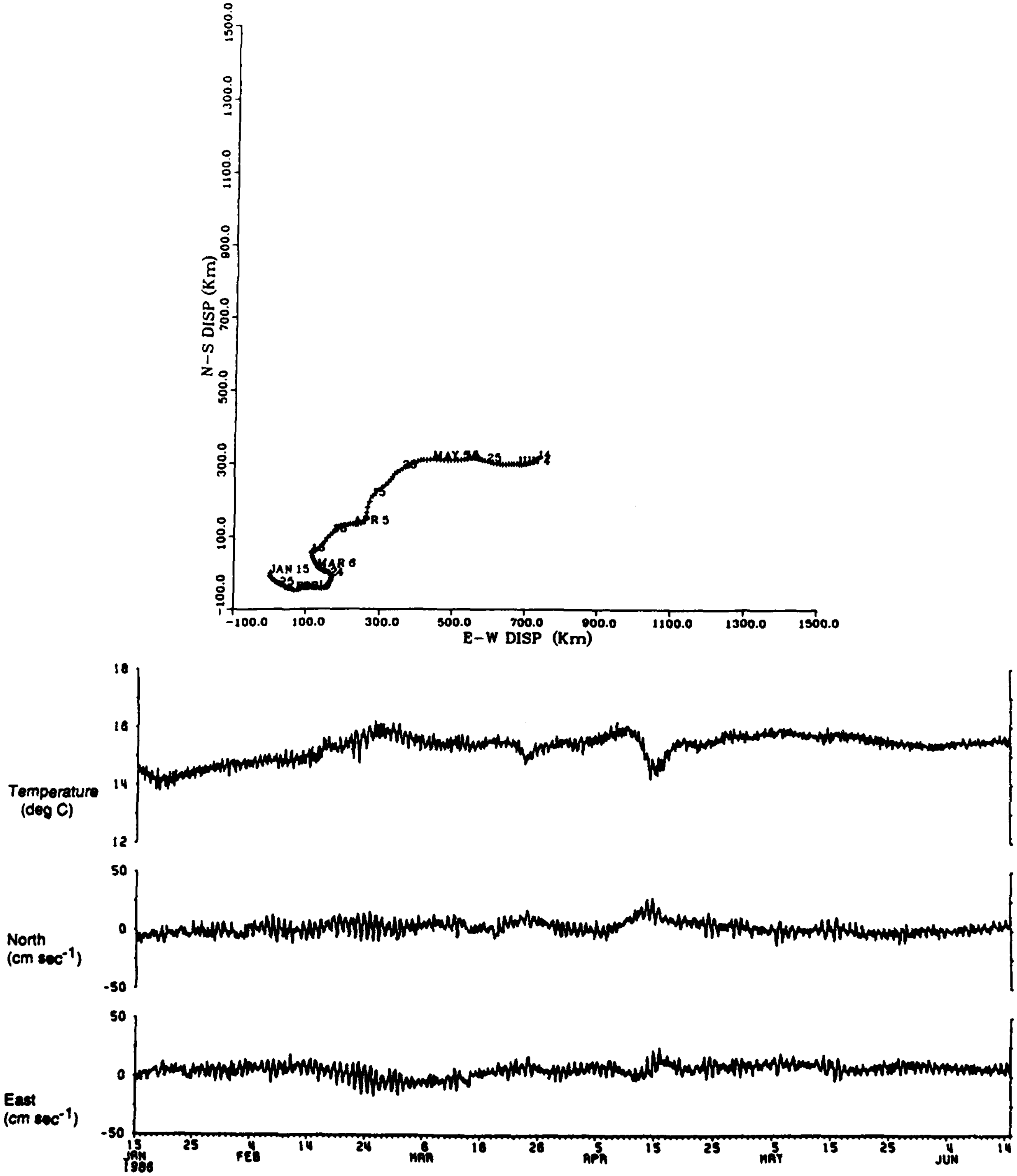
Temperature for Mooring F1 262m.



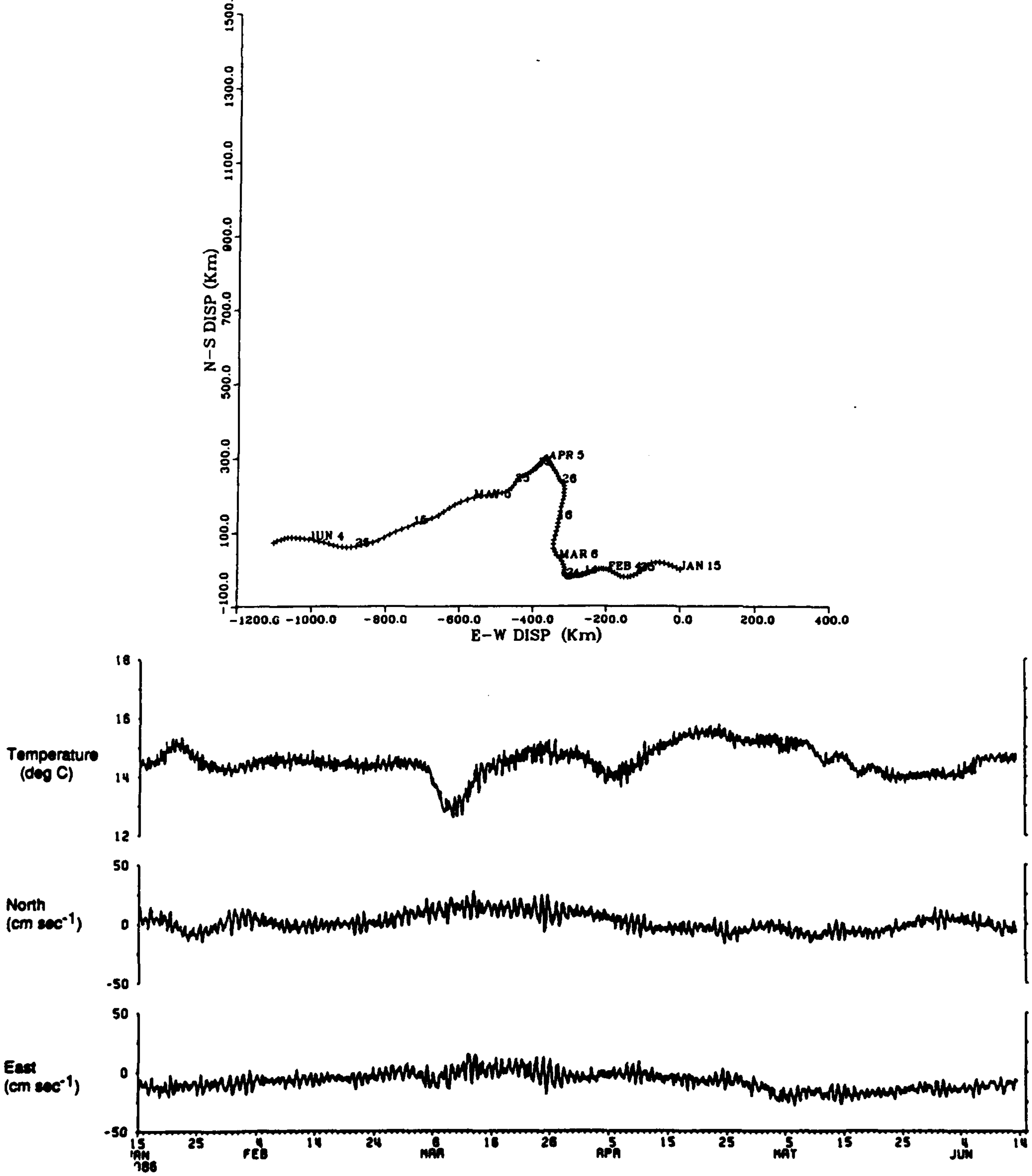
East, North, Temperature and progressive vector diagram for Mooring F1 487m.



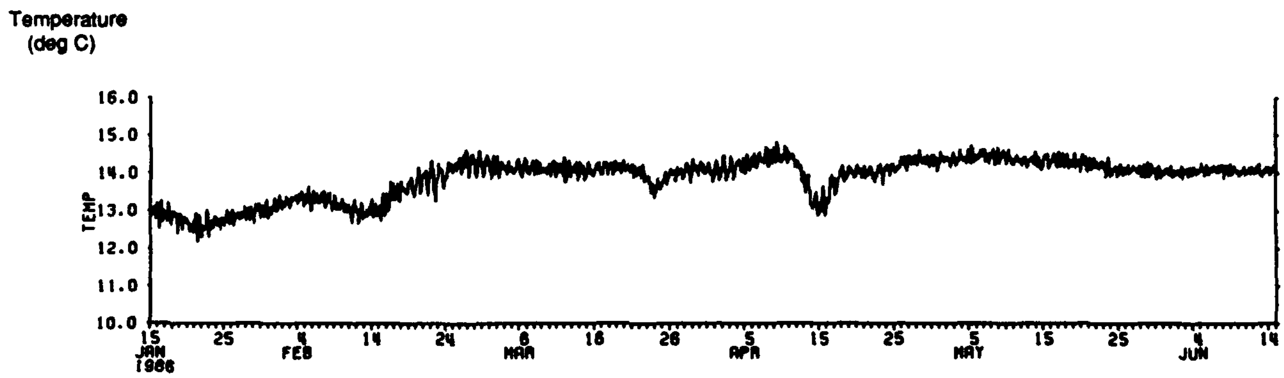
East, North, Temperature and progressive vector diagram for Mooring F12 485m.



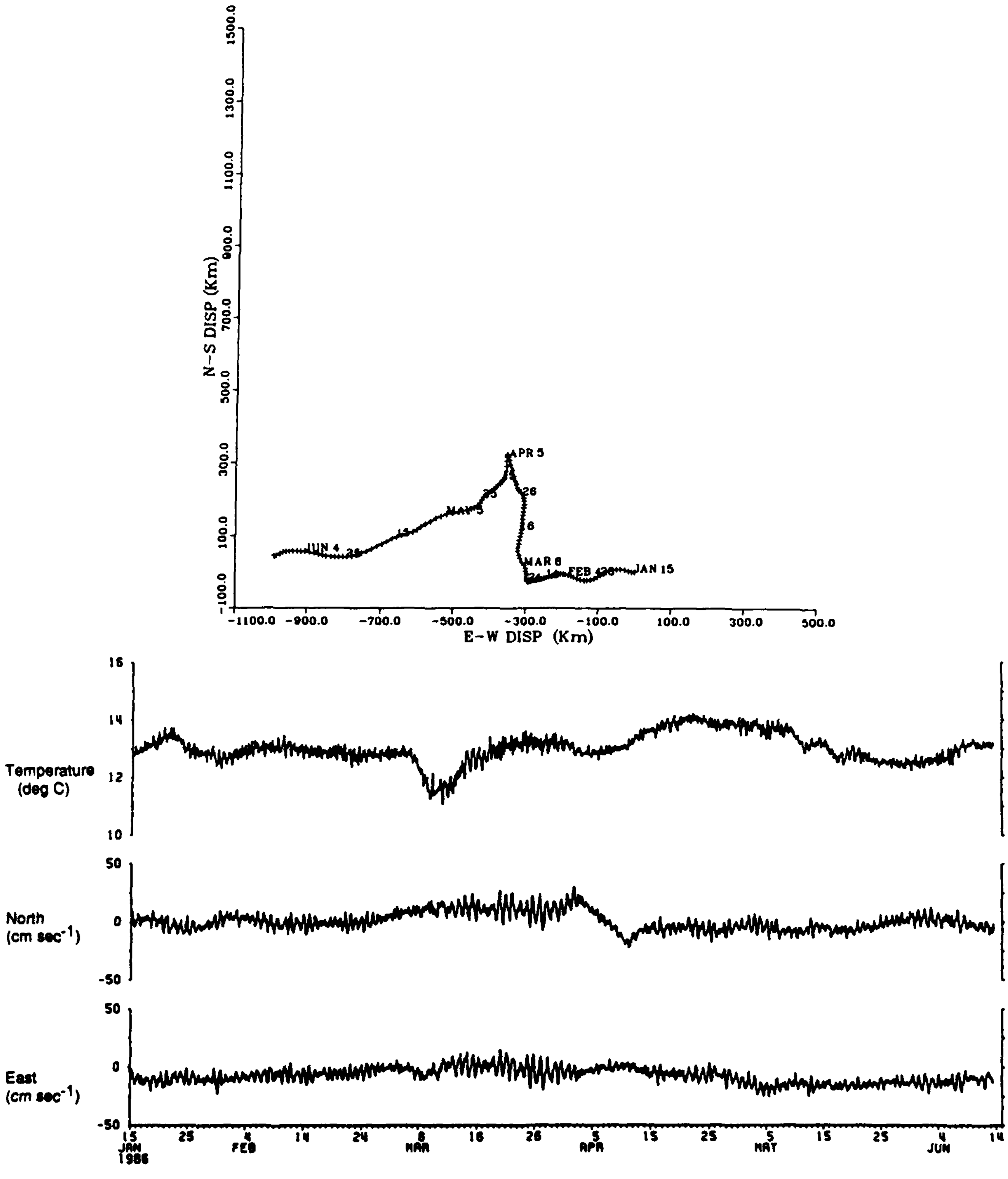
East, North, Temperature and progressive vector diagram for Mooring F1 562m.



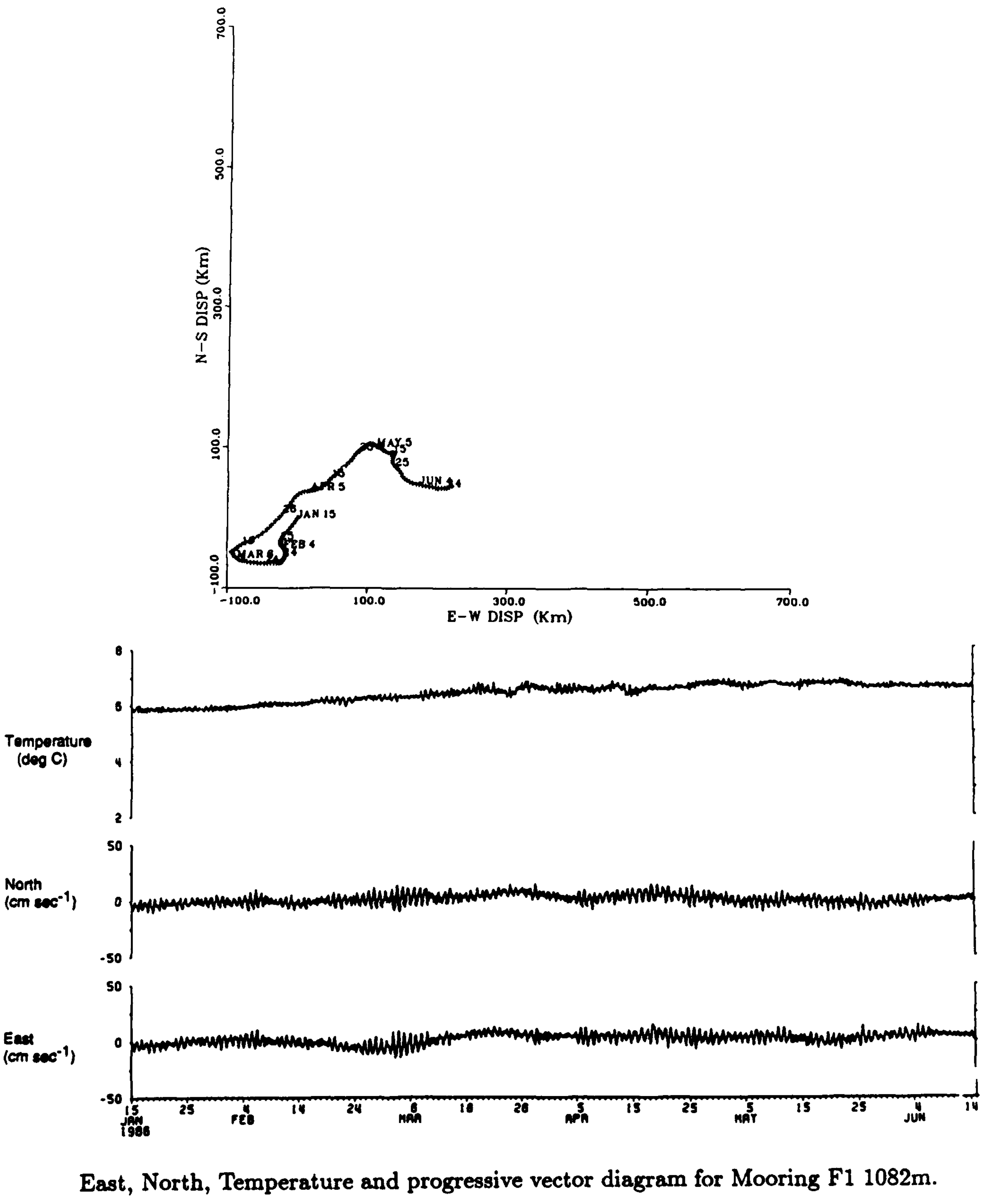
East, North, Temperature and progressive vector diagram for Mooring F12 559m.



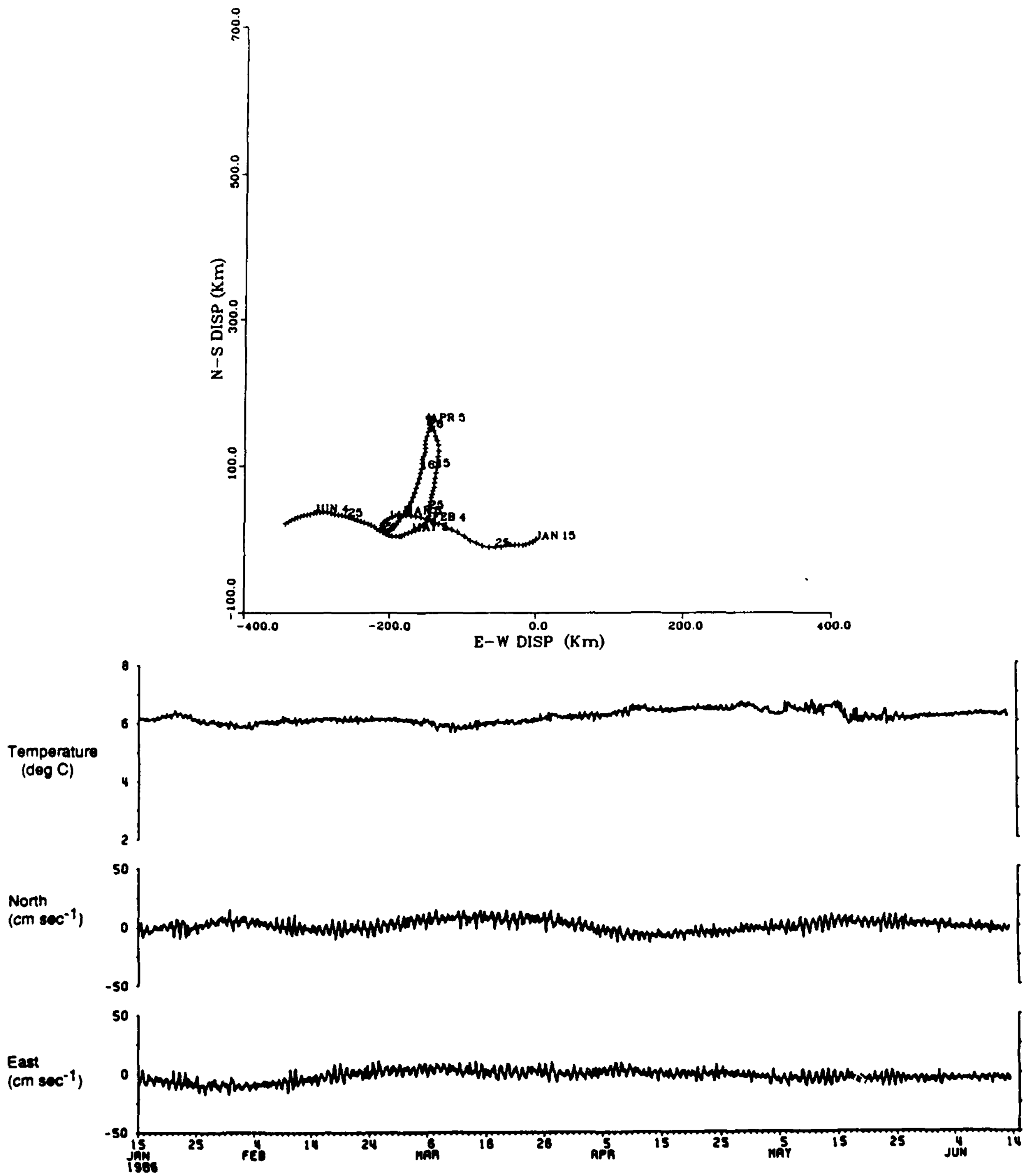
Temperature for Mooring F1 637m.



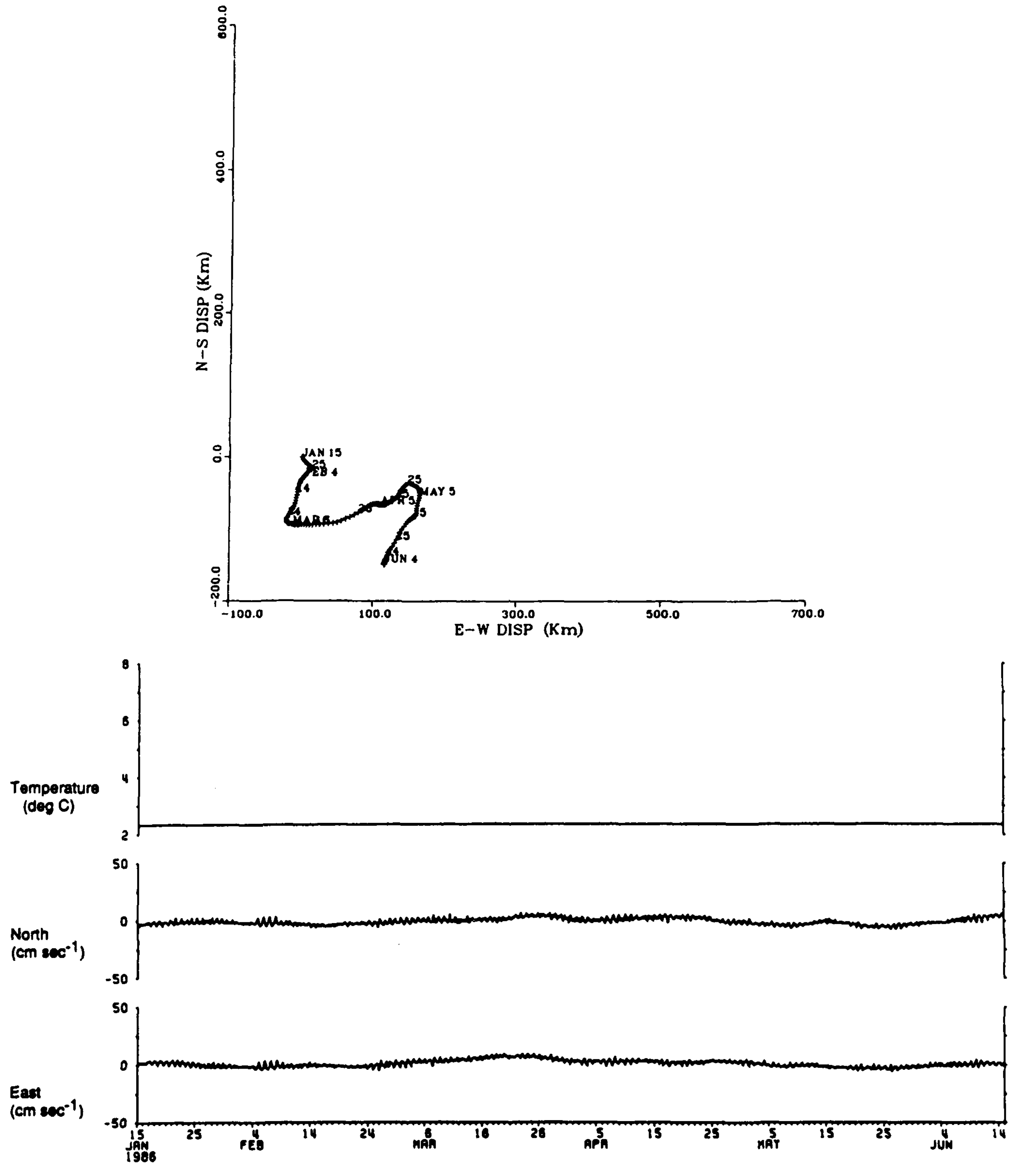
East, North, Temperature and progressive vector diagram for Mooring F12 634m.



East, North, Temperature and progressive vector diagram for Mooring F1 1082m.



East, North, Temperature and progressive vector diagram for Mooring F12 1059m.



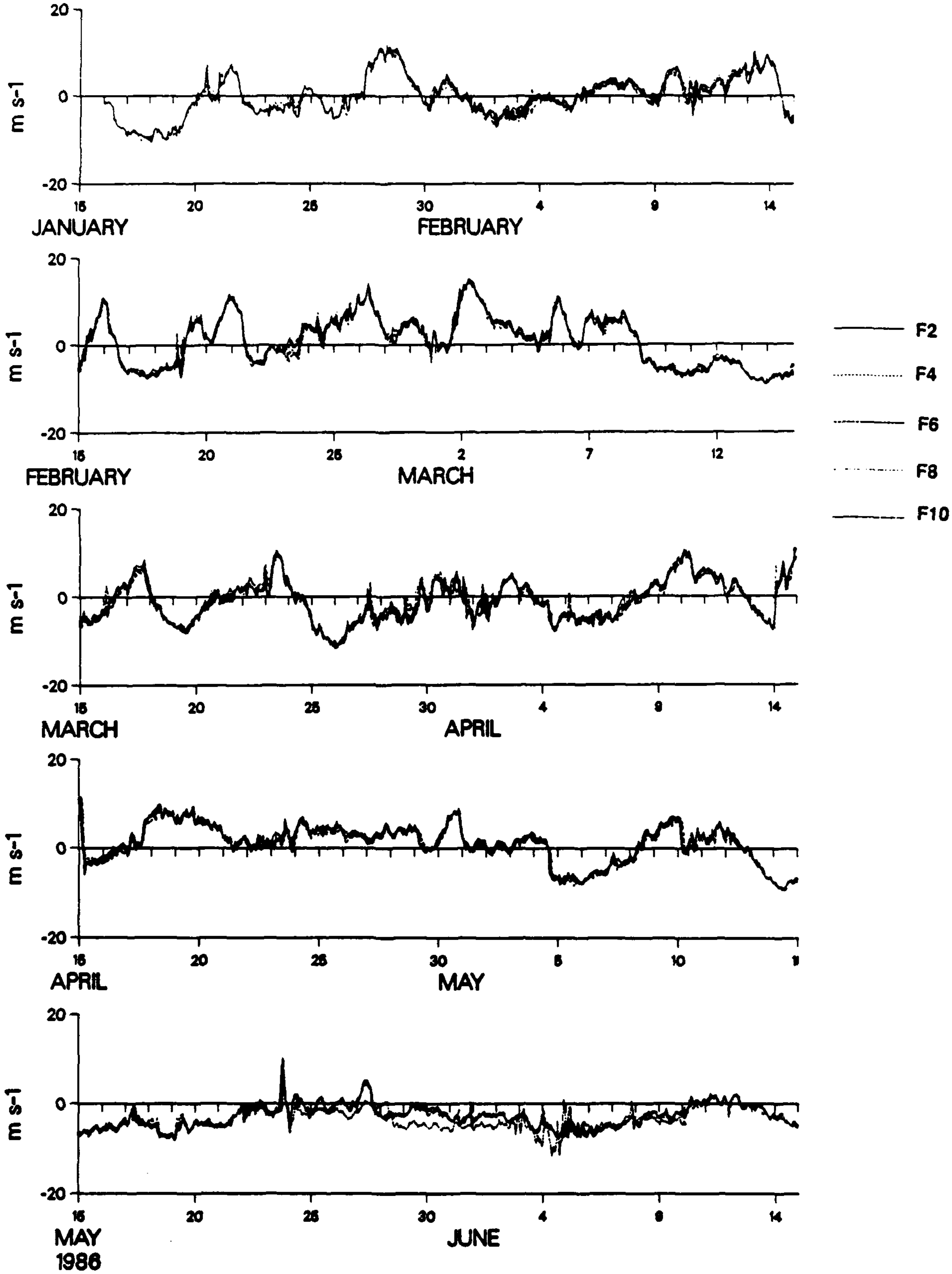
East, North, Temperature and progressive vector diagram for Mooring F1 4062m.

6. Composite Plots

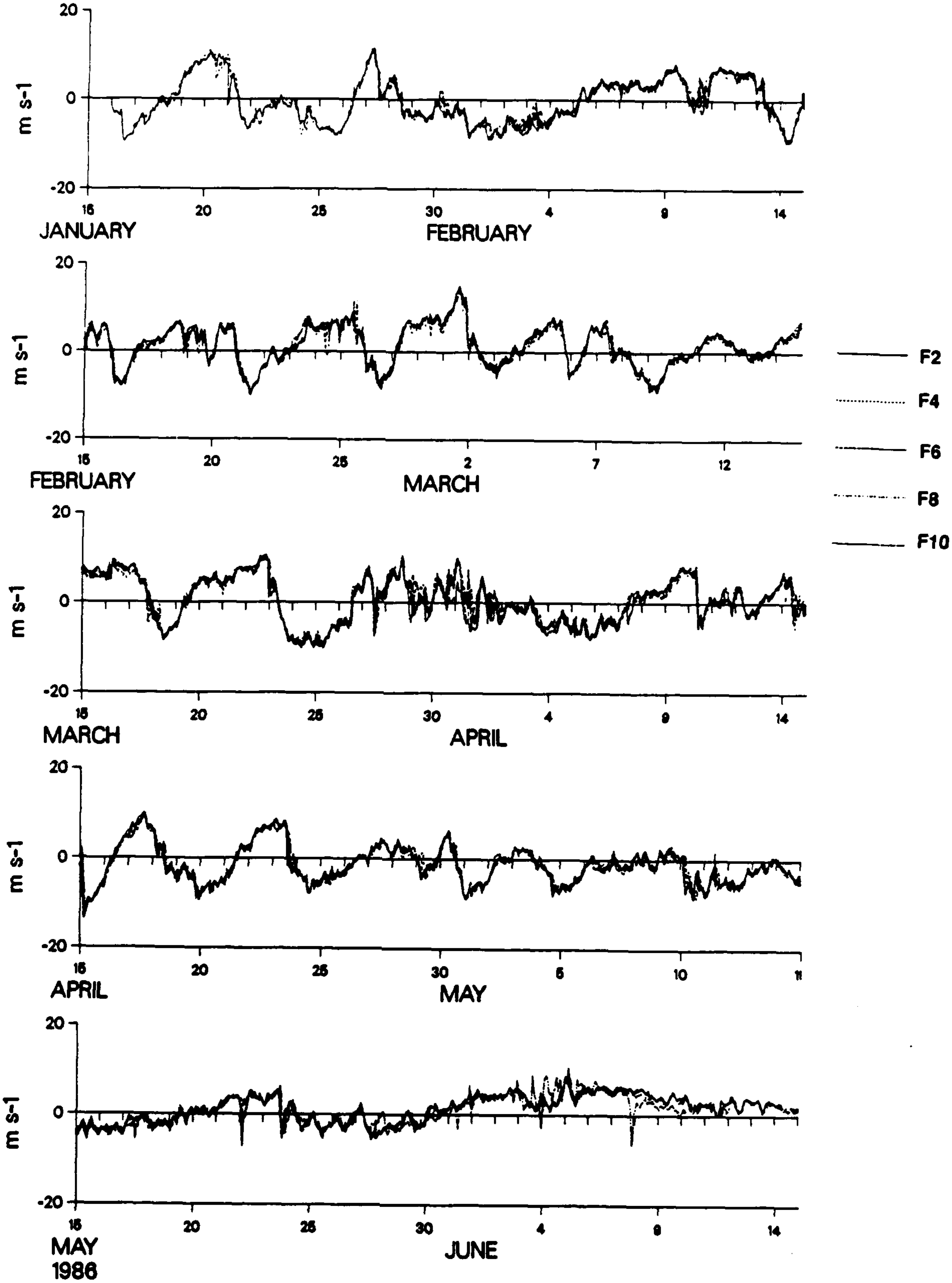
Meteorological and oceanographic data are presented in this section. Meteorological composites are first, current meter composites follow next and plots combining meteorological and oceanographic data are last. The time axes are set to approximately 6" for the FASINEX six month time period while the vertical scales change depending on the variables plotted.

Rotary spectral plots show clockwise component as a solid line and counter-clockwise component as a dashed line.

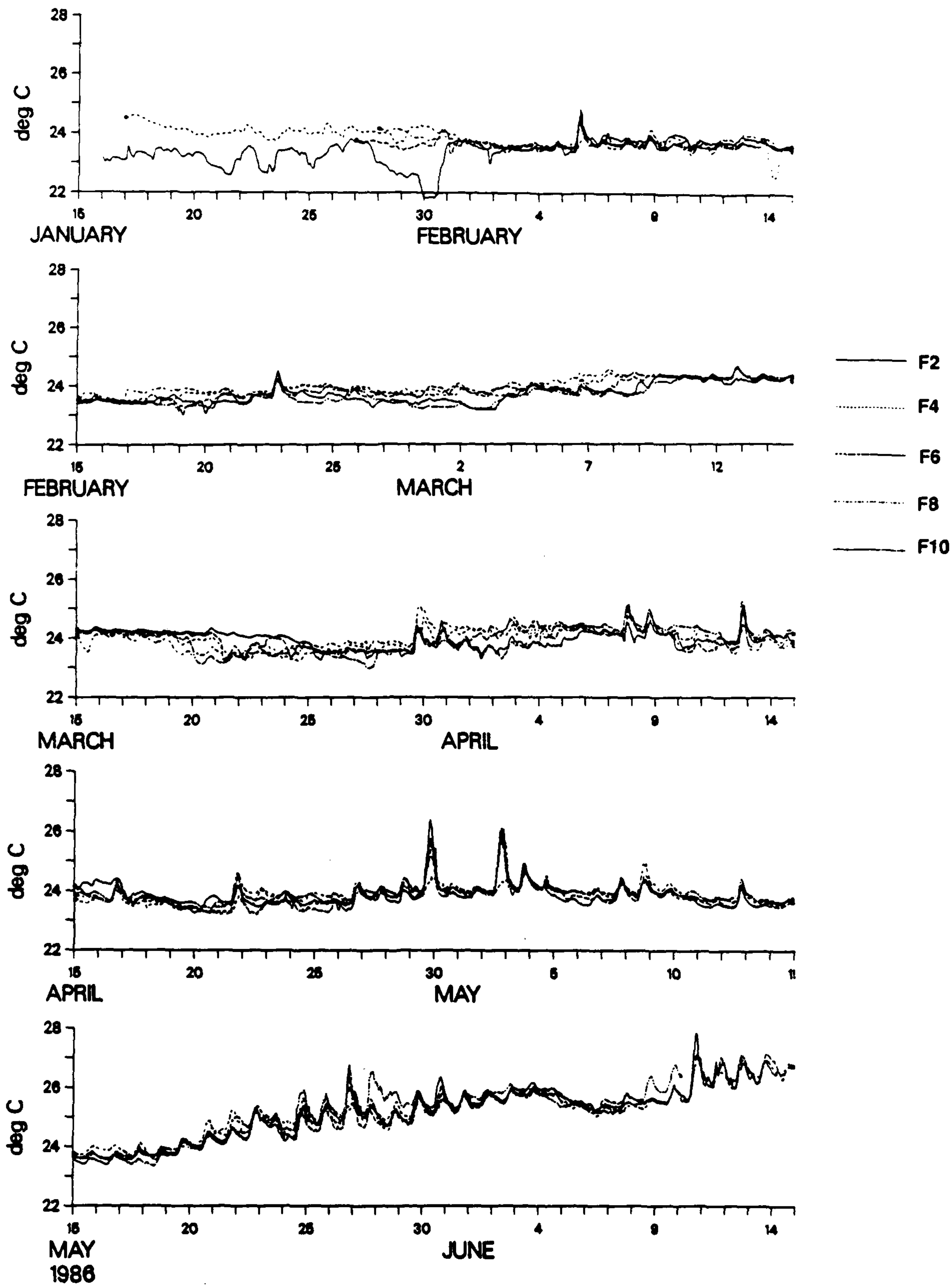
	pages
Meteorological variable overplots.	146-152
Surface mooring velocity stick plots.	153-158
Subsurface mooring velocity stick plots.	159-160
Surface mooring composite Temperature plots.	161-166
Subsurface moorings composite Temperature plots.	167-168
Composite velocity and Temperature spectra.	169-175



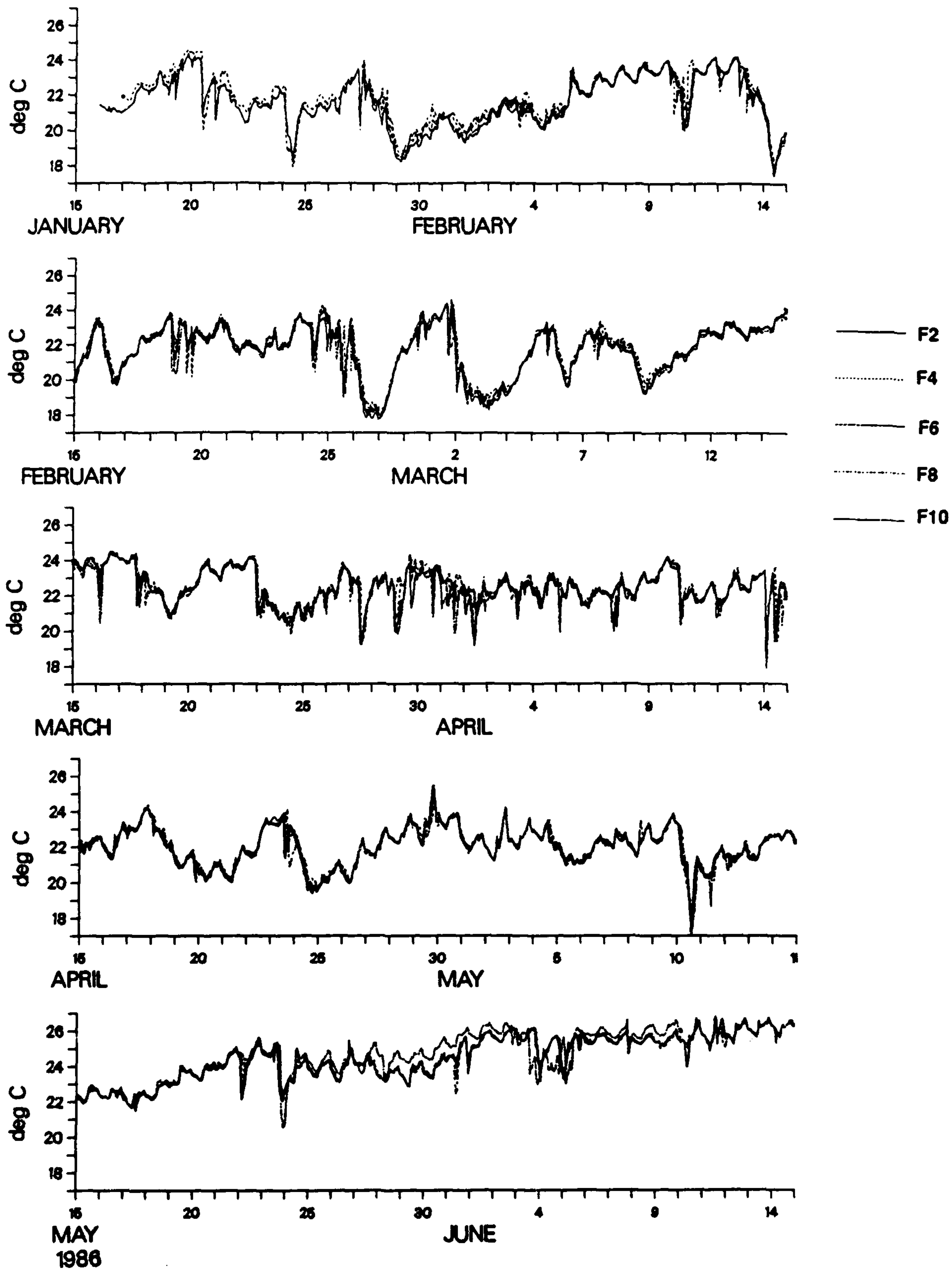
Five surface buoys East overplot.



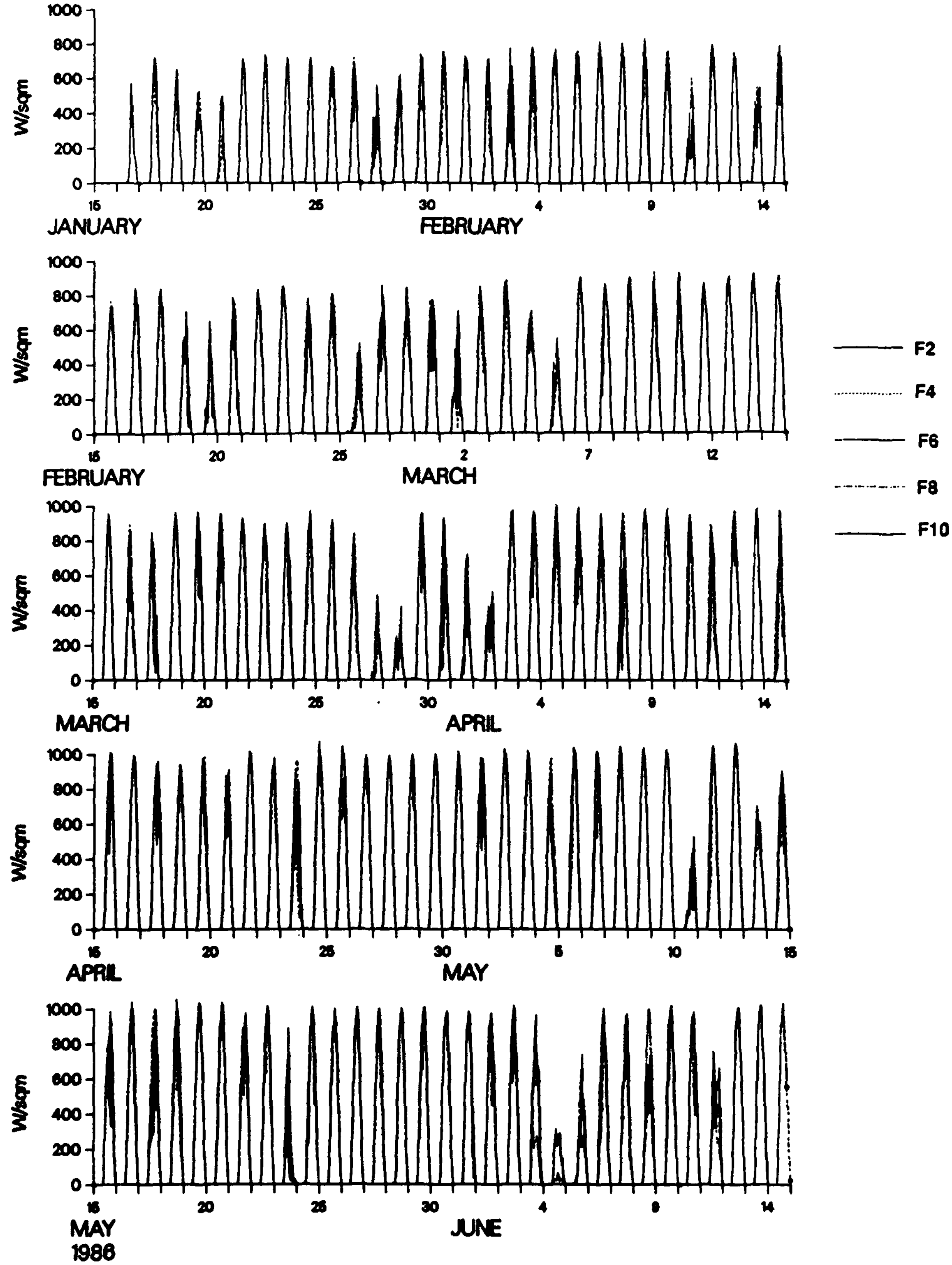
Five surface buoys North overplot.



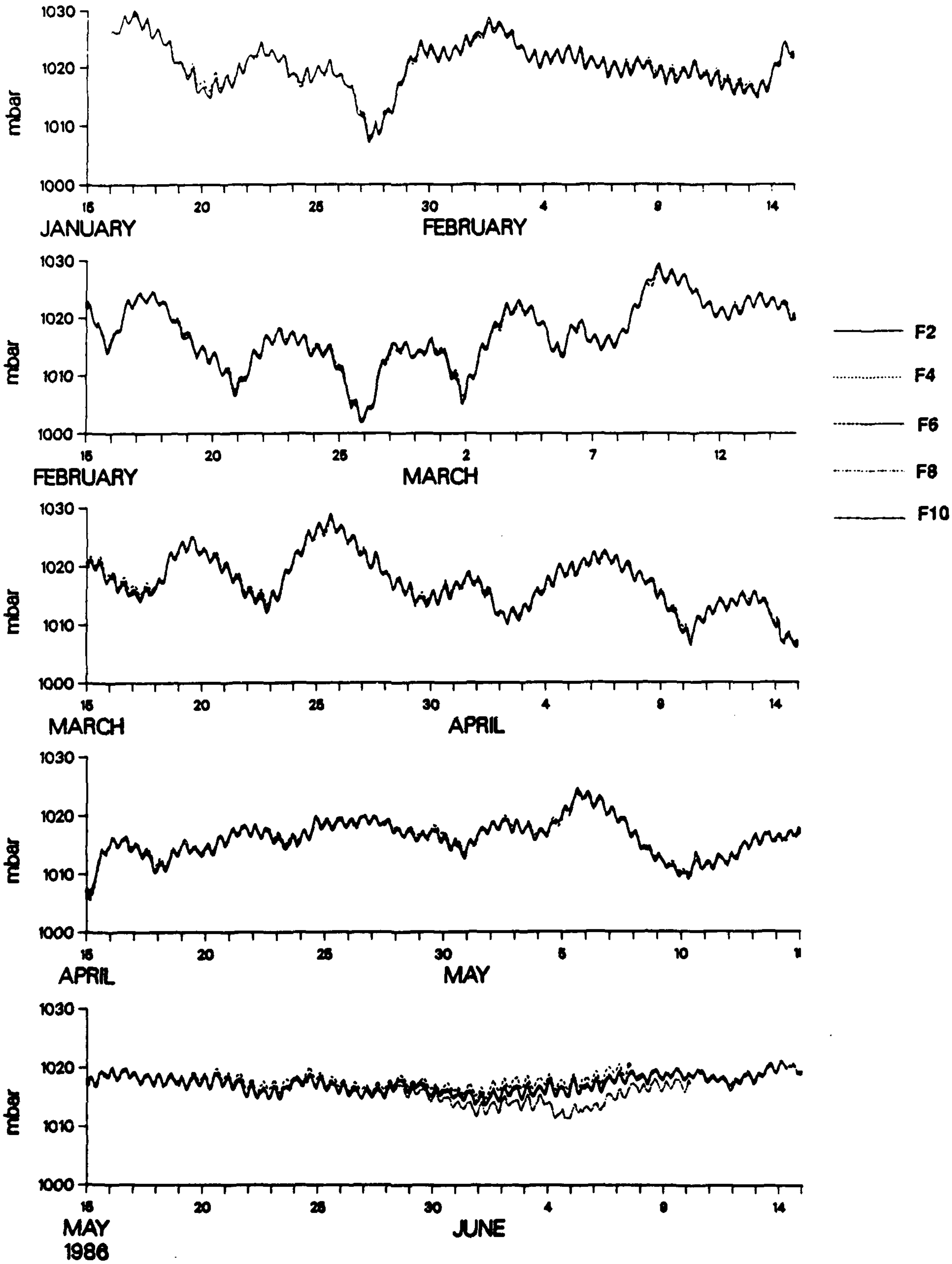
Five surface buoys Sea Temperature overplot.



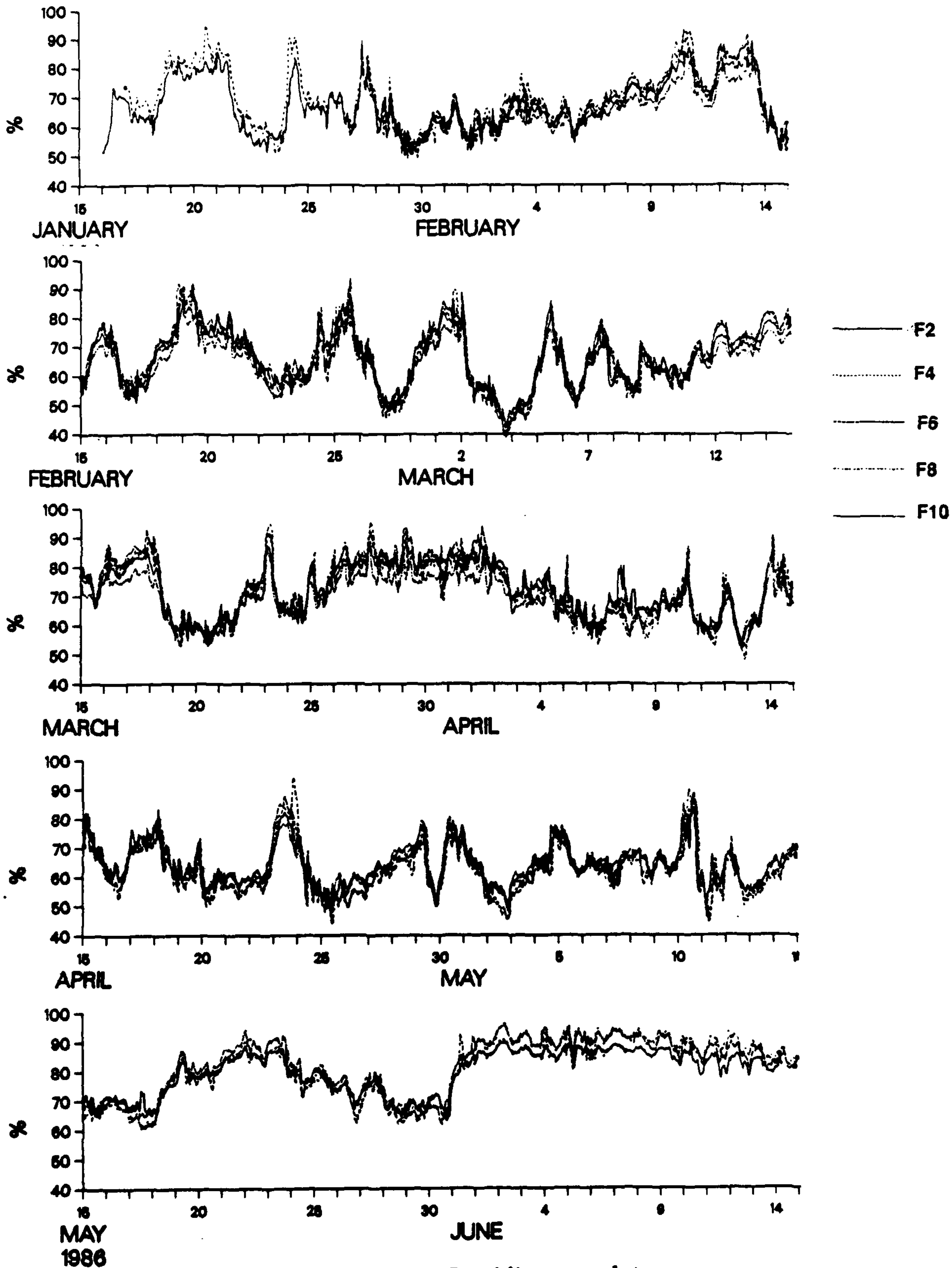
Five surface buoys Air Temperature overplot.



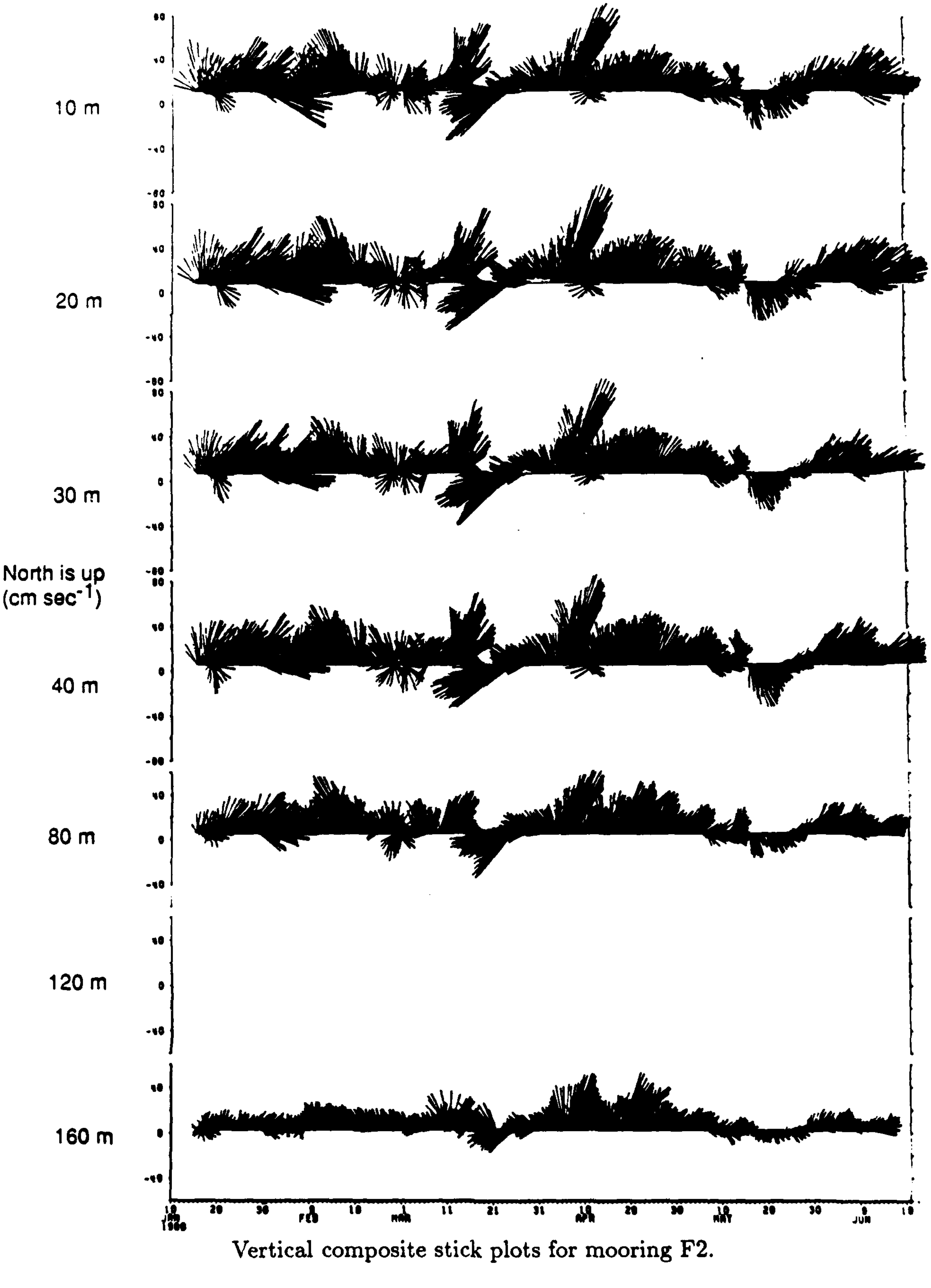
Five surface buoys Insolation overplot.



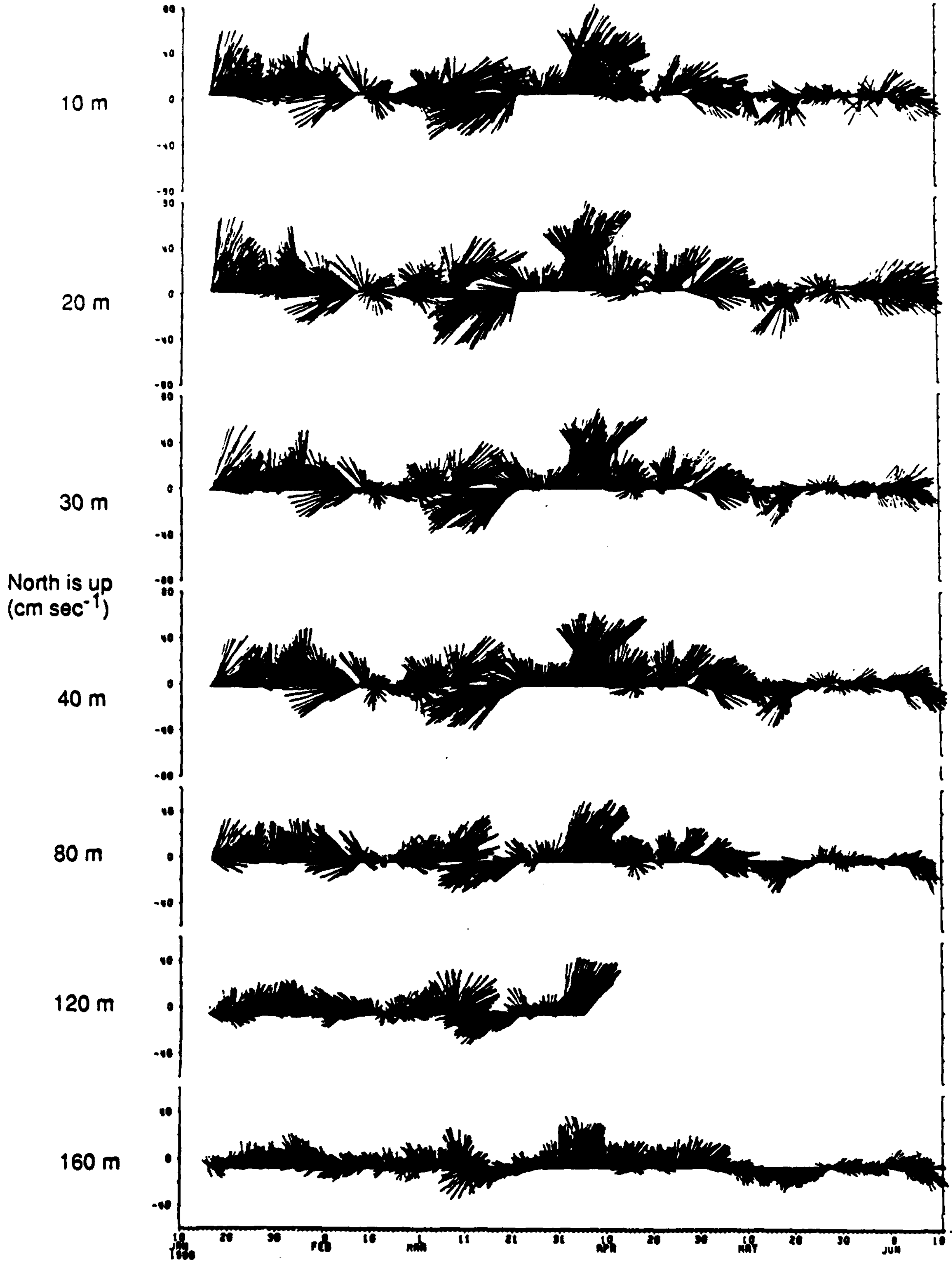
Five surface buoys Barometric Pressure overplot.



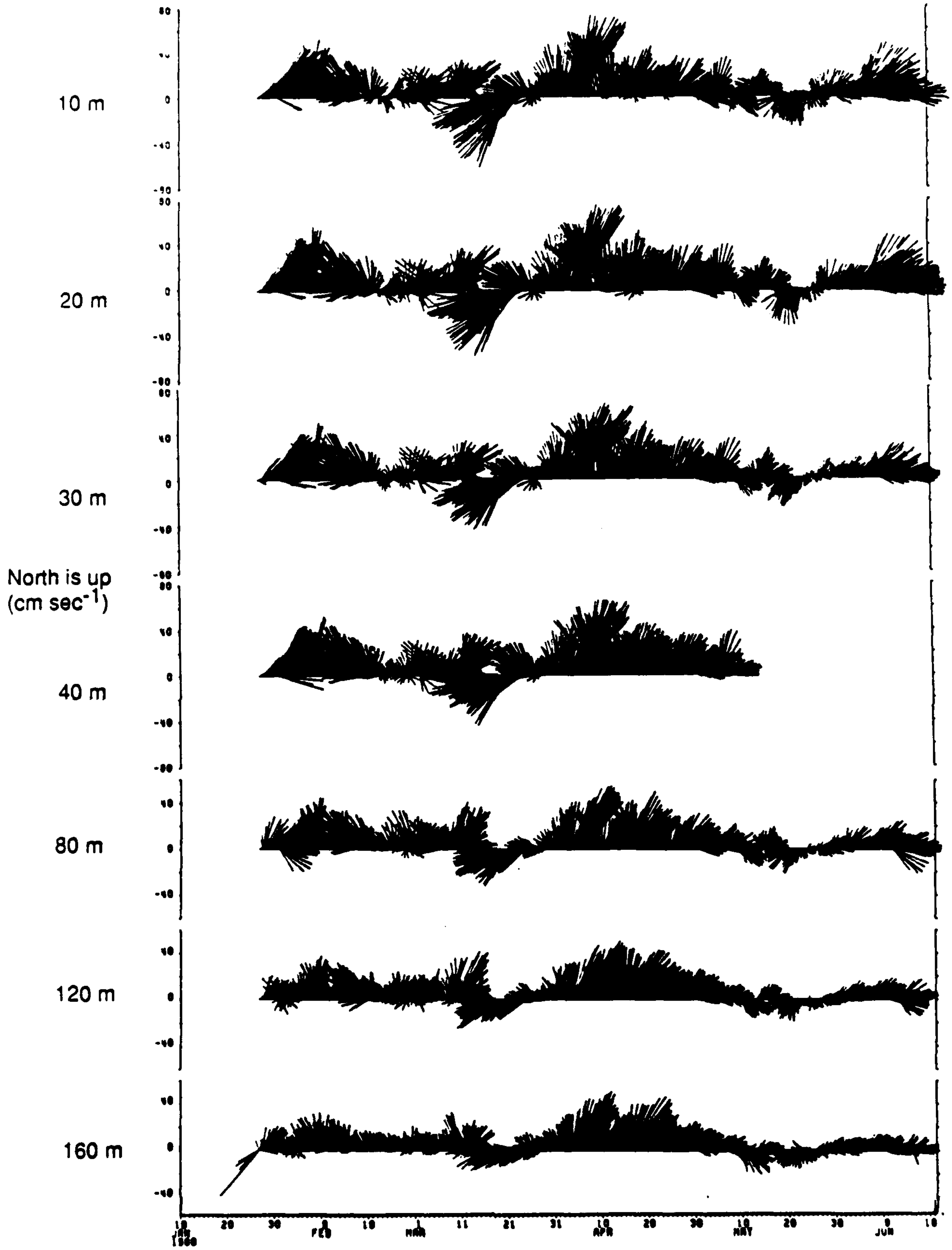
Five surface buoys Relative Humidity overplot.



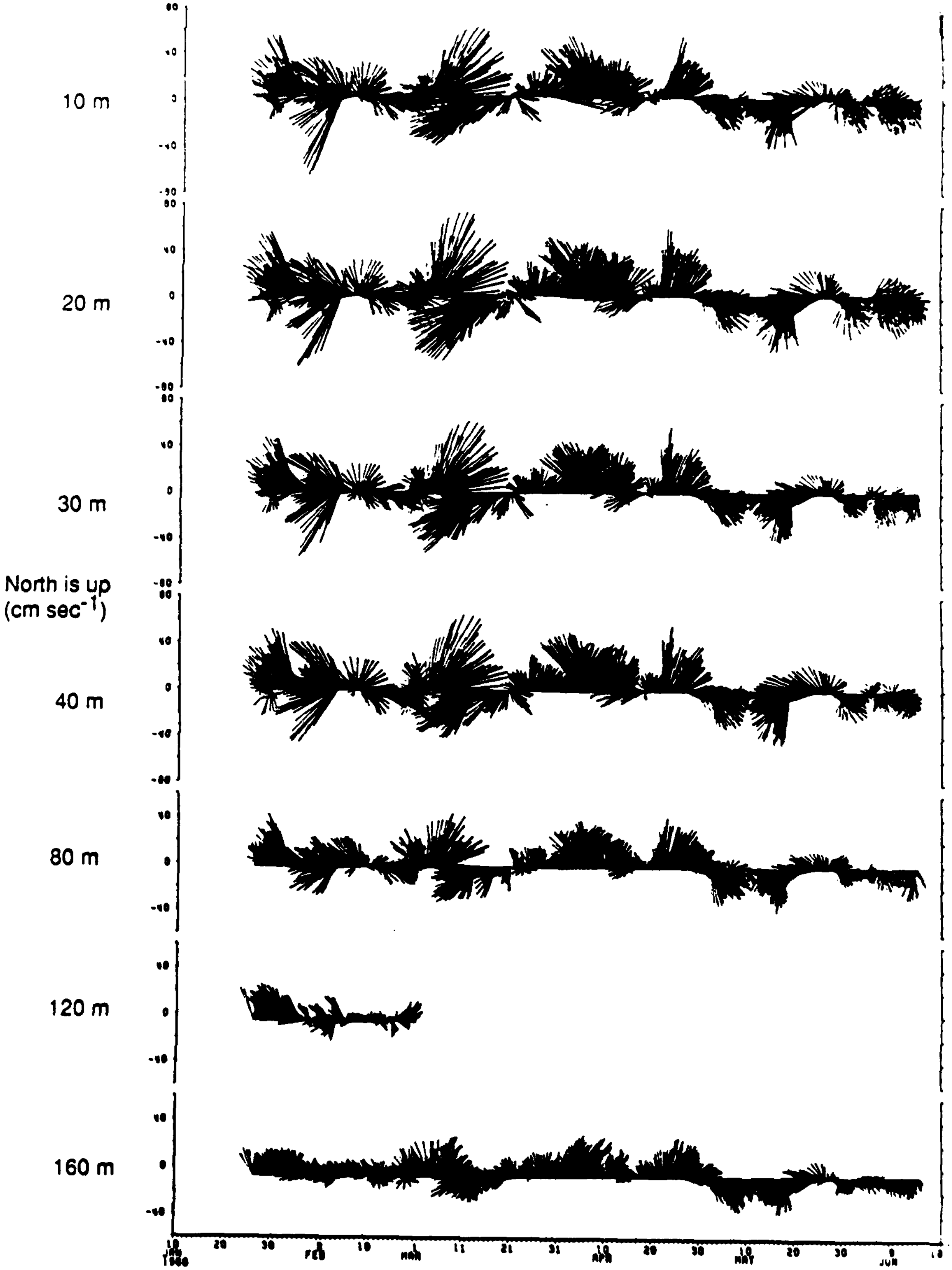
Vertical composite stick plots for mooring F2.



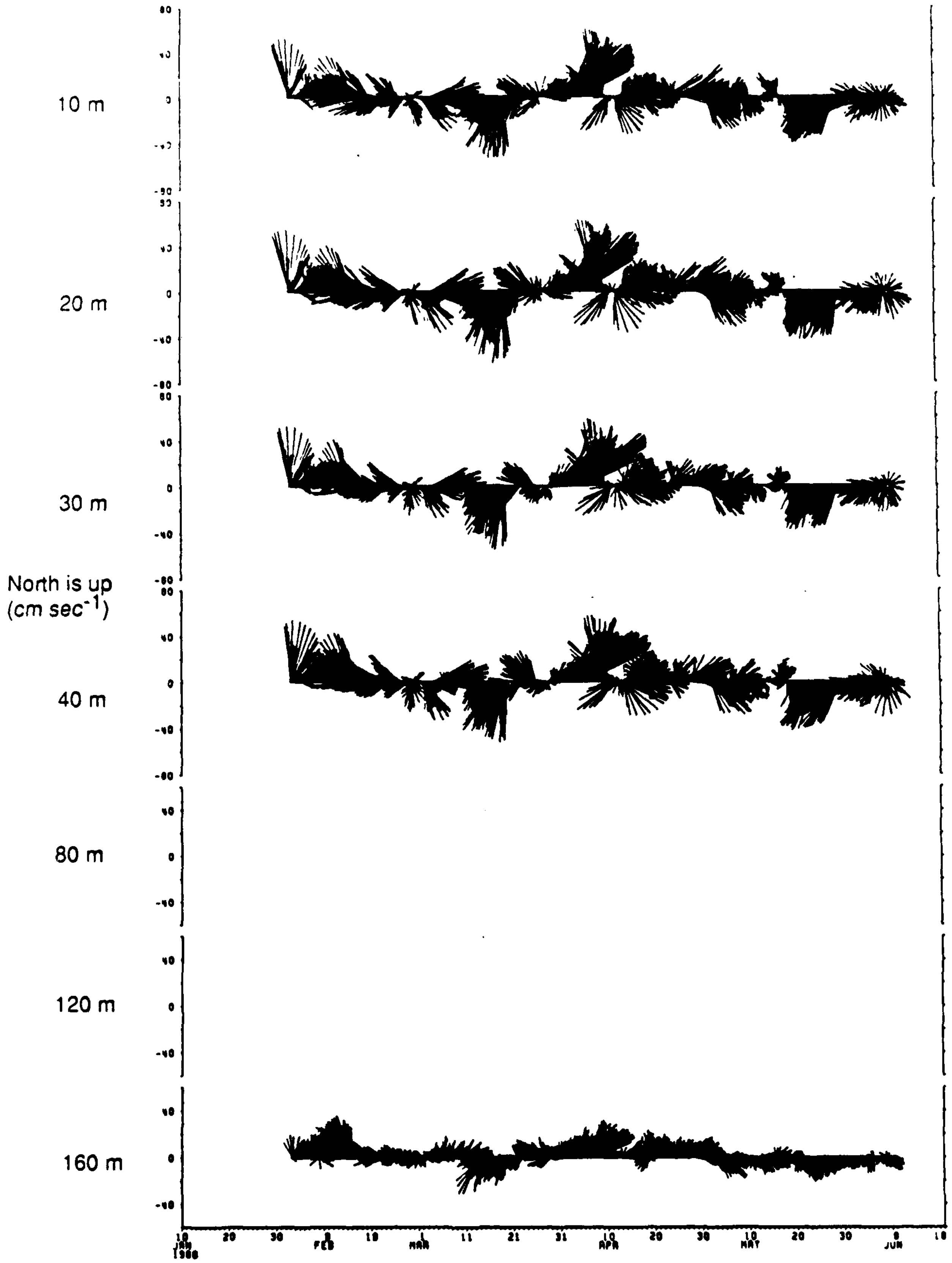
Vertical composite stick plots for mooring F4.



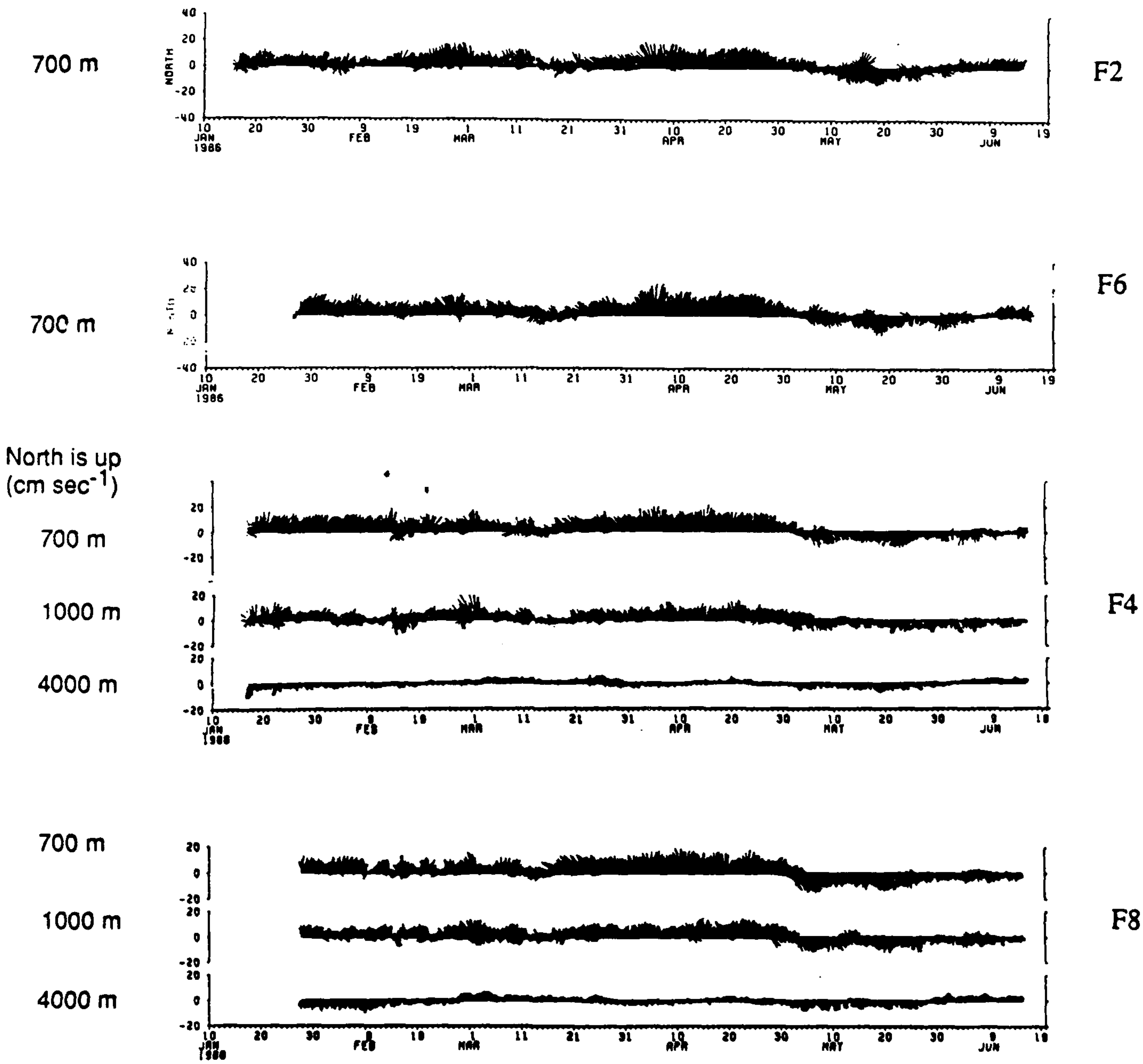
Vertical composite stick plots for mooring F6.



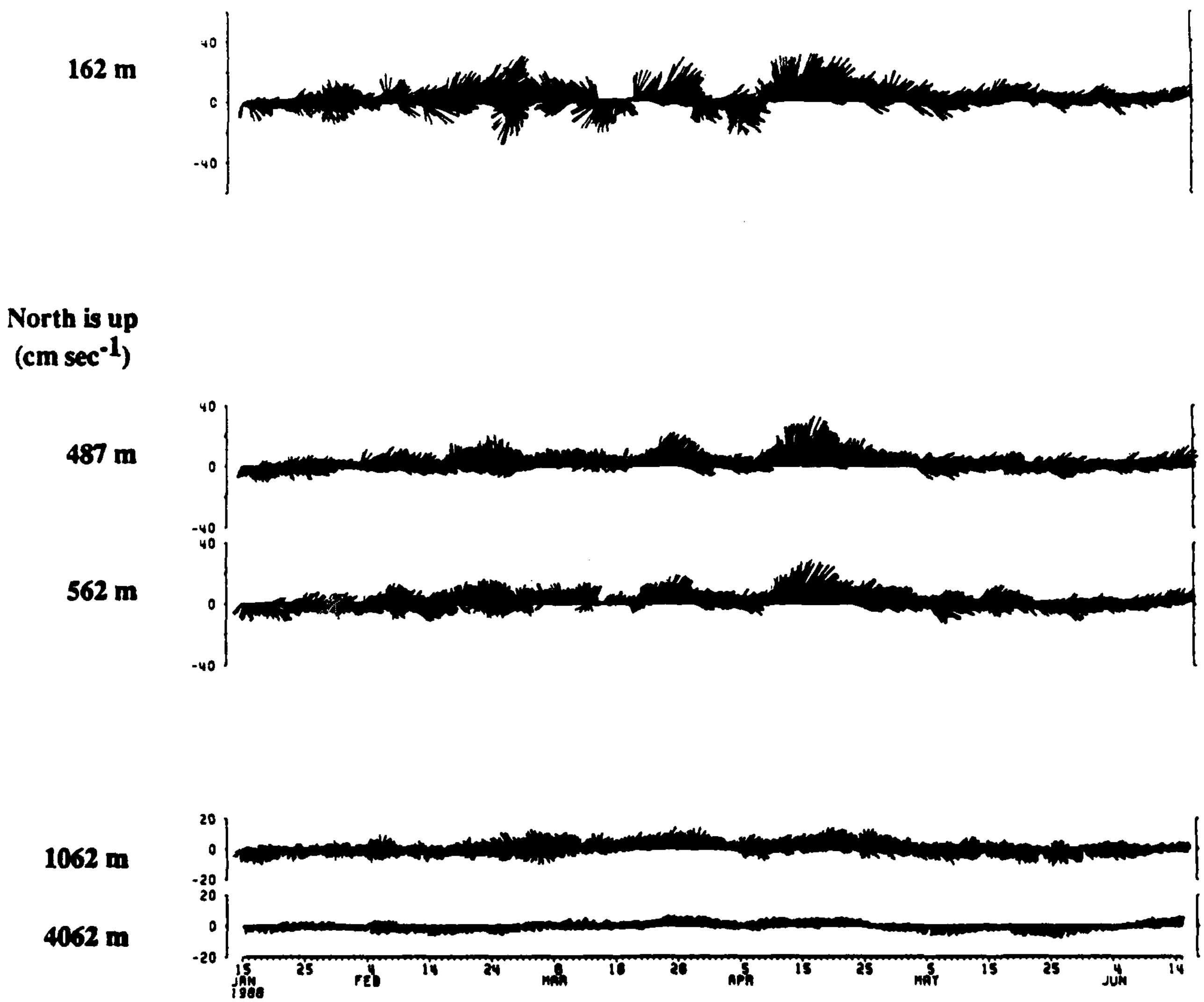
Vertical composite stick plots for mooring F8.



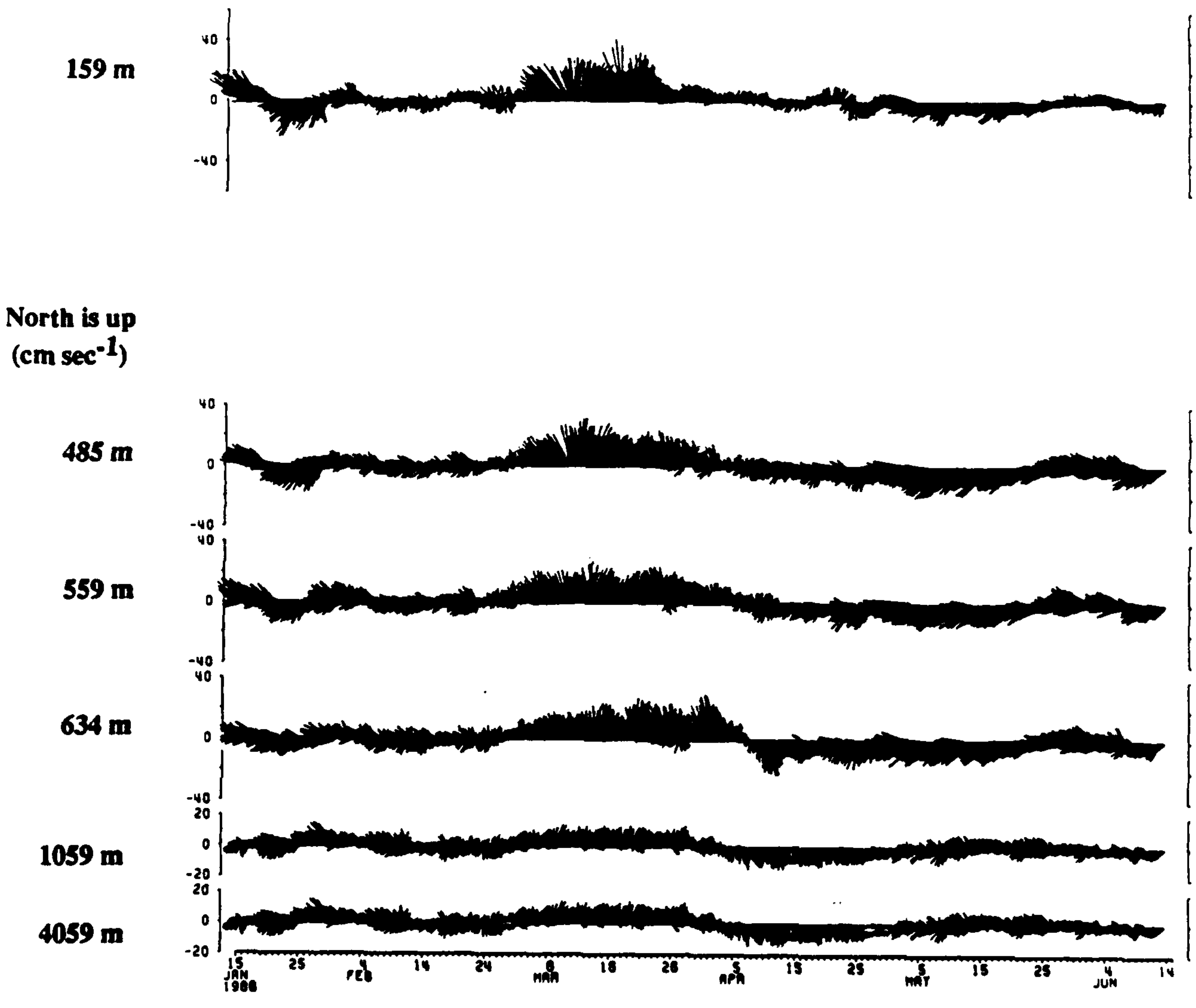
Vertical composite stick plots for mooring F10.



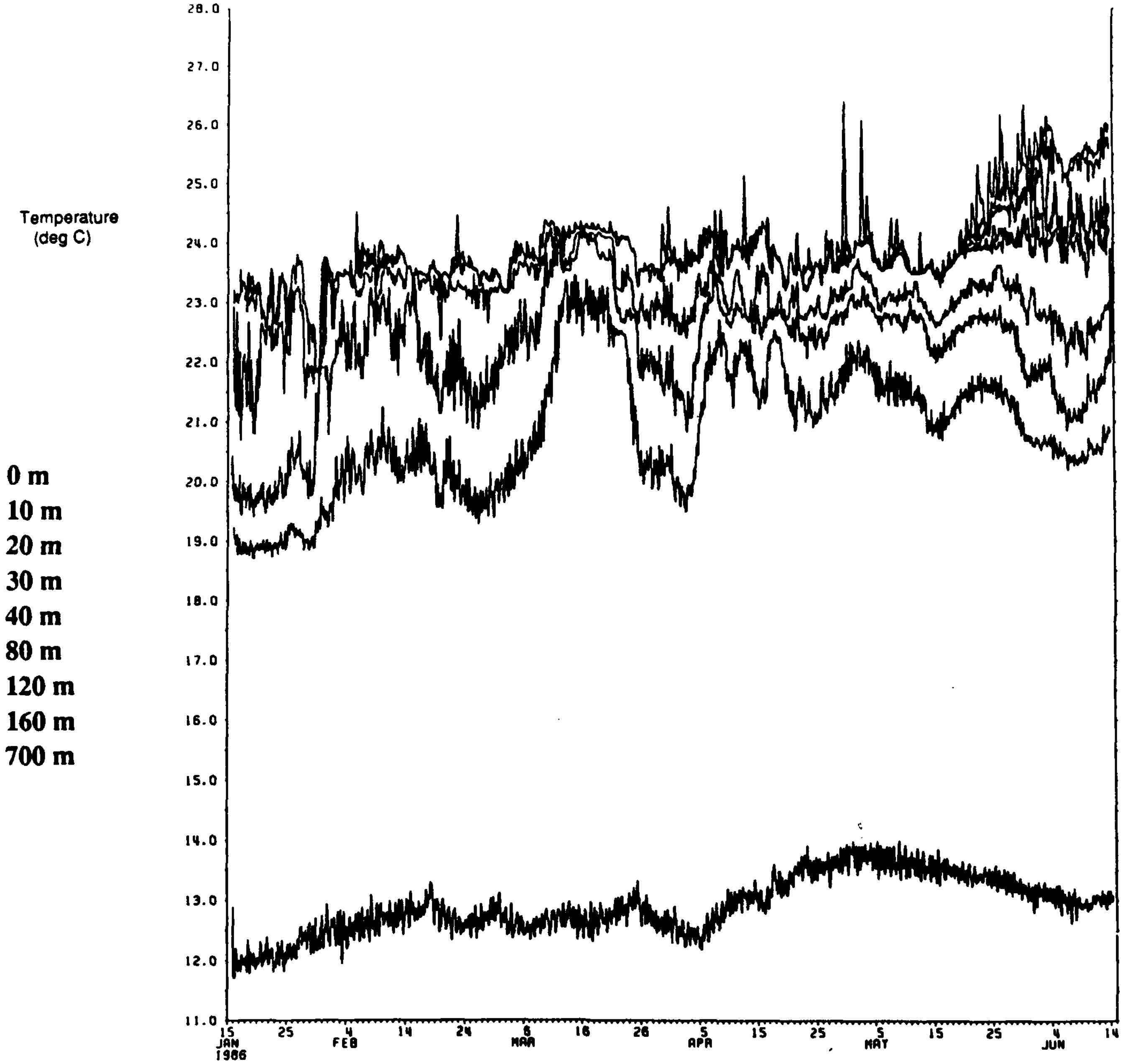
700 m stick plots for F2 and F6.
700 m, 1000 m and 4000 m stick plots for moorings F4 and F8.



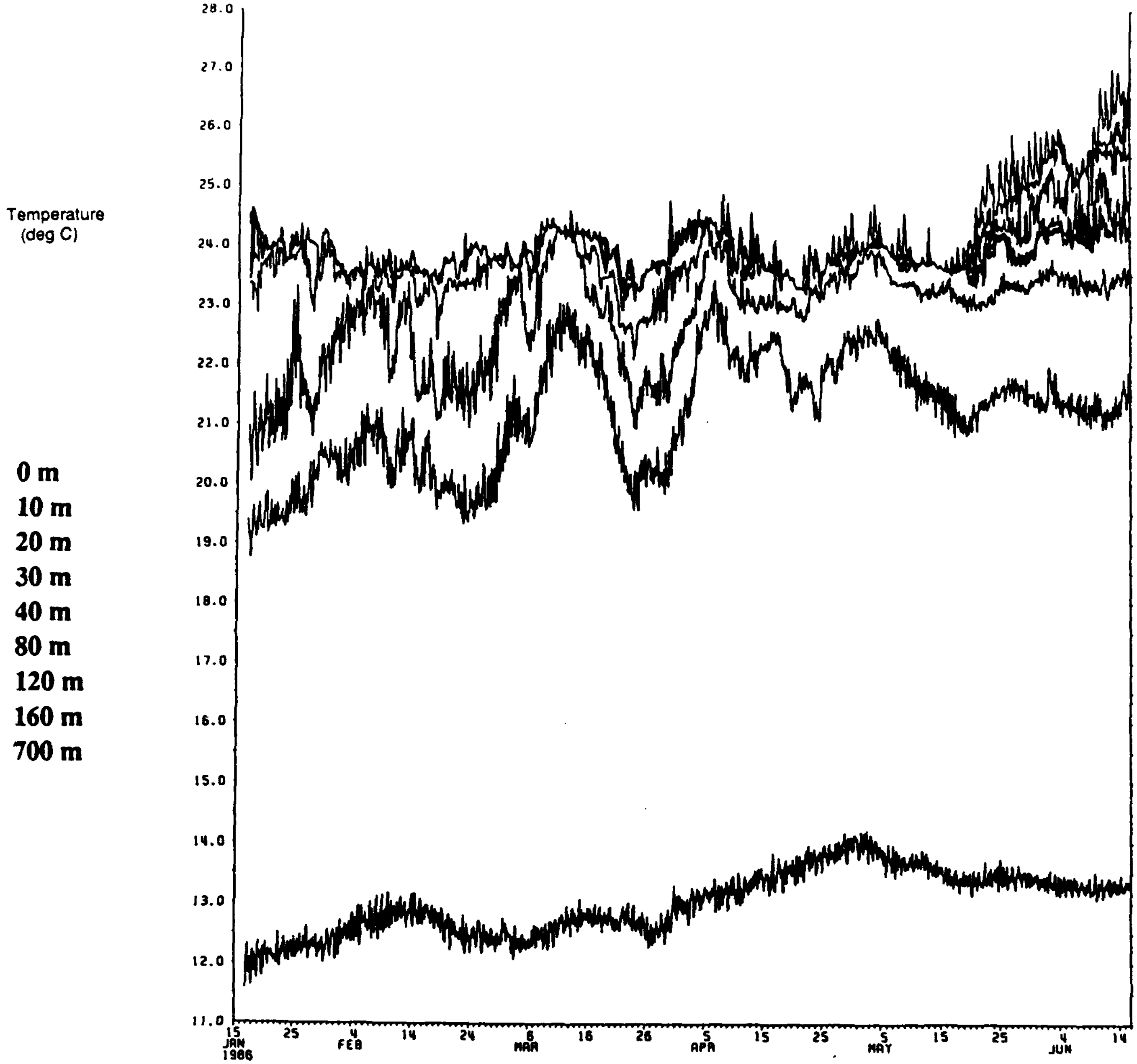
Vertical composite stick plots for moorings F1.



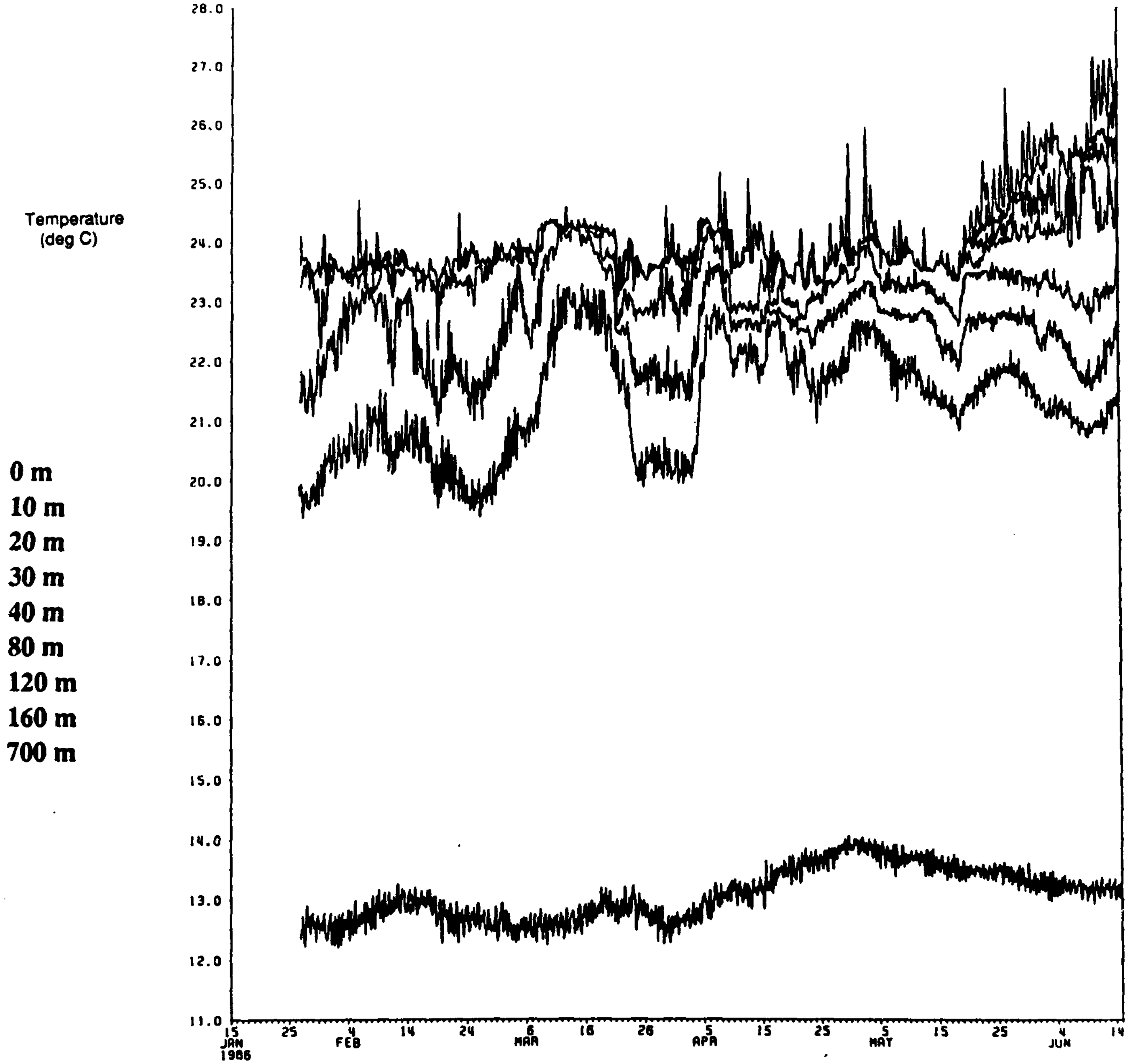
Vertical composite stick plots for mooring F12.



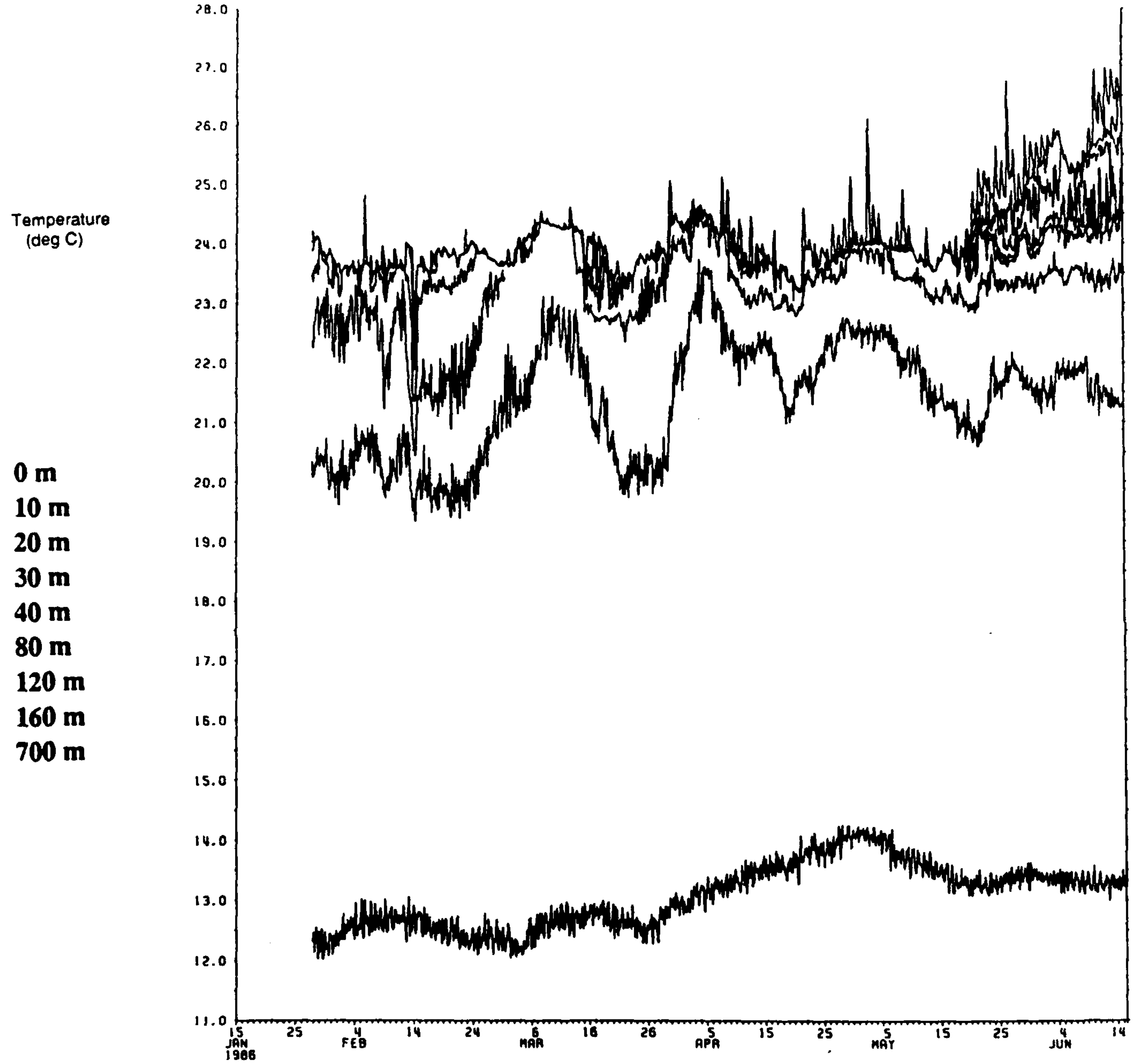
Vertical composite Temperature plots for mooring F2.



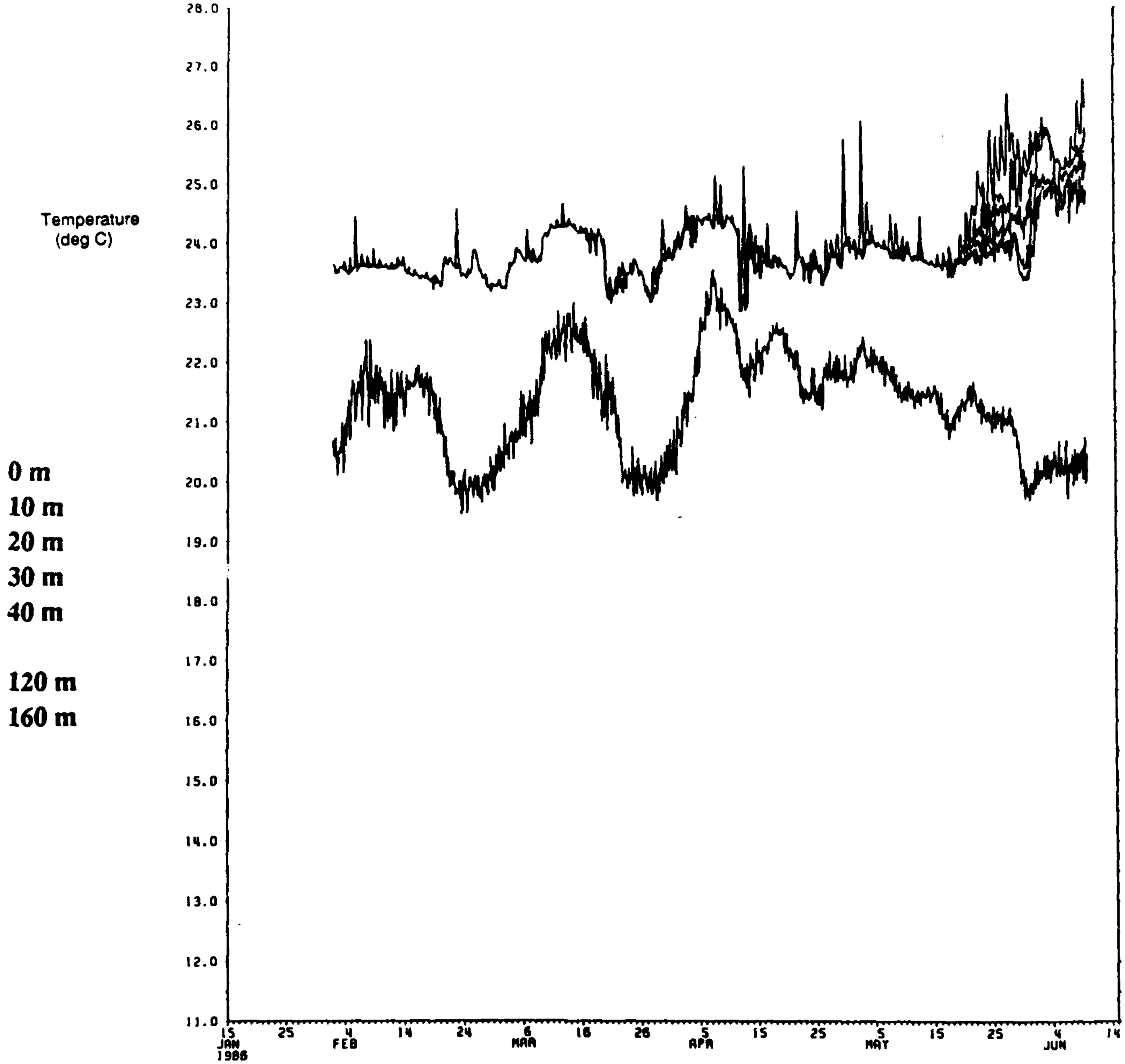
Vertical composite Temperature plots for mooring F4.



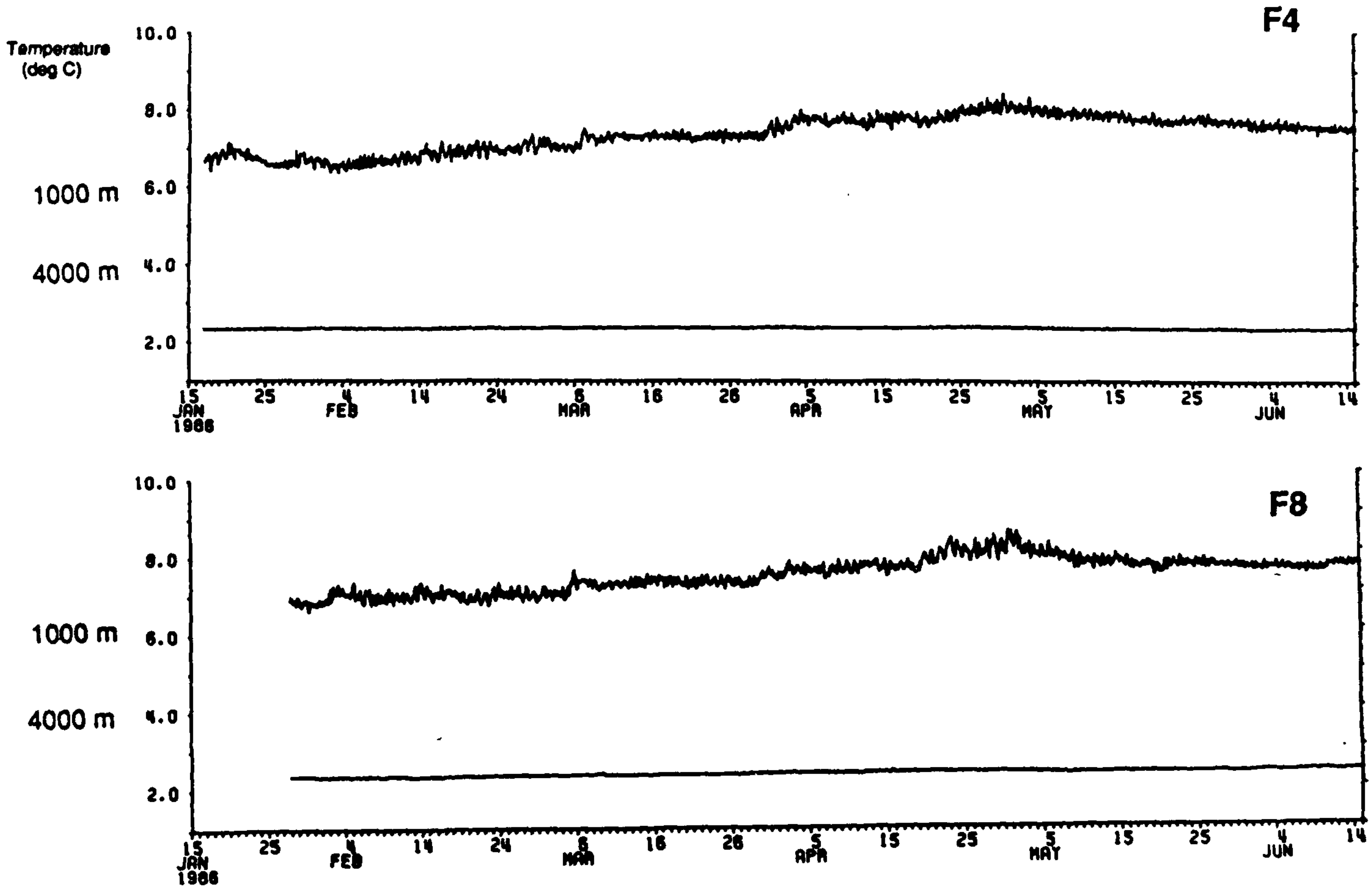
Vertical composite Temperature plots for mooring F6.



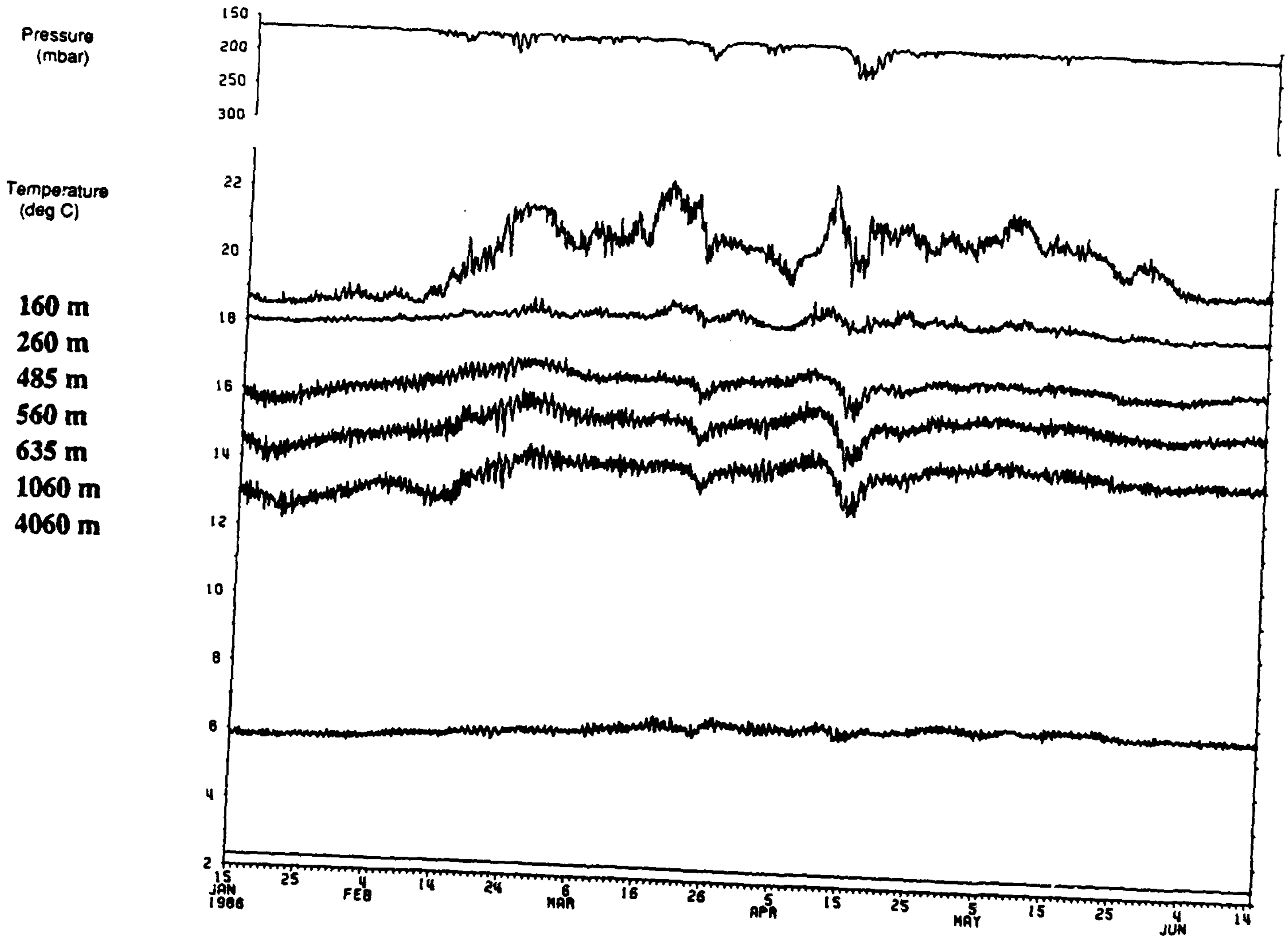
Vertical composite Temperature plots for mooring F8.



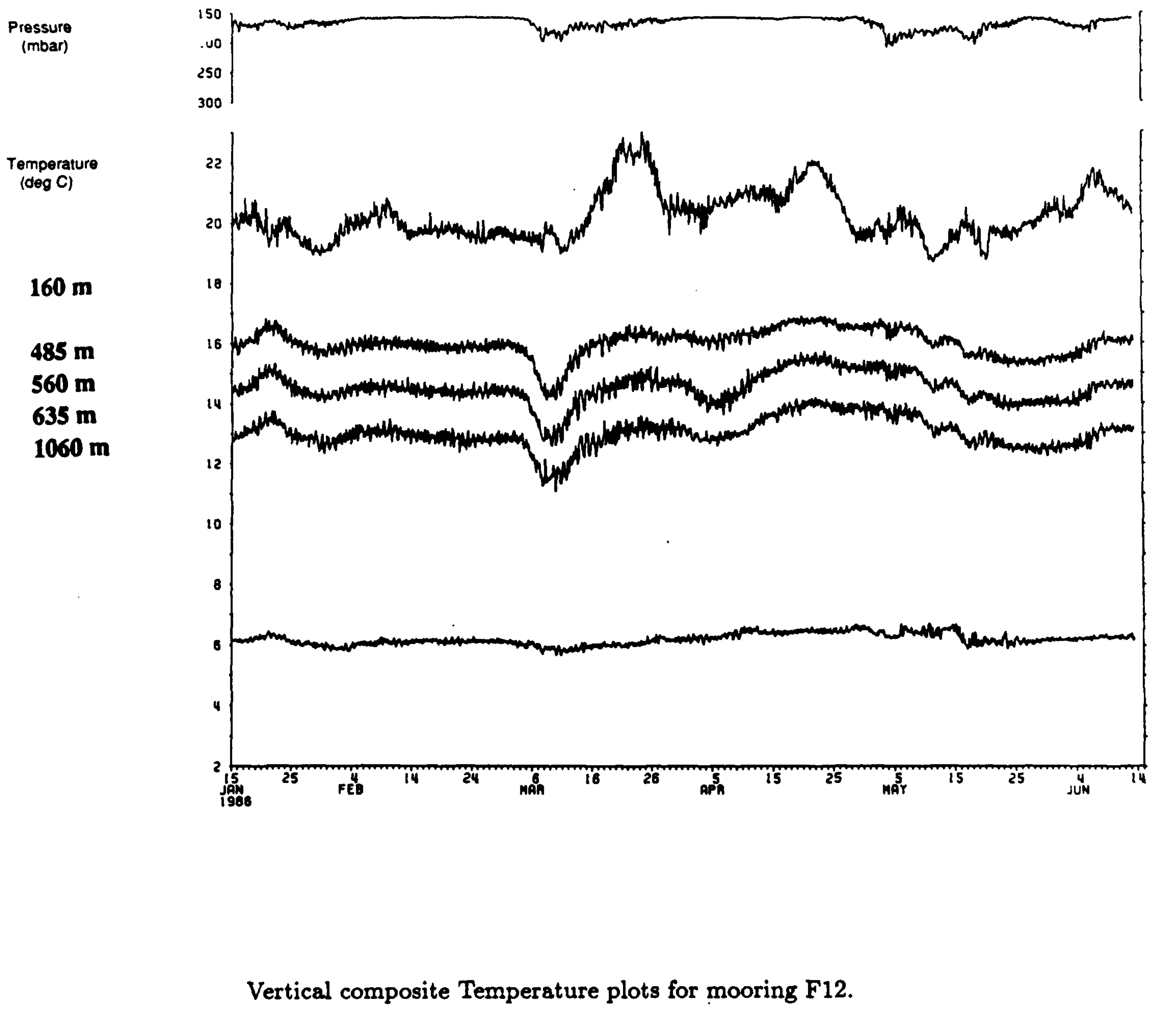
Vertical composite Temperature plots for mooring F10.



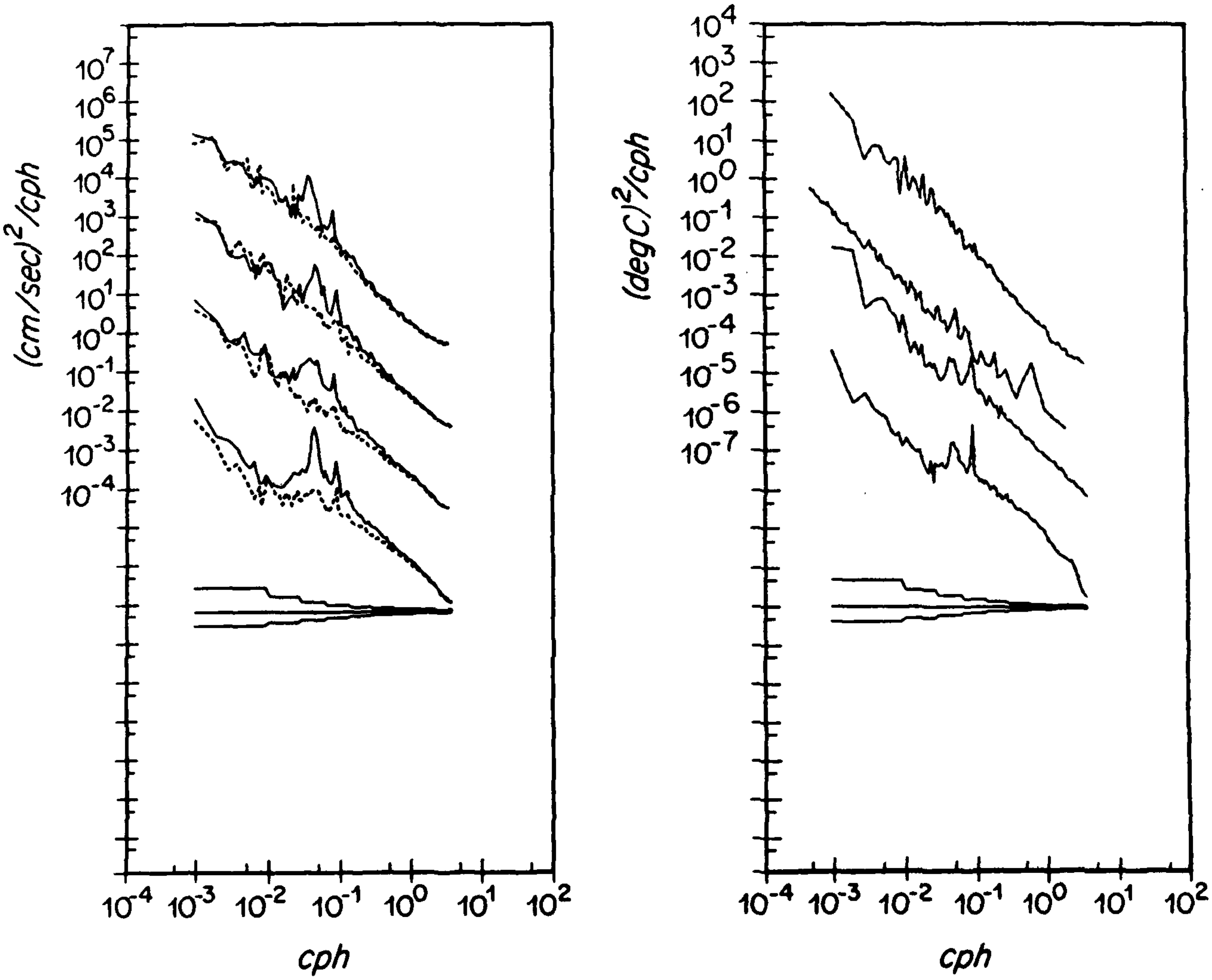
1000 m and 4000 m Temperature plots for moorings F4 and F8.



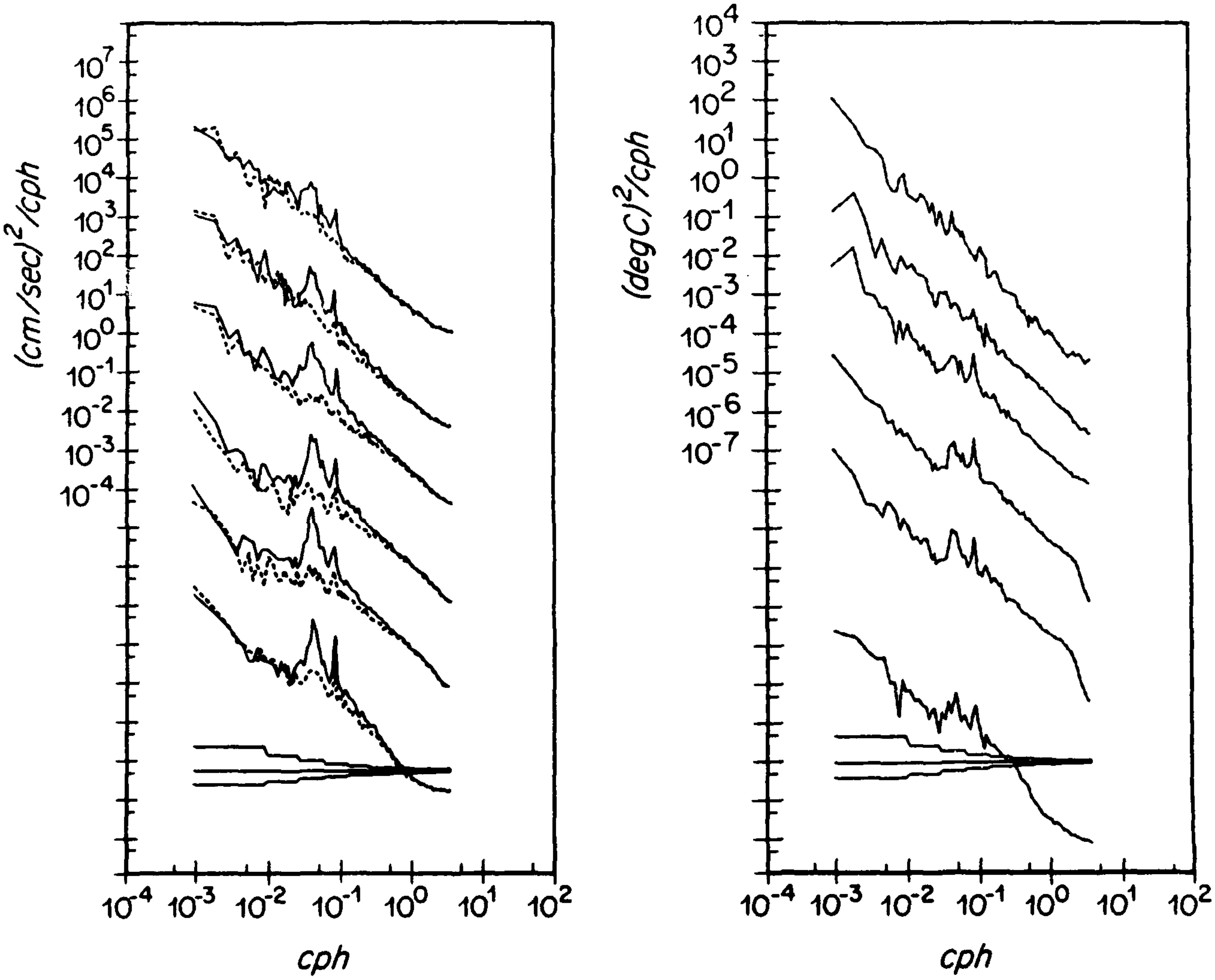
Vertical composite Temperature plots for mooring F1.



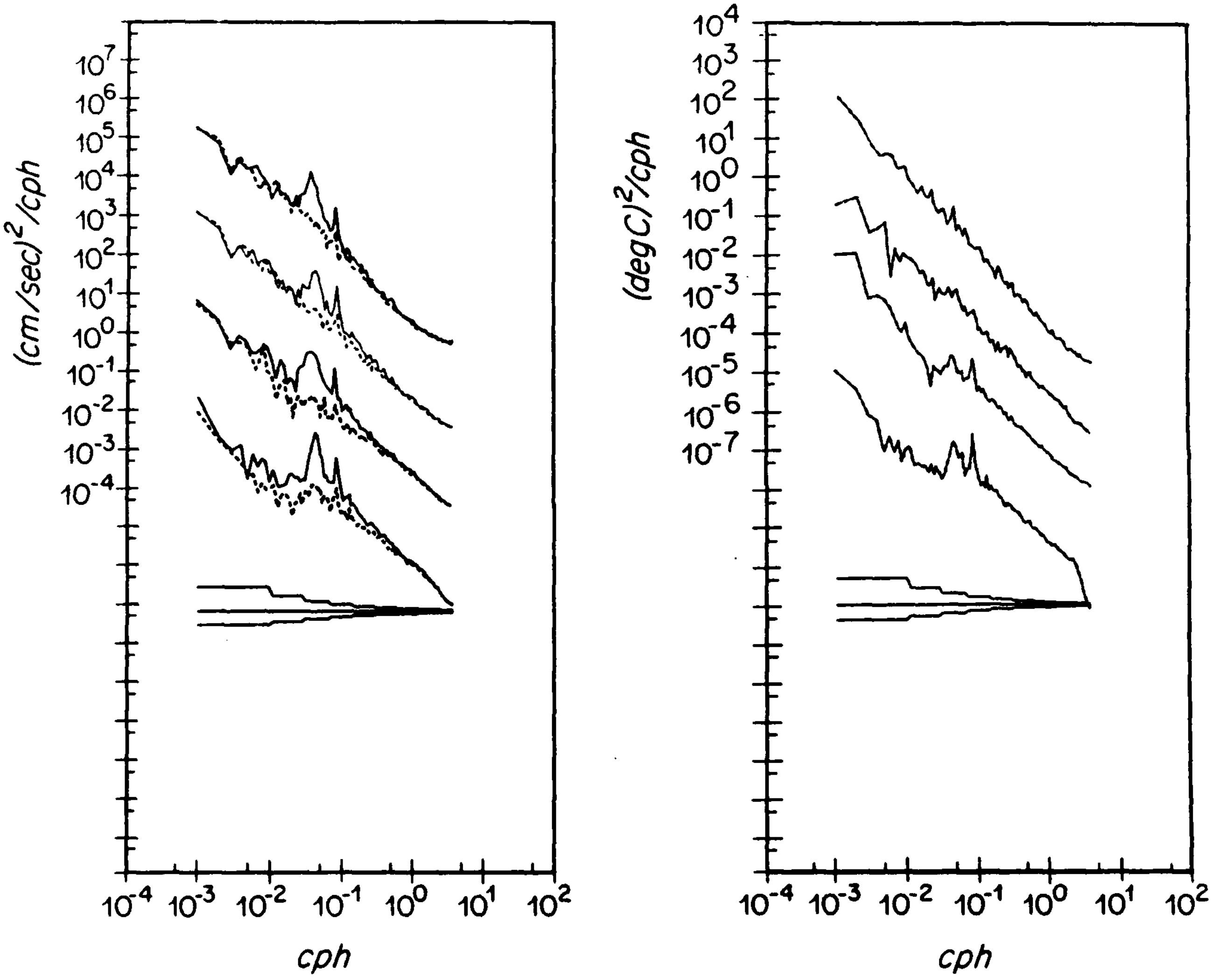
Vertical composite Temperature plots for mooring F12.



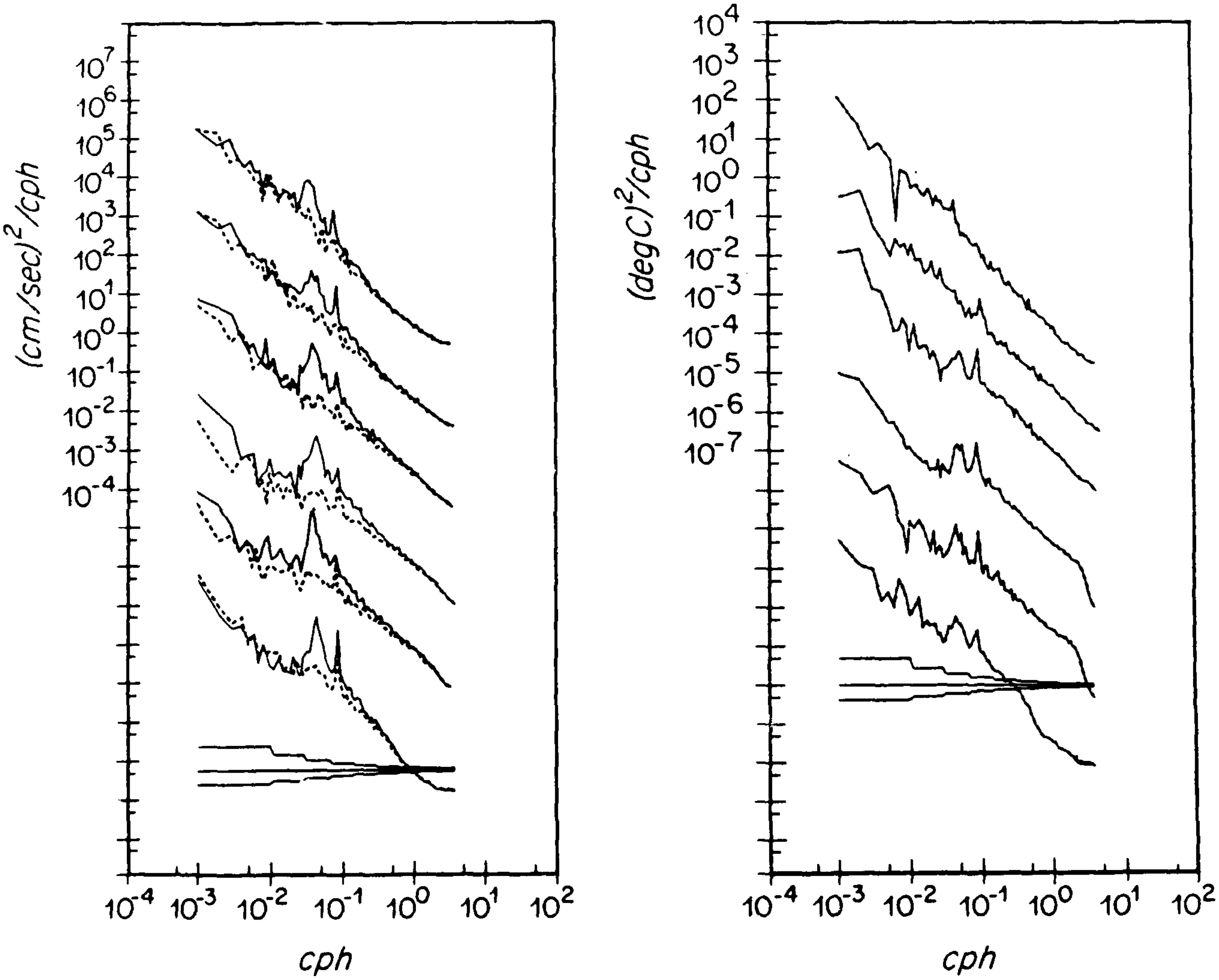
Vertical composite spectra for mooring F2. Data are from 10, 80, 160 and 700 m. Spectra are each shifted down two decades relative to that above.



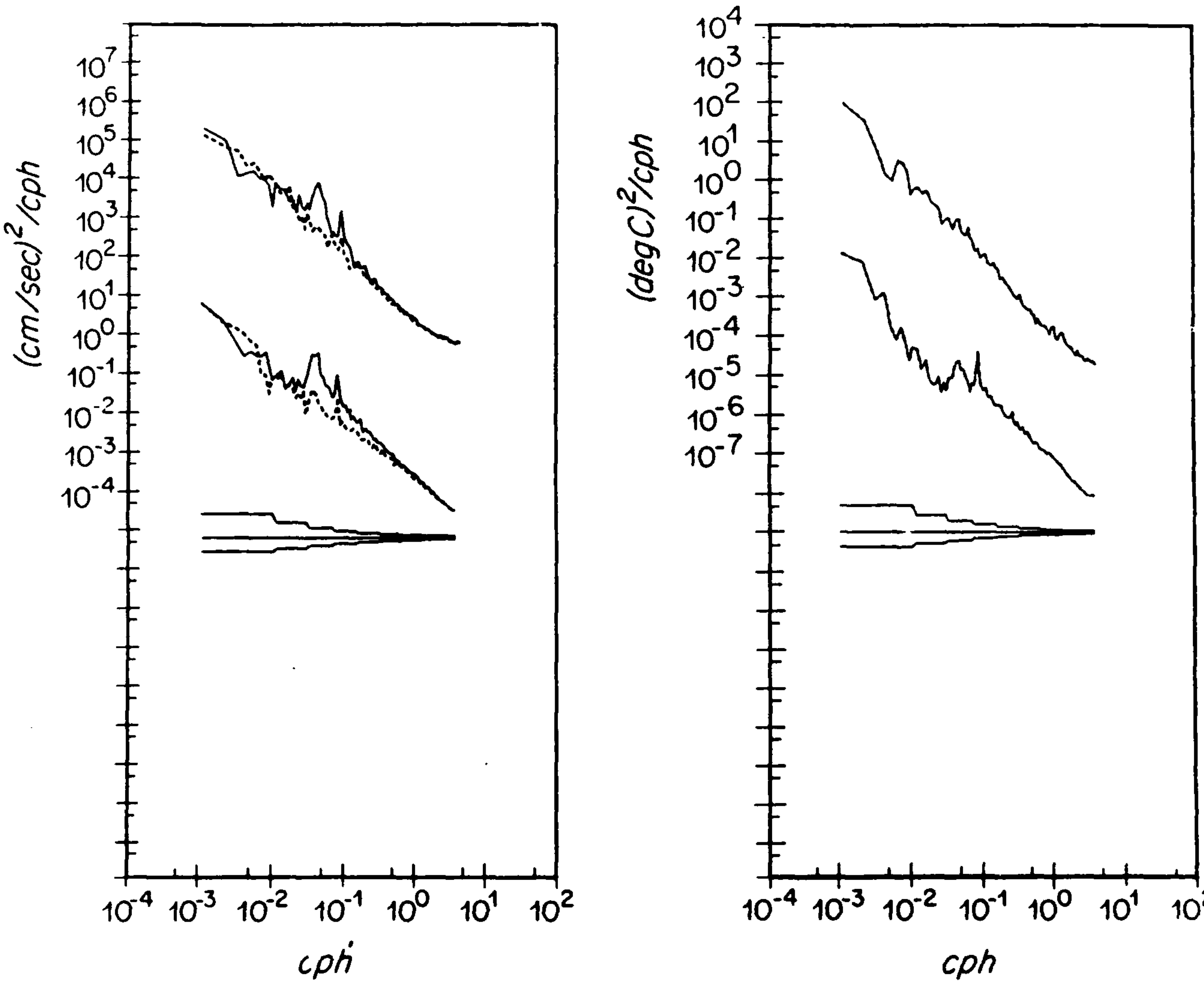
Vertical composite spectra for mooring F4. Data are from 10, 80, 160, 700, 1000, and 4000m. Spectra are each shifted down two decades relative to that above.



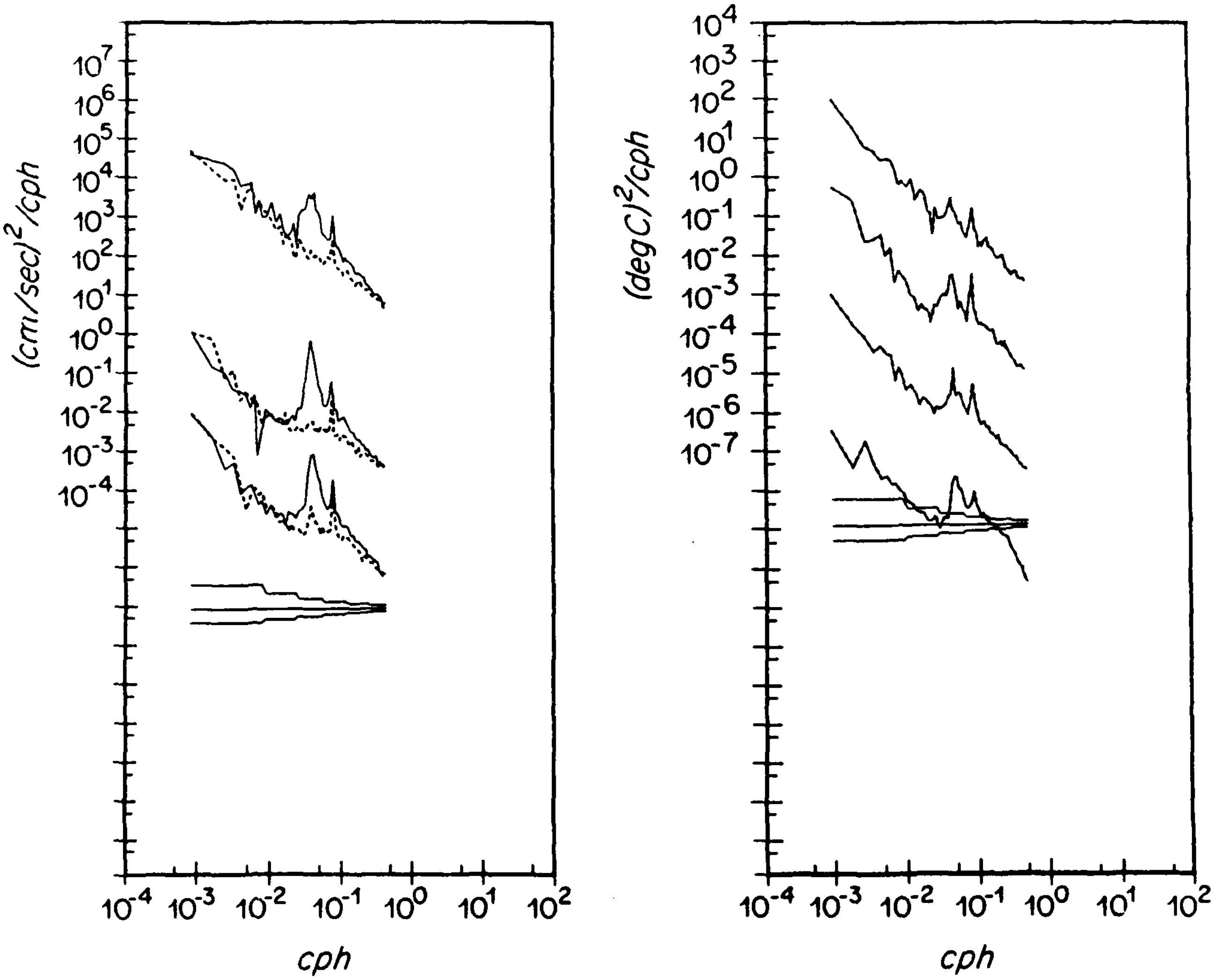
Vertical composite spectra for mooring F6. Data are from 10, 80, 160 and 700 m. Spectra are each shifted down two decades relative to that above.



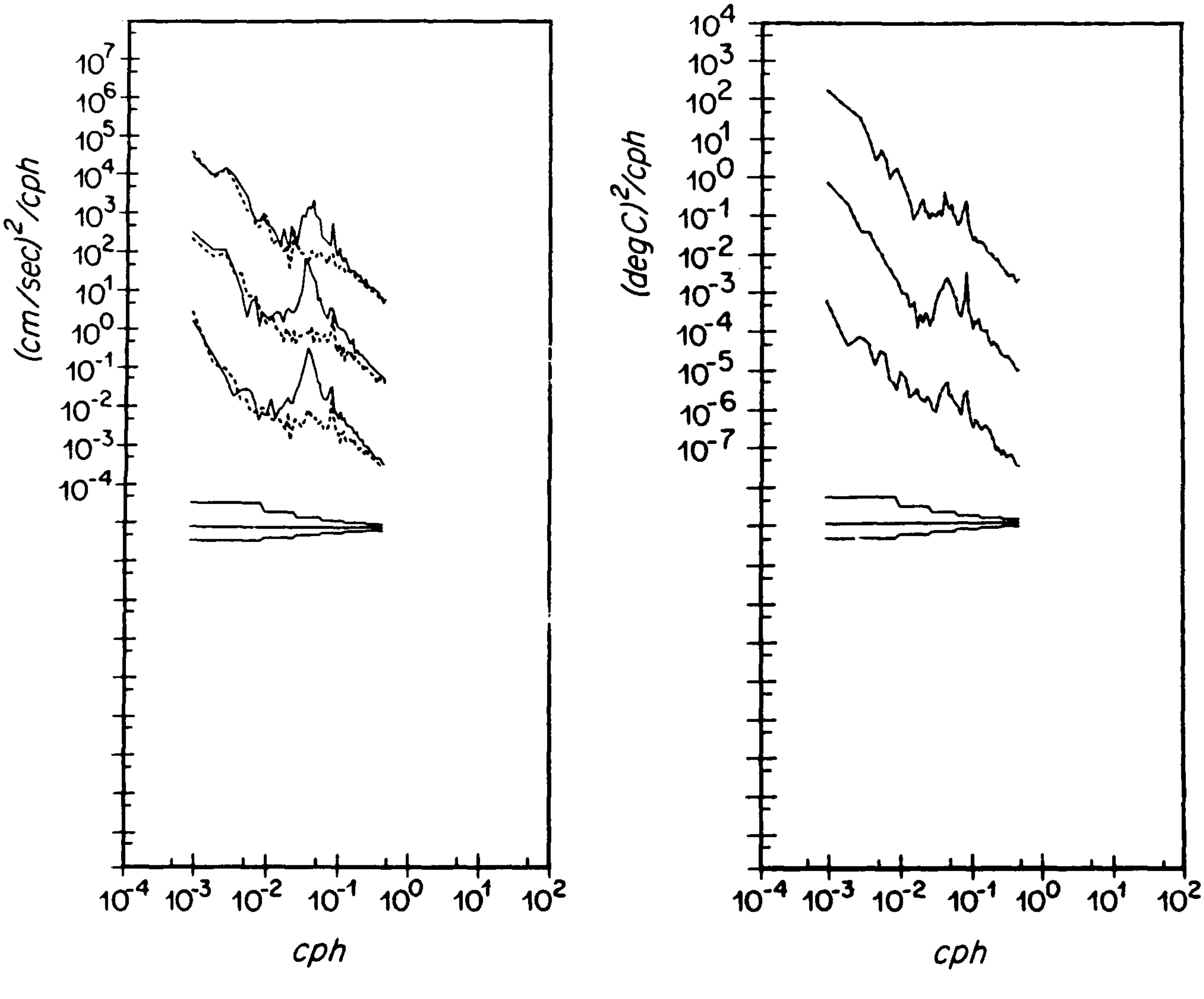
Vertical composite spectra for mooring F8. Data are from 10, 80, 160, 700, 1000, and 4000m. Spectra are each shifted down two decades relative to that above.



Vertical composite spectra for mooring F10. Data are from 10 and 160 m. Spectra are each shifted down four decades relative to that above to compare with other spectra composites.



Vertical composite spectra for mooring F1. Data are from 160, 635, 1060 and 4060 m. Spectra are each shifted down two decades relative to that above.



Vertical composite spectra for mooring F12. Data are from 160, 635 and 1060 m. Spectra are each shifted down two decades relative to that above.

7. Phase Two

Phase Two, the intensive scientific period began February 10, 1986 with the first flight of the NRL-P3. The R.V. OCEANUS and R.V. ENDEAVOR worked in the FASINEX area from February 12 until March 8, 1986. During Phase Two, six aircraft, the NRL-P3, NCAR Electra, NASA P3, NASA Electra, NASA C130 and the NOAA P3 flew a total of 41 flights in an area slightly north of the mooring array, while the two ships worked throughout the FASINEX area (Figure 7). This section contains plots on an expanded scale from February 10 to March 10.

	pages
Time series of VAWR meteorological data by buoy.	177-181
Wind progressive vector diagrams by buoy.	182-186
Heat Flux and Wind Stress by buoy.	187-191
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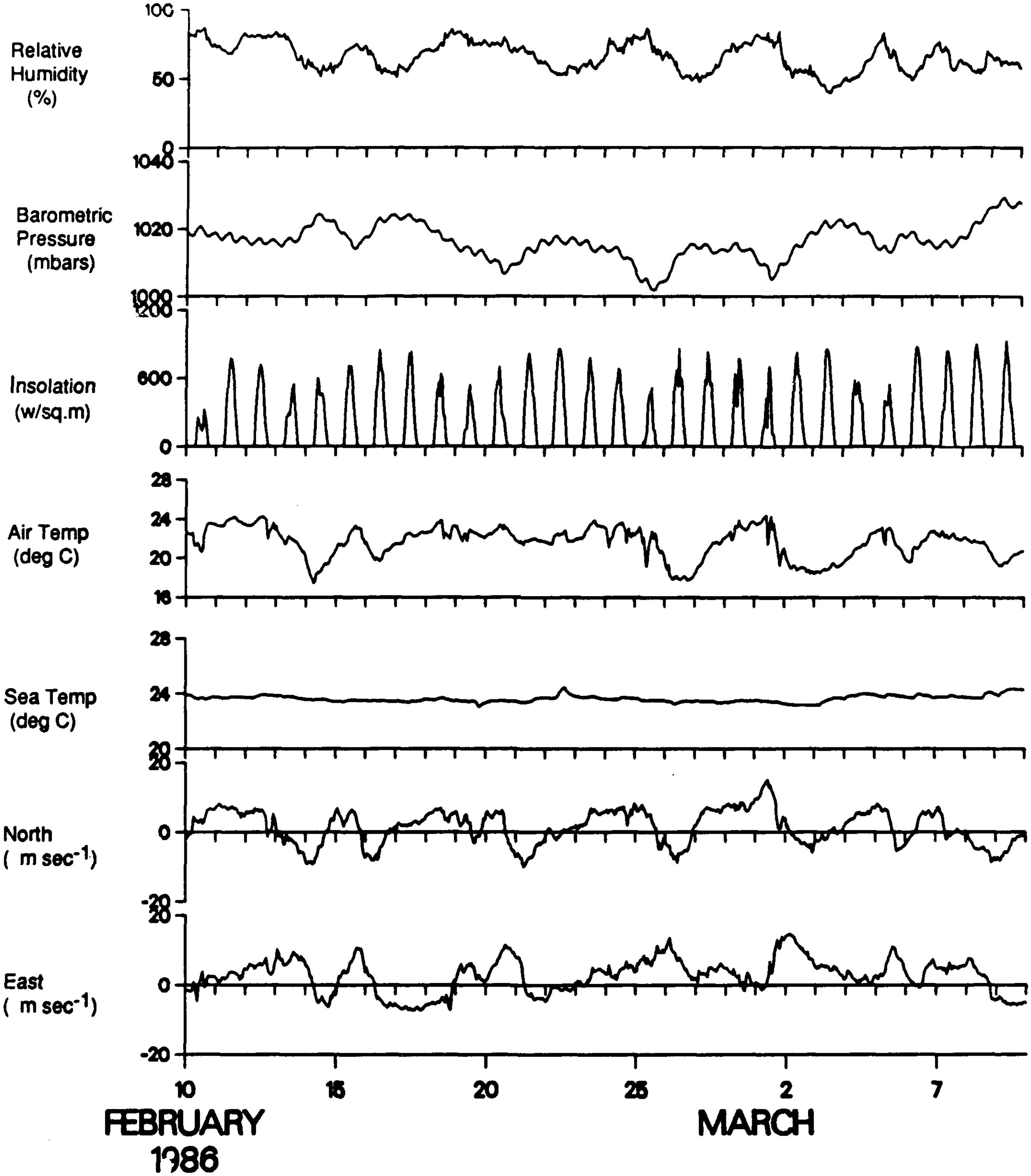
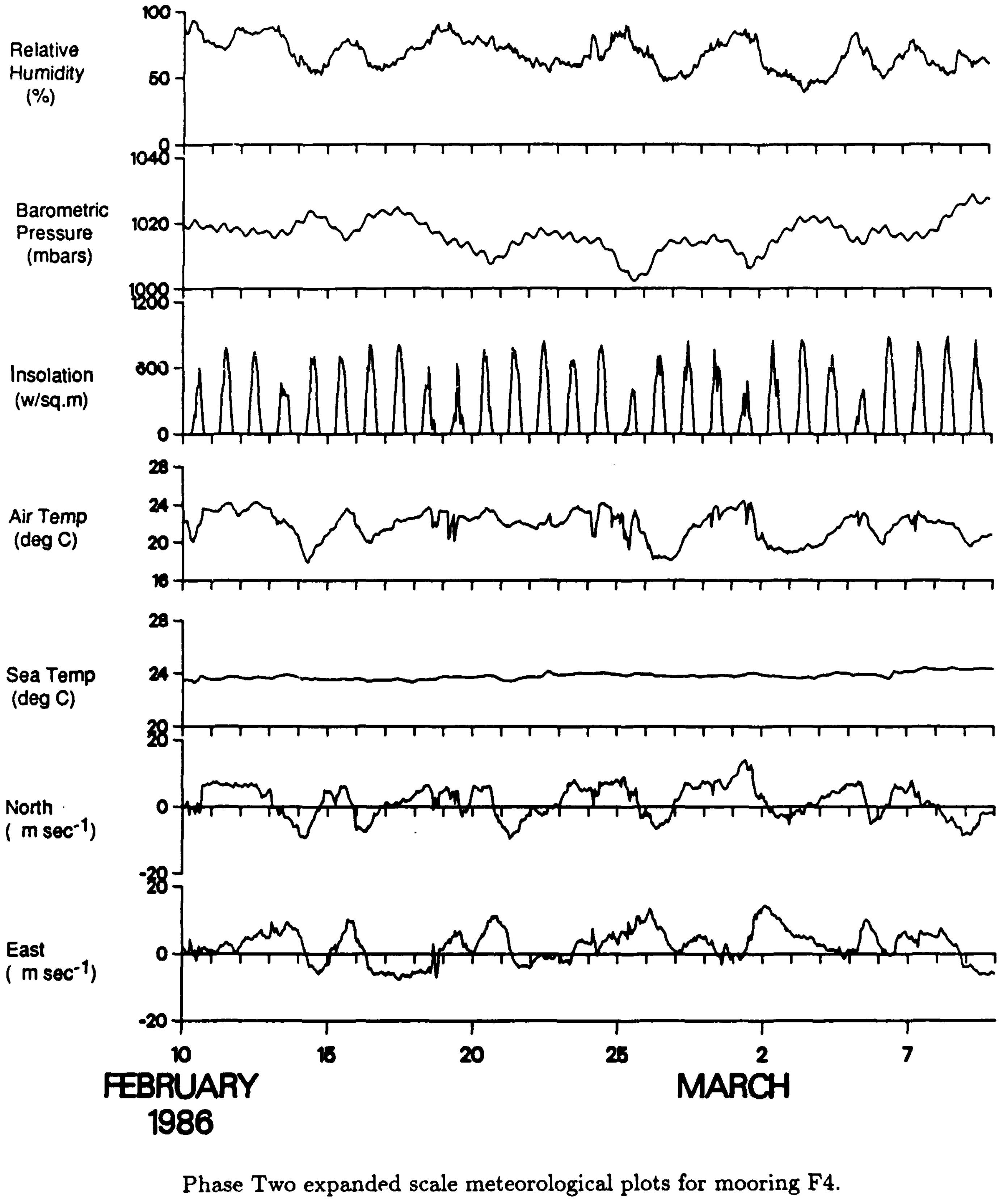
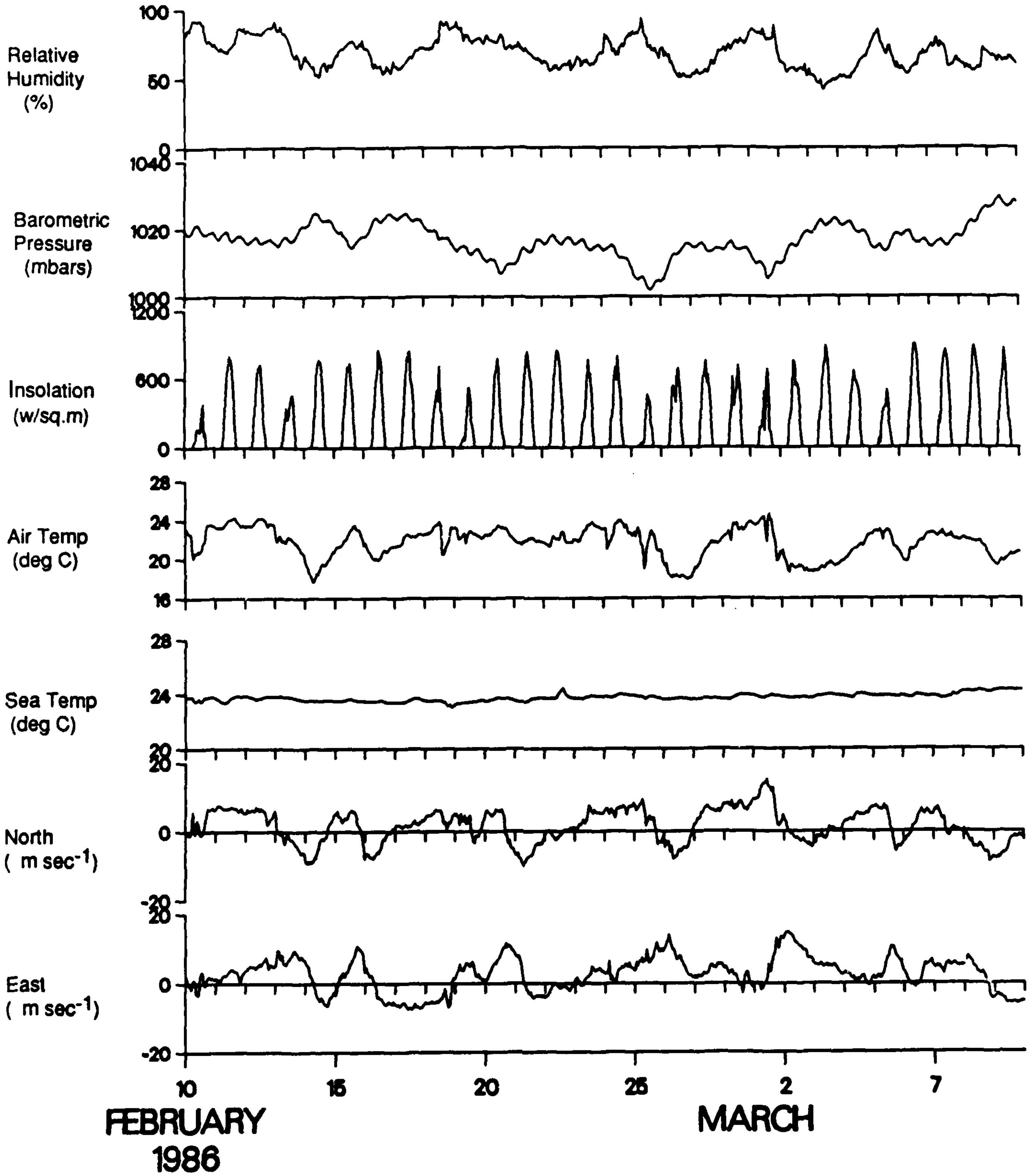
Surface mooring velocity stick plots	193-198
Subsurface moorings velocity stick plots	199-200
Surface moorings composite Temperature plots	201-206
Subsurface moorings composite Temperature plots	207-208
Phase Two Wind vector array plot	209
Horizontal composite Sea Temperature plots (10, 80, 160 m)	210-212



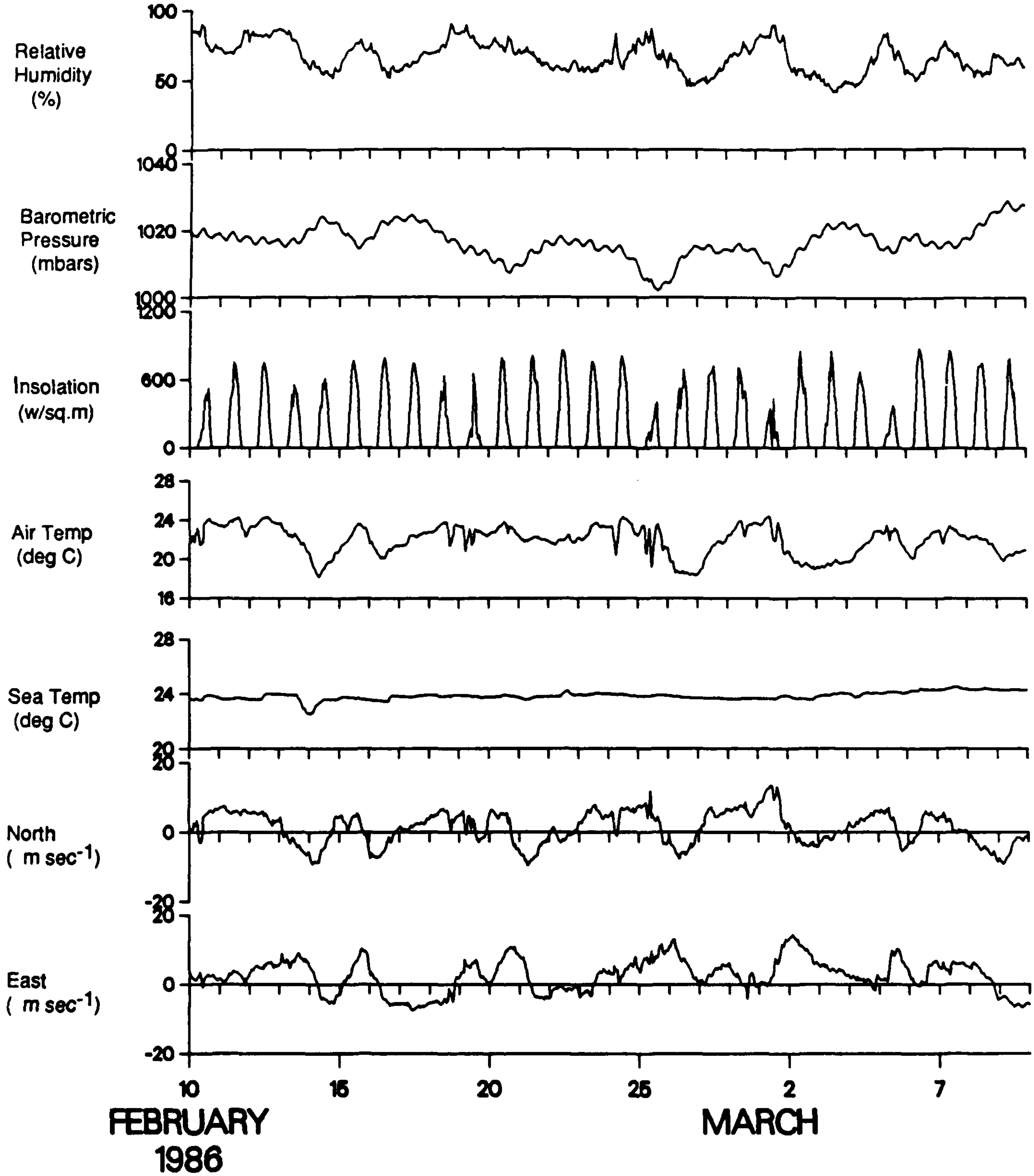
Phase Two expanded scale meteorological plots for mooring F2.



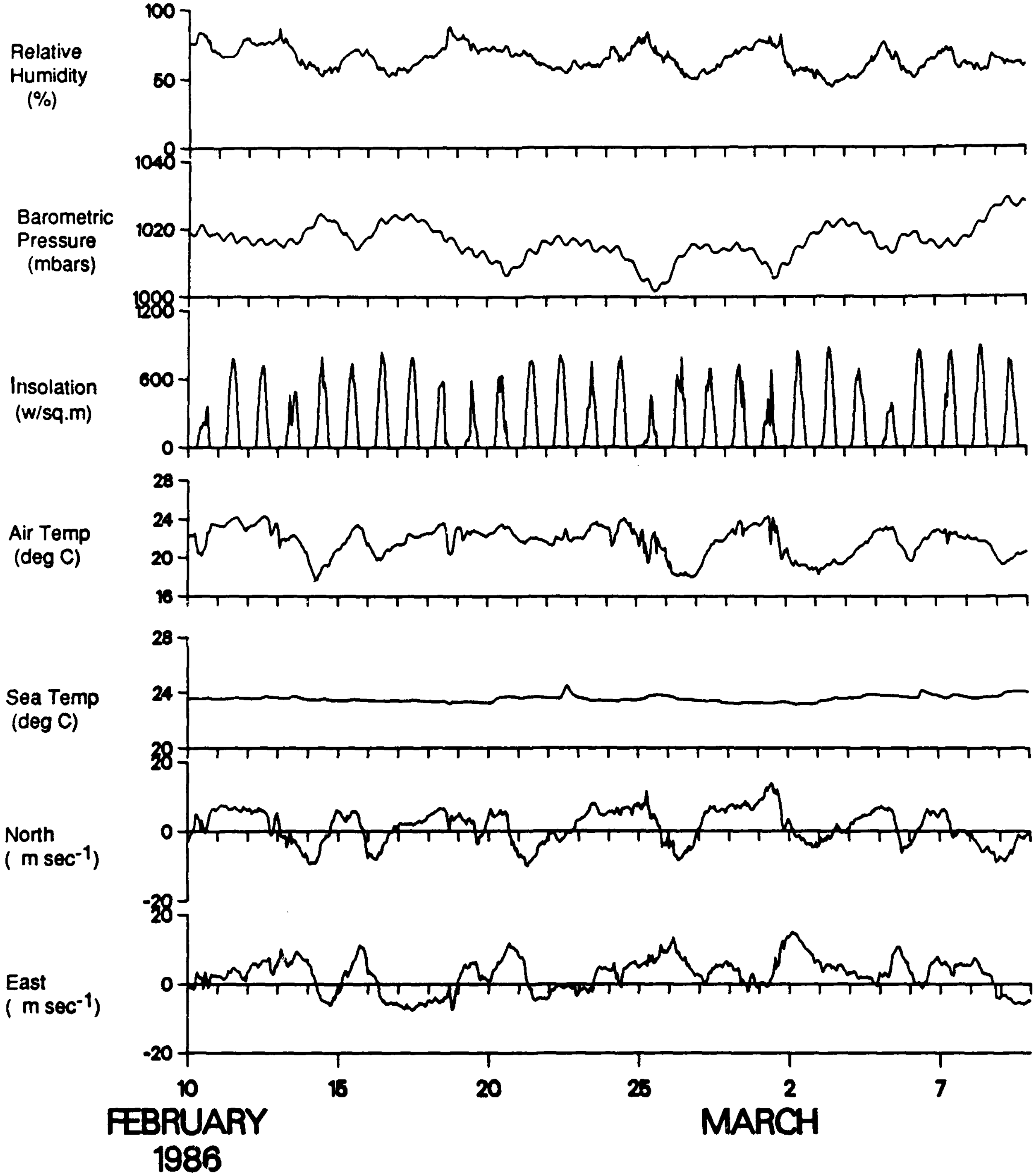
Phase Two expanded scale meteorological plots for mooring F4.



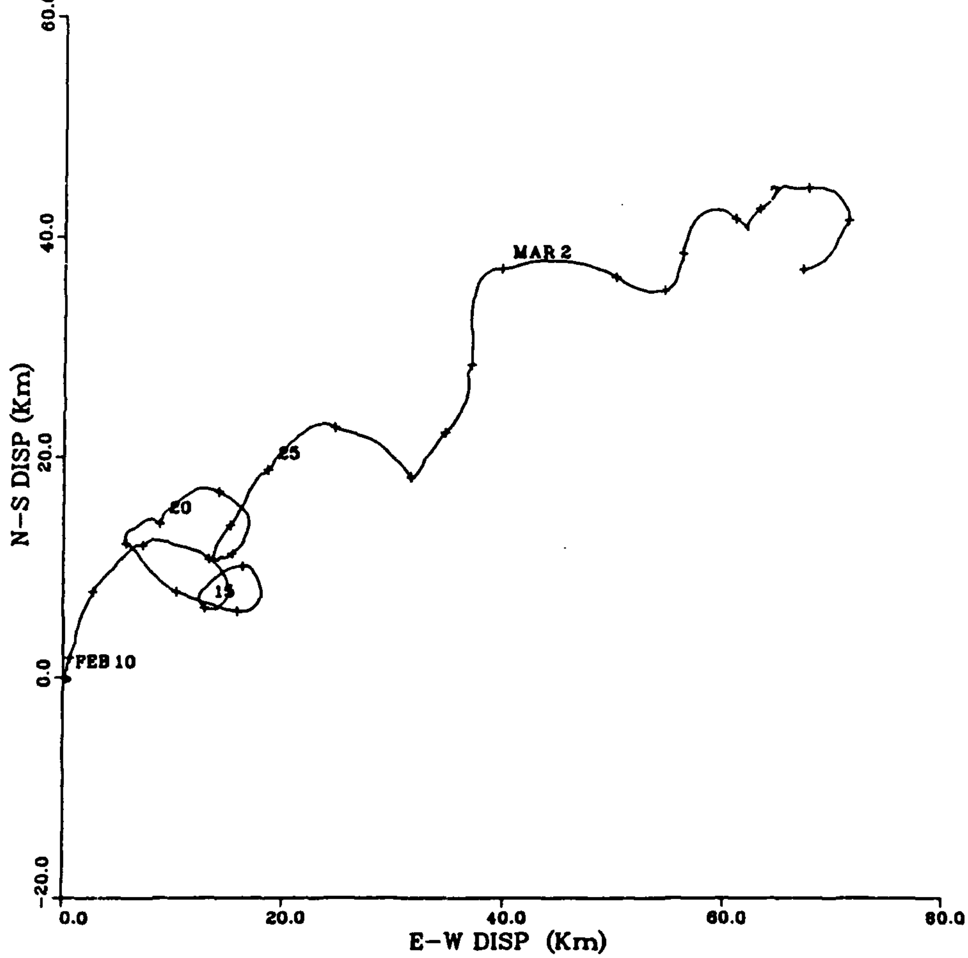
Phase Two expanded scale meteorological plots for mooring F6.



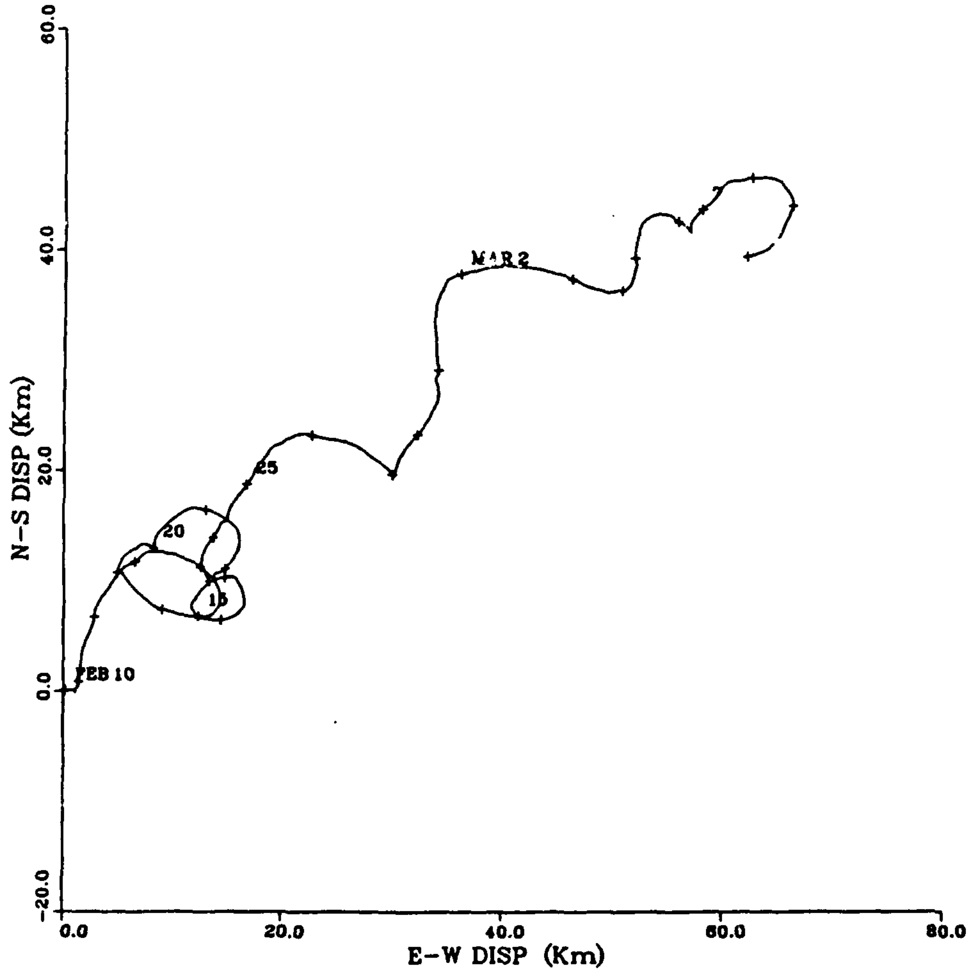
Phase Two expanded scale meteorological plots for mooring F8.



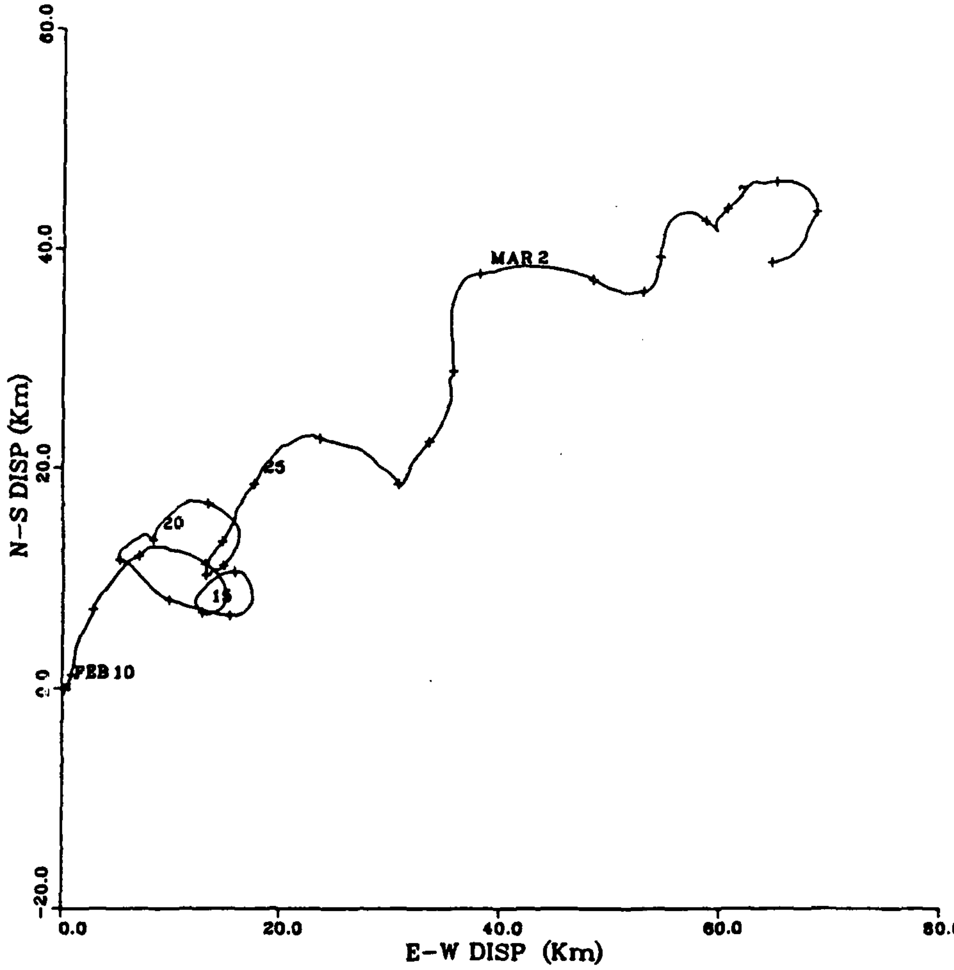
Phase Two expanded scale meteorological plots for mooring F10.



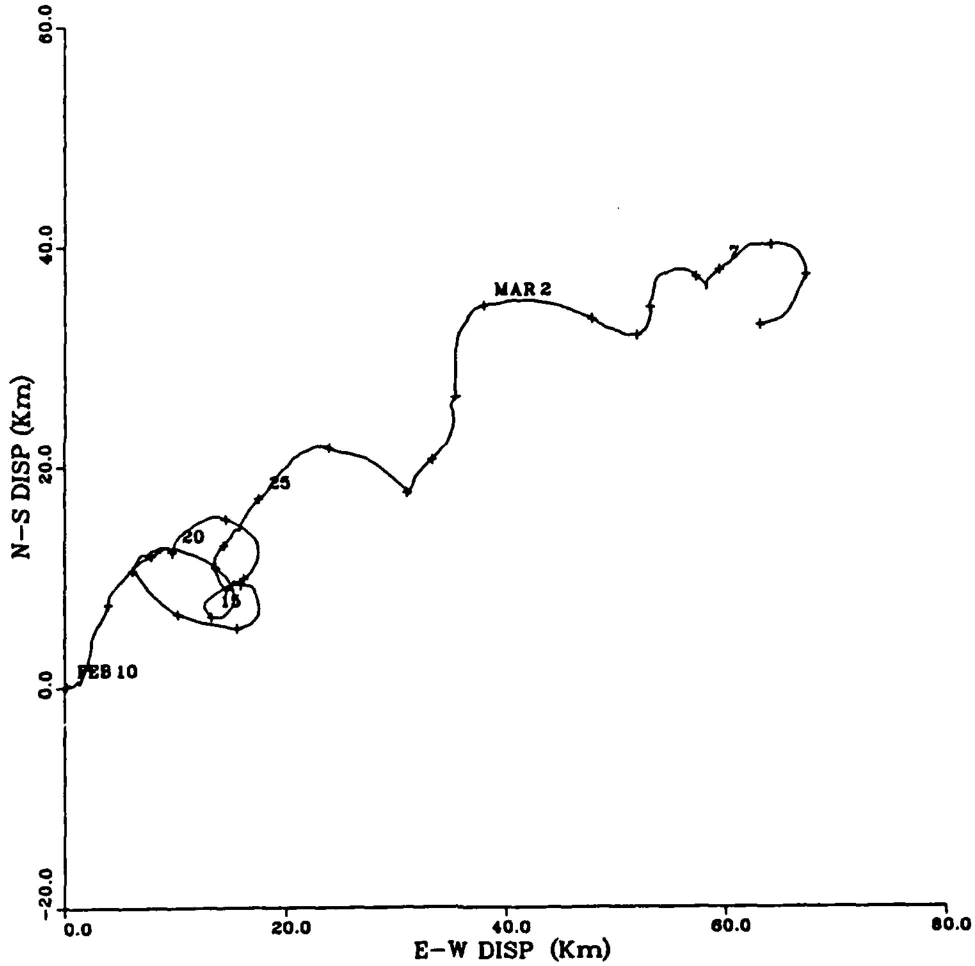
Phase Two Wind progressive vector diagram for F2.



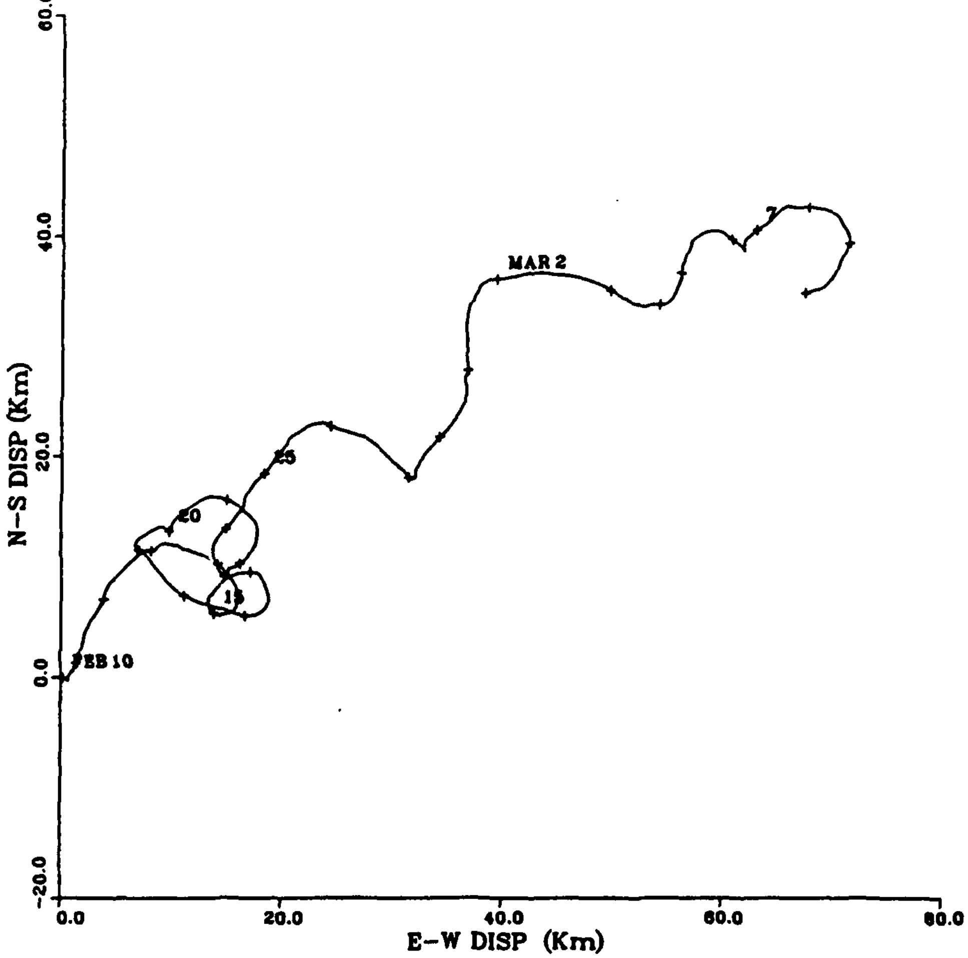
Phase Two Wind progressive vector diagram for F4.



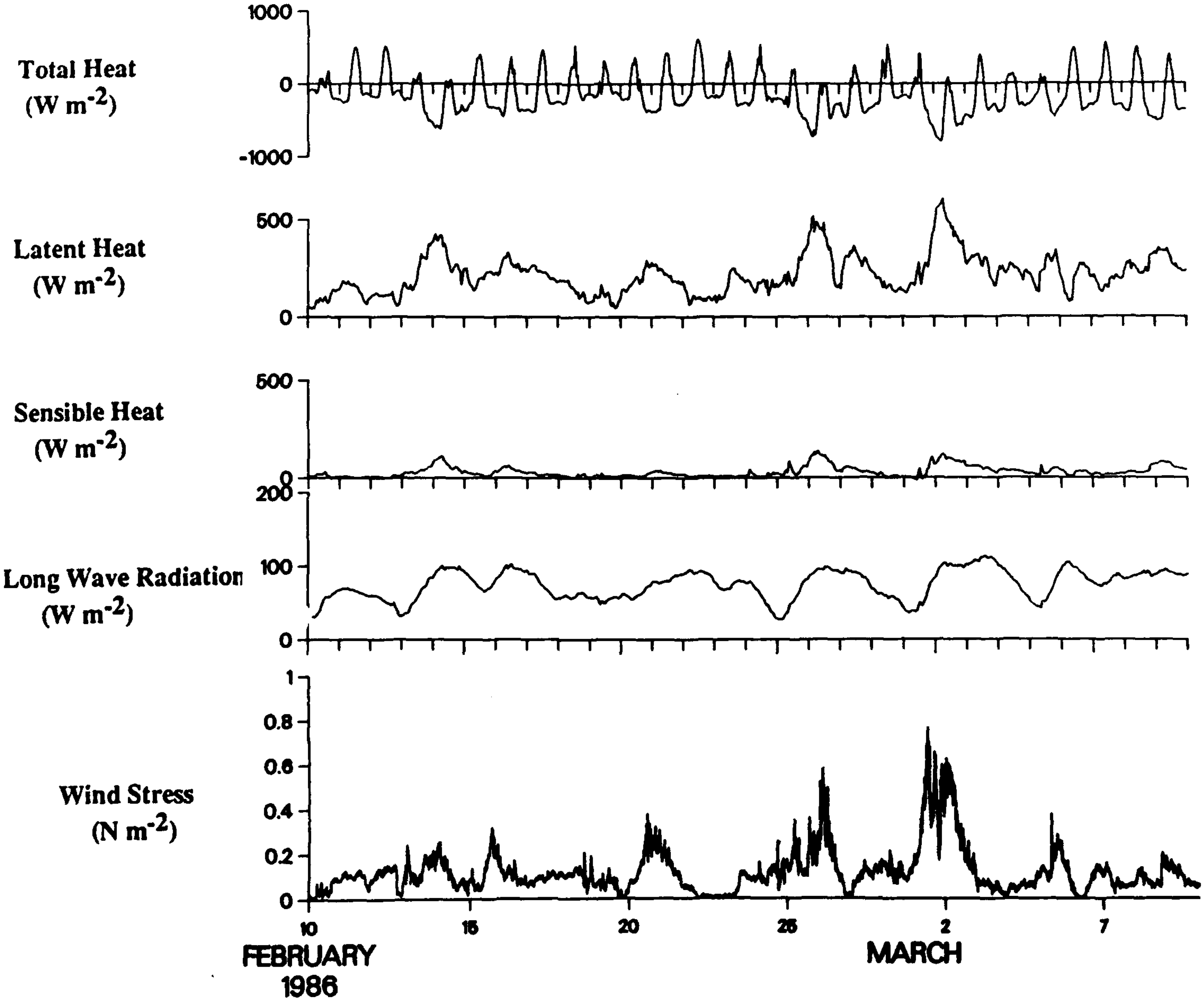
Phase Two Wind progressive vector diagram for F6.



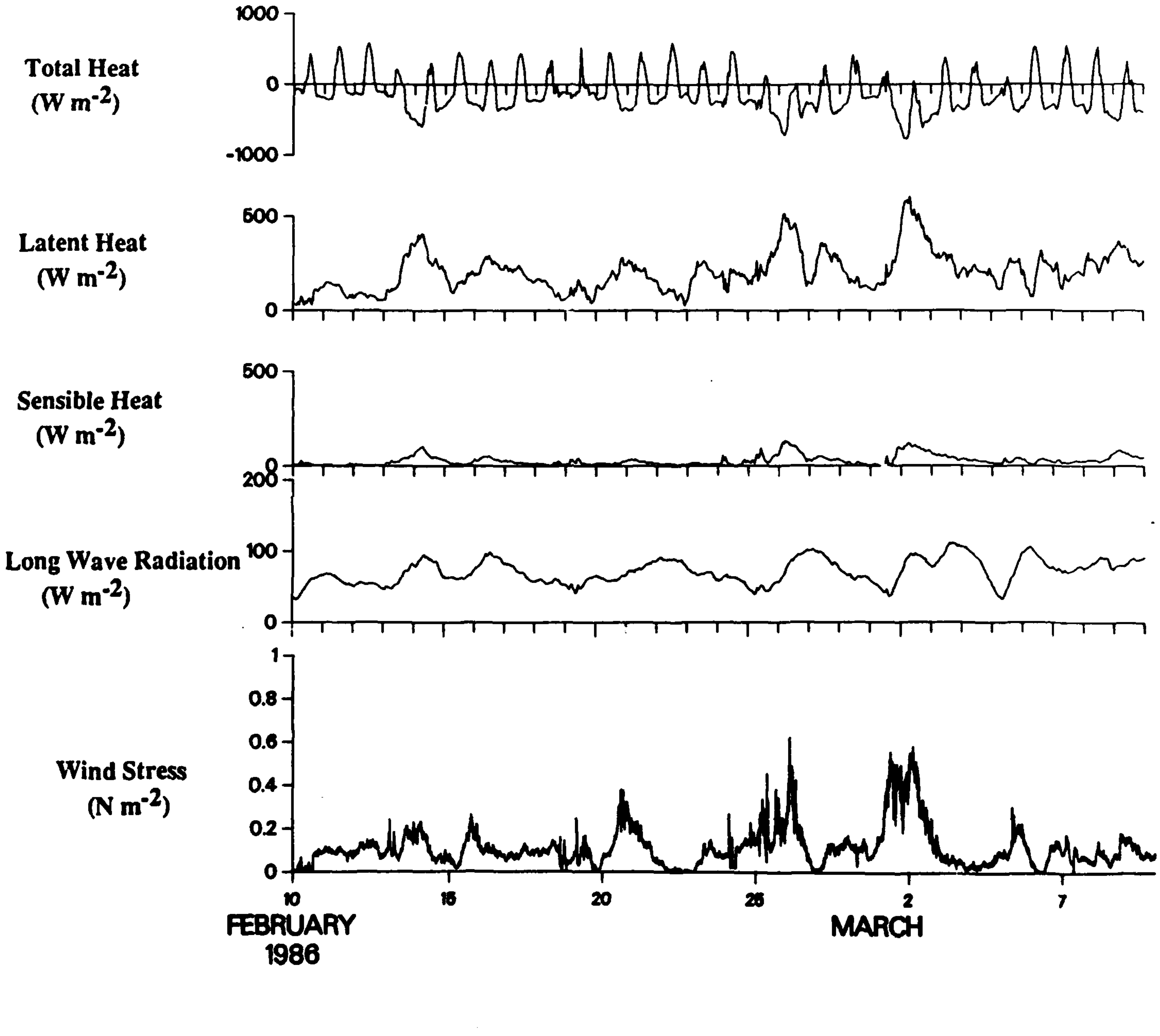
Phase Two Wind progressive vector diagram for F8.



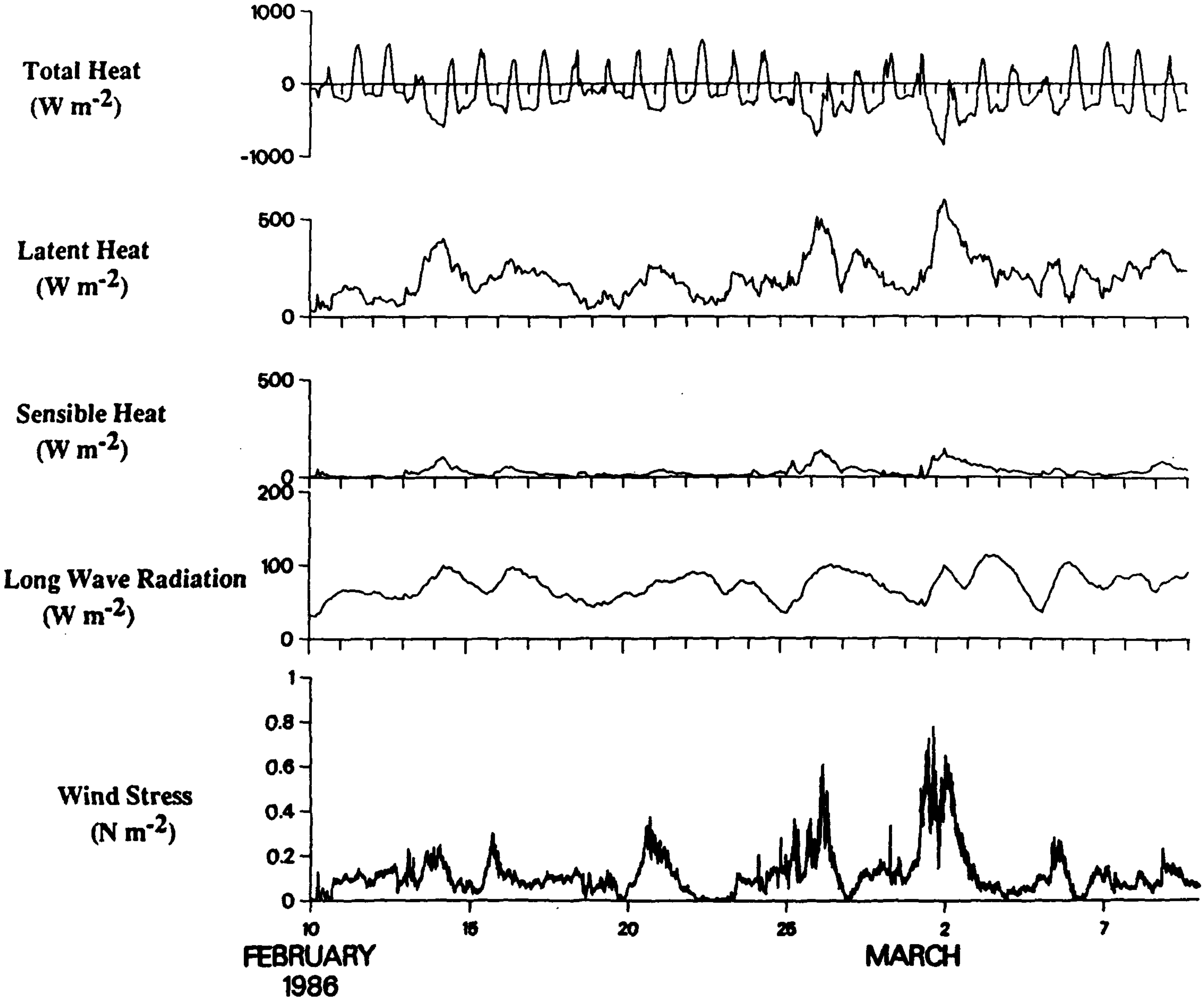
Phase Two Wind progressive vector diagram for F10.



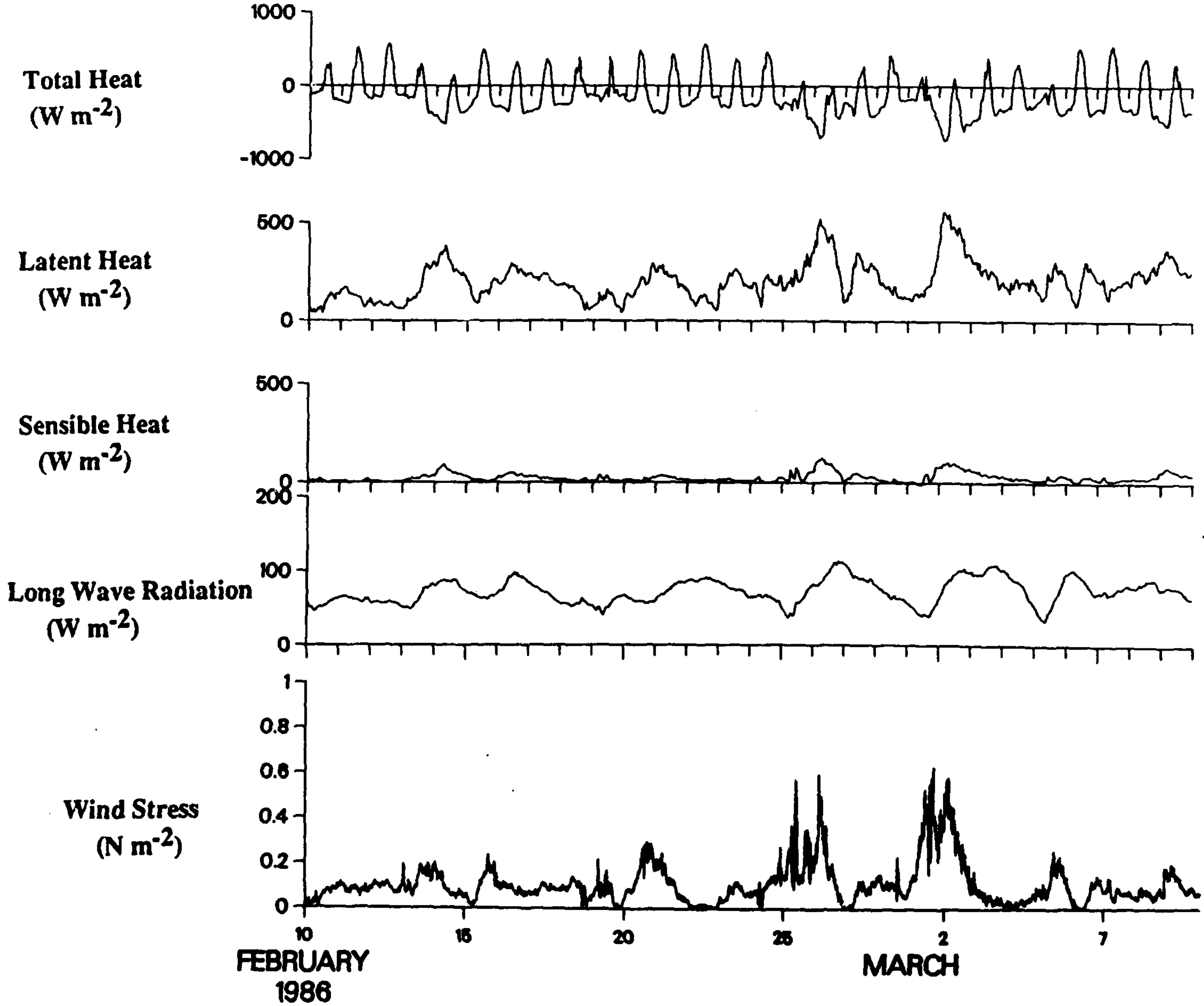
Phase Two mooring F2 Heat Flux and Wind Stress (magnitude) data set.



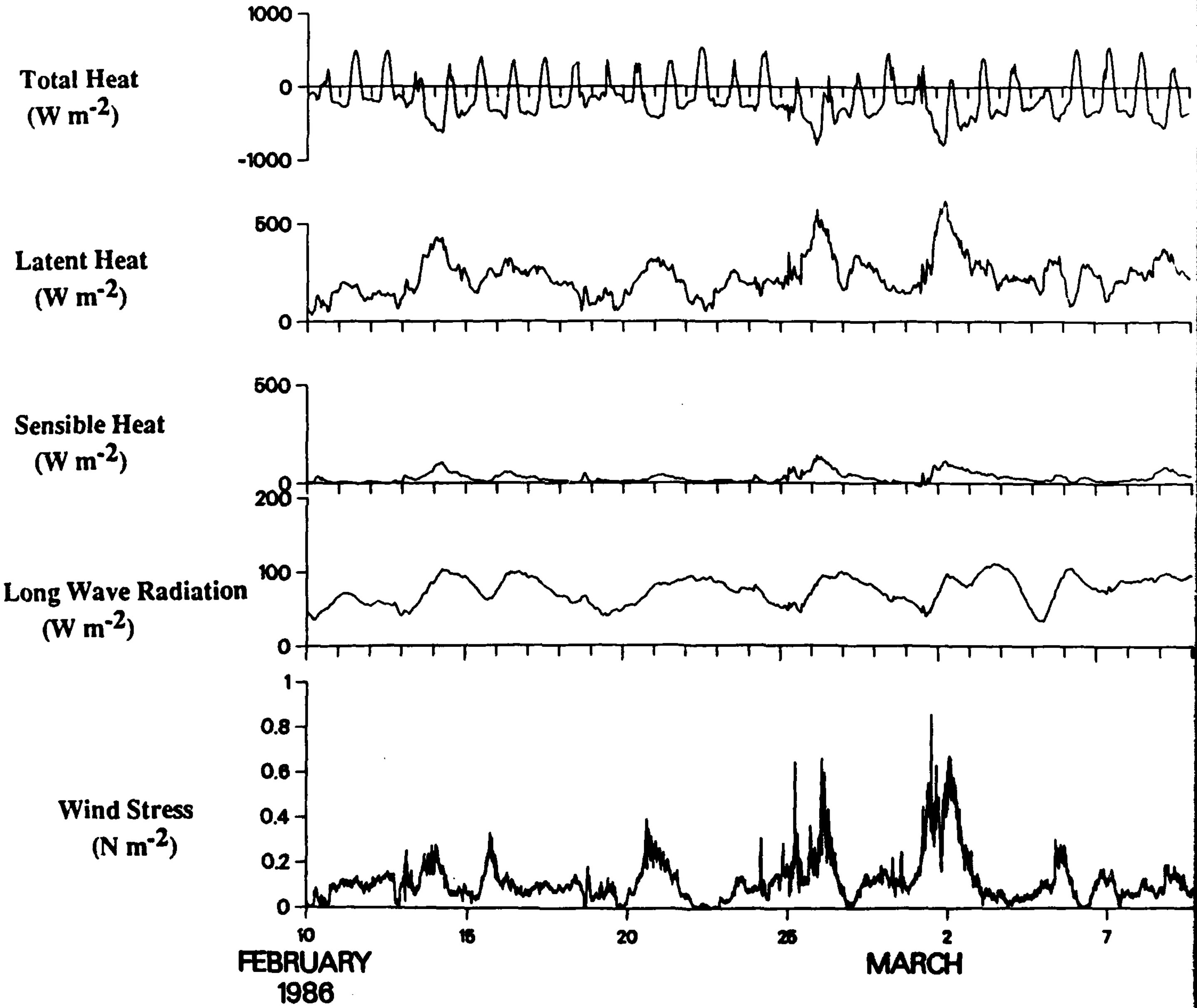
Phase Two mooring F4 Heat Flux and Wind Stress (magnitude) data set.



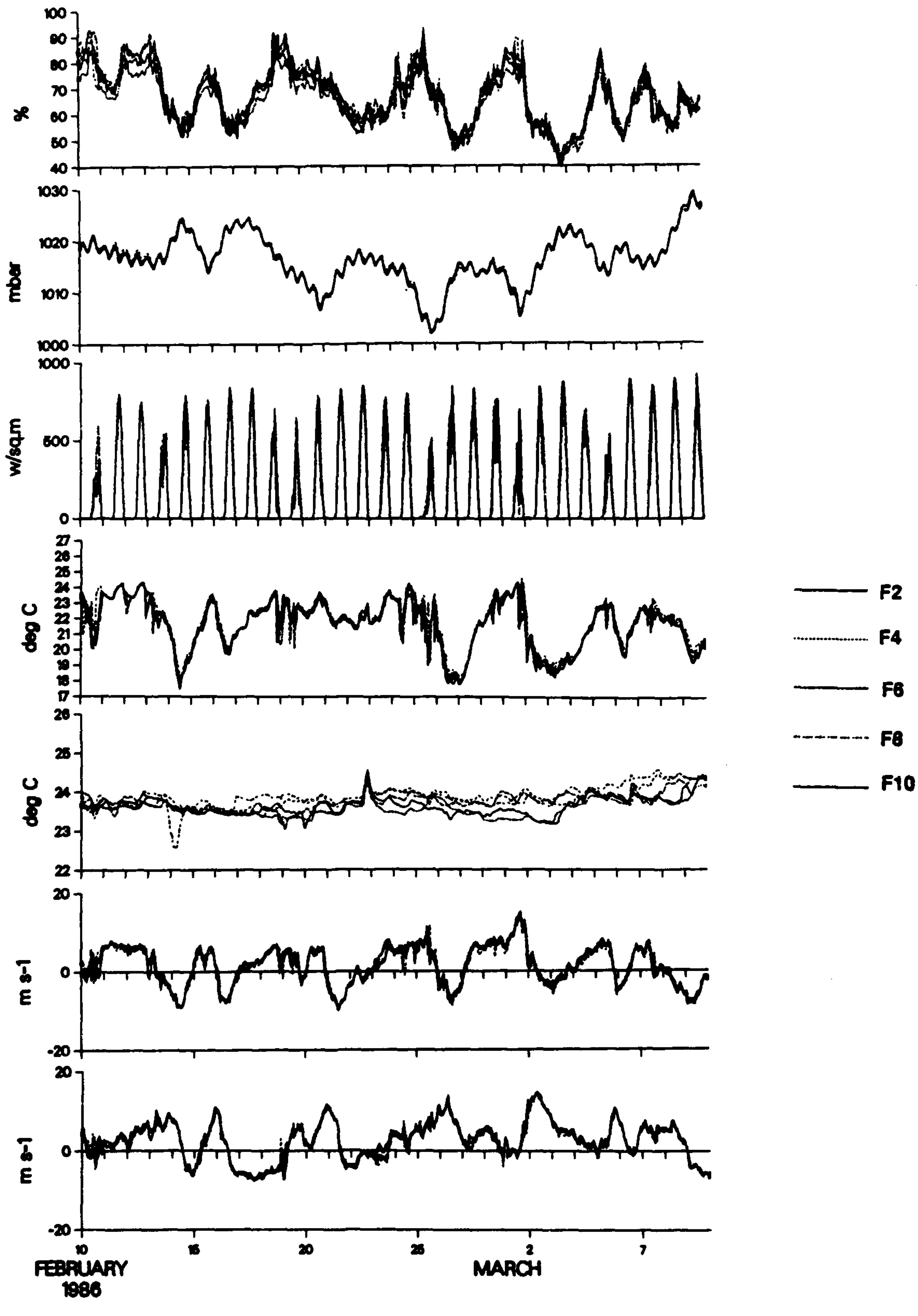
Phase Two mooring F6 Heat Flux and Wind Stress (magnitude) data set.



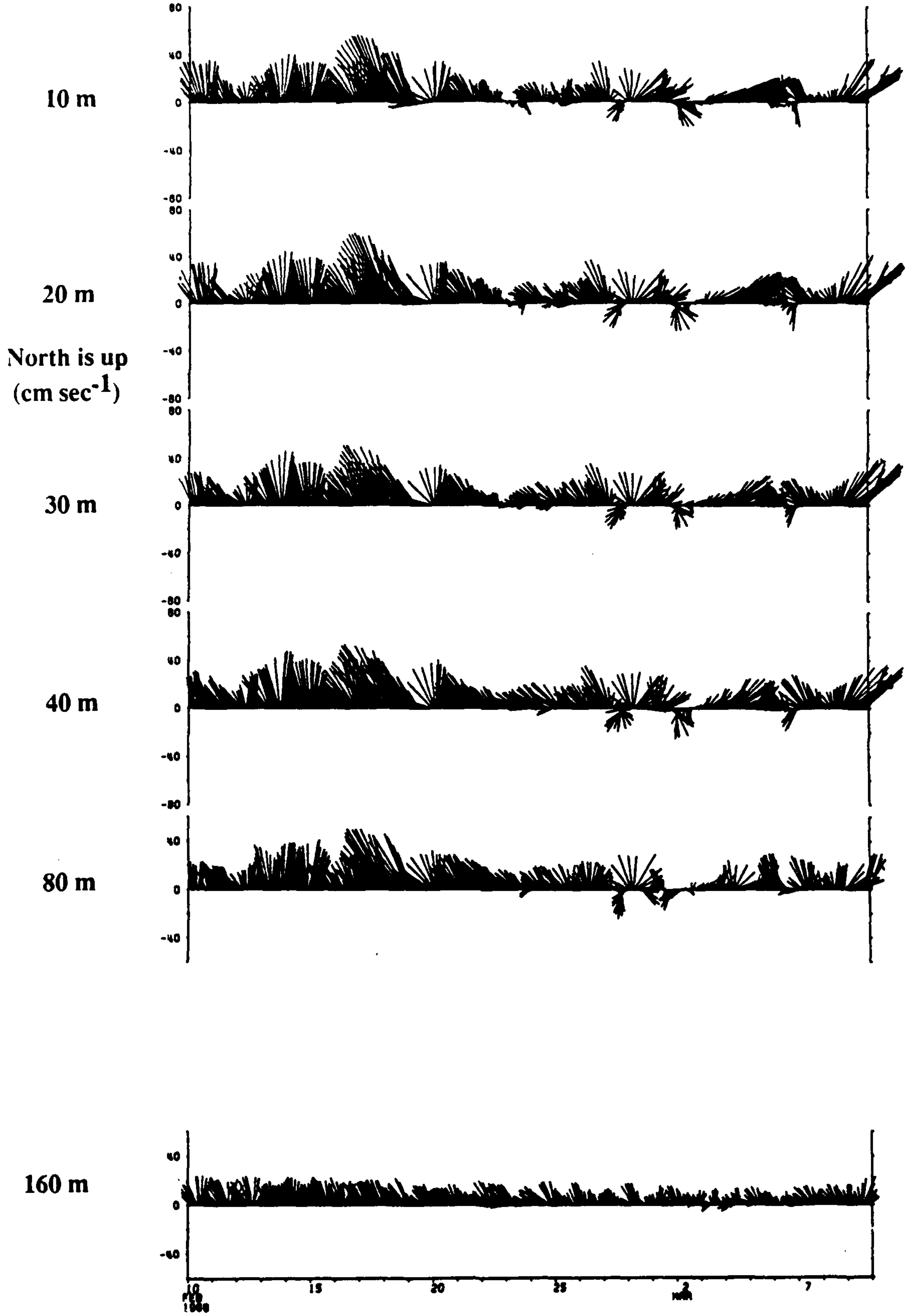
Phase Two mooring F8 Heat Flux and Wind Stress (magnitude) data set.



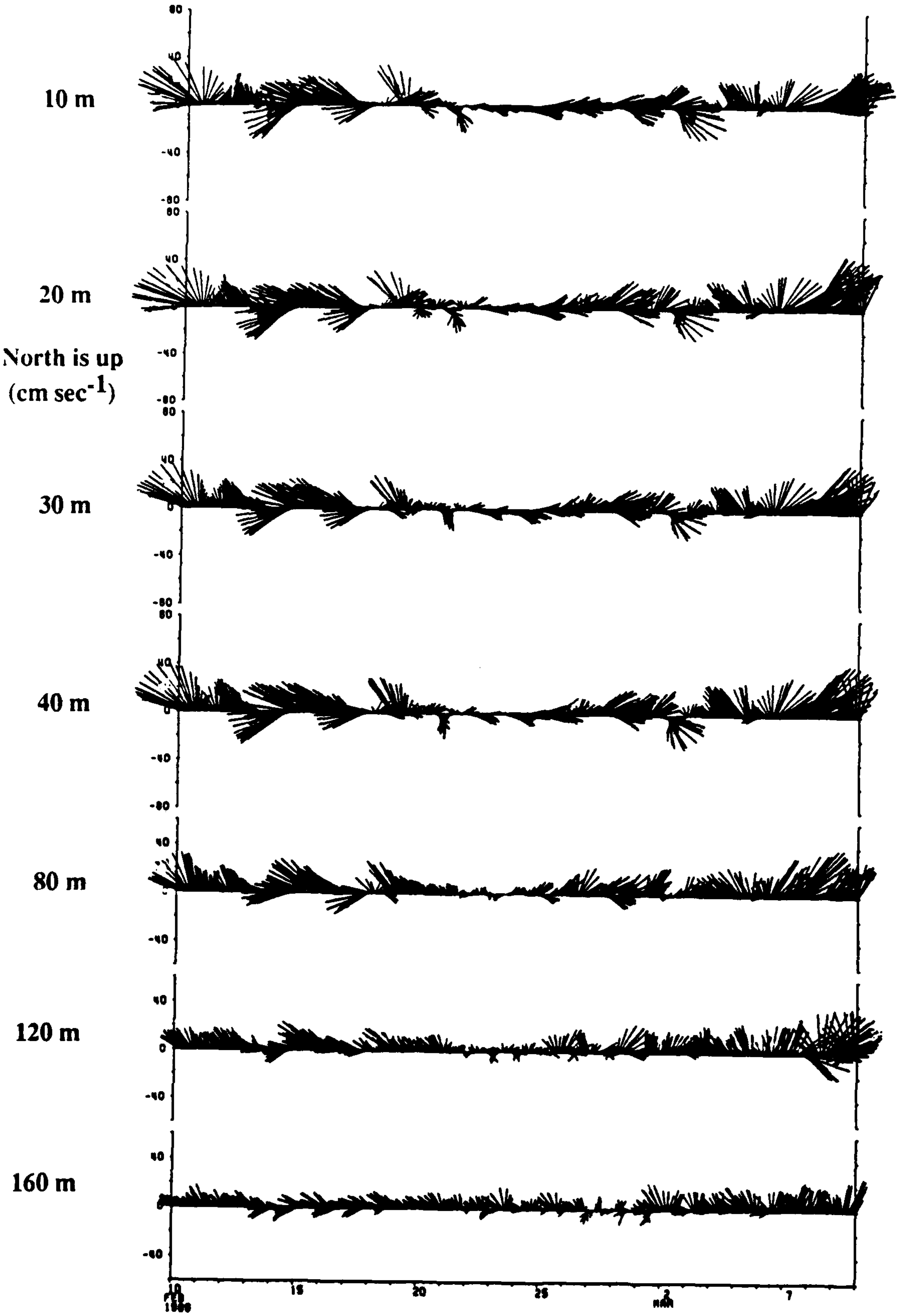
Phase Two mooring F10 Heat Flux and Wind Stress (magnitude) data set.



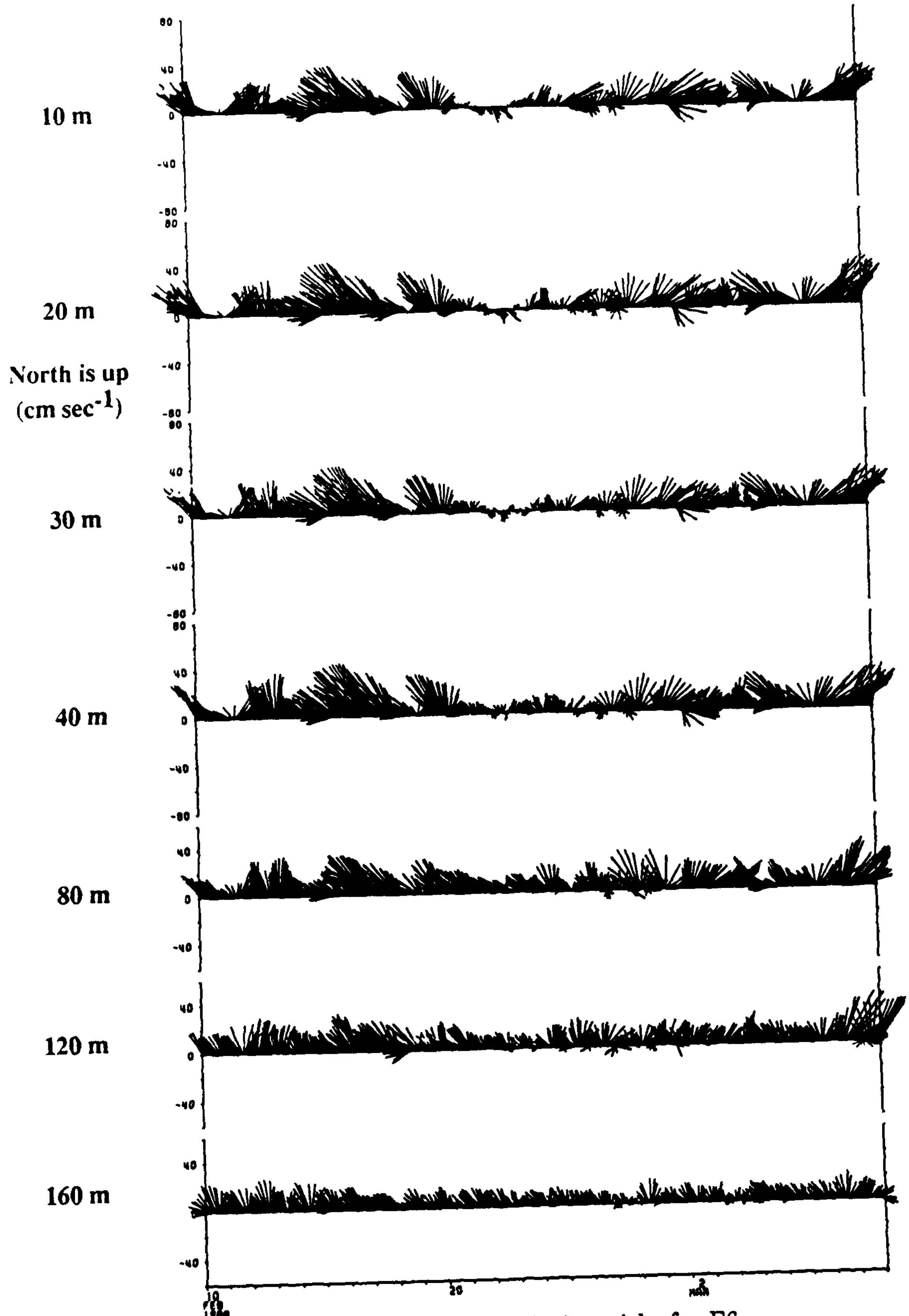
Phase Two meteorological overplot, all variables, five buoys.



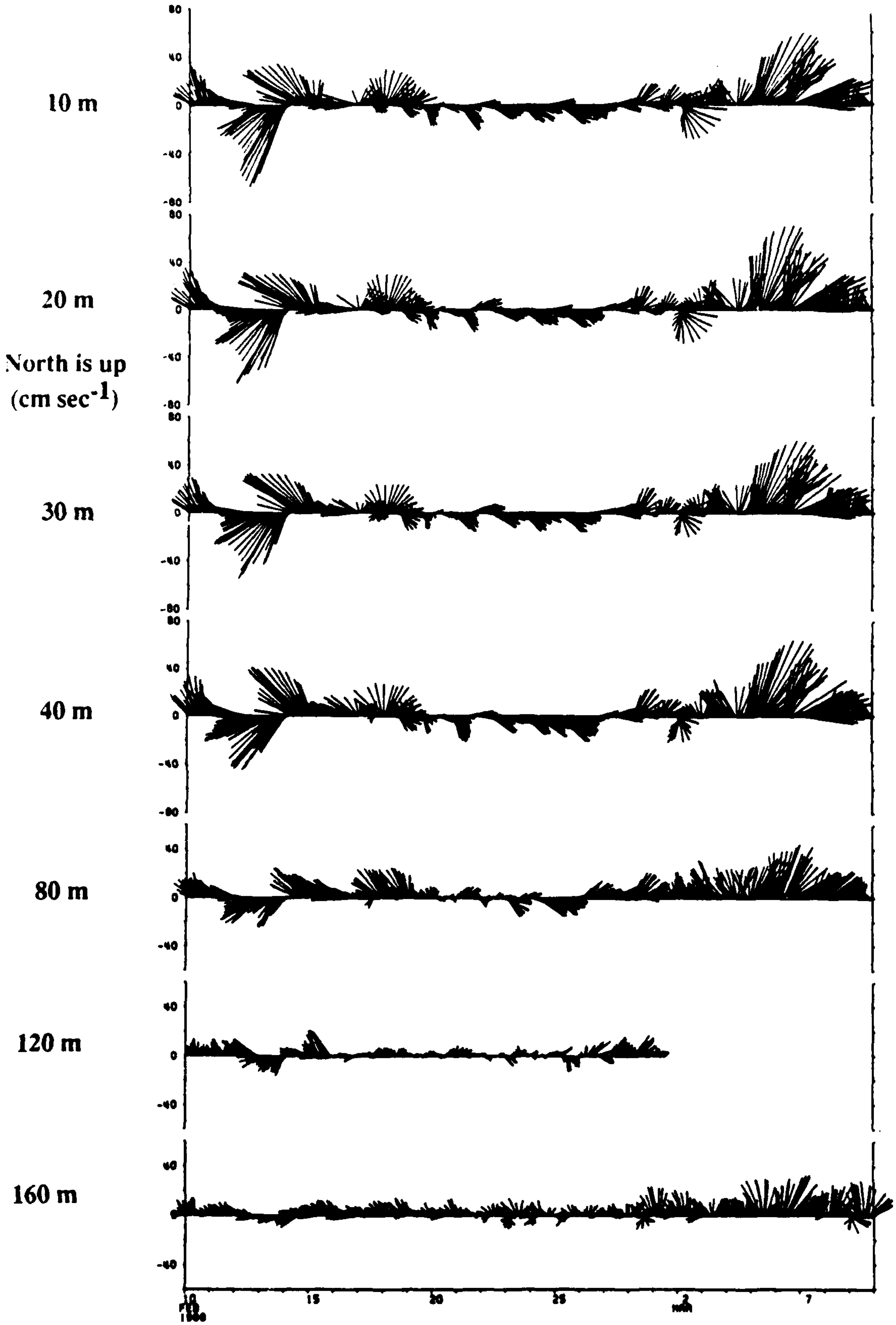
Phase Two composite velocity sticks for F2



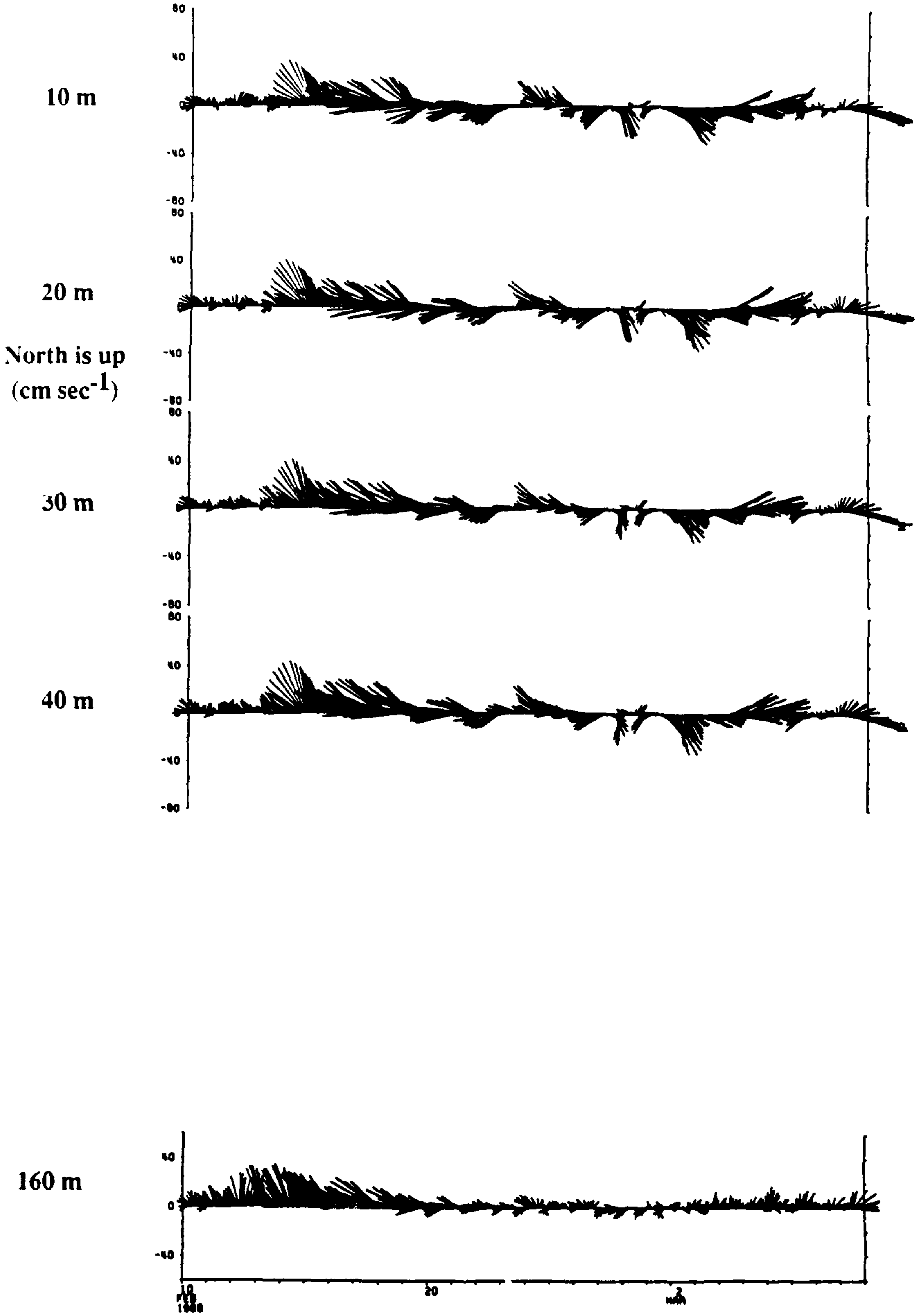
Phase Two composite velocity sticks for F4



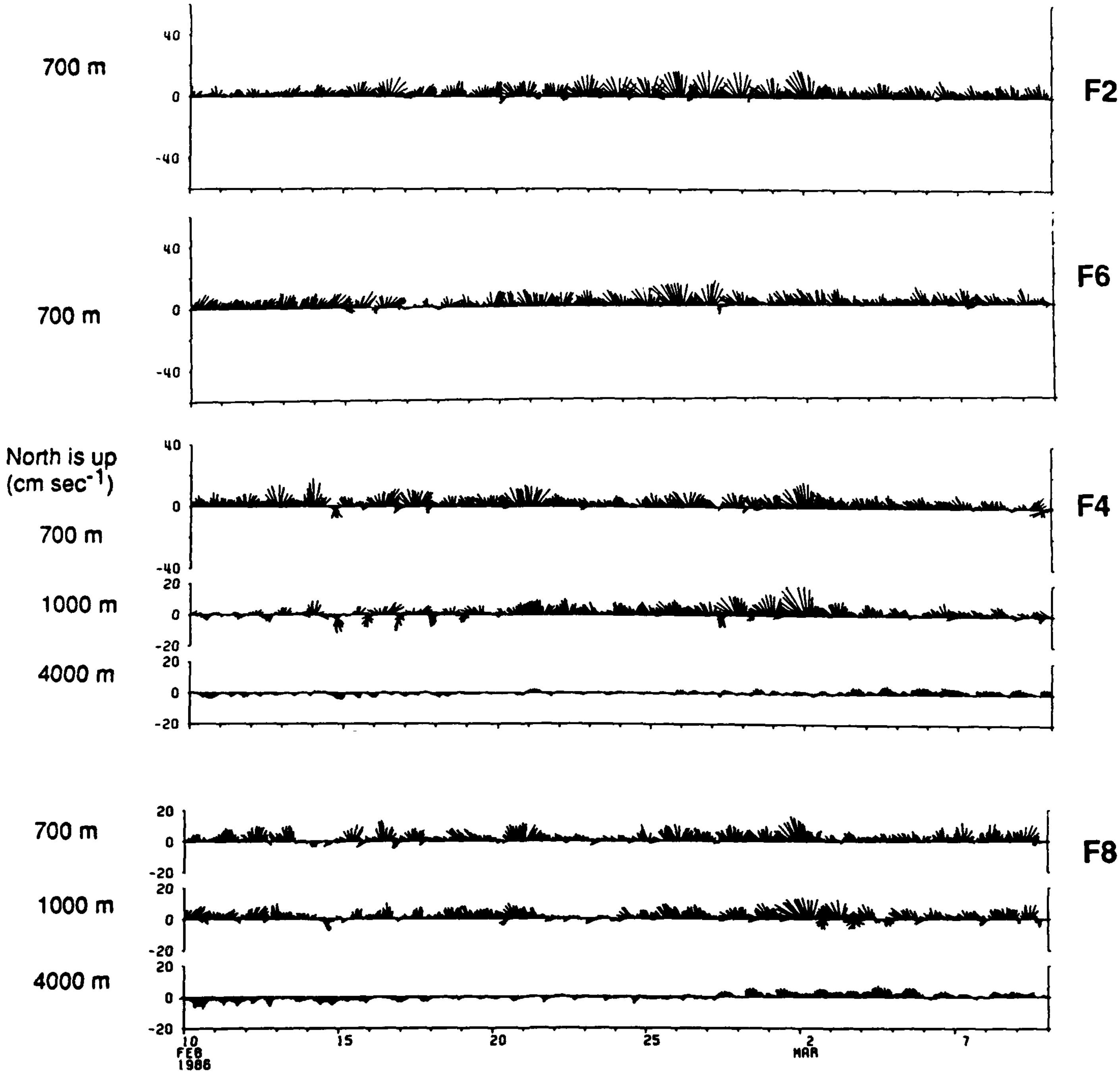
Phase Two composite velocity sticks for F6



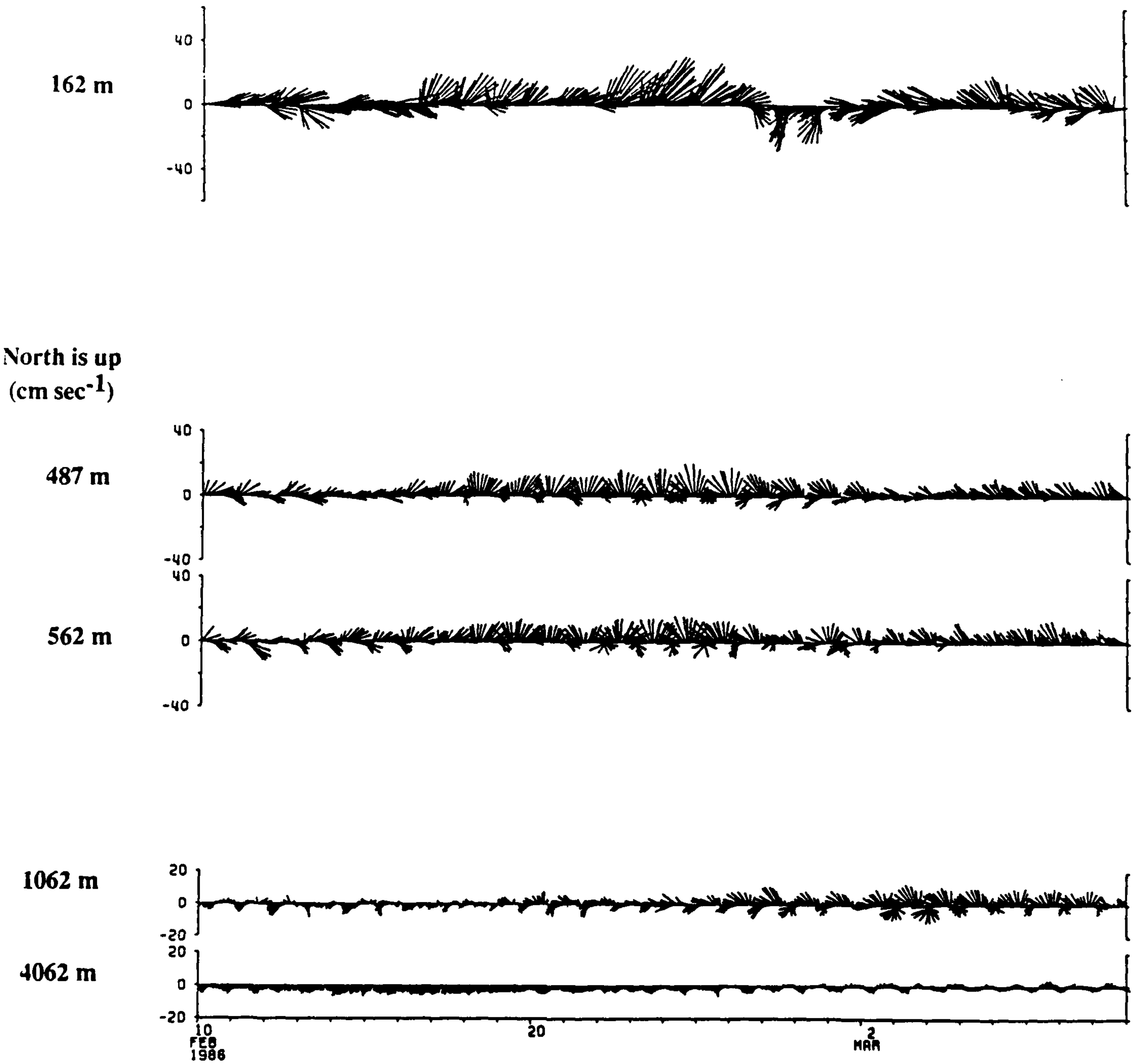
Phase Two composite velocity sticks for F8



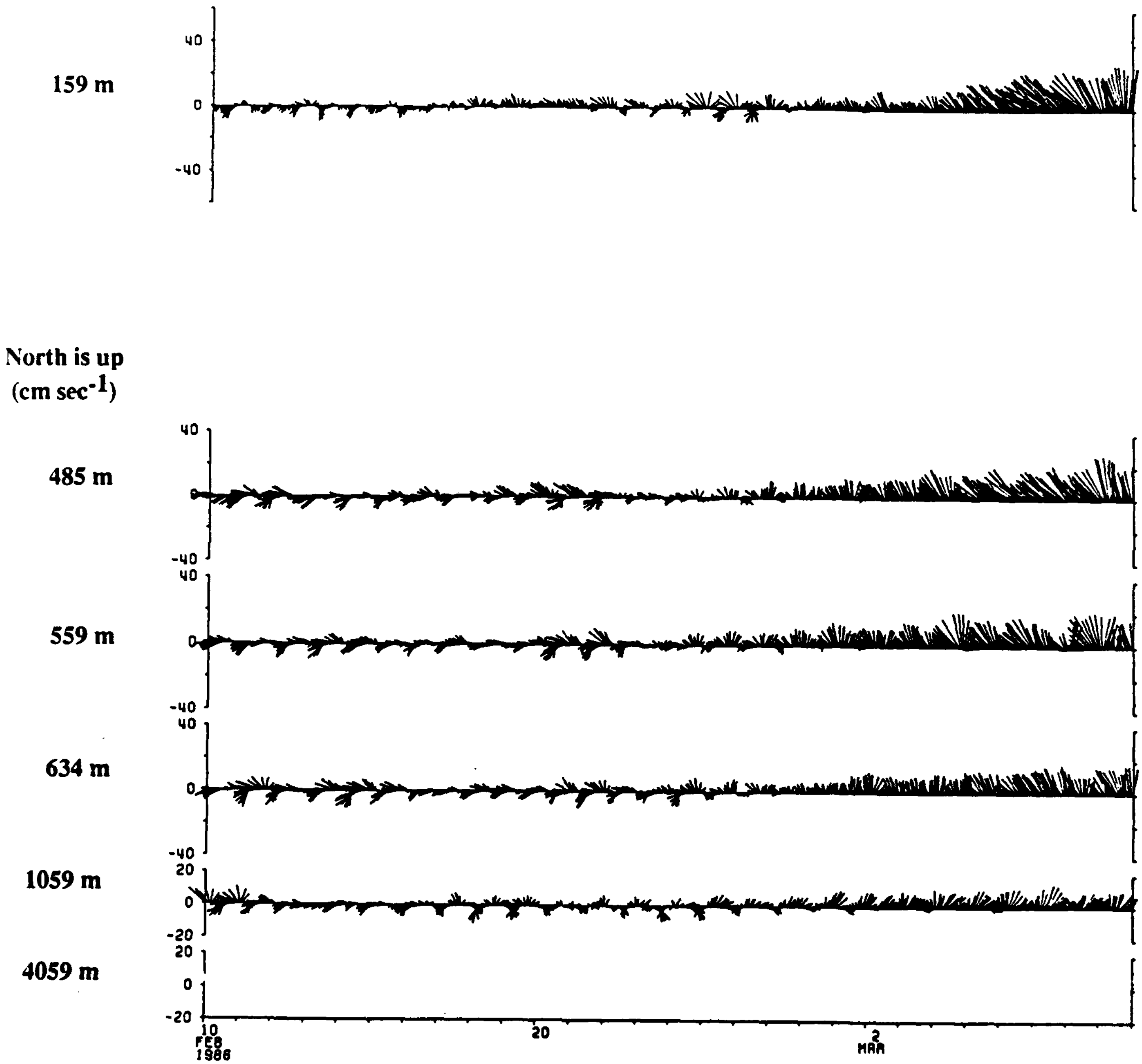
Phase Two composite velocity sticks for F10



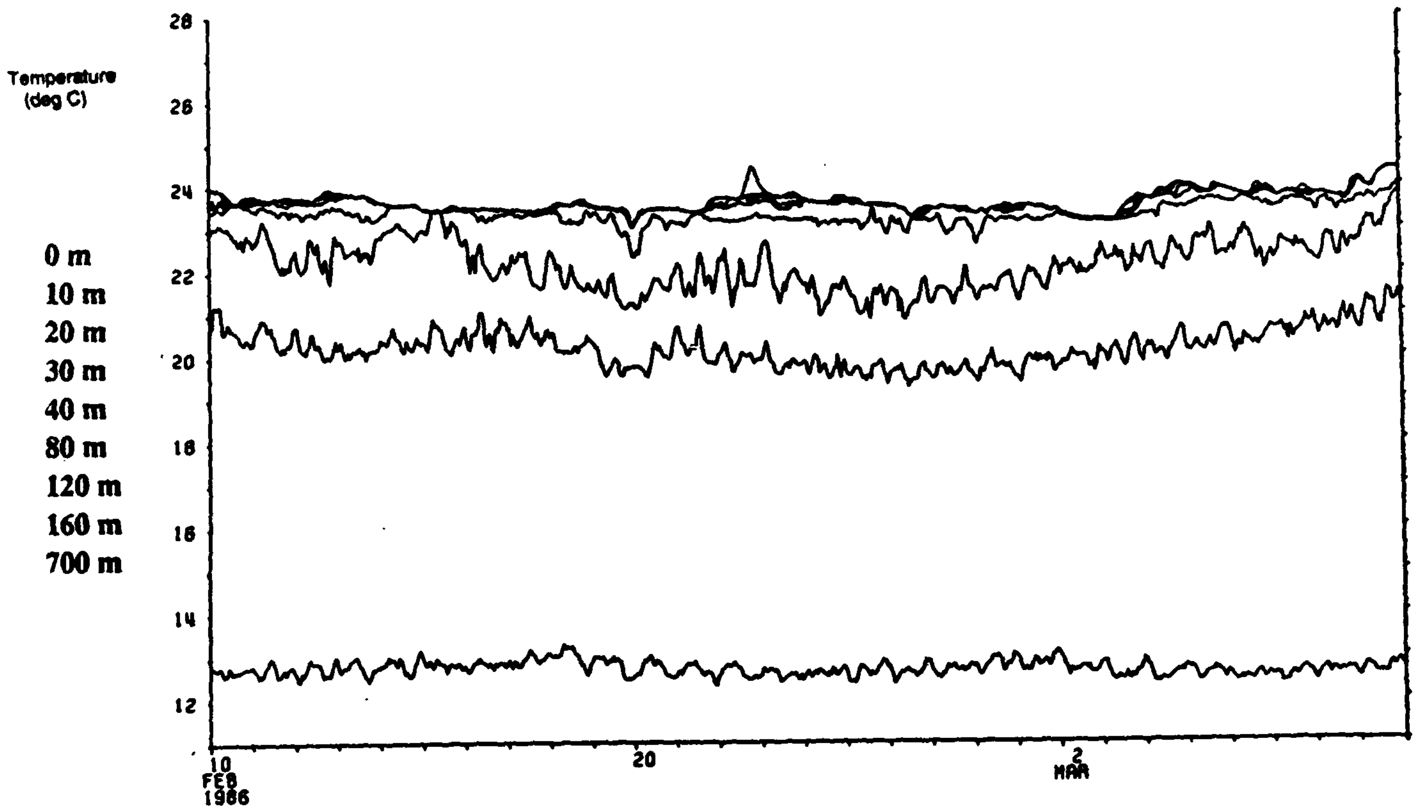
Phase Two composite deep velocity sticks.



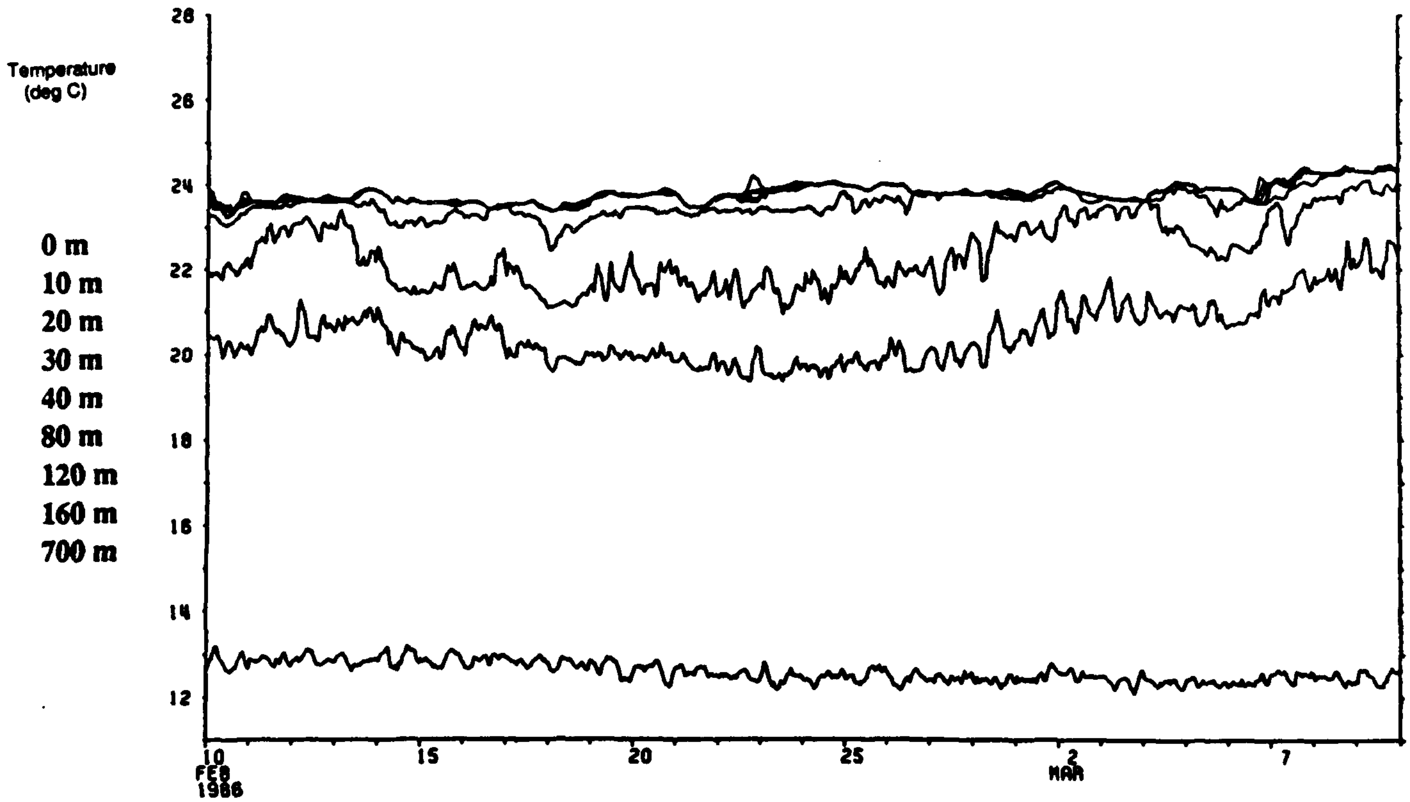
Phase Two composite velocity sticks for F1.



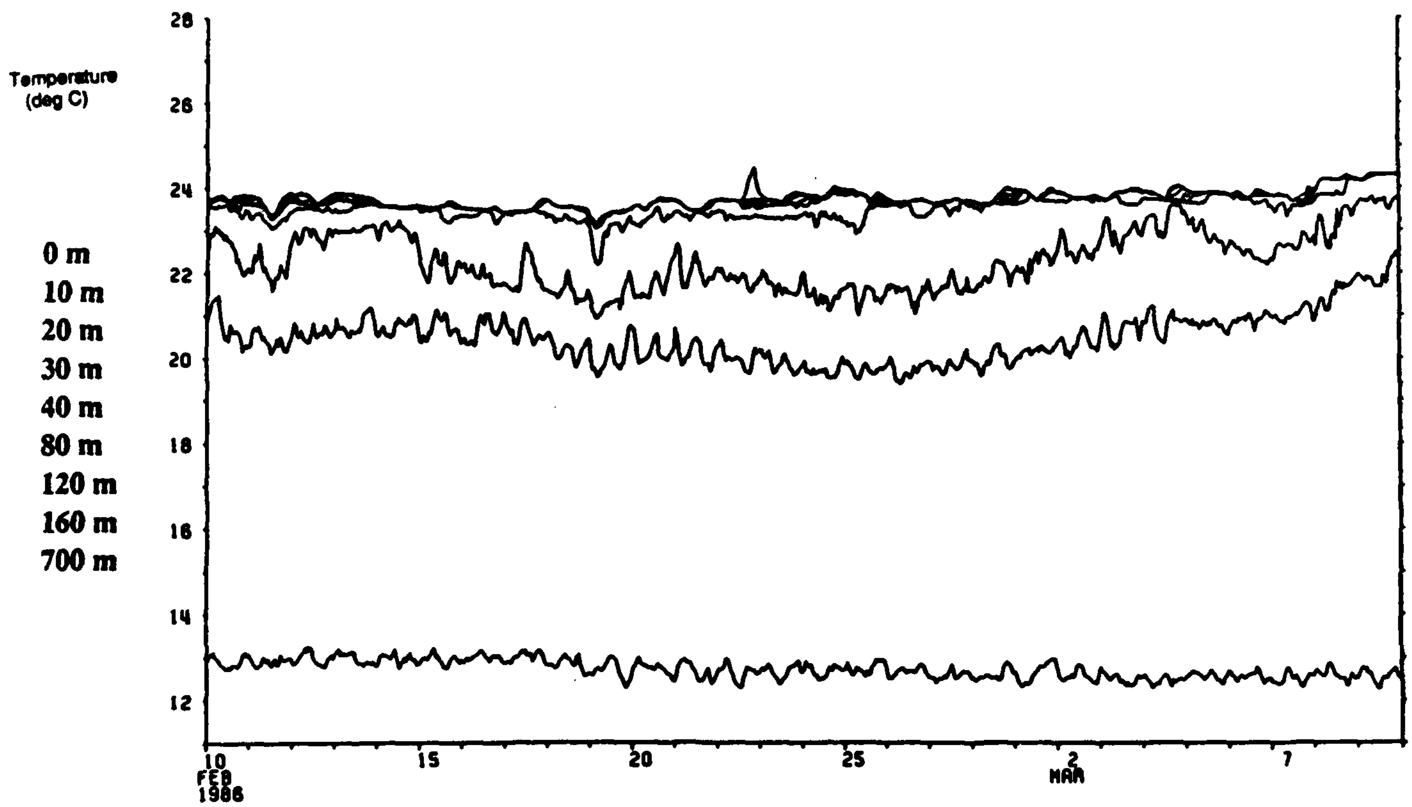
Phase Two composite velocity sticks for F12.



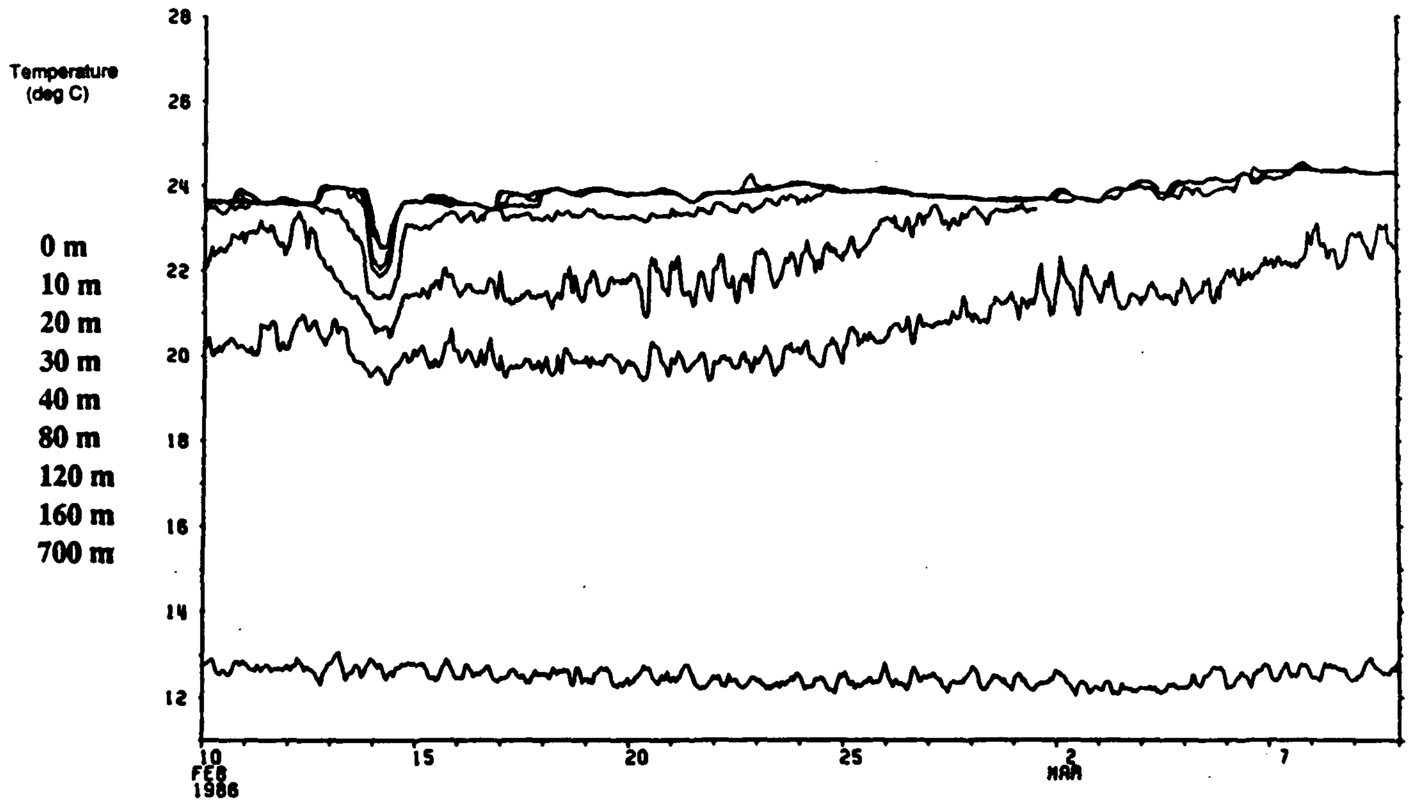
Phase Two composite Temperatures for F2.



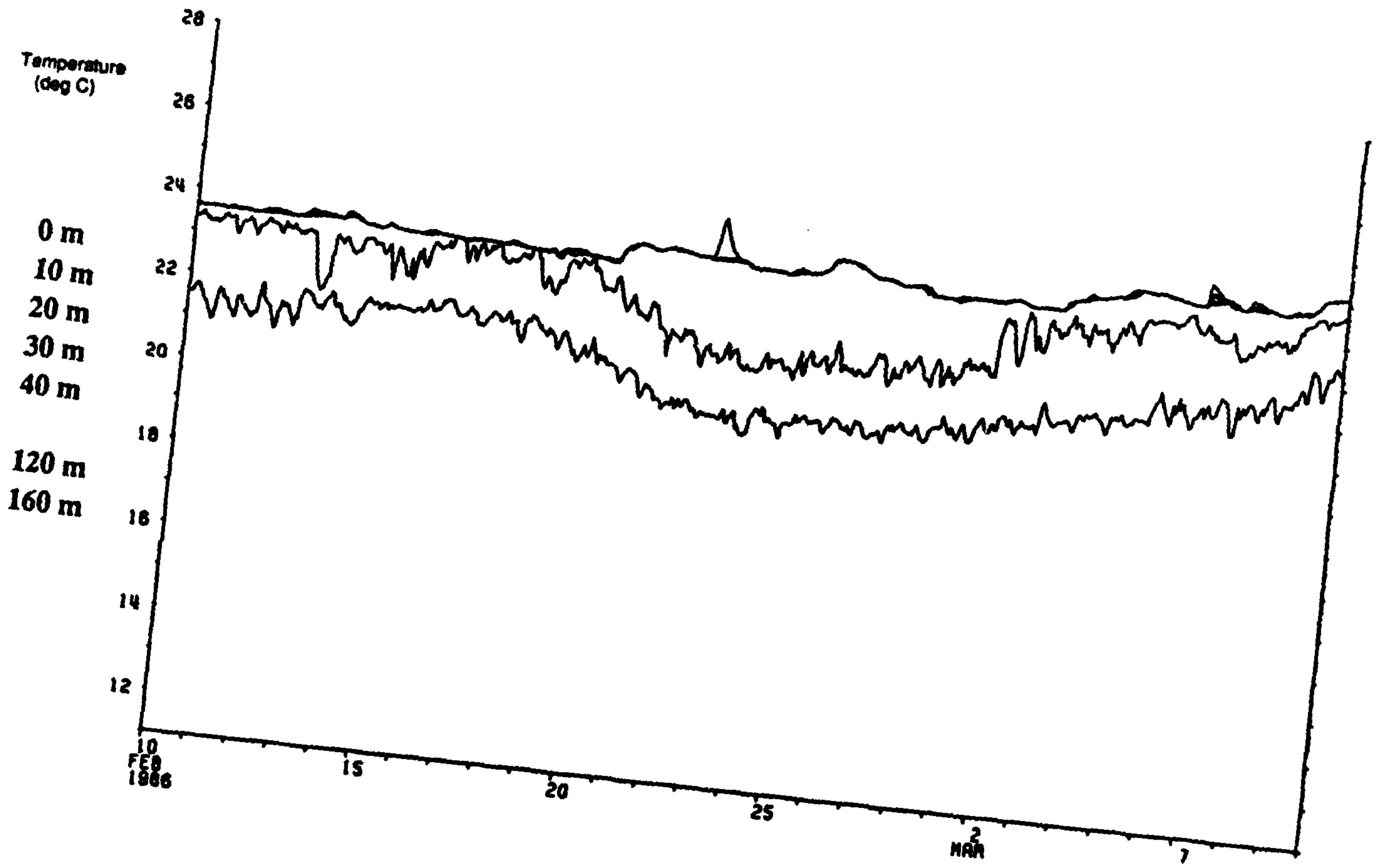
Phase Two composite Temperatures for F4.



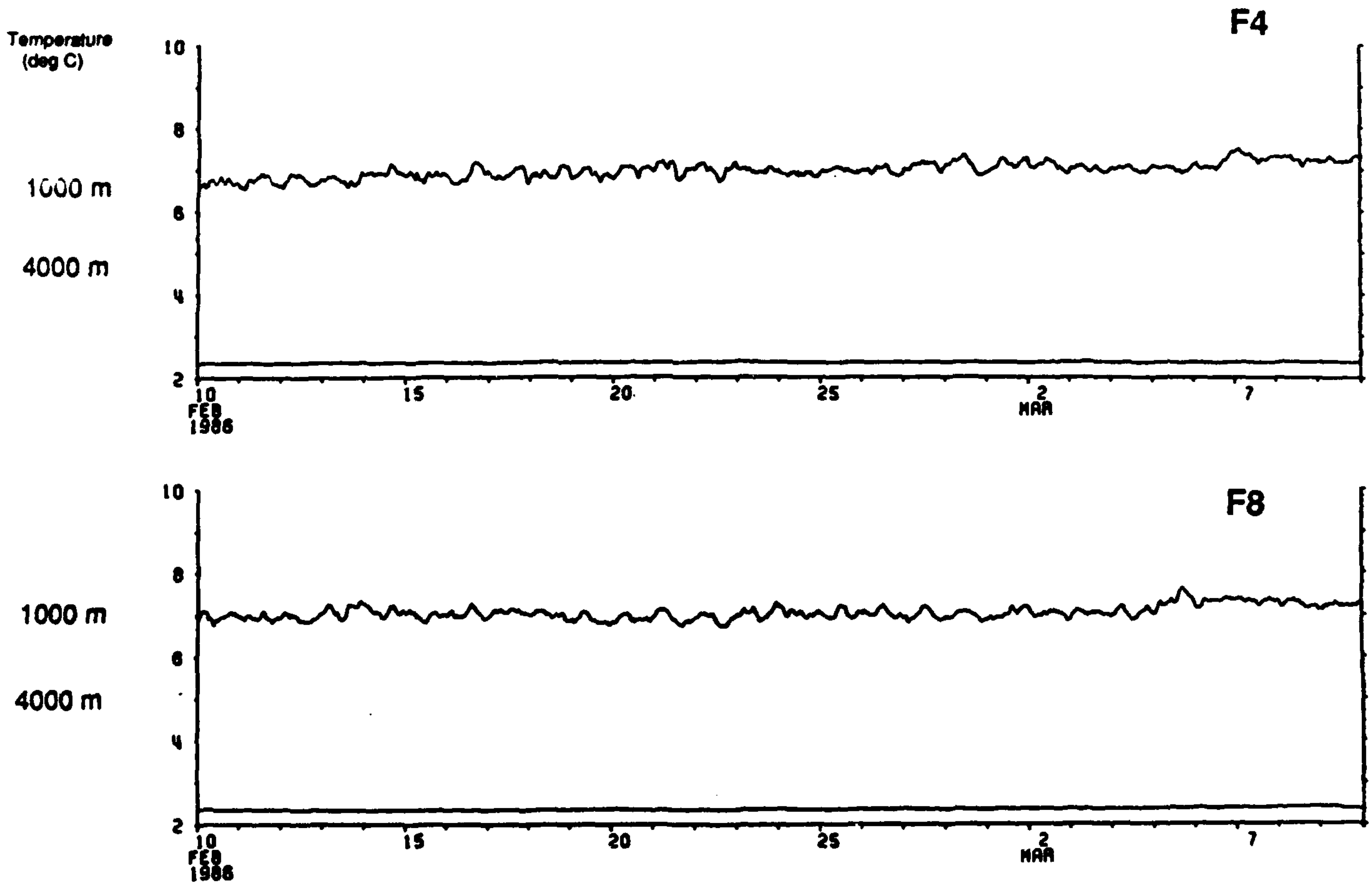
Phase Two composite Temperatures for F6.



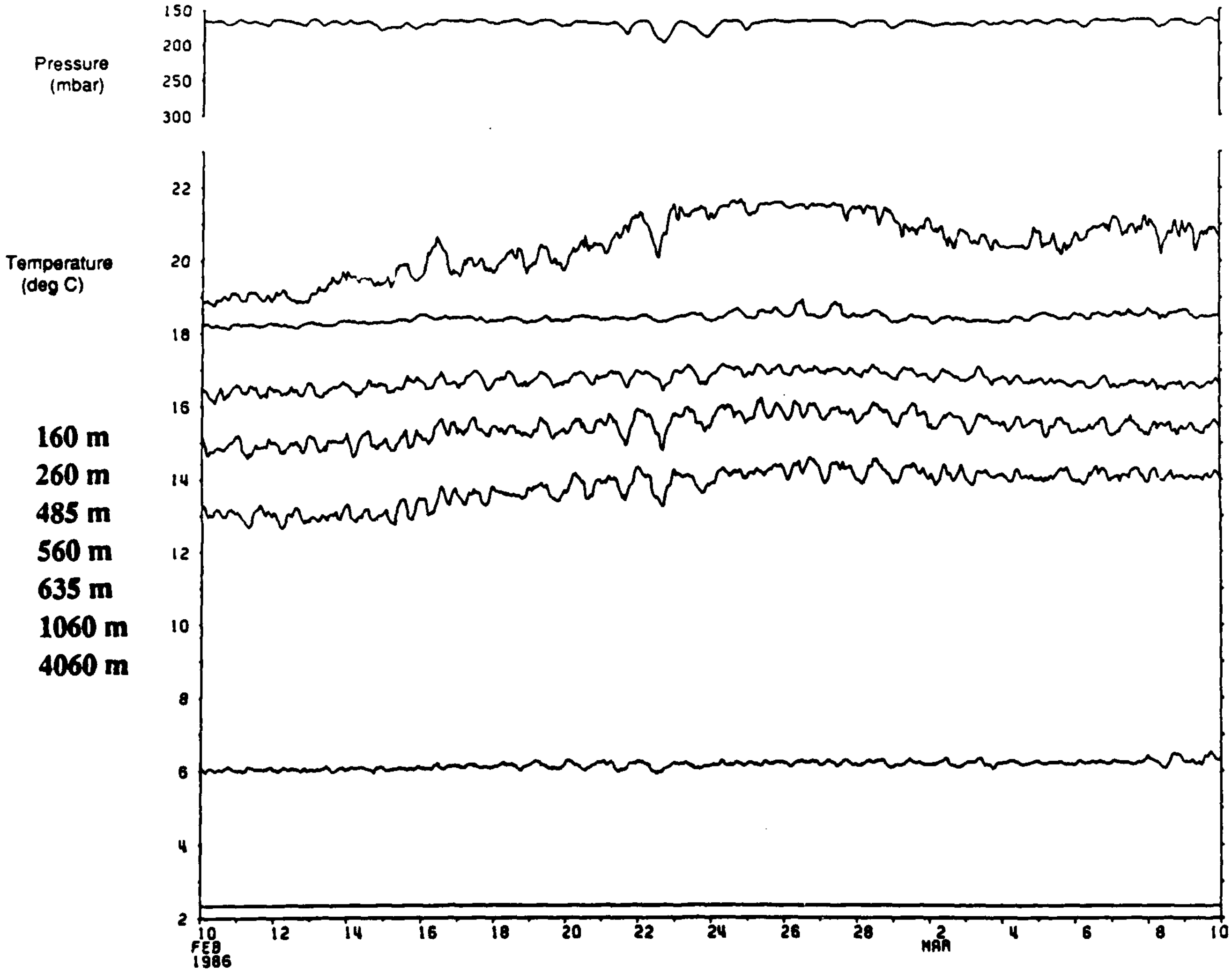
Phase Two composite Temperatures for F8.



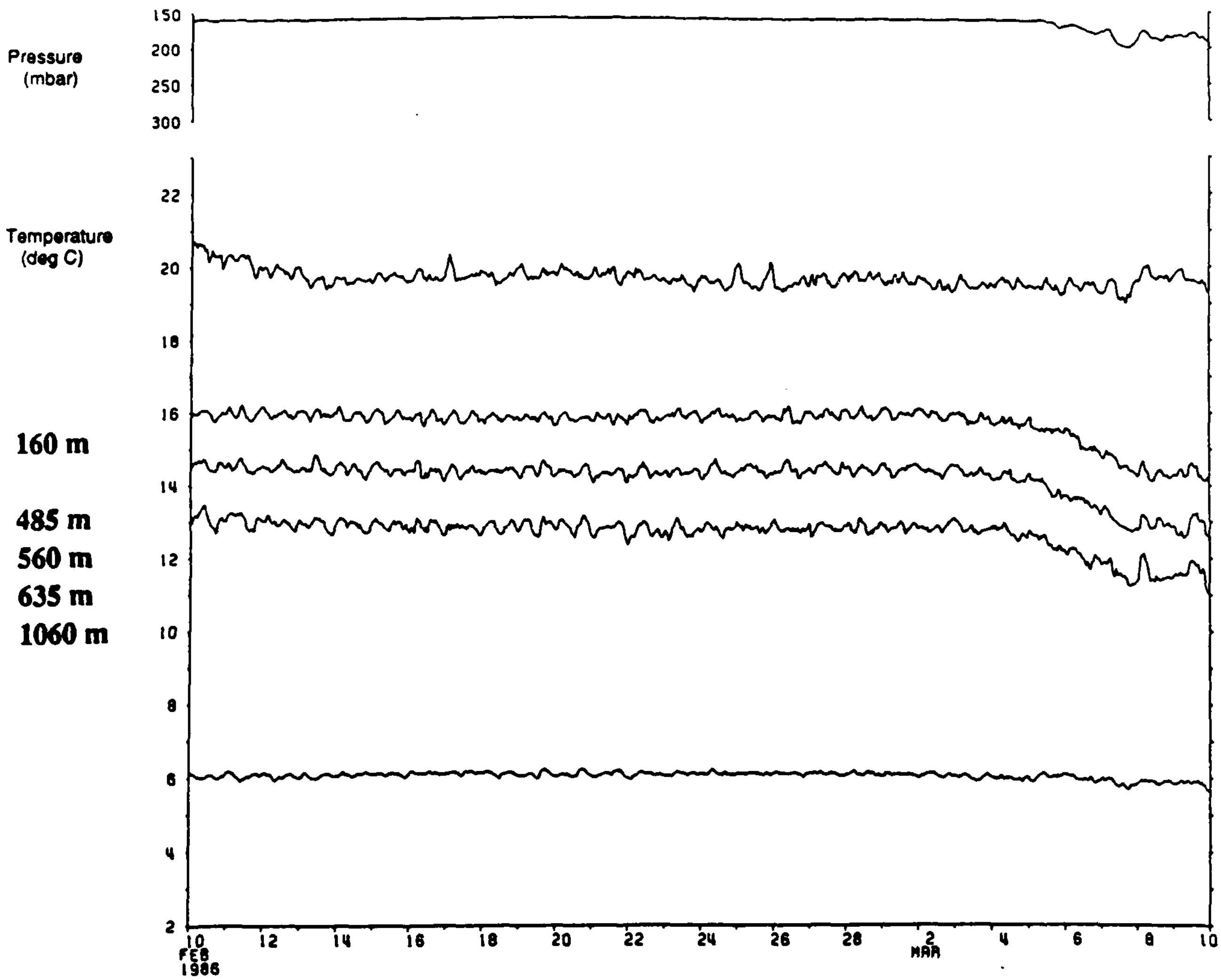
Phase Two composite Temperatures for F10.



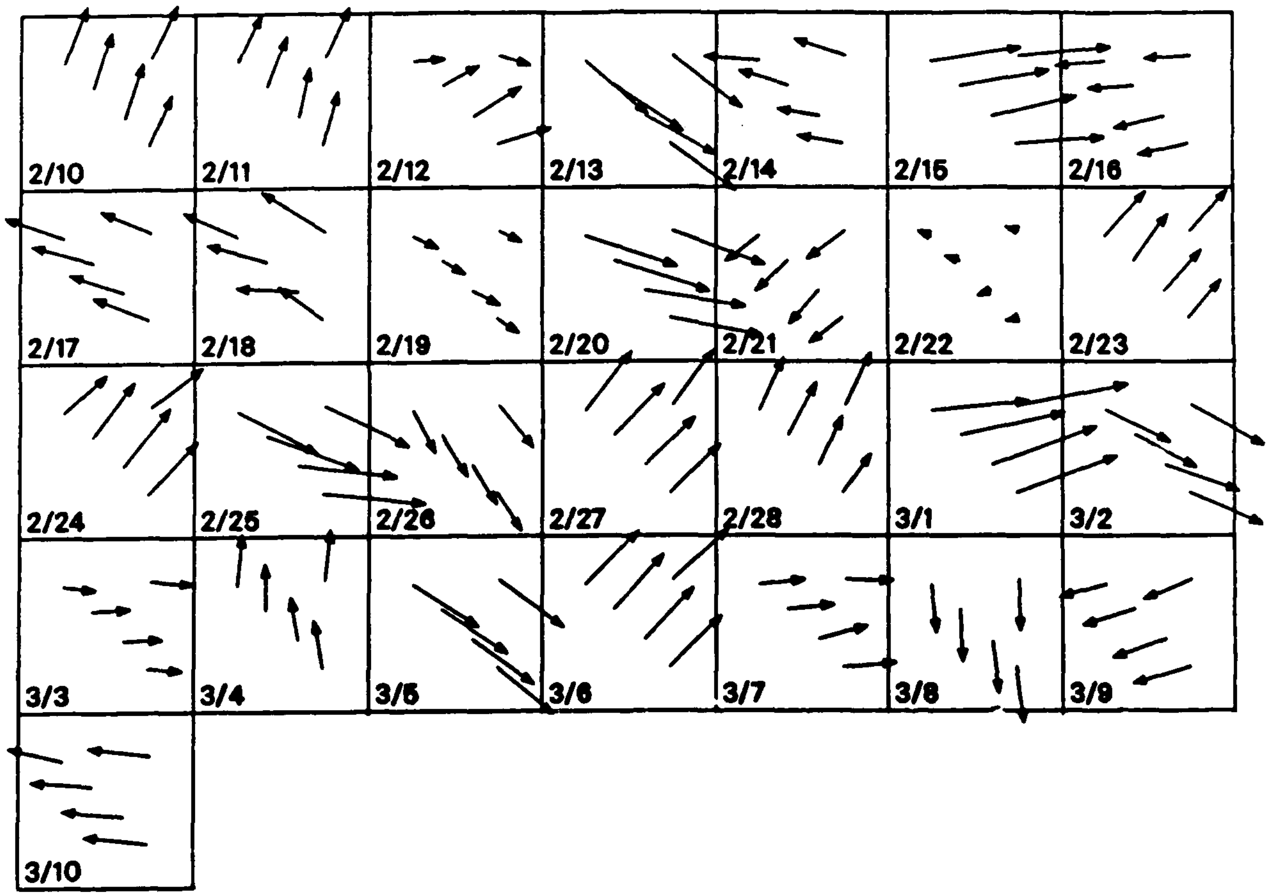
Phase Two deep temperatures for F4 and F8.



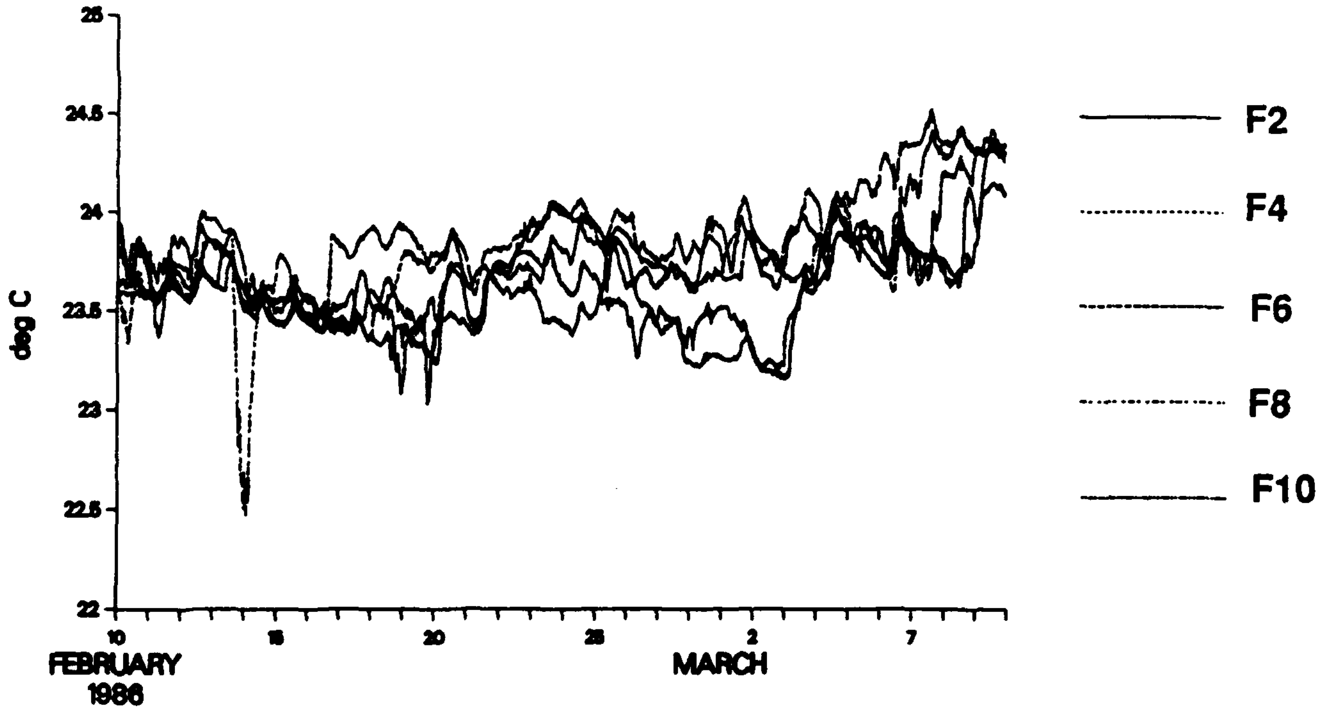
Phase Two composite Temperatures for F1.



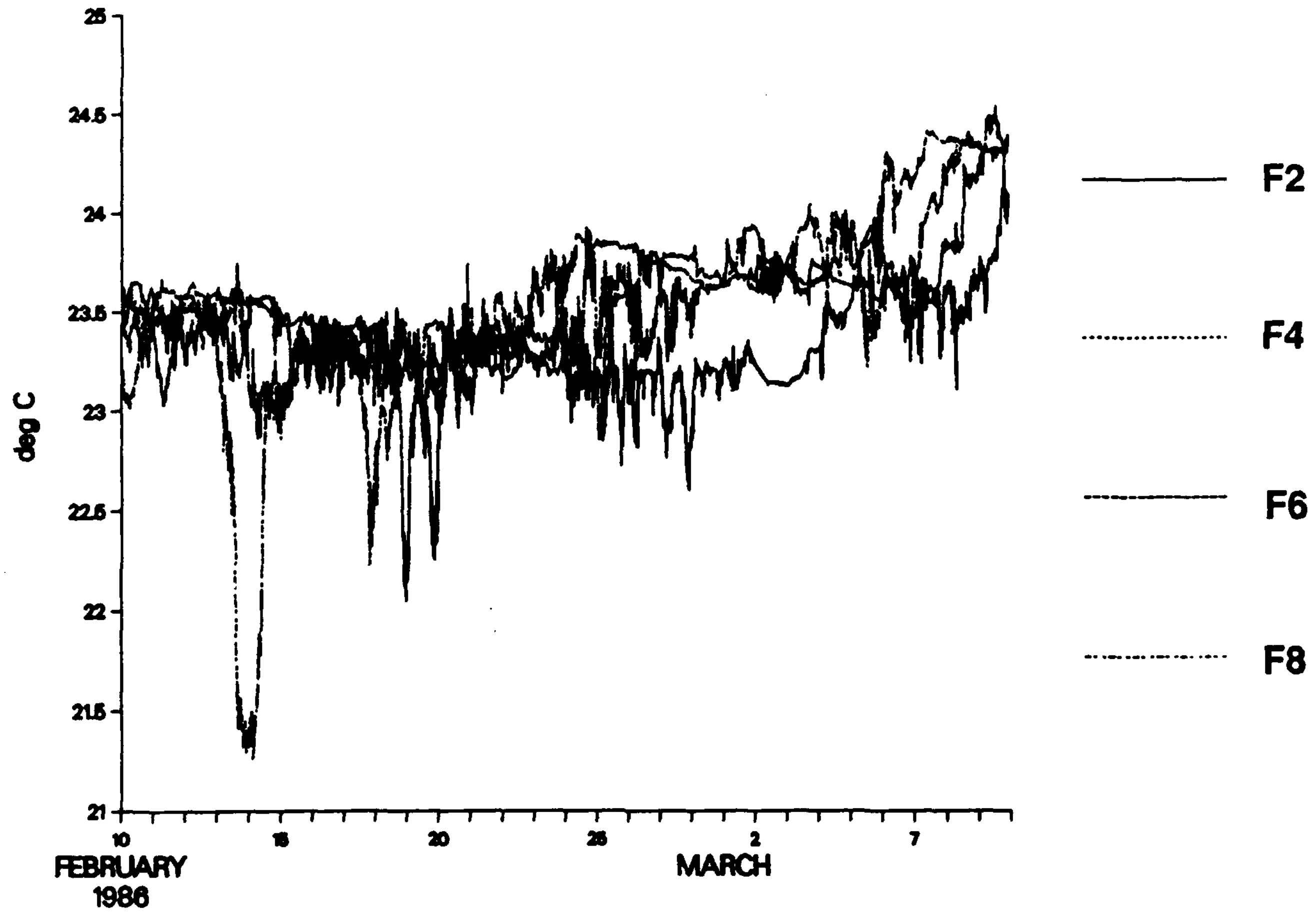
Phase Two composite Temperatures for F12.



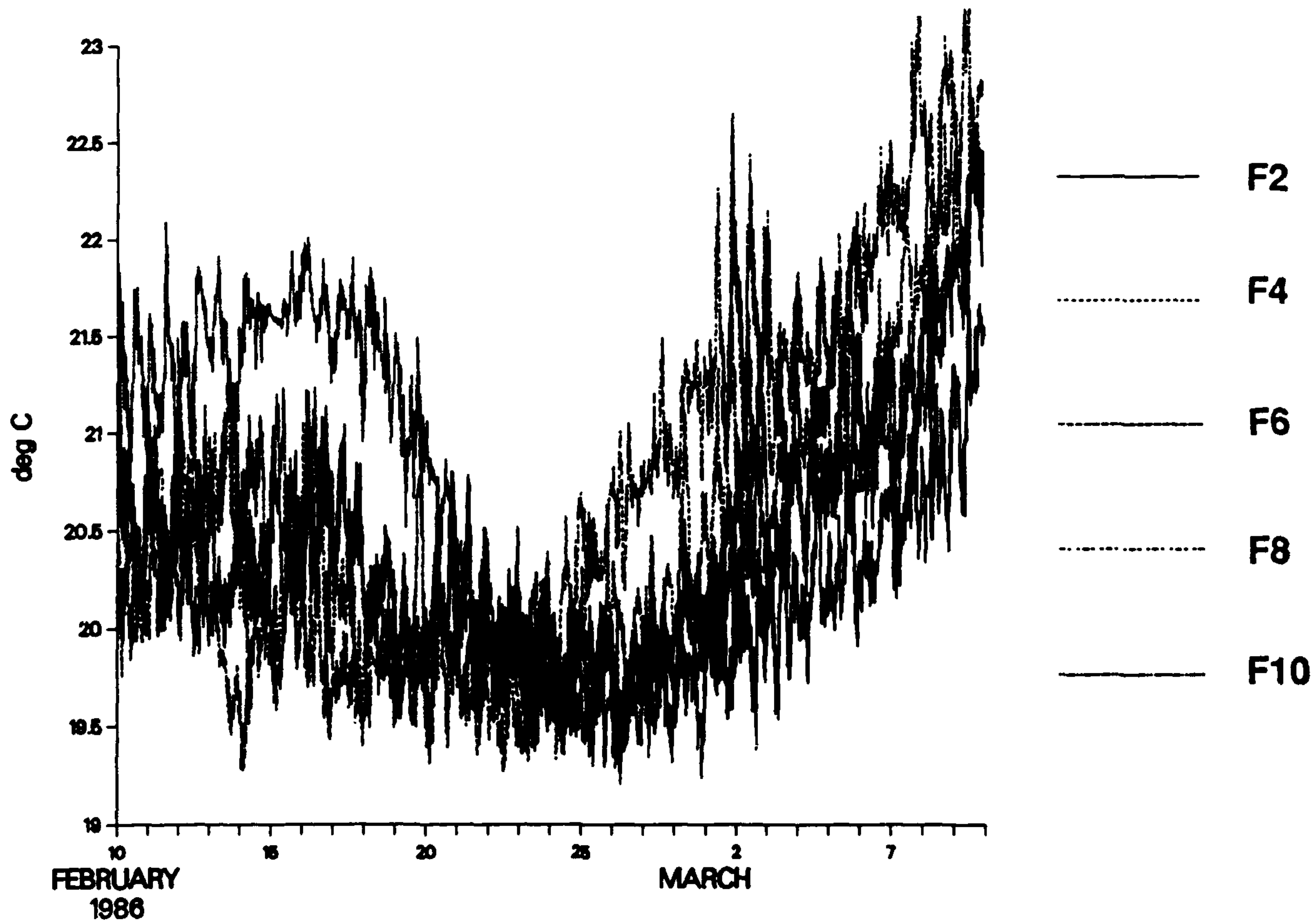
Phase Two Wind Vector Array plot for 5 surface buoys.



Phase Two horizontal Temperature composite for 10 m.



Phase Two horizontal Temperature composite for 80 m.



Phase Two horizontal Temperature composite for 160 m.

8. Statistics

Basic statistics for the surface moorings are presented in Table 10 and 11. Table 12 presents data from the subsurface moorings during the FASINEX time period, matching the time series from the second table. Table 13 shows the statistics for the complete time series for the subsurface moorings.

Basic computations for variables in the following tables are:

Mean $= \frac{\Sigma x_i}{n} = \overline{x}$

Variance $= \frac{\Sigma(x_i)^2 - n\overline{x}^2}{n-1} = \sigma^2$

Standard Deviation $= \sigma$

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Surface mooring meteorological statistics	214
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Subsurface moorings total time period statistics	217

Table 9.
Surface mooring meteorological statistics.

Meteorology Statistics

Buoy	mean u m s^{-1}	mean v m s^{-1}	mean T_s deg	mean T_a deg	mean SW W m^{-2}	mean BP mb	mean RH % RH	var u $(m\ s^{-1})^2$	var v $(m\ s^{-1})^2$
F2	-0.103	0.558	24.13	22.60	244.85	1017.11	70.26	21.58	20.58
F4	-0.349	0.643	24.17	22.68	240.28	1017.60	70.31	20.70	19.22
F6	-0.229	0.634	24.13	22.66	244.24	1017.43	72.13	21.29	20.12
F8	-0.313	0.594	24.22	22.74	237.54	1017.14	70.32	20.28	18.17
F10	0.769	0.441	23.83	22.07	226.85	1017.15	*	23.66	23.10

* Record shorter, 86/02/02 to 86/05/14, and RH from VAWR failed.

Table 10.
Surface Mooring Current Meter Statistics, 86/02/02 to 86/06/14

Depth m	mean u cm s^{-1}	mean v cm s^{-1}	mean spd cm s^{-1}	mean dir deg	mean temp deg C	var u $(cm\ s^{-1})^2$	var v $(cm\ s^{-1})^2$	var spd $(cm\ s^{-1})^2$	var dir $(deg)^2$	var temp $(deg\ C)^2$
Mooring 845										
10	5.15	11.25	23.47	147.9	24.02	312.73	277.37	192.6	15285	0.389
20	4.70	13.93	26.44	150.33	23.96	356.52	340.41	214.13	16211	0.288
30	3.04	12.73	23.88	149.35	23.82	279.85	301.74	182.9	16218	0.108
40	3.08	15.11	26.82	154.41	23.75	335.95	328.69	183.23	17058	0.074
80	2.71	12.23	21.17	145.46	23.18	207.59	195.72	112.03	16522	0.169
160	0.87	9.11	14.66	167.16	21.09	96.89	110.21	75.81	17584	0.851
700	-0.33	3.48	6.54	177.24	13.01	20.74	25.12	15.37	17353	0.175
Mooring 846										
10	1.06	6.19	21.03	178.63	24.09	404.05	275.63	276.7	13244	0.372
20	-0.02	8.18	25.32	170.93	24.00	440.27	416.57	282.47	13878	0.263
30	0.55	6.85	21.83	171.28	23.87	373.95	305.46	250.21	13232	0.124
40	0.32	8.60	24.04	171.42	23.81	415.25	330.54	241.95	13191	0.094
80	0.19	6.19	18.10	171.27	23.42	229.09	192.55	132.21	14021	0.146
120	-3.84	8.31	18.11	217.09	22.57	191.65	174.38	121.90	14449	0.729
160	-1.12	4.88	13.71	190.29	21.35	102.88	118.80	58.65	14177	0.760
700	-0.67	2.86	6.53	195.03	13.11	17.65	31.47	15.17	15142	0.236
1000	-0.48	1.10	4.78	196.82	7.45	12.03	18.73	9.35	12110	0.178
4000	0.06	-0.39	2.17	176.8	2.37	2.72	3.67	1.81	8328	0.0002
Mooring 847										
10	2.50	10.05	22.46	156.98	24.03	317.10	285.73	205.60	15364	0.382
20	1.34	12.99	25.46	161.25	23.95	368.93	339.66	231.24	16725	0.274
30	1.69	10.64	22.14	159.37	23.83	303.34	255.16	184.57	16046	0.130
40	-1.50	16.85	27.31	177.55	23.73	373.94	288.38	202.56	19717	0.082
80	1.31	10.71	20.47	161.76	23.35	228.33	199.50	125.28	16588	0.148
120	2.06	9.46	18.29	162.72	22.58	192.22	159.09	110.44	16161	0.429
160	0.72	8.00	14.94	167.94	21.35	118.94	115.84	76.10	16499	0.782
700	-0.30	3.06	6.25	182.88	13.10	18.08	27.44	15.94	15921	0.189
Mooring 848										
10	-0.41	1.51	22.24	175.72	24.10	390.91	297.18	195.90	10663	0.352
20	-1.45	2.33	24.67	174.88	24.03	418.94	395.37	213.29	11103	0.266
30	-1.49	2.05	21.91	172.59	23.91	342.63	306.30	175.49	10991	0.138
40	-1.70	3.88	23.92	176.16	23.82	399.24	340.65	185.69	11581	0.121
80	-1.50	2.76	18.52	176.74	23.45	229.25	209.53	105.62	11696	0.193
160	-5.26	5.15	11.32	235.85	22.27	83.87	64.78	74.69	11746	0.512
700	-1.89	2.26	14.01	191.77	21.44	114.83	133.01	60.26	12472	0.878
1000	-0.47	1.28	5.07	199.90	7.47	13.29	19.65	9.099	12969	0.127
4000	-0.23	-0.61	2.83	183.03	2.37	4.57	6.10	3.055	9083	0.0004
Mooring 849										
10	3.63	2.11	21.38	162.77	23.77	320.51	307.61	188.82	10705	0.101
20	2.84	3.67	23.75	170.33	23.75	376.16	369.71	203.40	11670	0.103
30	2.24	3.04	21.23	174.07	23.73	321.38	283.80	168.85	11612	0.109
40	2.47	3.90	23.26	172.18	23.70	380.27	308.87	169.32	12029	0.113
160	-0.12	4.57	13.46	170.34	21.42	130.50	96.52	66.62	13891	0.751

Table 11.
Subsurface moorings FASINEX time period current meter statistics.

Mooring 829

Depth (m)	mean u	mean v	mean spd	mean dir	mean temp	var u	var v	var spd	var dir	var temp
162	7.01	2.99	13.29	109.97	20.58	89.10	71.18	41.65	7201.99	0.68
262	–	–	–	–	18.50	–	–	–	–	0.03
487	5.61	3.86	9.92	108.22	16.68	38.46	34.29	20.71	8825.99	0.04
562	5.93	3.14	9.75	107.04	15.46	35.21	32.44	17.61	8181.73	0.10
637	–	–	–	–	14.00	–	–	–	–	0.15
1062	2.08	0.74	6.23	140.22	6.46	22.87	19.39	8.27	9582.23	0.06
4062	0.98	-0.98	4.10	146.99	2.34	9.32	8.13	2.59	6180.65	0.00

Mooring 830

Depth (m)	mean u	mean v	mean spd	mean dir	mean temp	var u	var v	var spd	var dir	var temp
159	-5.00	2.01	9.50	233.06	20.28	37.04	59.54	35.39	9132.06	0.69
259	–	–	–	–	–	–	–	–	–	–
485	-9.16	0.66	13.28	240.80	15.98	63.26	72.05	43.27	7434.63	0.23
559	-8.17	0.73	12.34	239.98	14.49	58.95	59.50	33.49	7763.94	0.27
634	-7.29	0.51	12.04	240.08	13.00	47.88	72.57	28.75	7704.52	0.28
1059	-1.93	0.04	6.79	203.23	6.18	21.35	28.27	7.79	9911.11	0.03
4059	–	–	–	–	–	–	–	–	–	–

Table 12.
Basic statistics on the F1 and F12 moorings.

Depth (m)	Duration of Velocity Record	Duration of Temp Record	Means			Standard Deviation		
			u	*v*	*t*	*u*	*v*	*t*
Mooring F1								
162	10/29/84 - 6/18/86	10/29/84 - 6/18/86	2.6	-2.1	19.60	9.6	11.6	0.90
262	10/29/84 - 4/17/85	10/29/84 - 6/18/86	4.6	-3.3	18.31	6.2	8.5	0.22
487	10/29/84 - 6/18/86	10/29/84 - 6/18/86	1.7	-1.4	16.45	6.1	8.3	0.36
562	10/29/84 - 6/18/86	10/29/84 - 6/18/86	1.5	-1.7	15.12	5.9	7.5	0.44
637	10/29/84 - 3/21/85	10/29/84 - 6/18/86	2.7	-0.9	13.59	3.0	3.6	0.45
1062	10/29/84 - 6/18/86	12/14/84 - 6/18/86	0.4	-1.5	6.06	3.3	3.9	0.21
4062	10/29/84 - 6/18/86	10/29/84 - 6/18/86	0.8	-2.6	2.34	3.3	4.3	0.01
Mooring F12								
159	10/30/84 - 6/13/86	10/30/84 - 6/13/86	-0.2	-1.2	20.05	10.2	9.1	0.73
259	10/30/84 - 11/1/84	10/30/84 - 12/27/84	–	–	–	–	–	–
485	10/30/84 - 6/13/86	10/30/84 - 6/13/86	-1.7	-1.4	16.09	8.6	7.3	0.55
559	10/30/84 - 6/13/86	10/30/84 - 6/13/86	-1.4	-1.7	14.61	7.6	6.8	0.57
634	10/30/84 - 6/13/86	10/30/84 - 6/13/86	-0.9	-2.0	13.04	7.1	6.8	0.59
1059	10/30/84 - 6/13/86	10/30/84 - 6/13/86	0.8	-2.4	5.99	4.6	6.4	0.25
4059	10/30/84 - 7/24/85	10/30/84 - 7/24/85	1.7	1.0	2.33	3.5	4.9	0.02

9. Long Term Subsurface Mooring Plots

The FASINEX subsurface moorings were on station for approximately 22 months. The plots that were presented in the earlier sections of this report covered the six month FASINEX field program time period. This section presents the remaining data, totally and then broken down into segments of the first 16 months of the long term study. First, there are oceanic velocity and temperature plots for the total time period. Time series of East, North and Temperature are shown, along with the 22 month long progressive vector diagrams. Then there are expanded scale composite plots showing approximately six months of data each. The breakdown allows for the 4th segement of the data to match the FASINEX time period. The time periods for these segments are October 29, 1984 - March 1, 1985, April 1, 1985 - August 1, 1985, September 1, 1985 to January 15, 1986. (Already presented January 15, 1986 to June 15, 1986.) All plots are from one hour averaged files.

Throughout the plots in this section, the depths of the instruments are given specifically for each mooring. The schematic shown in Figure 15 gives a nominal depth for the instrumentation.

The number of points used in the spectral plot are listed in the caption at the bottom of the page. These spectra are one piece with frequency band averaging applied.

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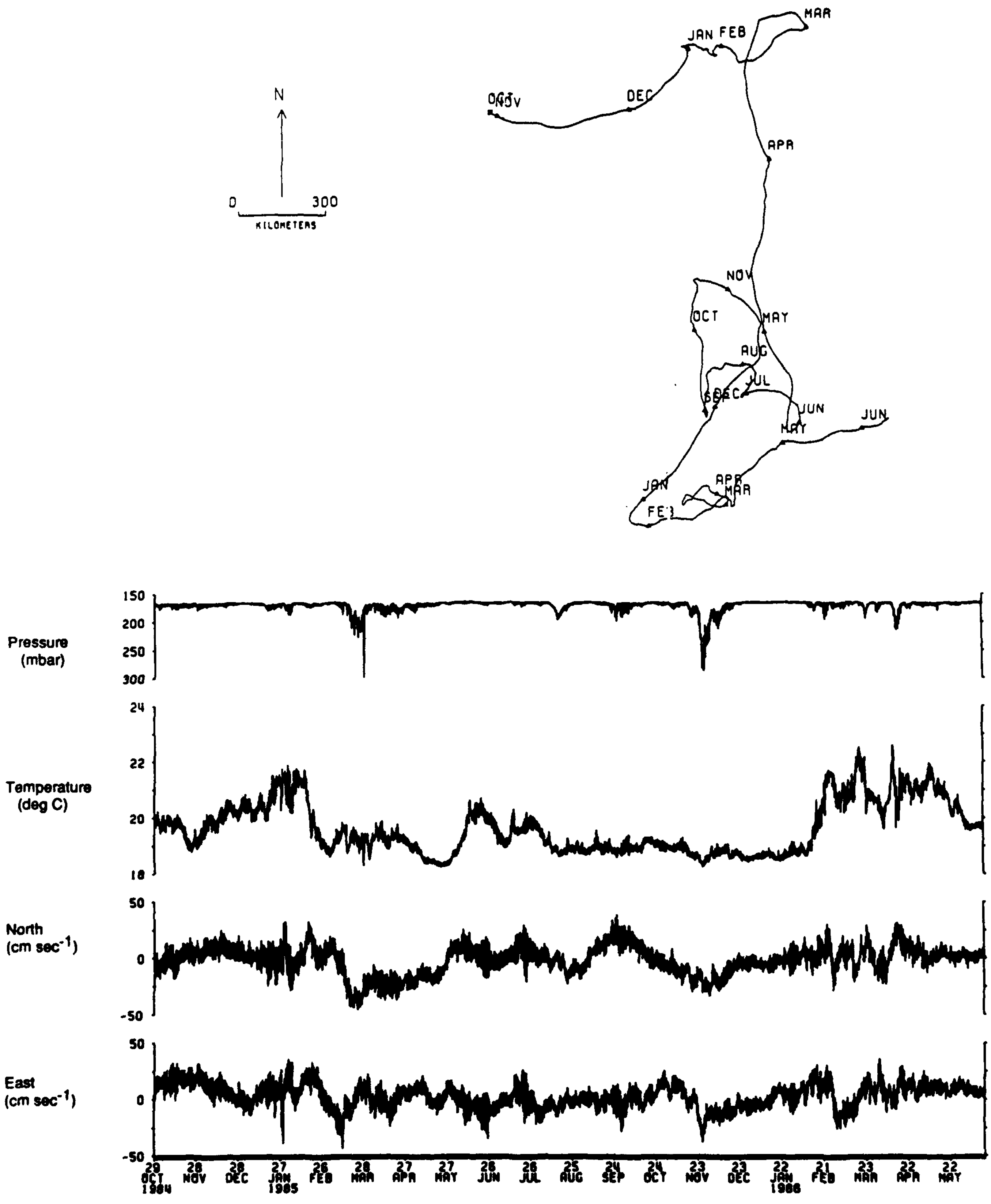
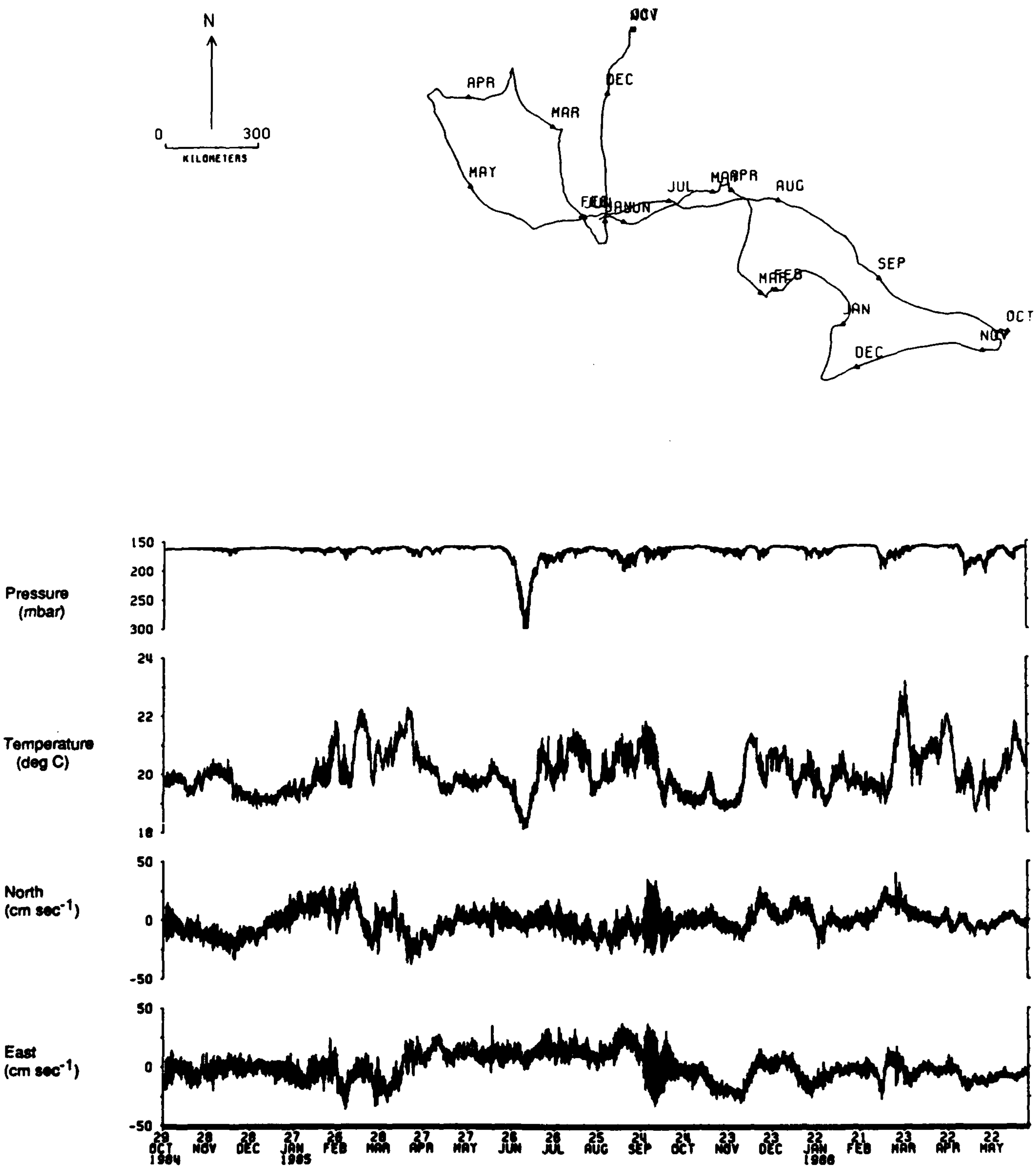
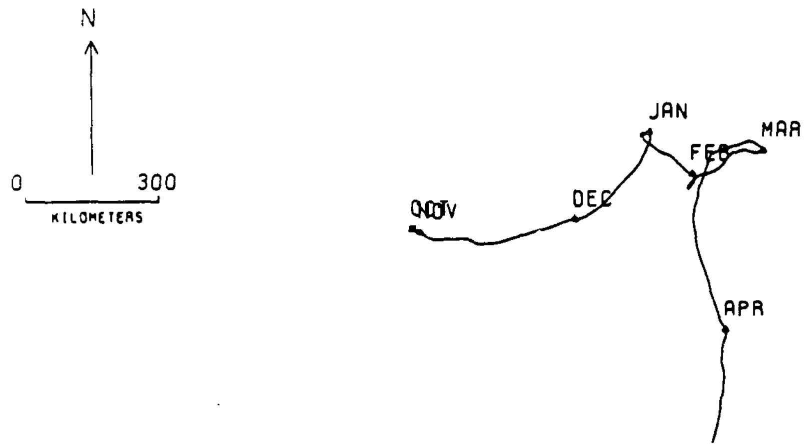
Current meter time series and progressive vector diagrams	219-232
Six month sectional velocity plots	233-238
Two year composite Temperature plots	239-240
Six month sectional temperature plots	241-246
Velocity and Temperature spectra	247-260

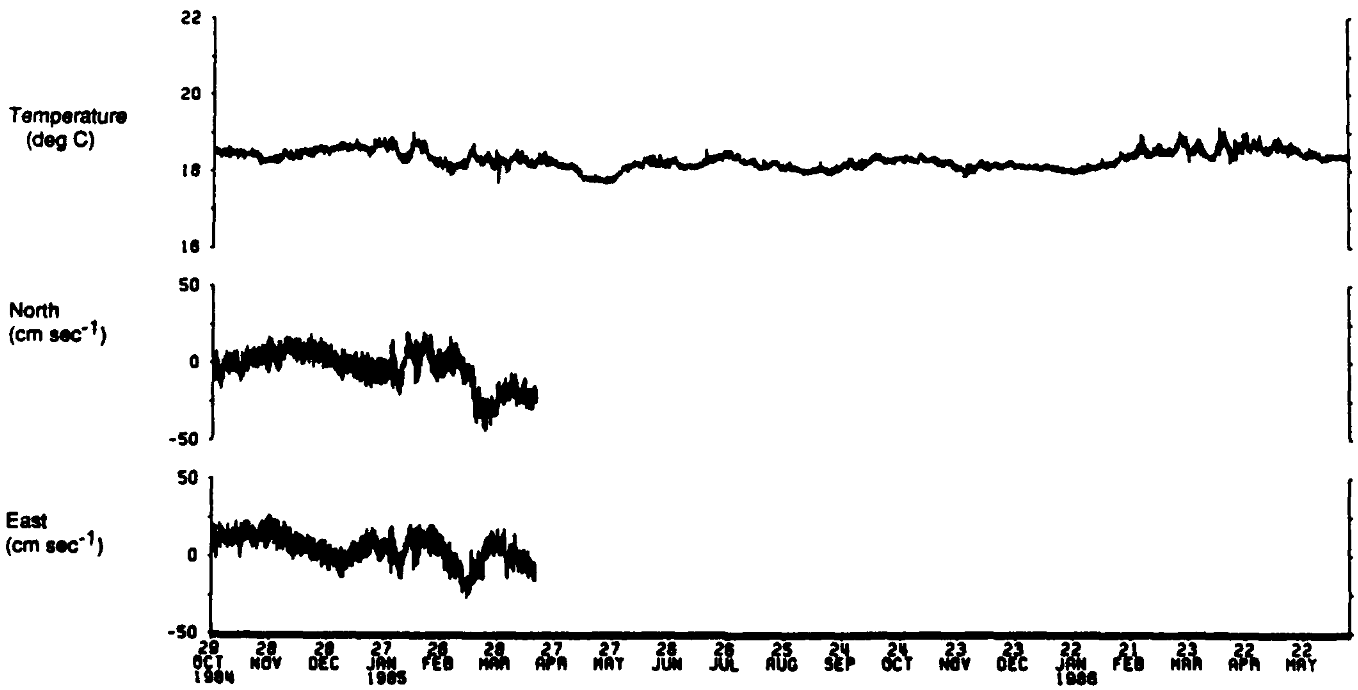


East, North, Temperature, Pressure and progressive vector diagram for Mooring F1 162 m.

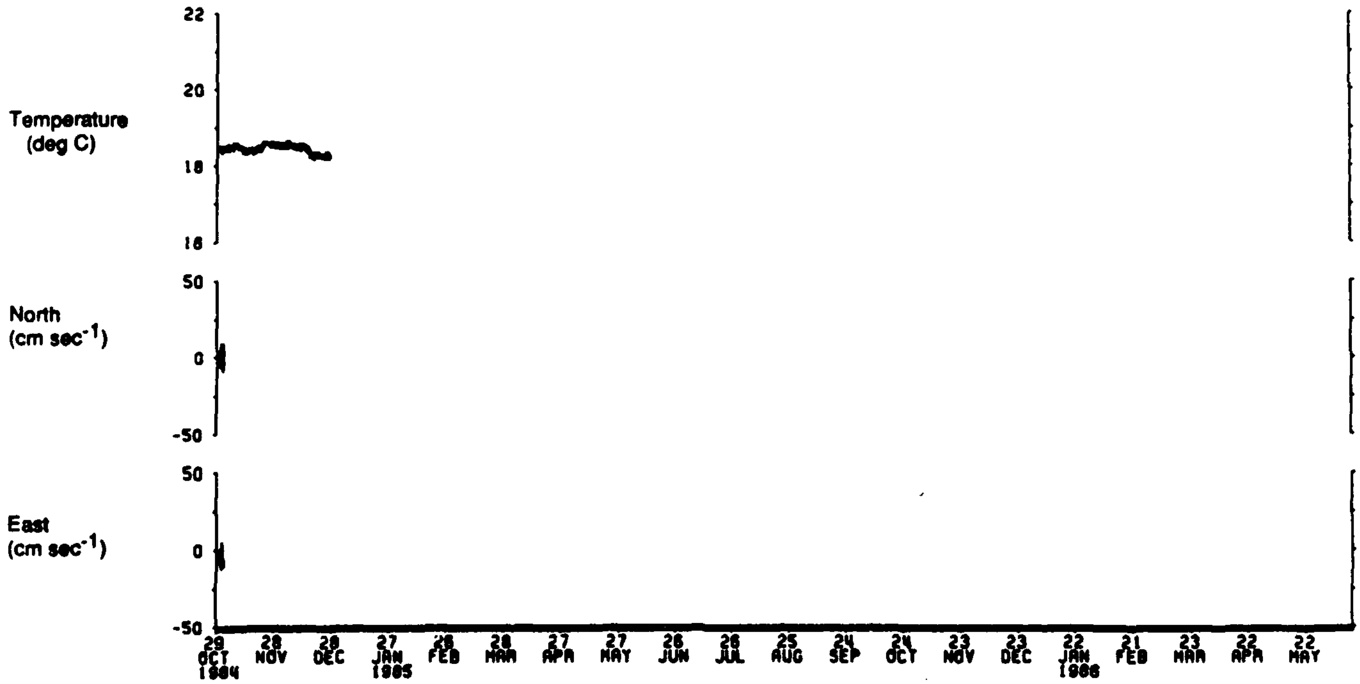


East, North, Temperature, Pressure and progressive vector diagram for Mooring F12 159 m.

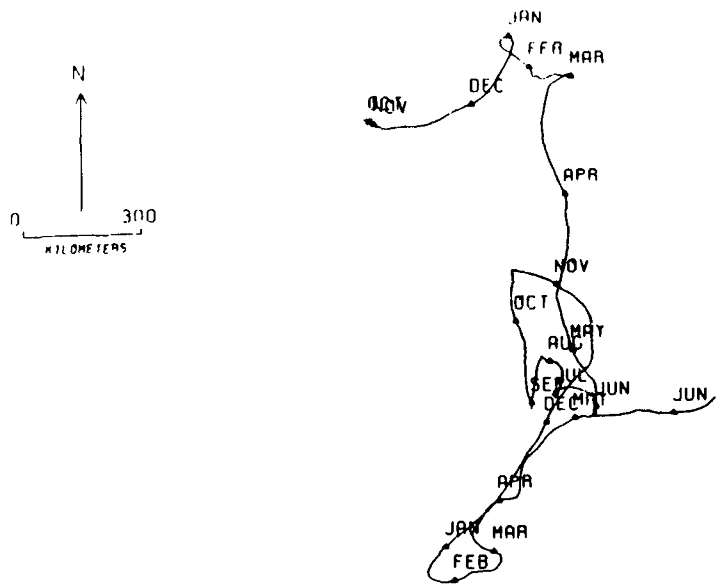


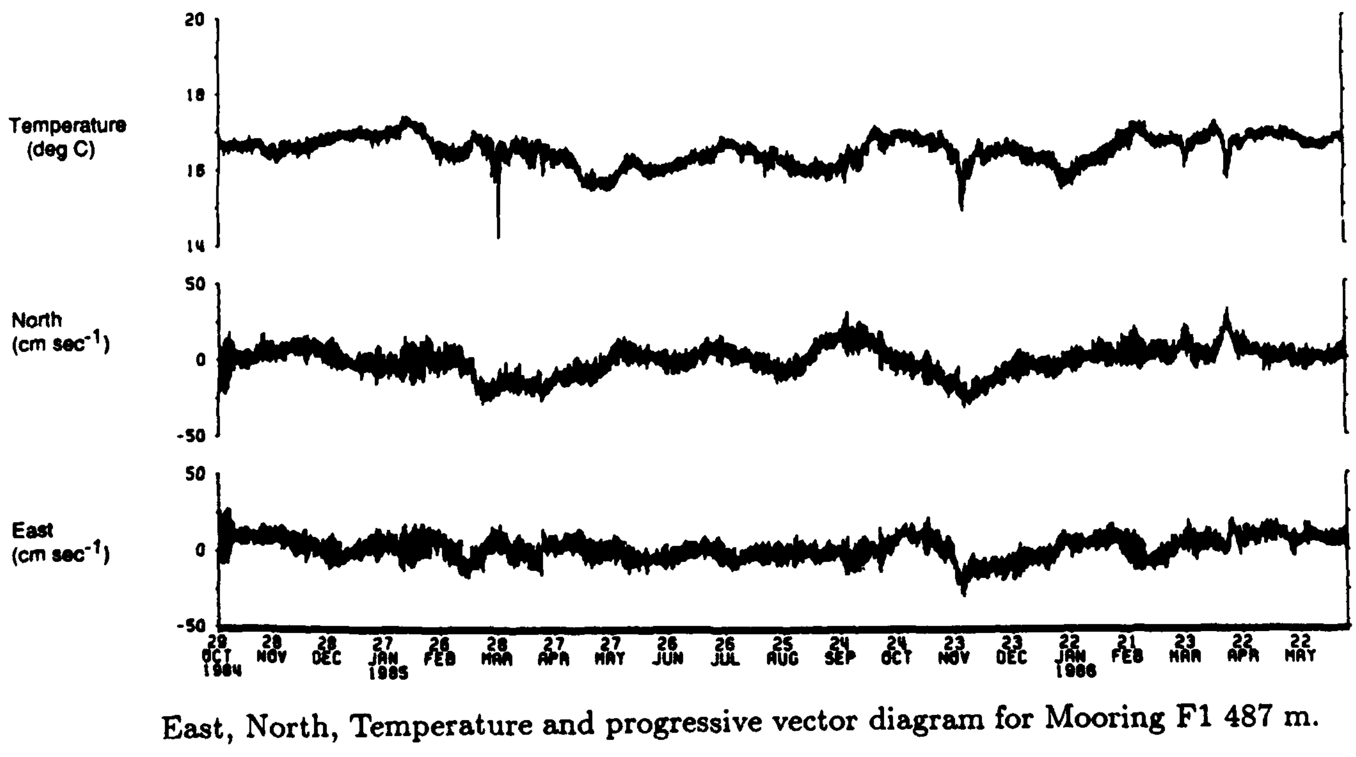


East, North, Temperature and progressive vector diagram for Mooring F1 262 m.

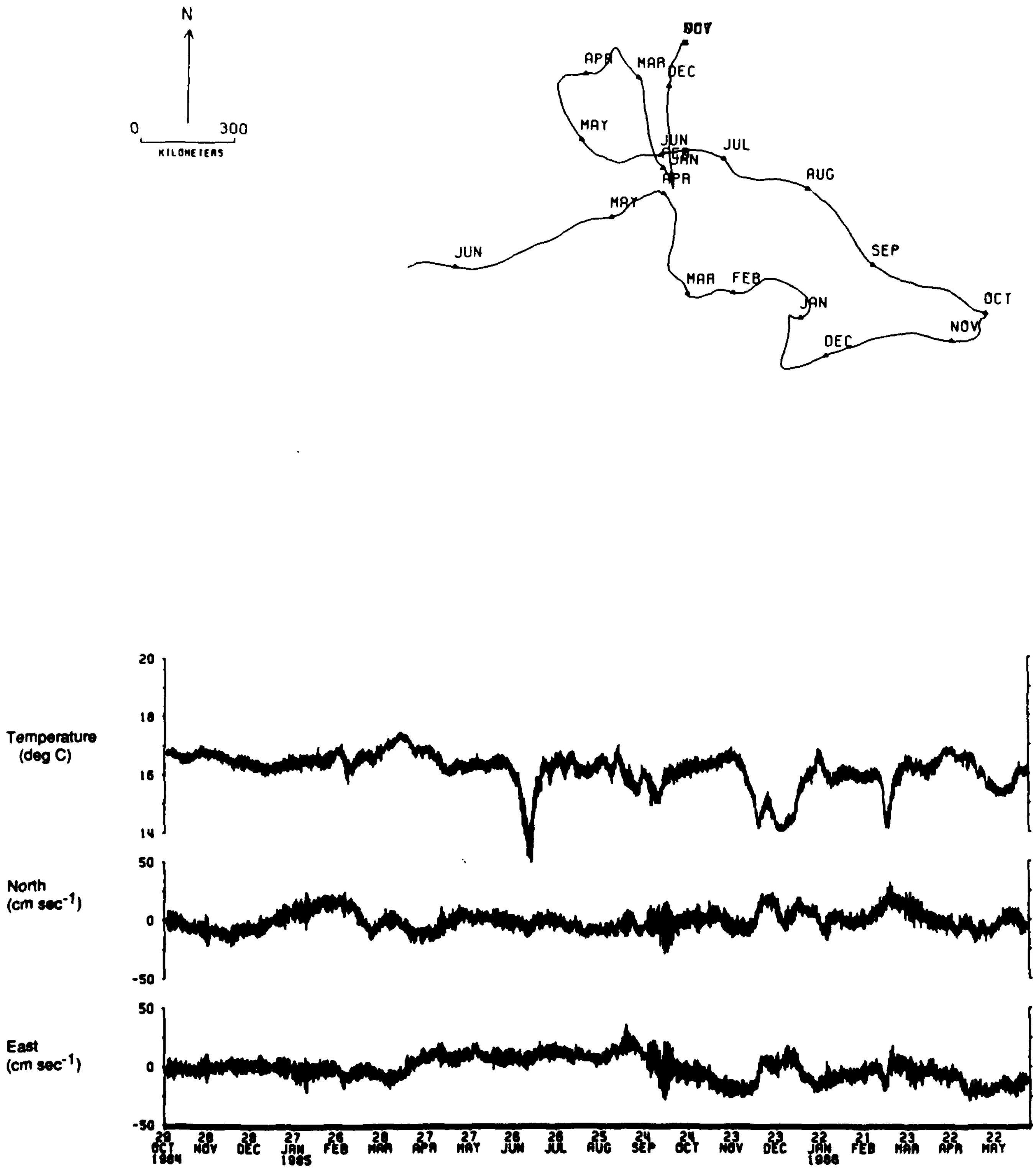


East, North and Temperature for Mooring F12 259 m.

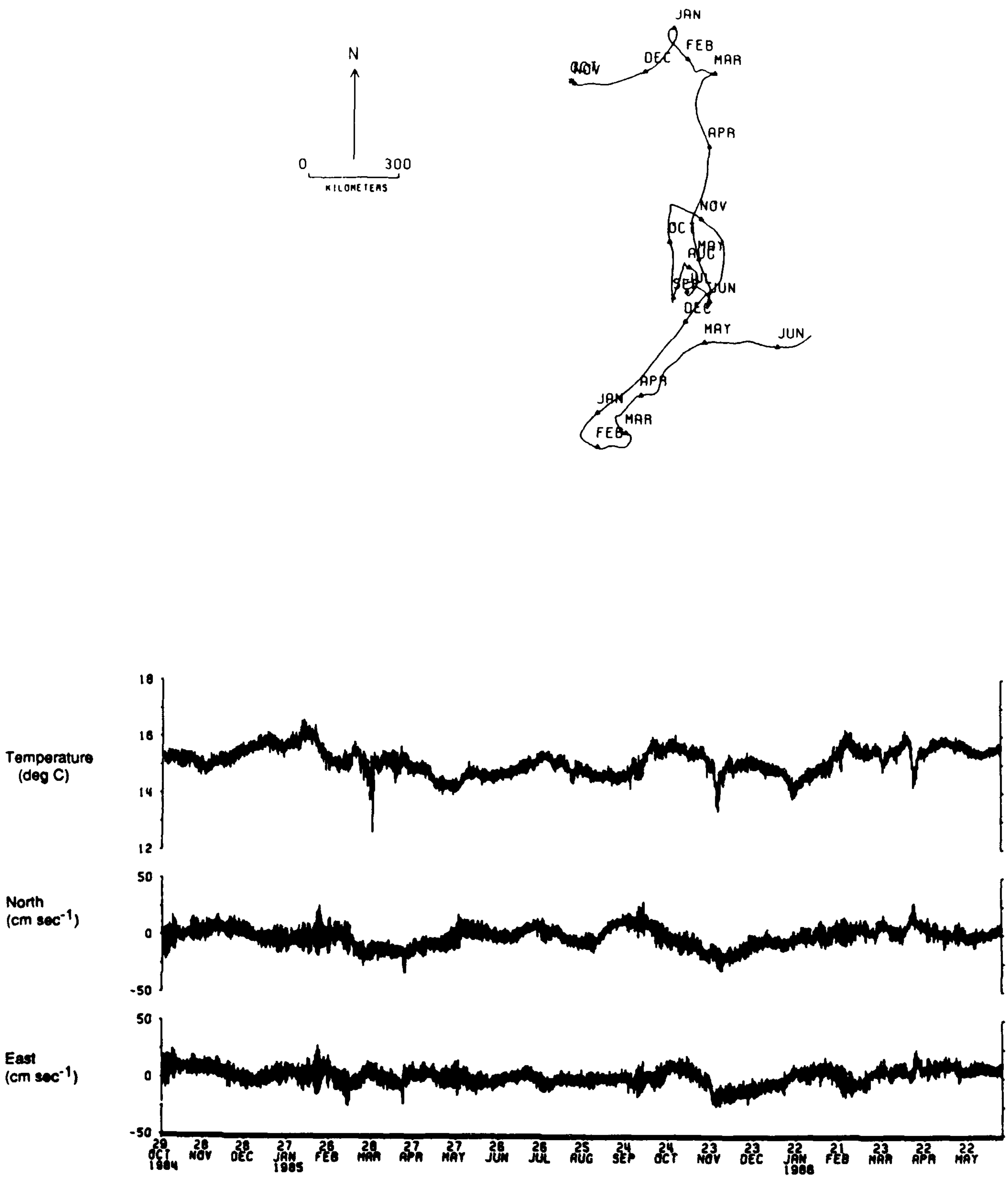




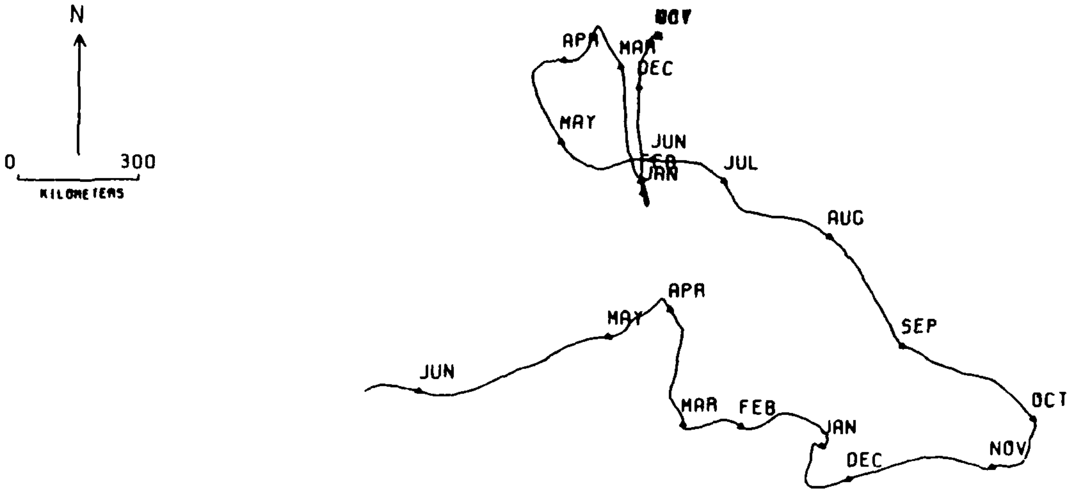
East, North, Temperature and progressive vector diagram for Mooring F1 487 m.

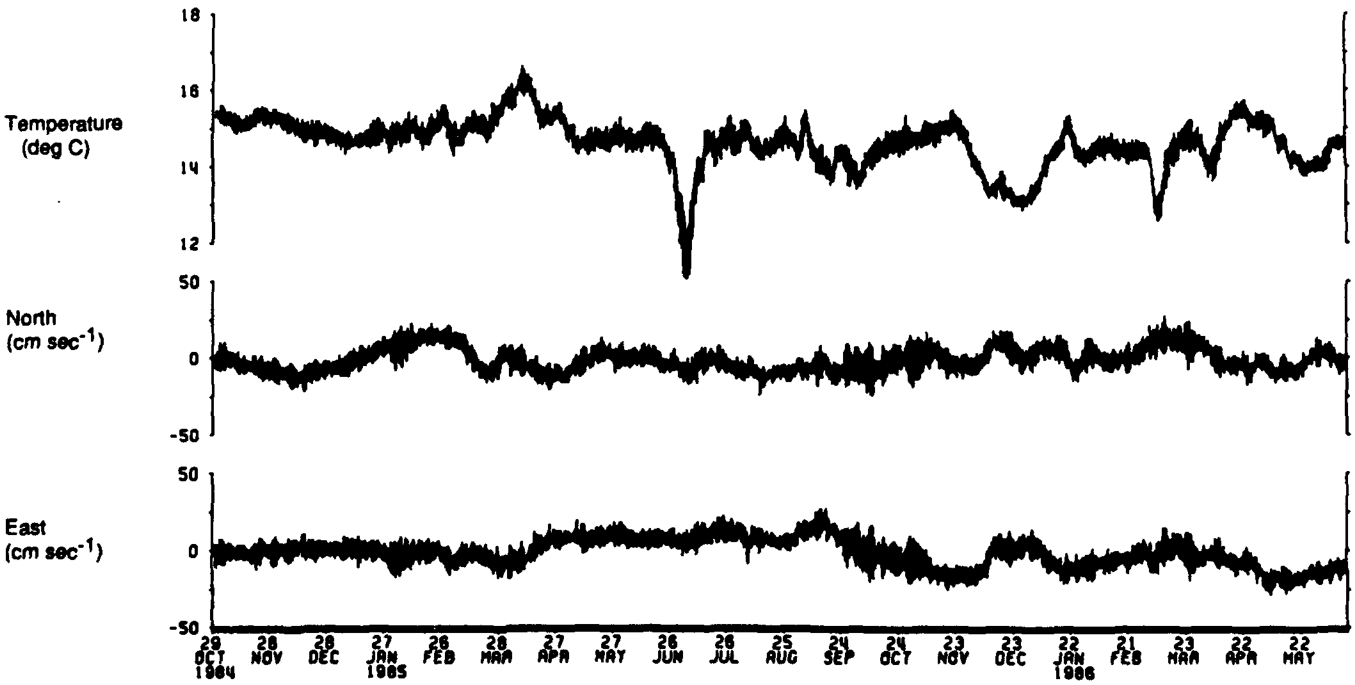


East, North, Temperature and progressive vector diagram for Mooring F12 485 m.

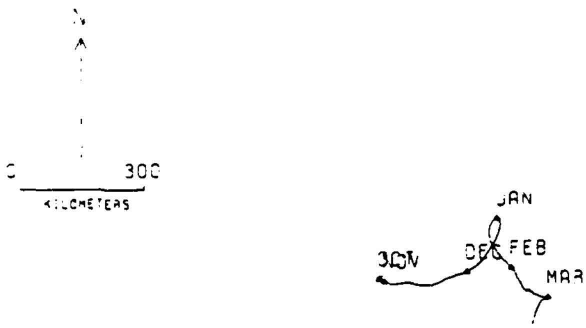


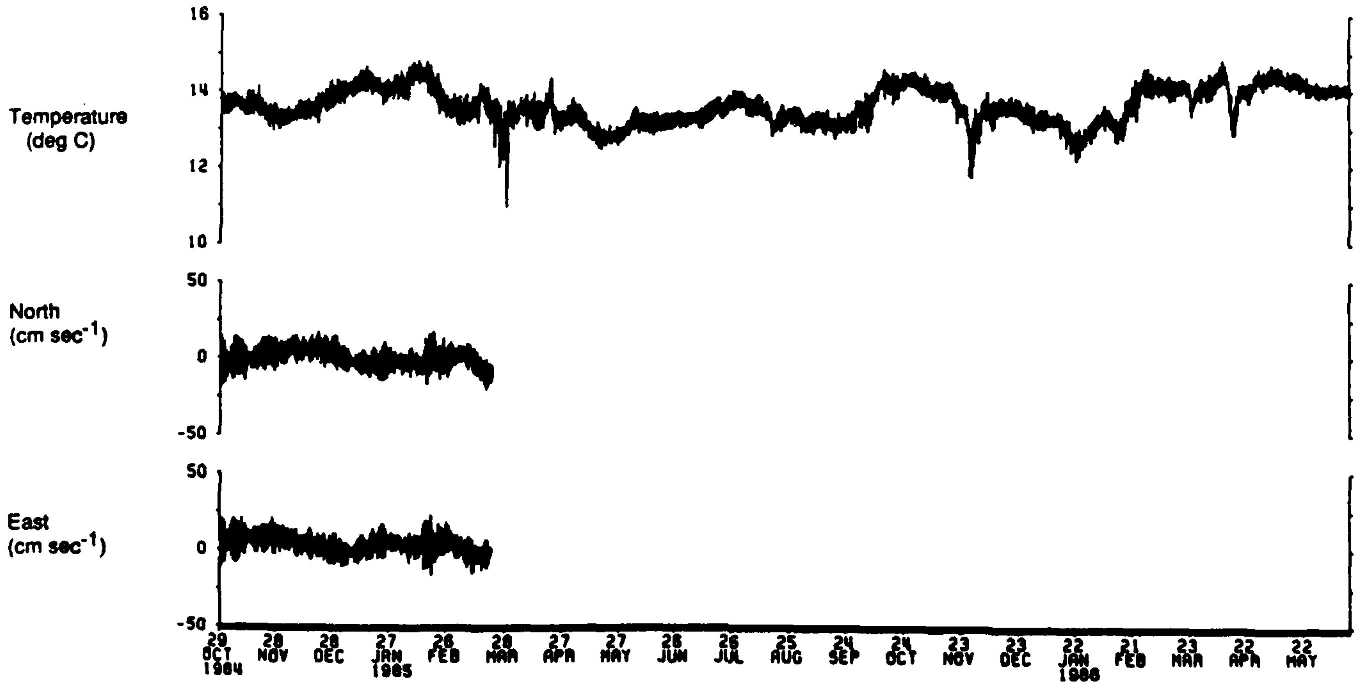
East, North, Temperature and progressive vector diagram for Mooring F1 562 m.



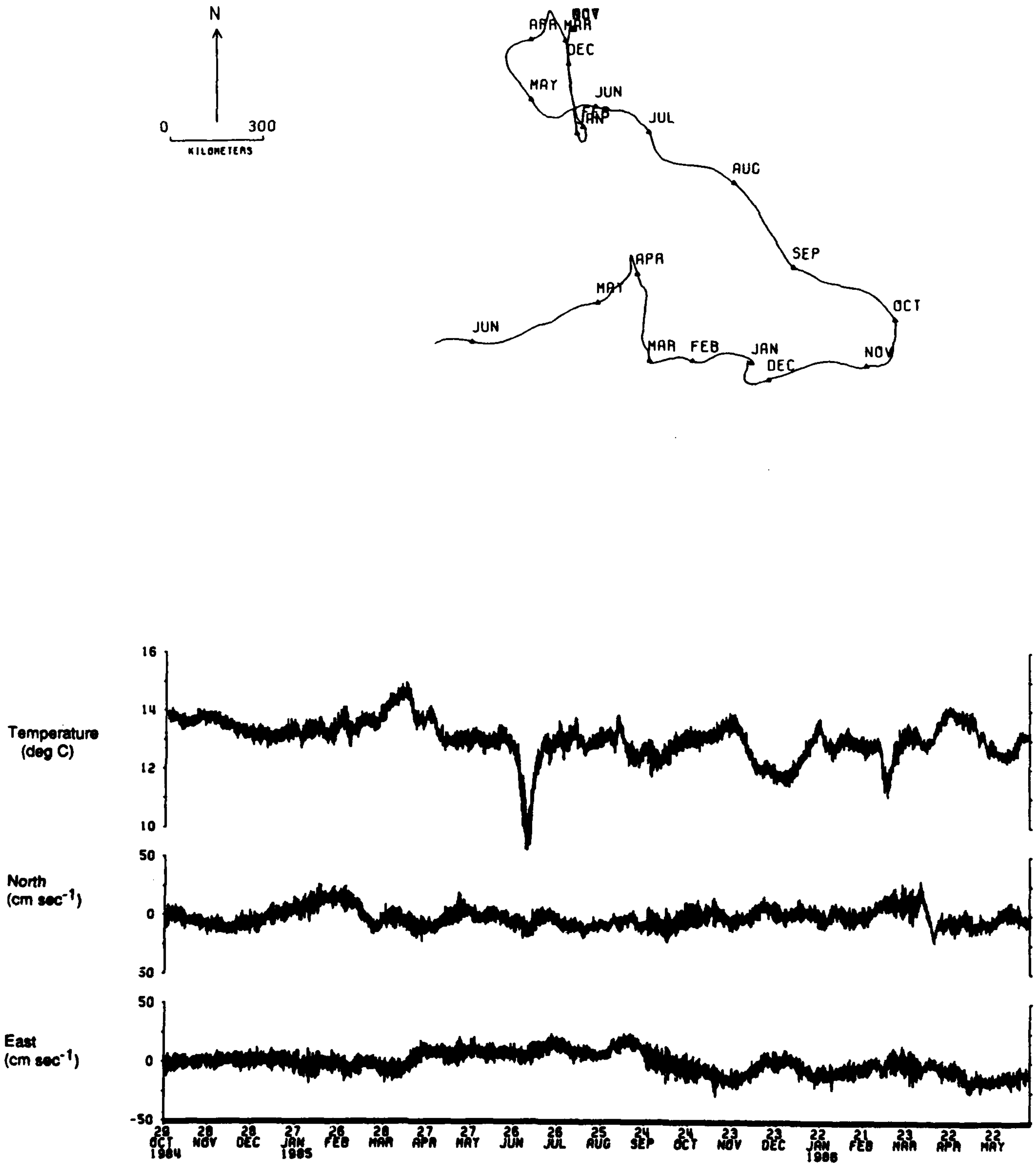


East, North, Temperature and progressive vector diagram for Mooring F12 559 m.

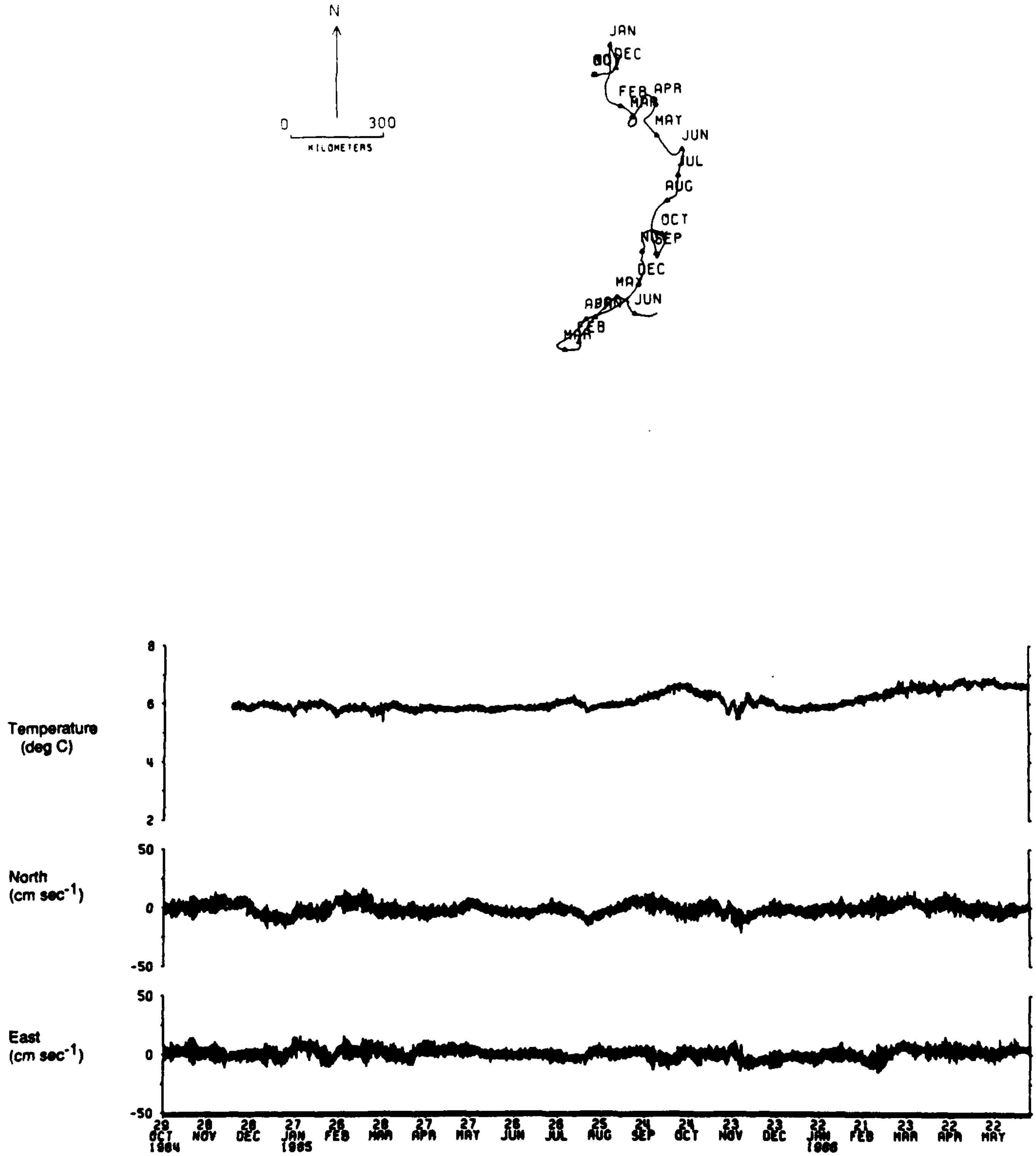




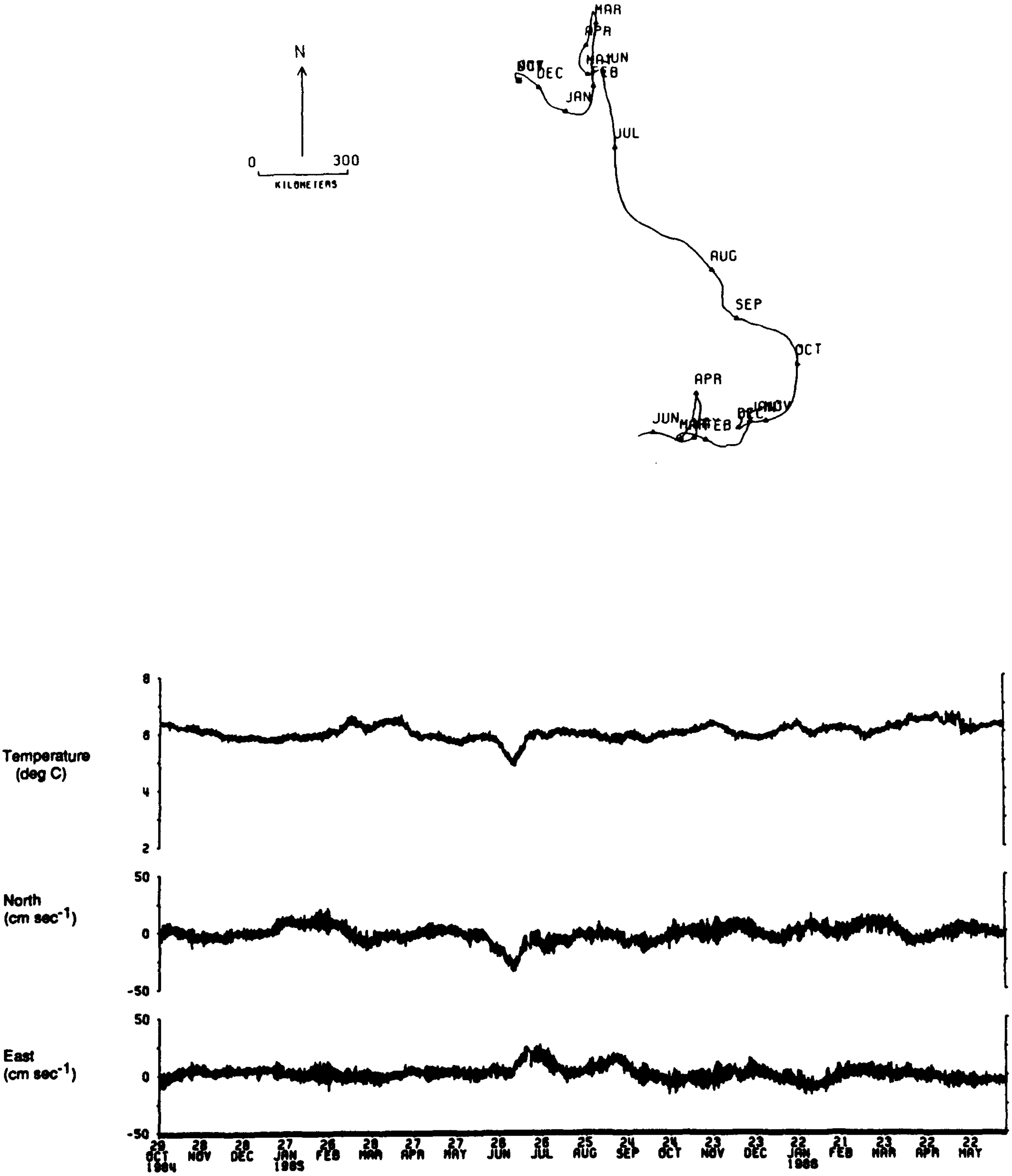
East, North, Temperature and progressive vector diagram for Mooring F1 637 m.



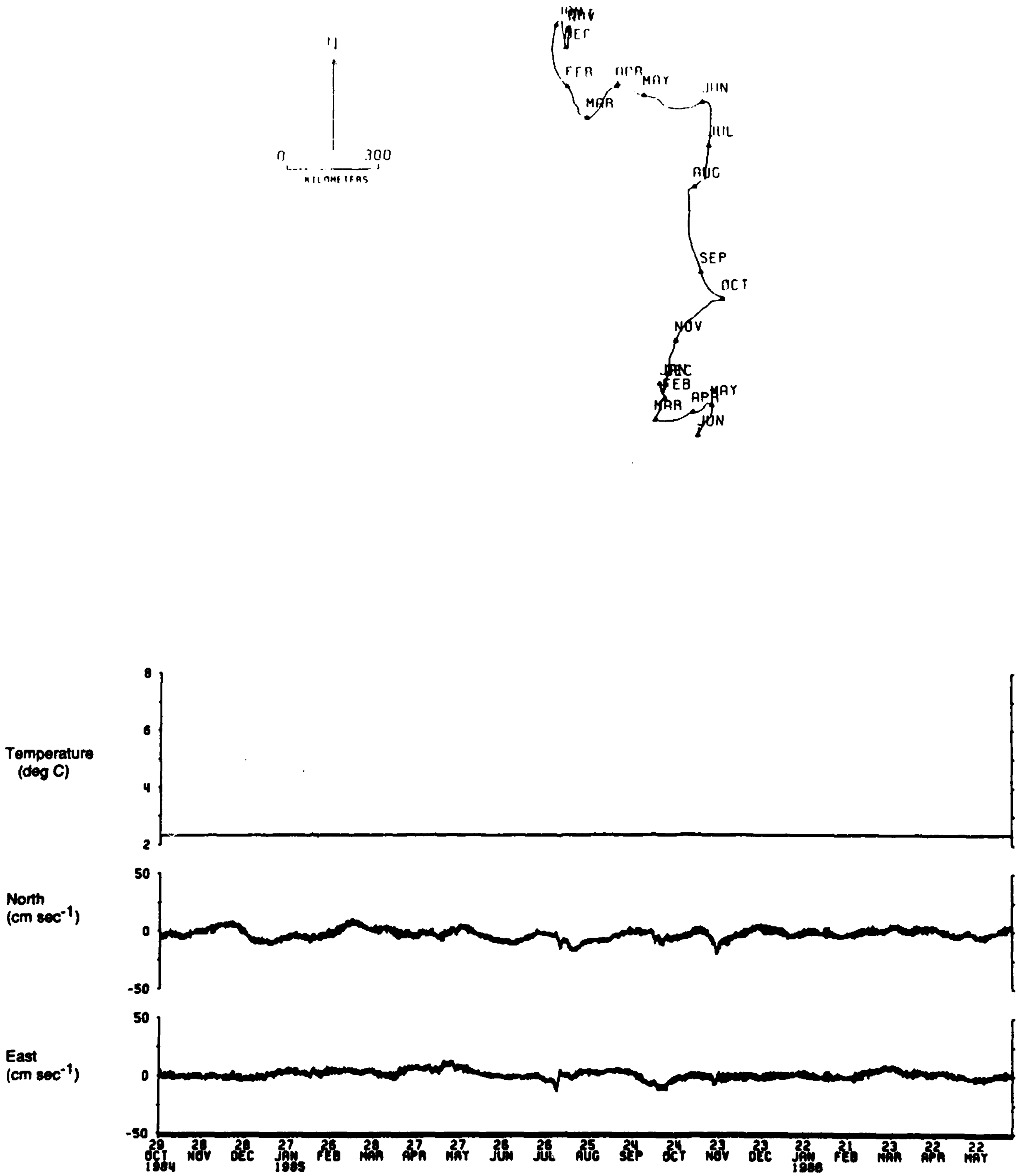
East, North, Temperature and progressive vector diagram for Mooring F12 634 m.



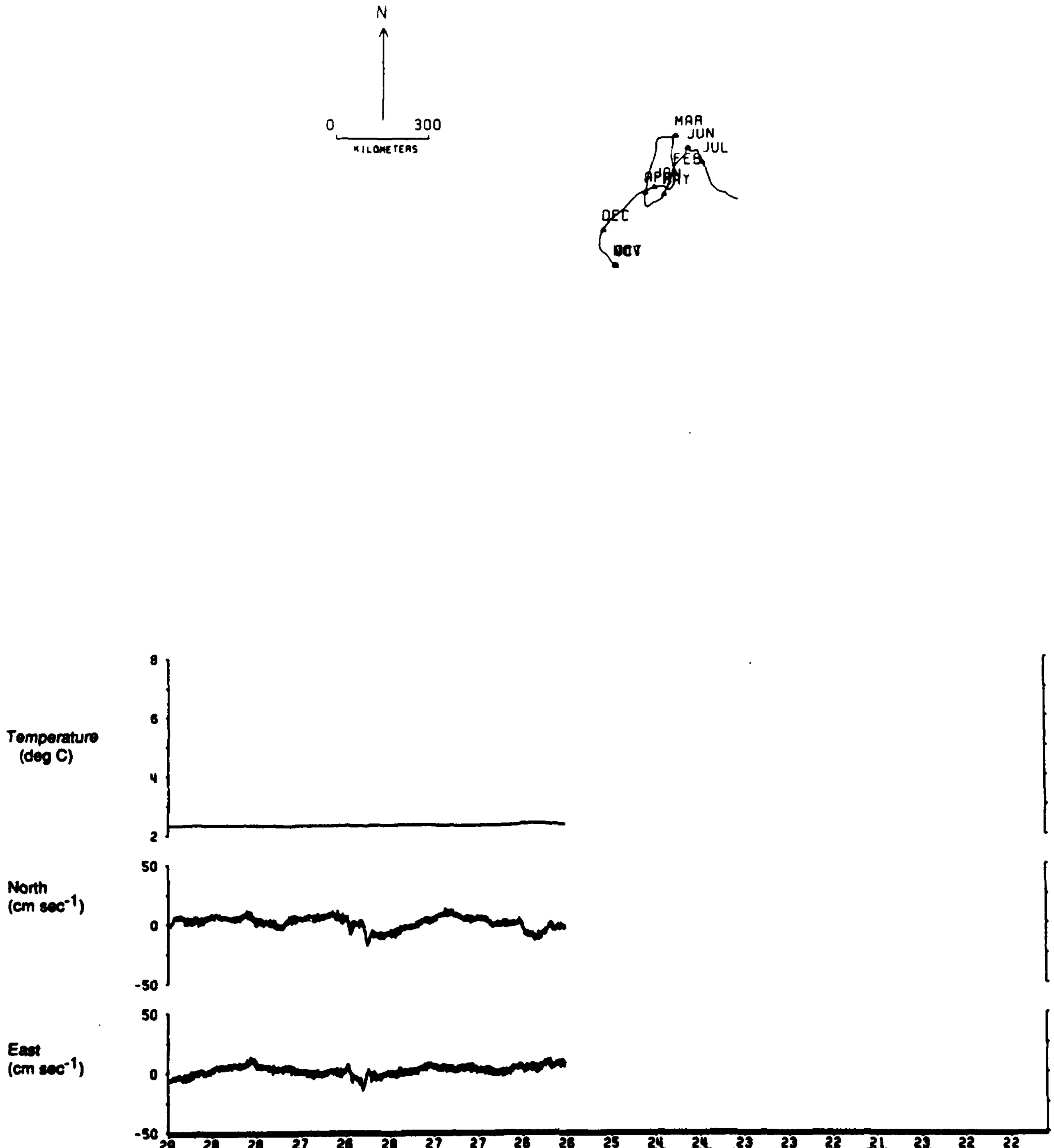
East, North, Temperature and progressive vector diagram for Mooring F1 1062 m.



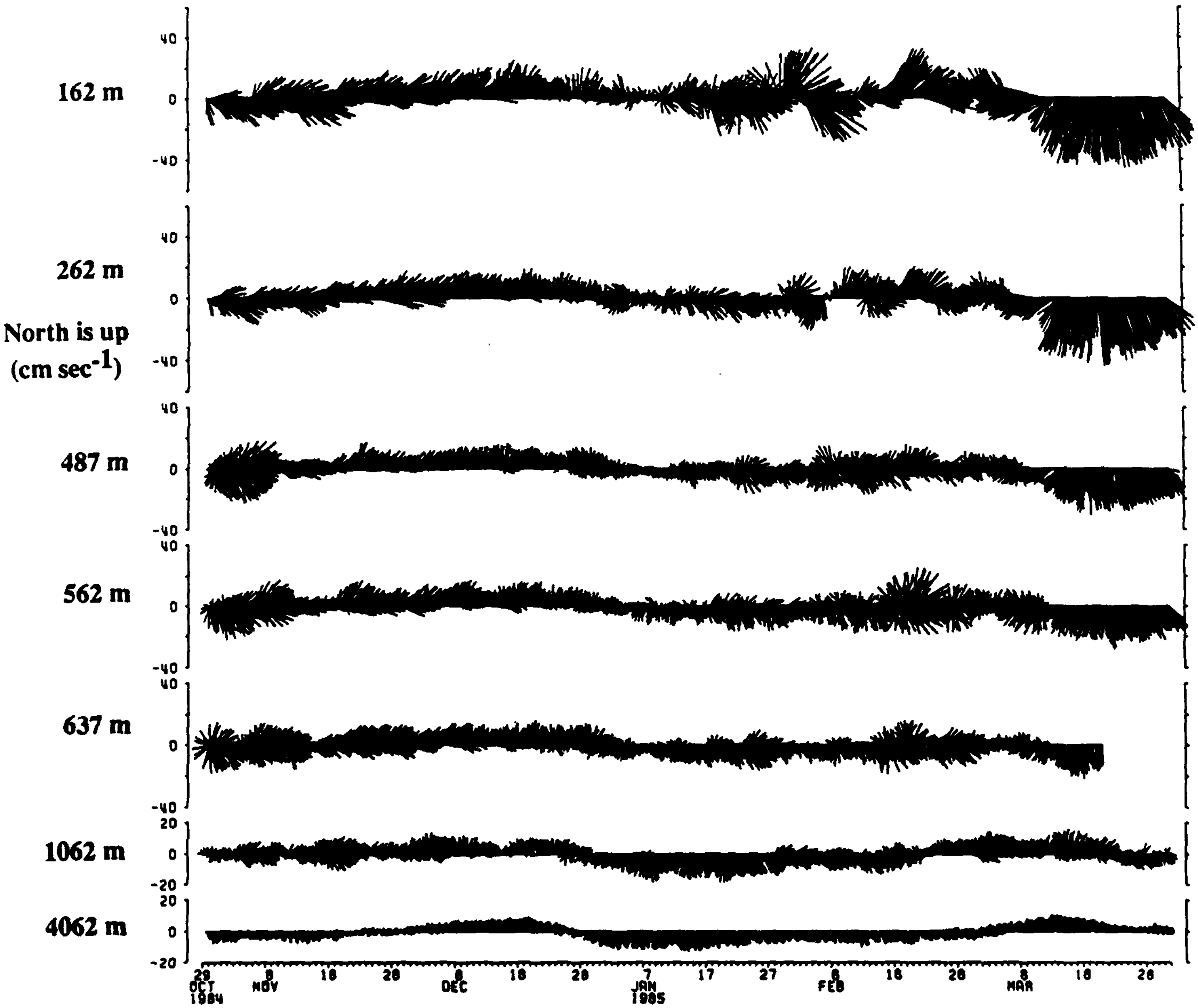
East, North, Temperature and progressive vector diagram for Mooring F12 1059 m.



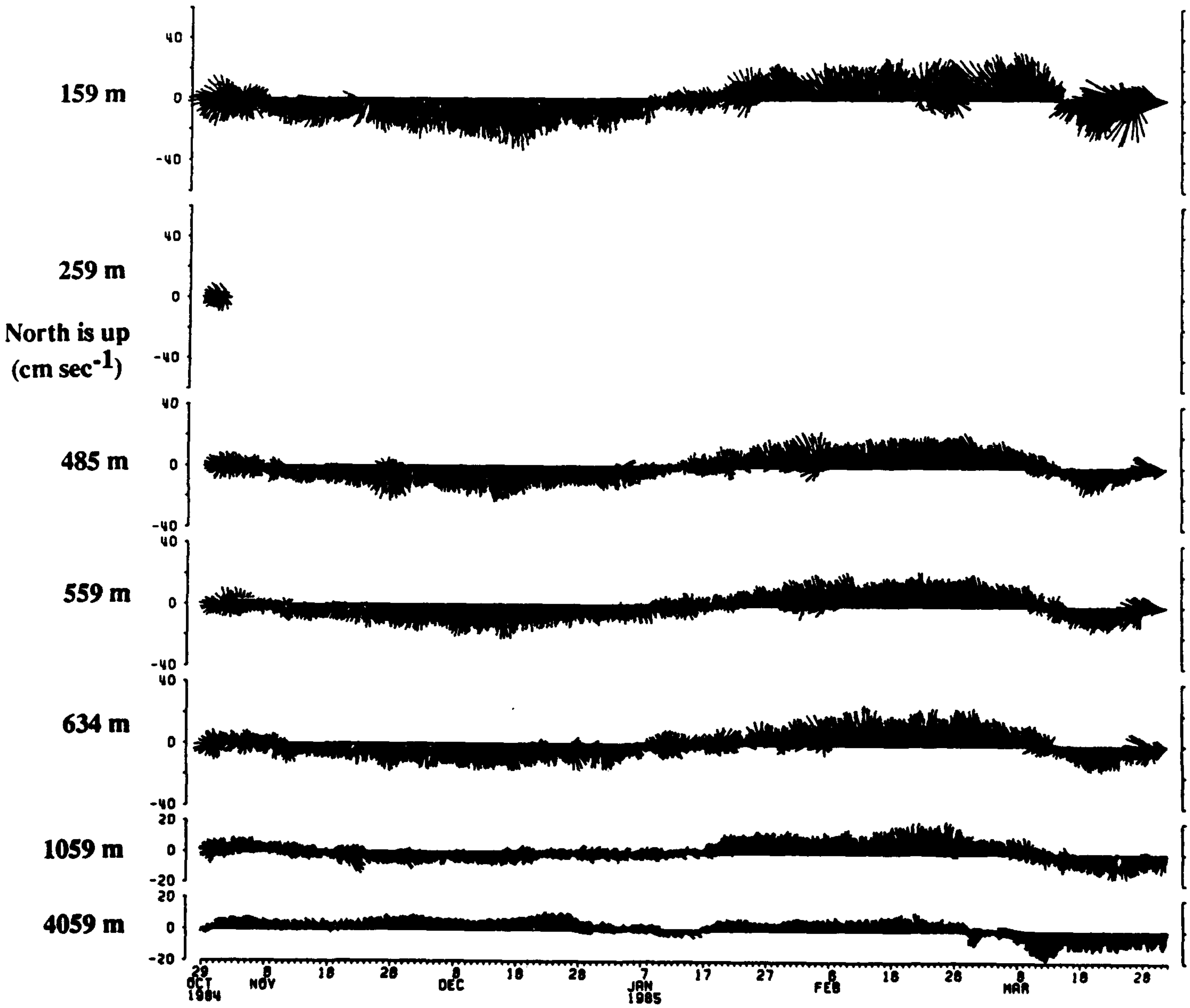
East, North, Temperature and progressive vector diagram for Mooring F1 4062 m.



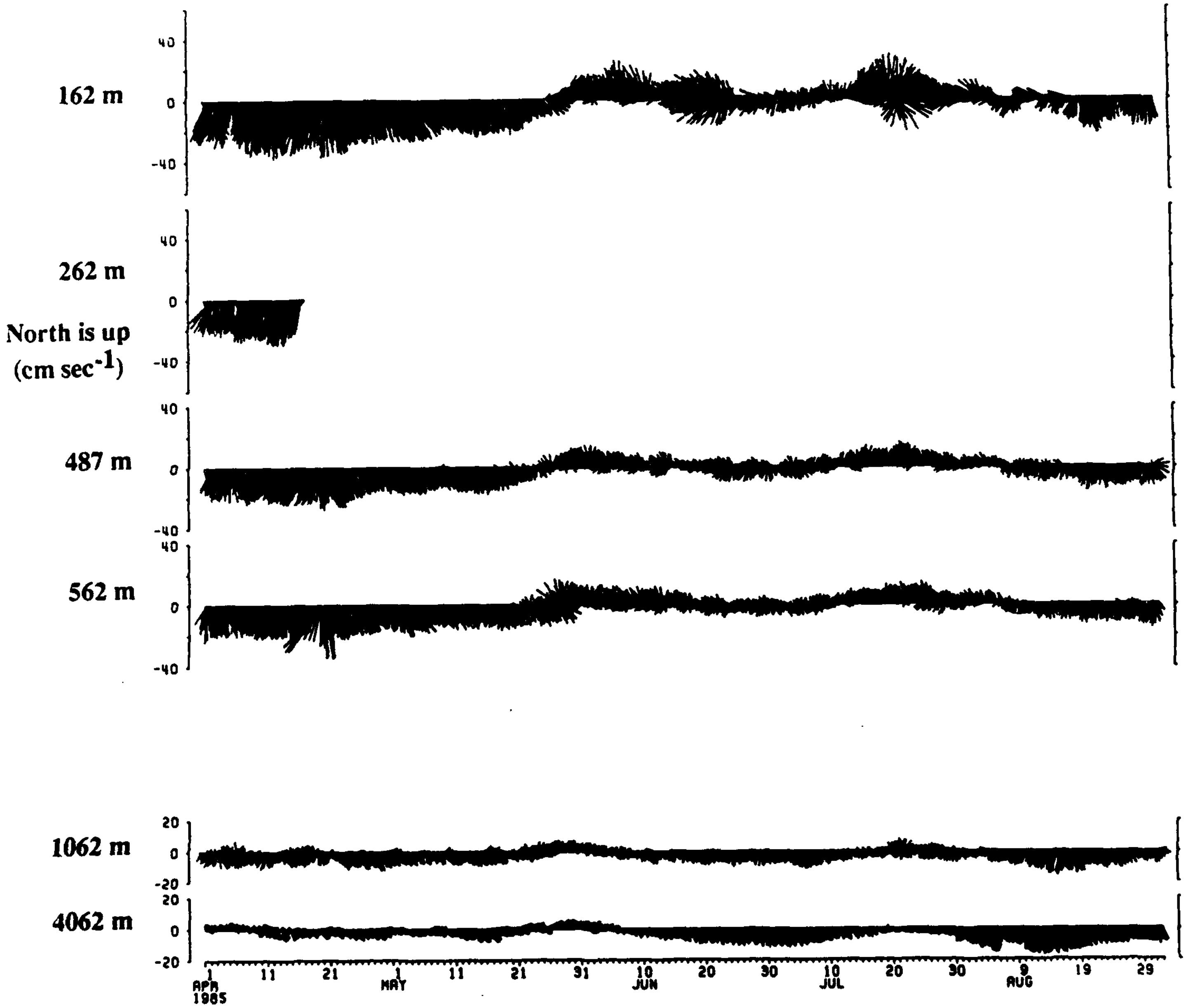
East, North, Temperature and progressive vector diagram for Mooring F12 4059 m.



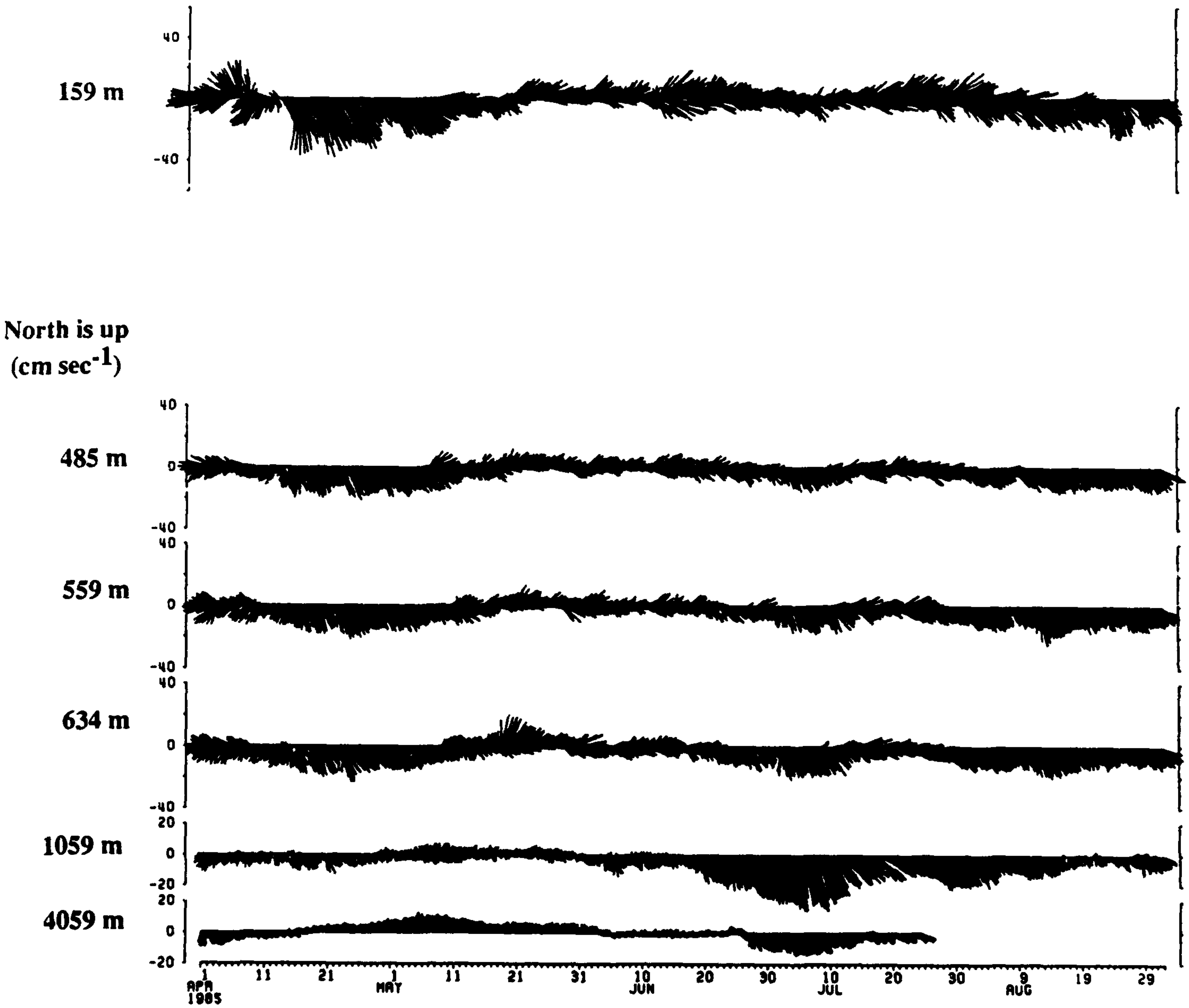
Vertical composite stick plot for Mooring F1 - Time Period 1.



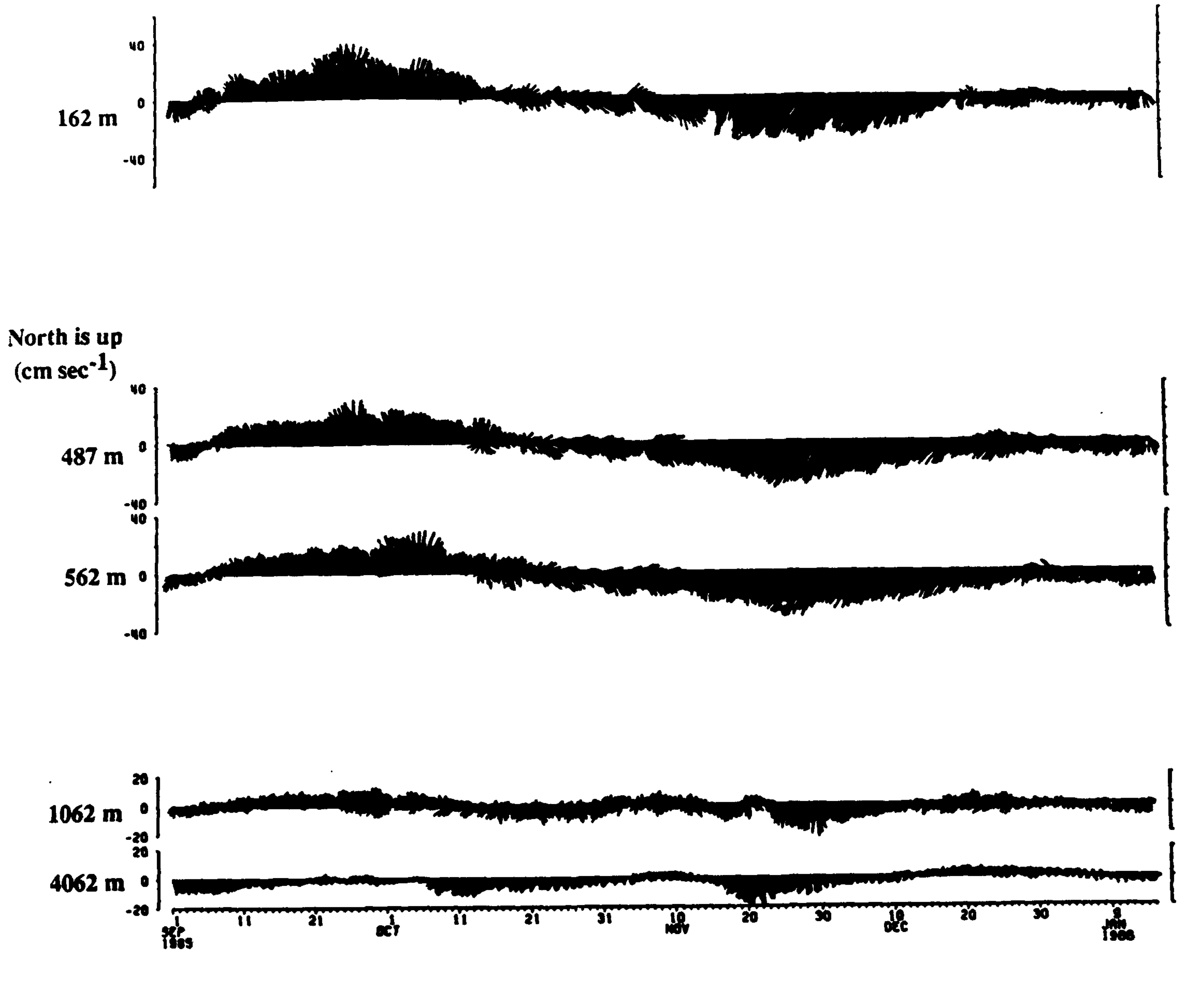
Vertical composite stick plot for Mooring F12 - Time Period 1.



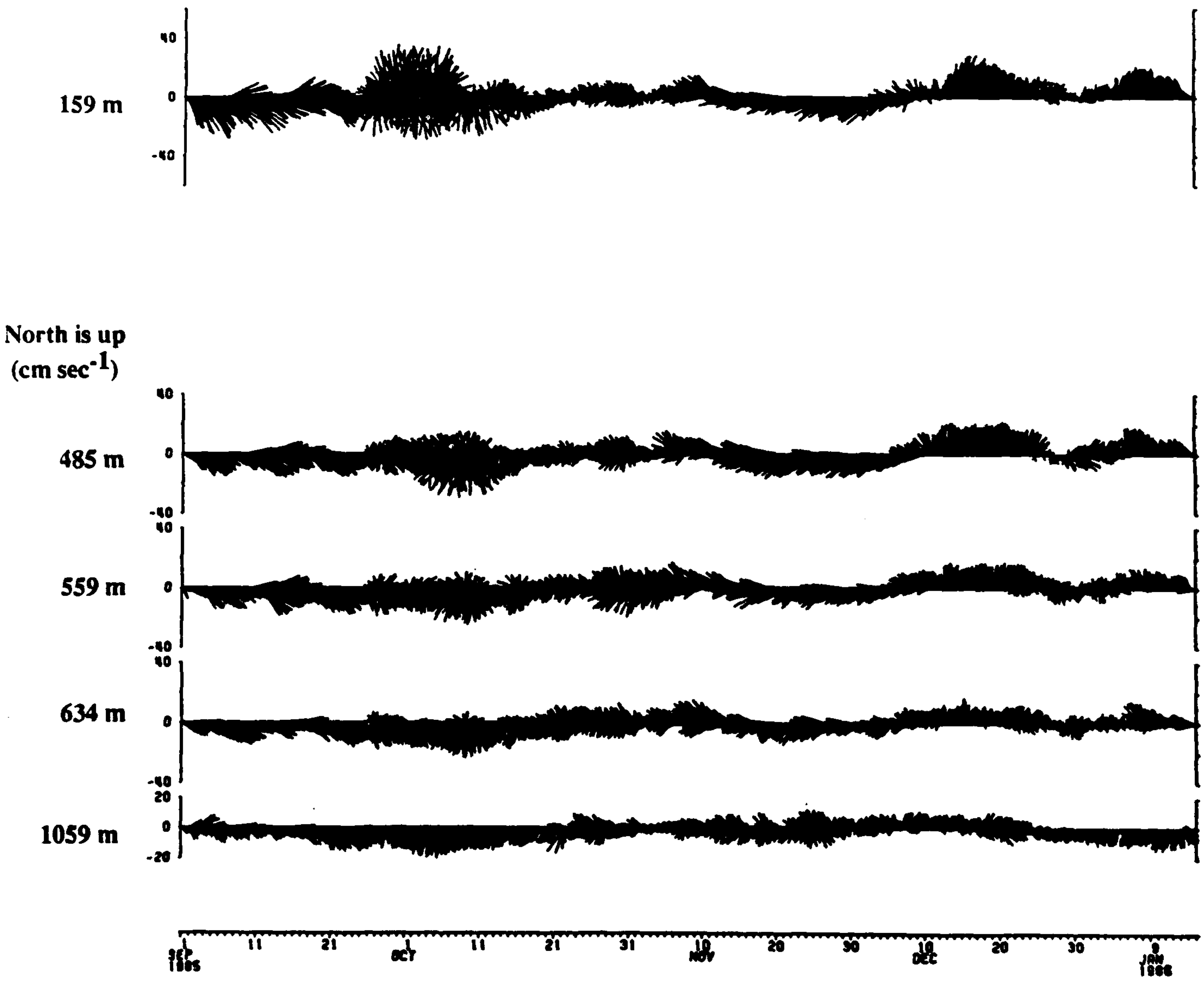
Vertical composite stick plot for Mooring F1 - Time Period 2.



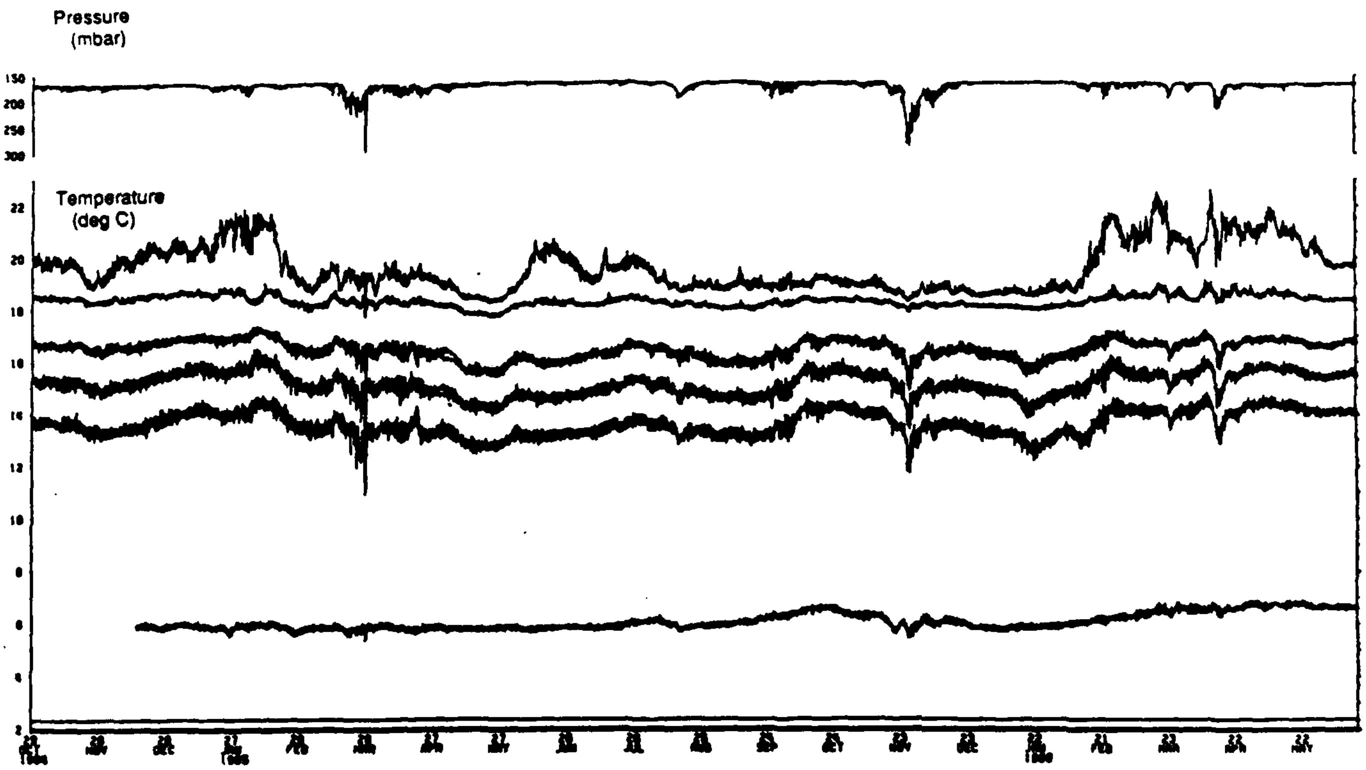
Vertical composite stick plot for Mooring F12 - Time Period 2.



Vertical composite stick plot for Mooring F1 - Time Period 3.

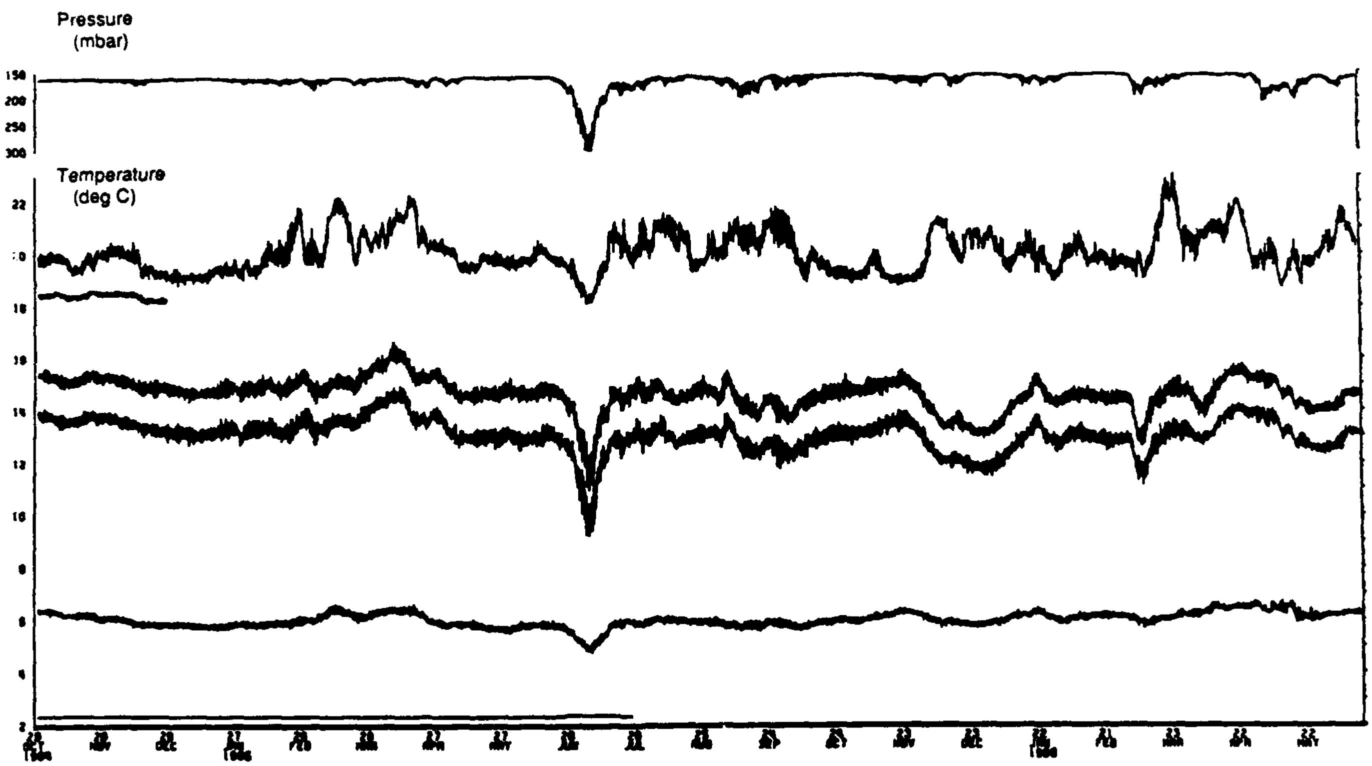


Vertical composite stick plot for Mooring F12 - Time Period 3.



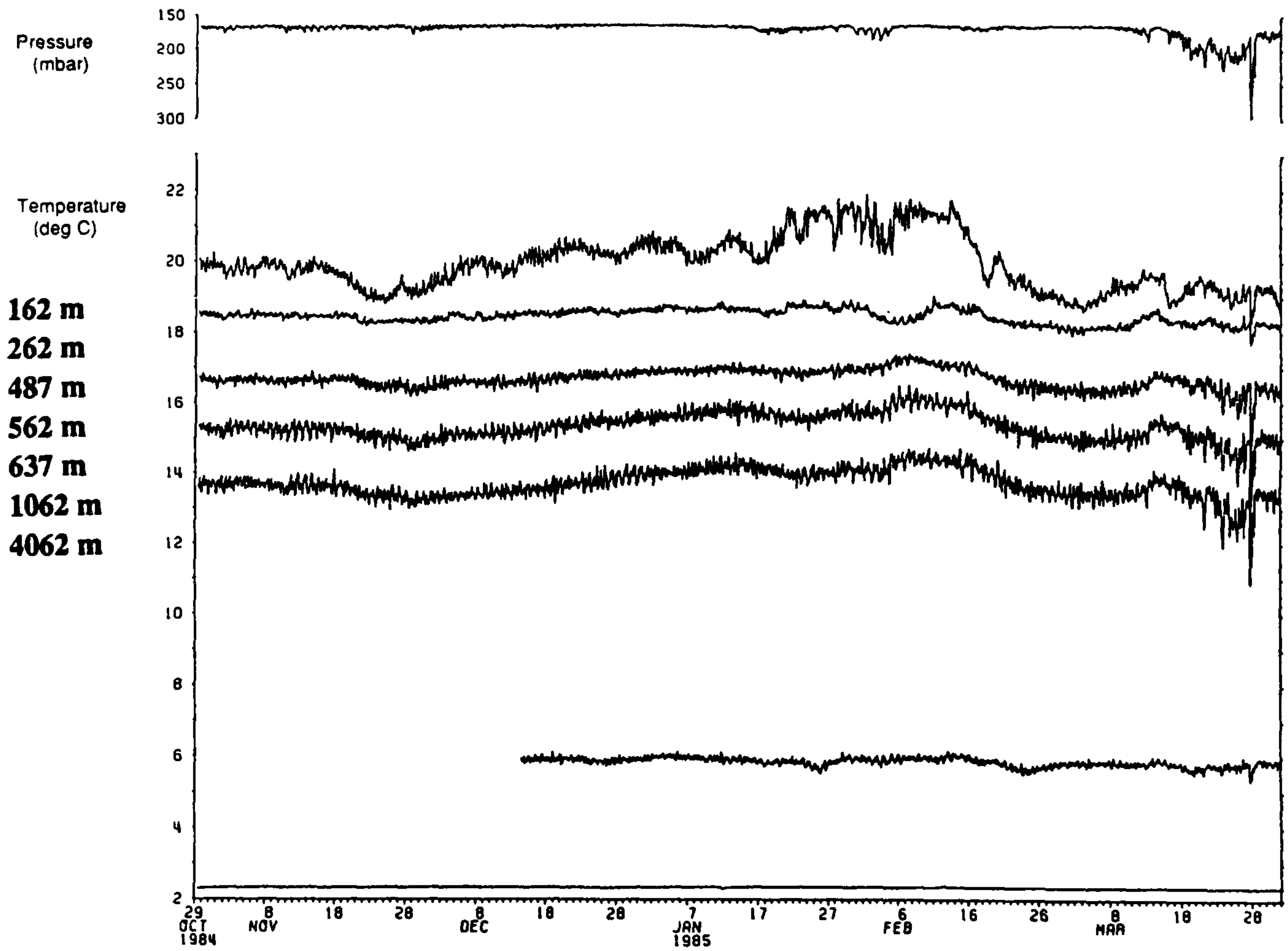
162 m
262 m
487 m
562 m
637 m
1062 m
4062 m

Composite 22 month Temperature and Pressure for Mooring F1.

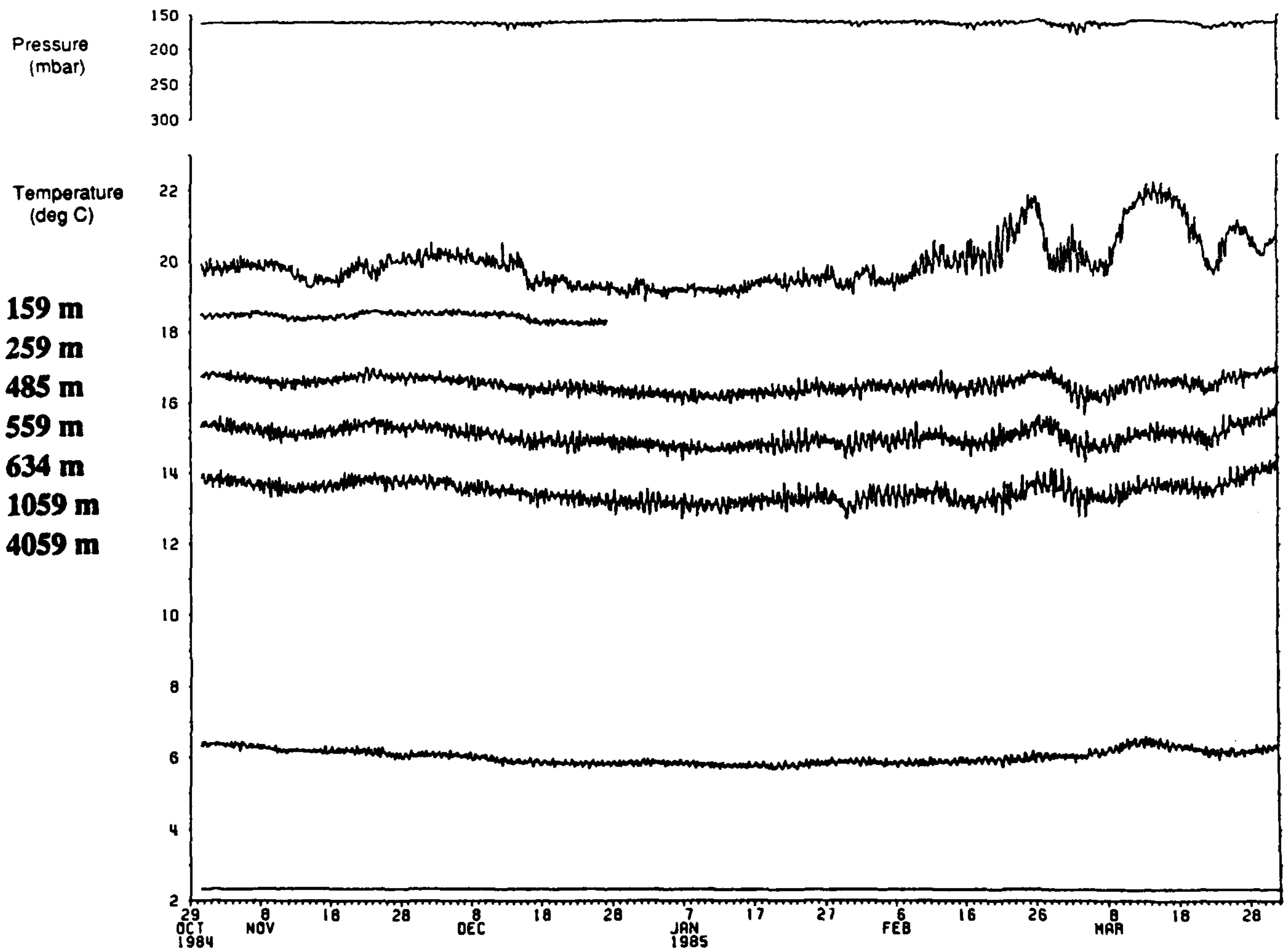


159 m
259 m
485 m
559 m
634 m
1059 m
4059 m

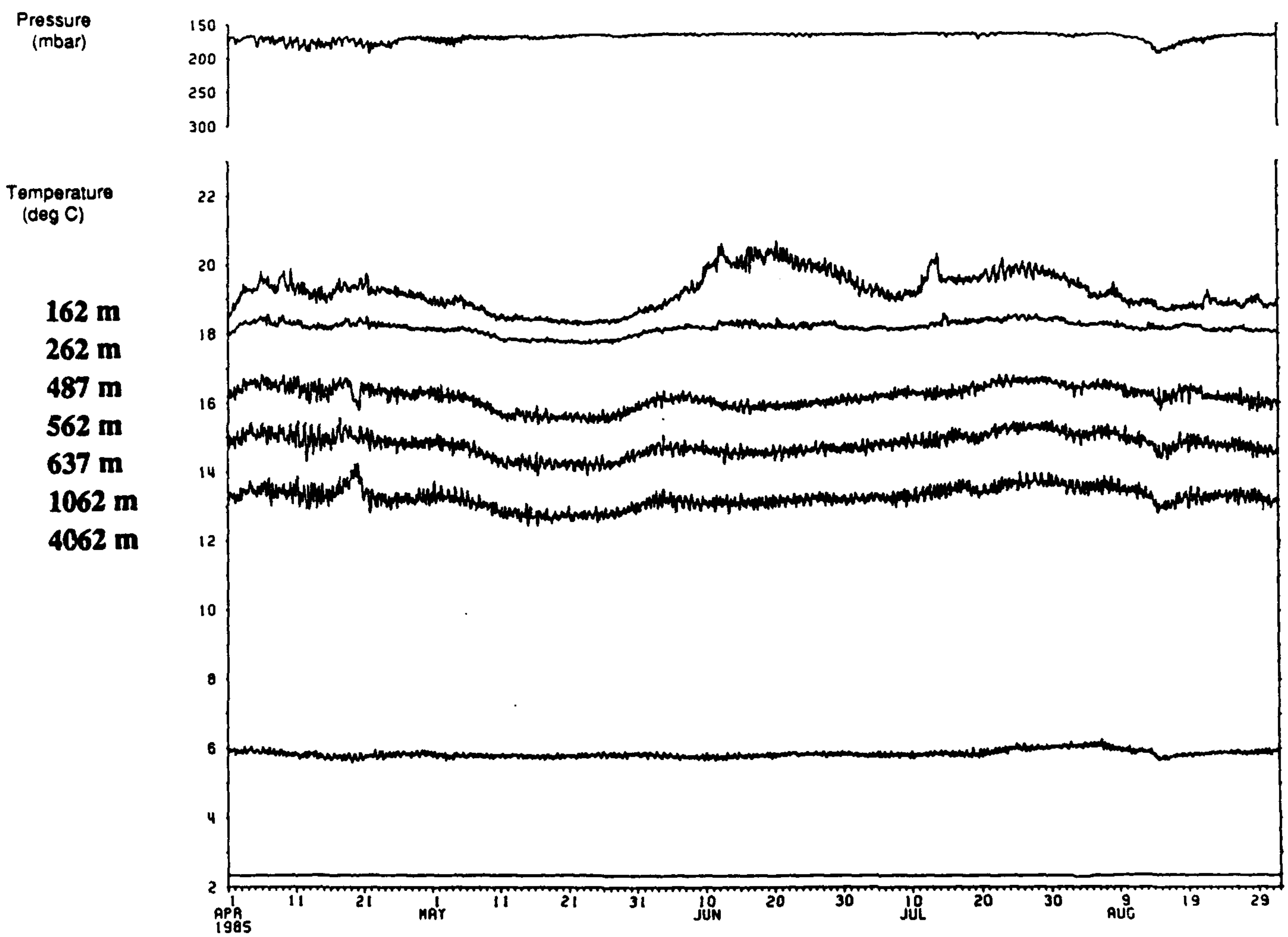
Composite 22 month Temperature and Pressure for Mooring F12.



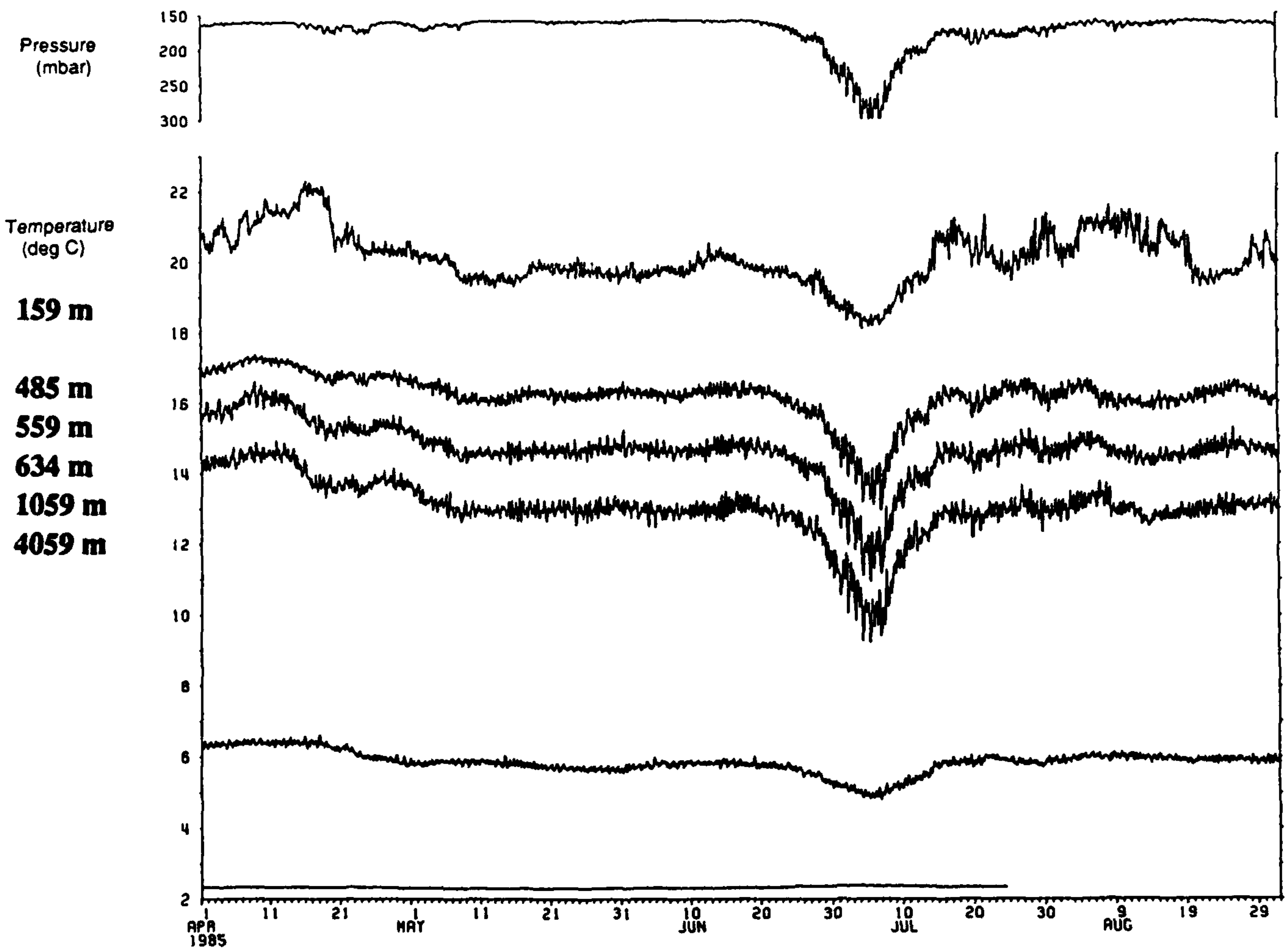
Composite Temperature and Pressure for Mooring F1 - Time Period 1.



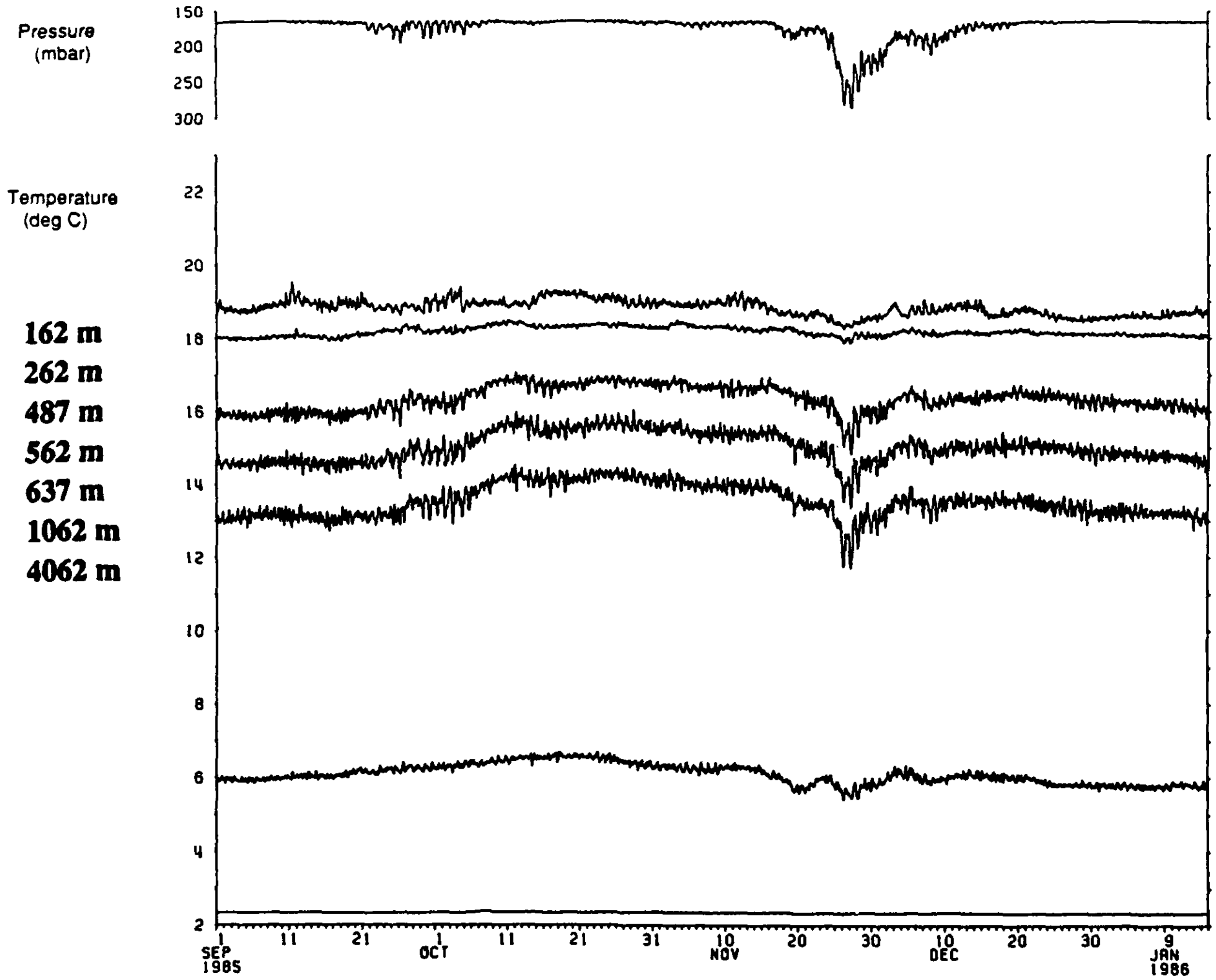
Composite Temperature and Pressure for Mooring F12 - Time Period 1.



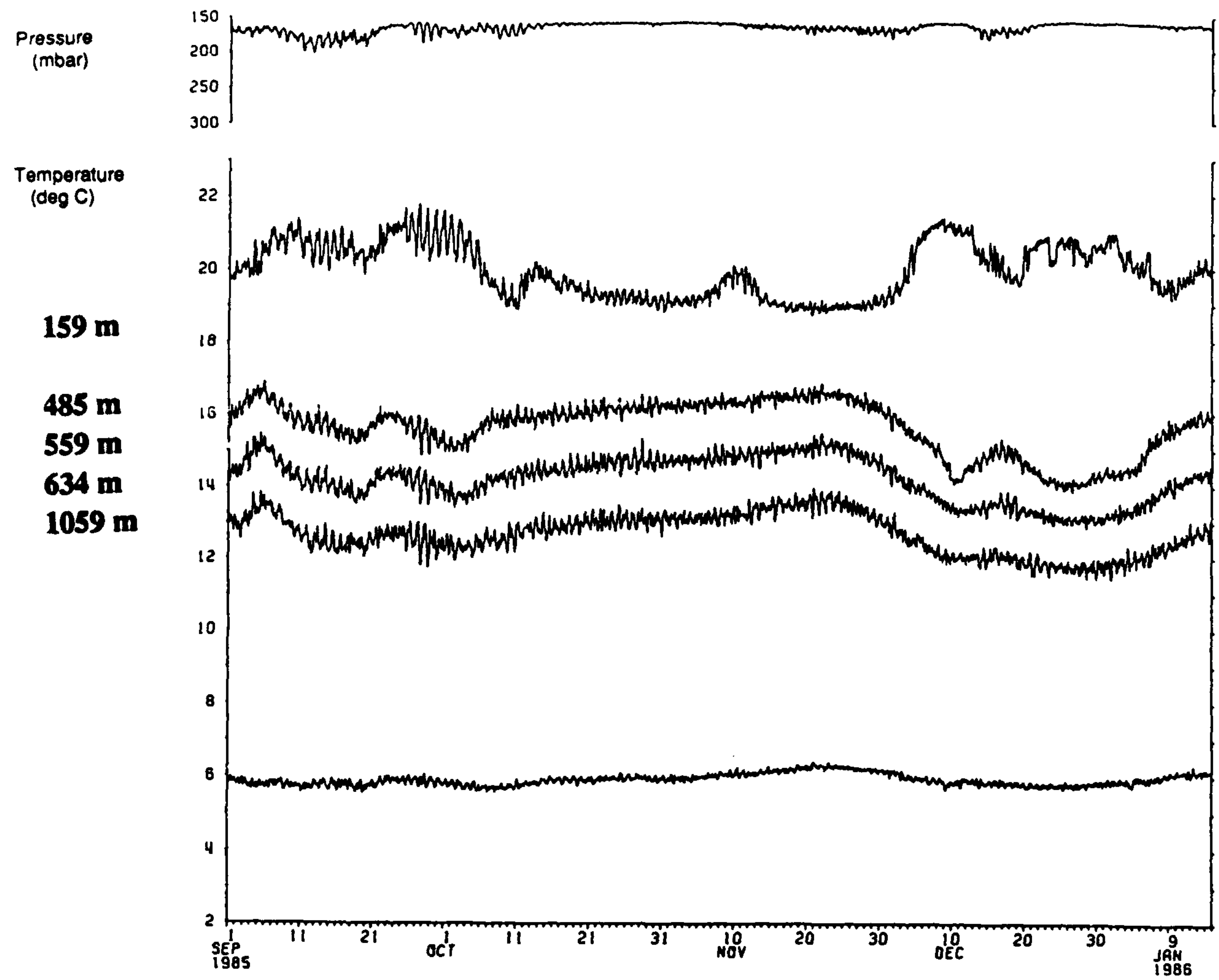
Composite Temperature and Pressure for Mooring F1 - Time Period 2.



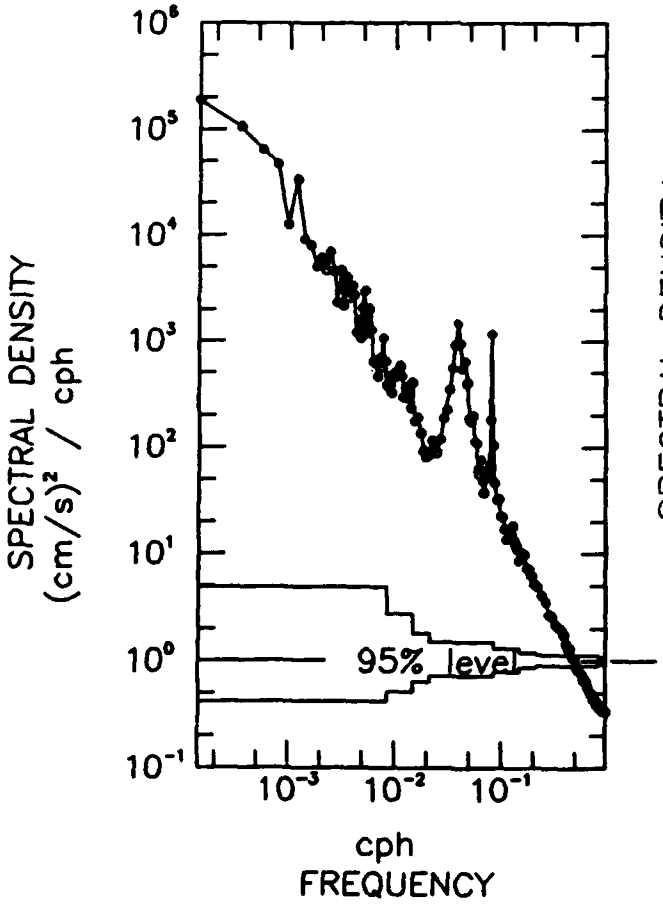
Composite Temperature and Pressure for Mooring F12 - Time Period 2.

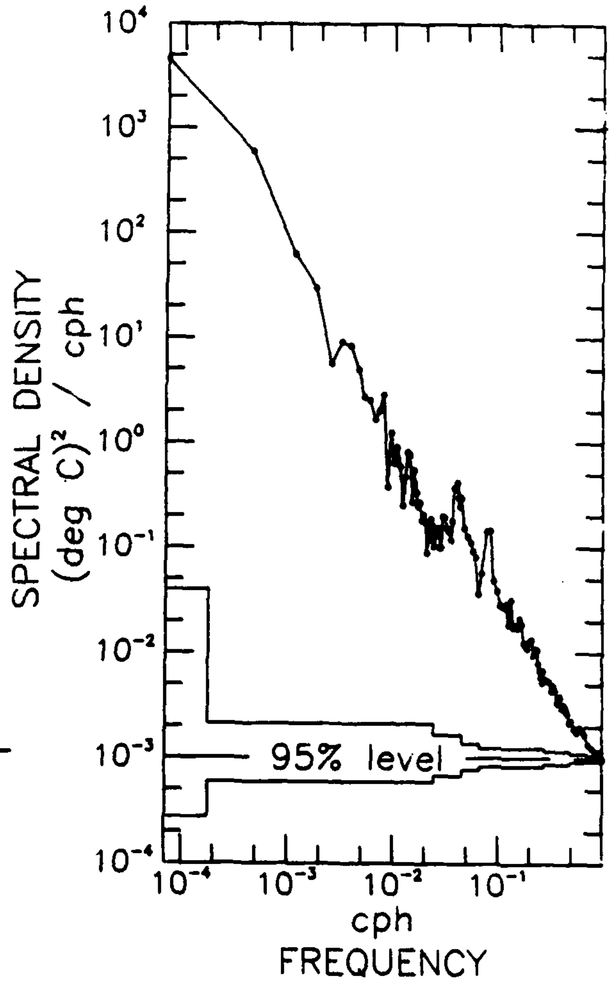


Composite Temperature and Pressure for Mooring F1 - Time Period 3.

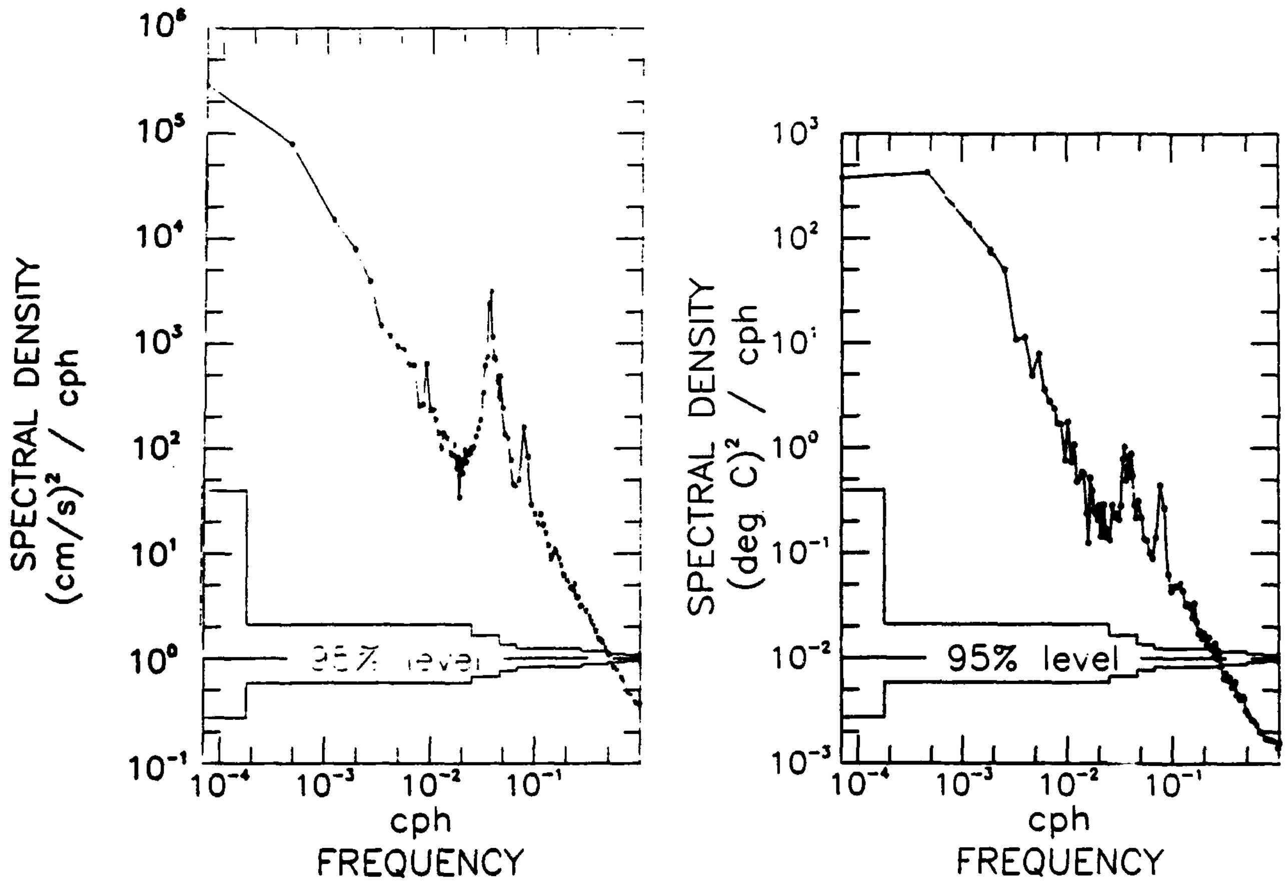


Composite Temperature and Pressure for Mooring F12 - Time Period 3.

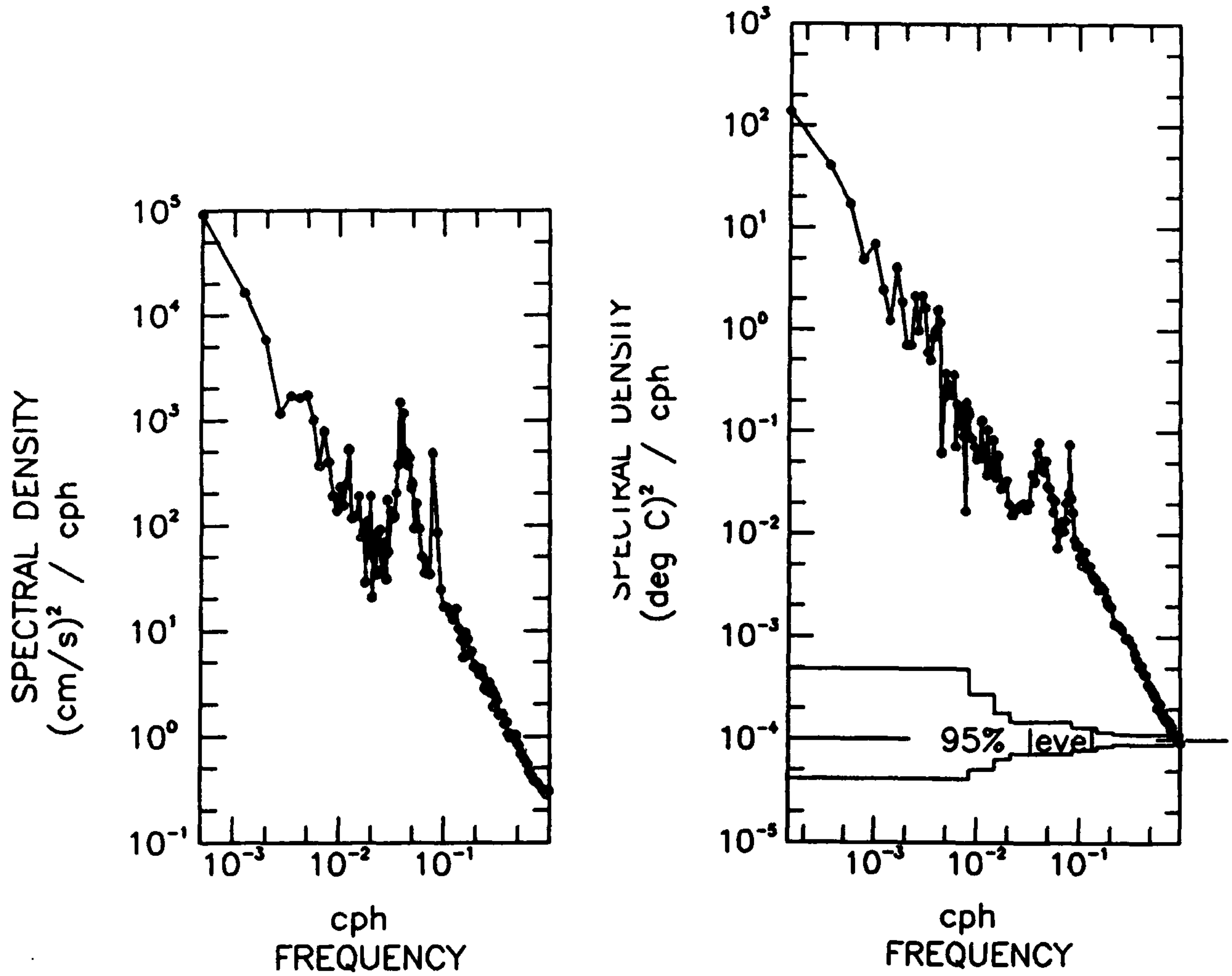




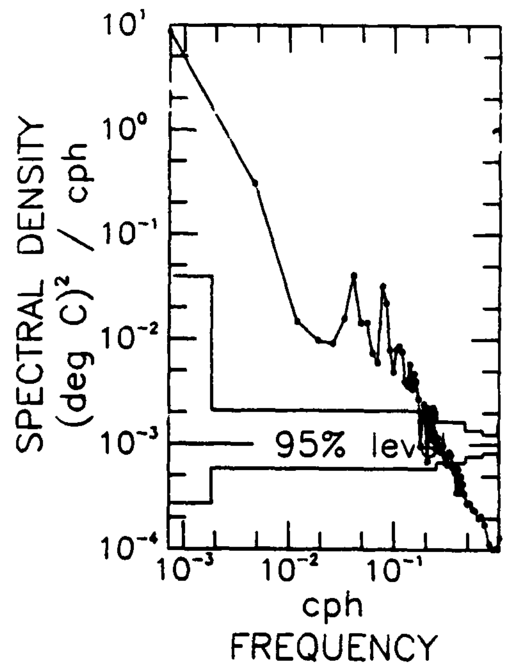
Velocity(8112) and Temperature(28566) Spectra for Mooring F1 162 m.



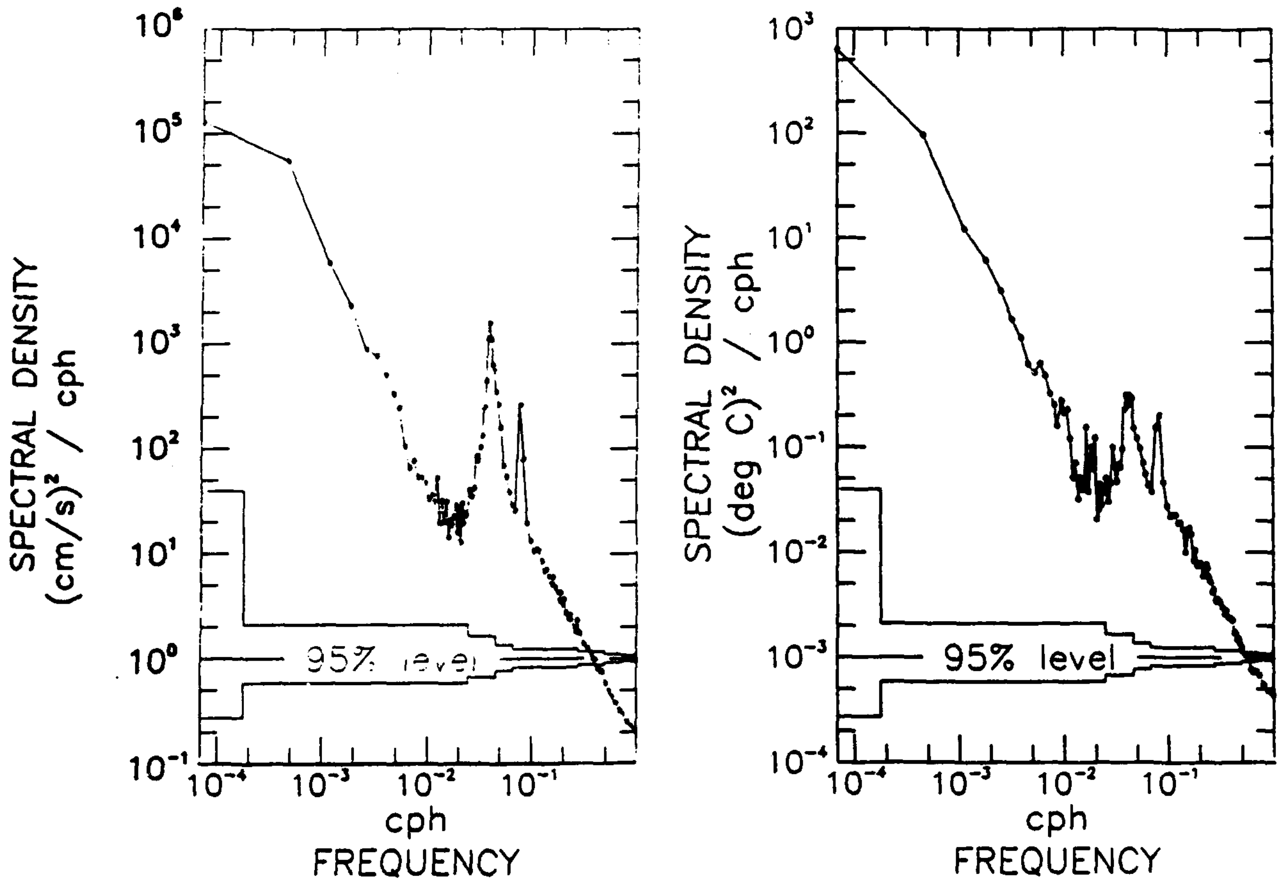
Velocity(28350) and Temperature(28350) Spectra for Mooring F12 159 m.



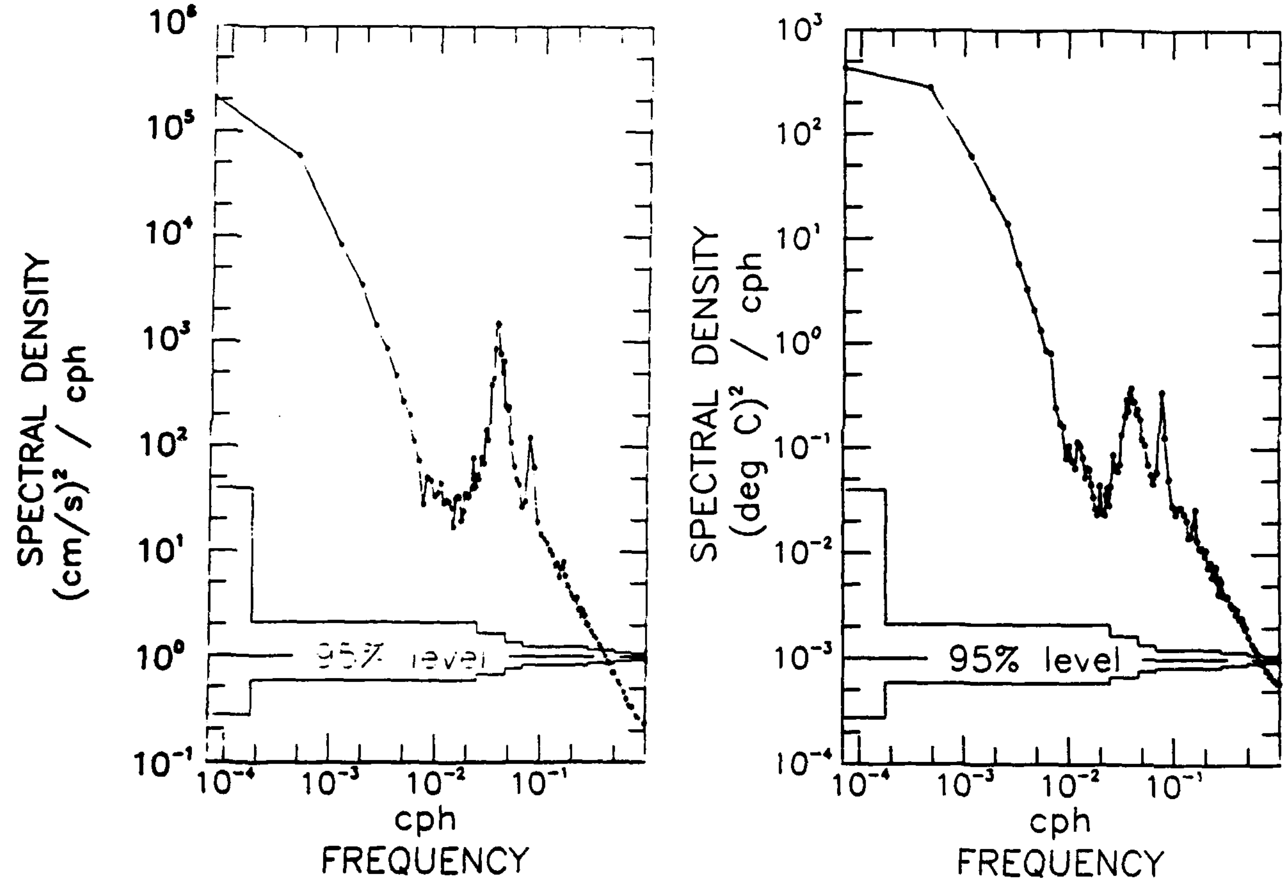
Velocity(7000) and Temperature Spectra for Mooring F1 262 m.



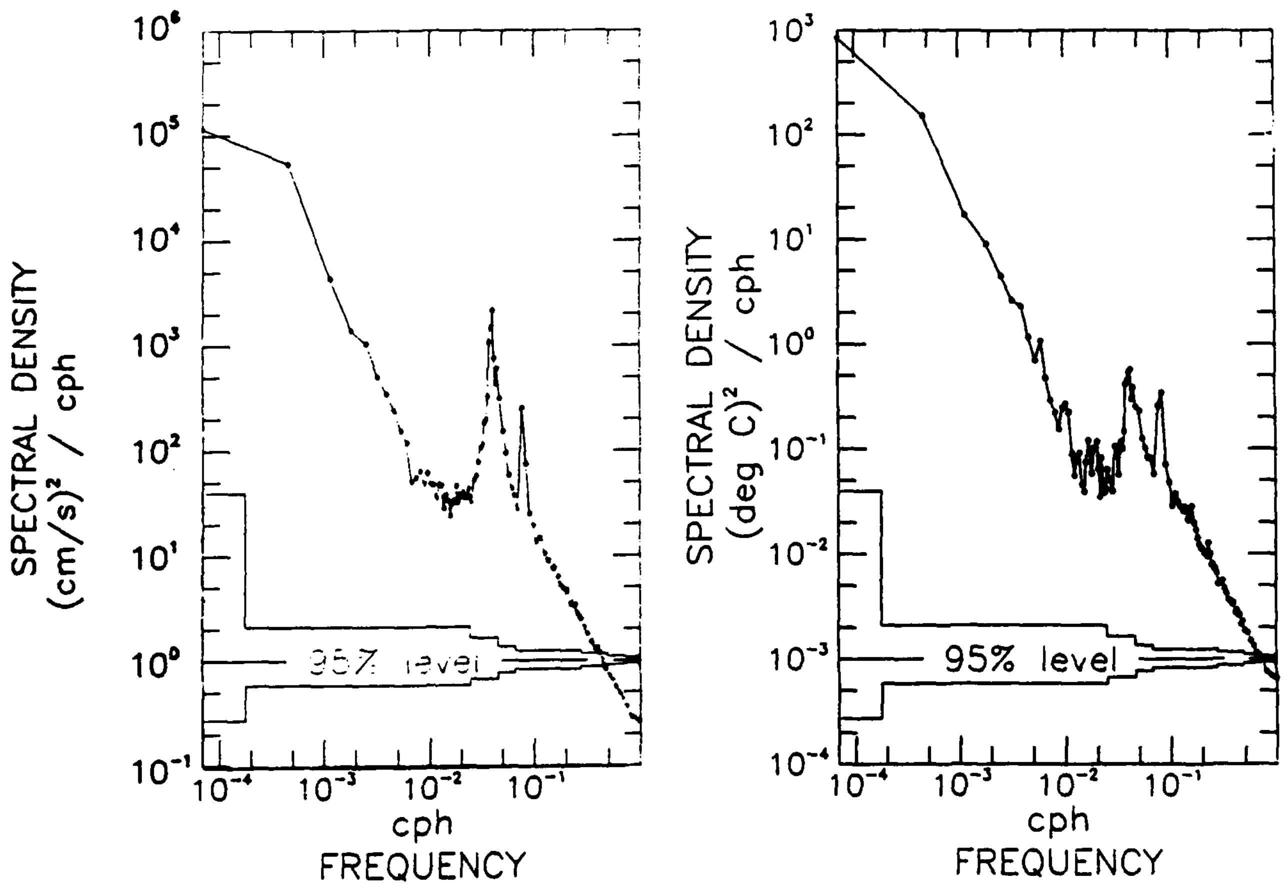
Temperature(2754) Spectrum for Mooring F12 259 m.



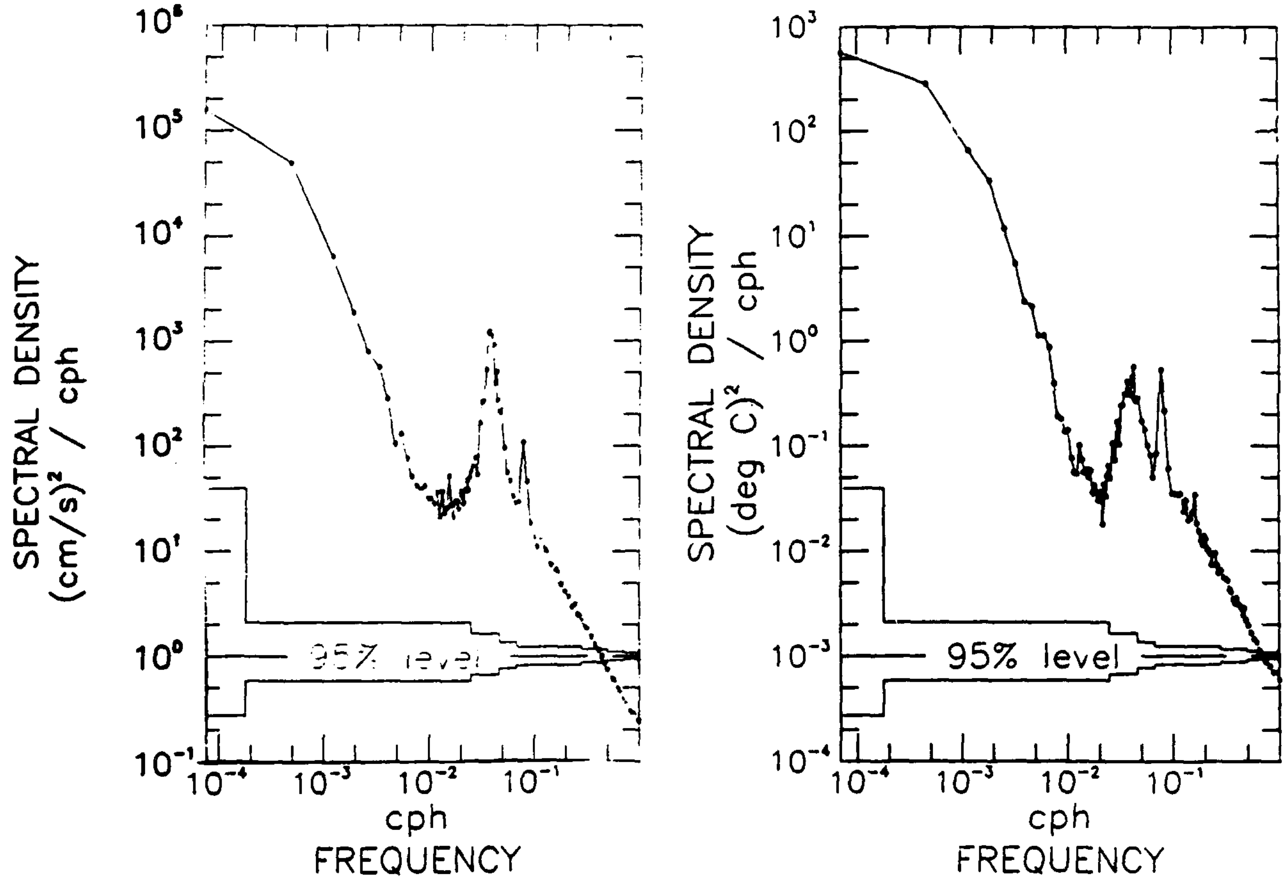
Velocity(28566) and Temperature(28566) Spectra for Mooring F1 487 m.



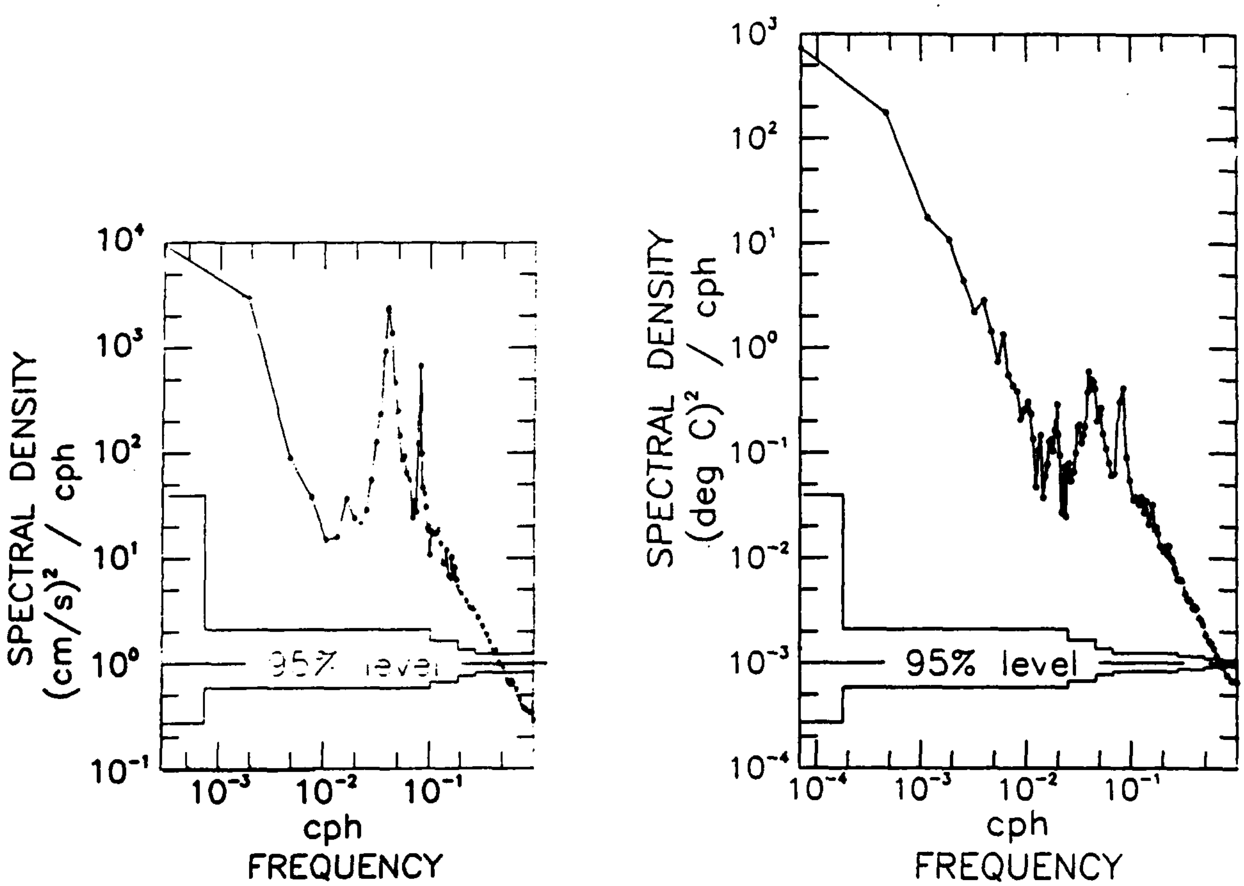
Velocity(28350) and Temperature(28350) Spectra for Mooring F12 485 m.



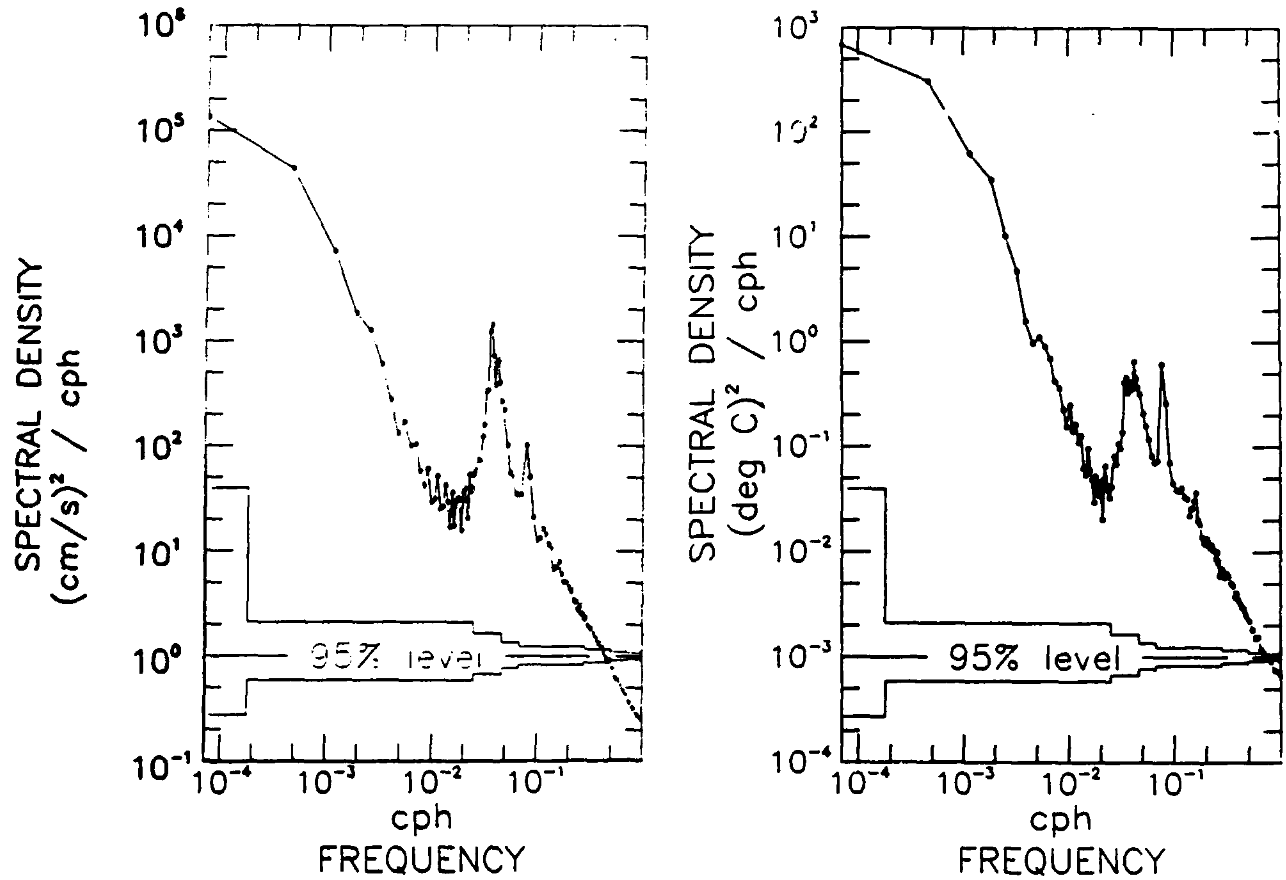
Velocity(28566) and Temperature(28566) Spectra for Mooring F1 562 m.



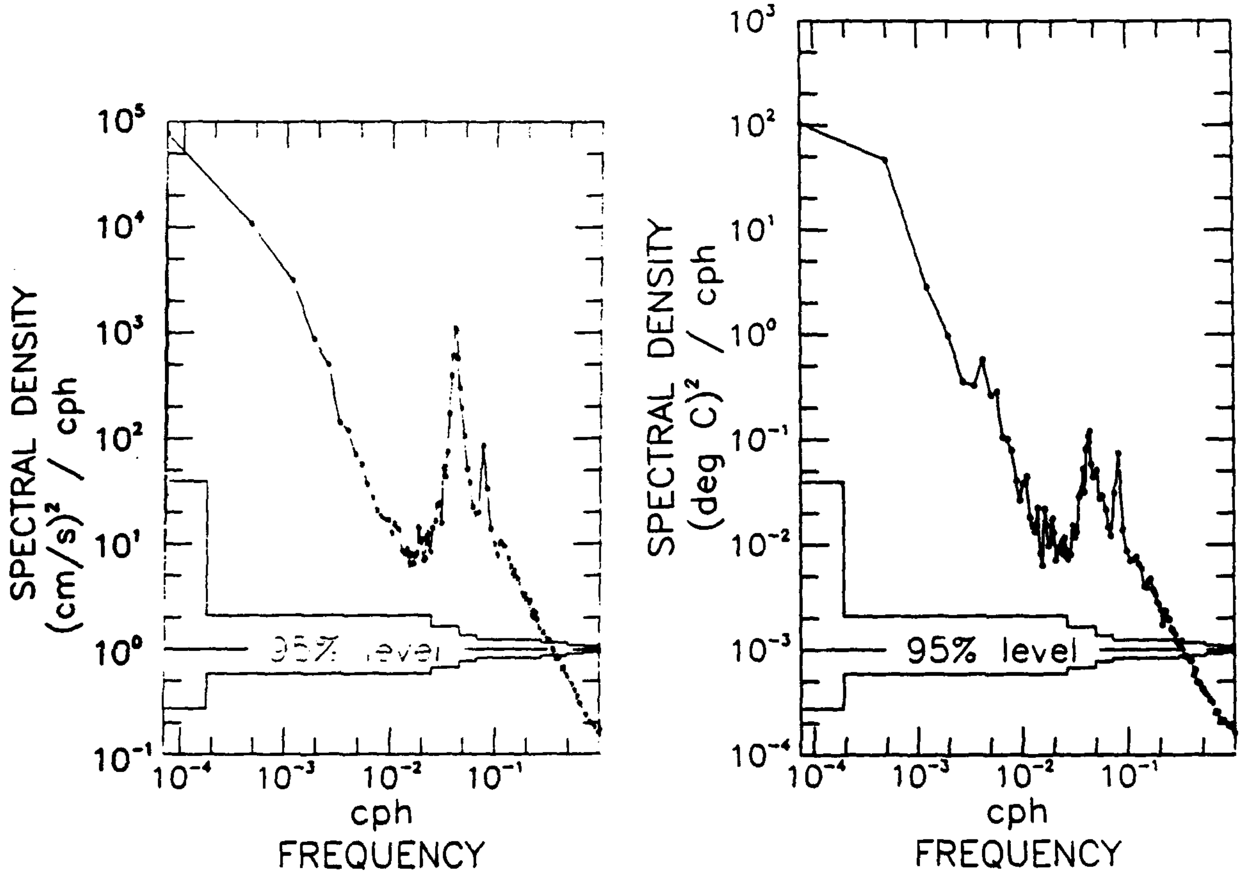
Velocity(28350) and Temperature(28350) Spectra for Mooring F12 559 m.



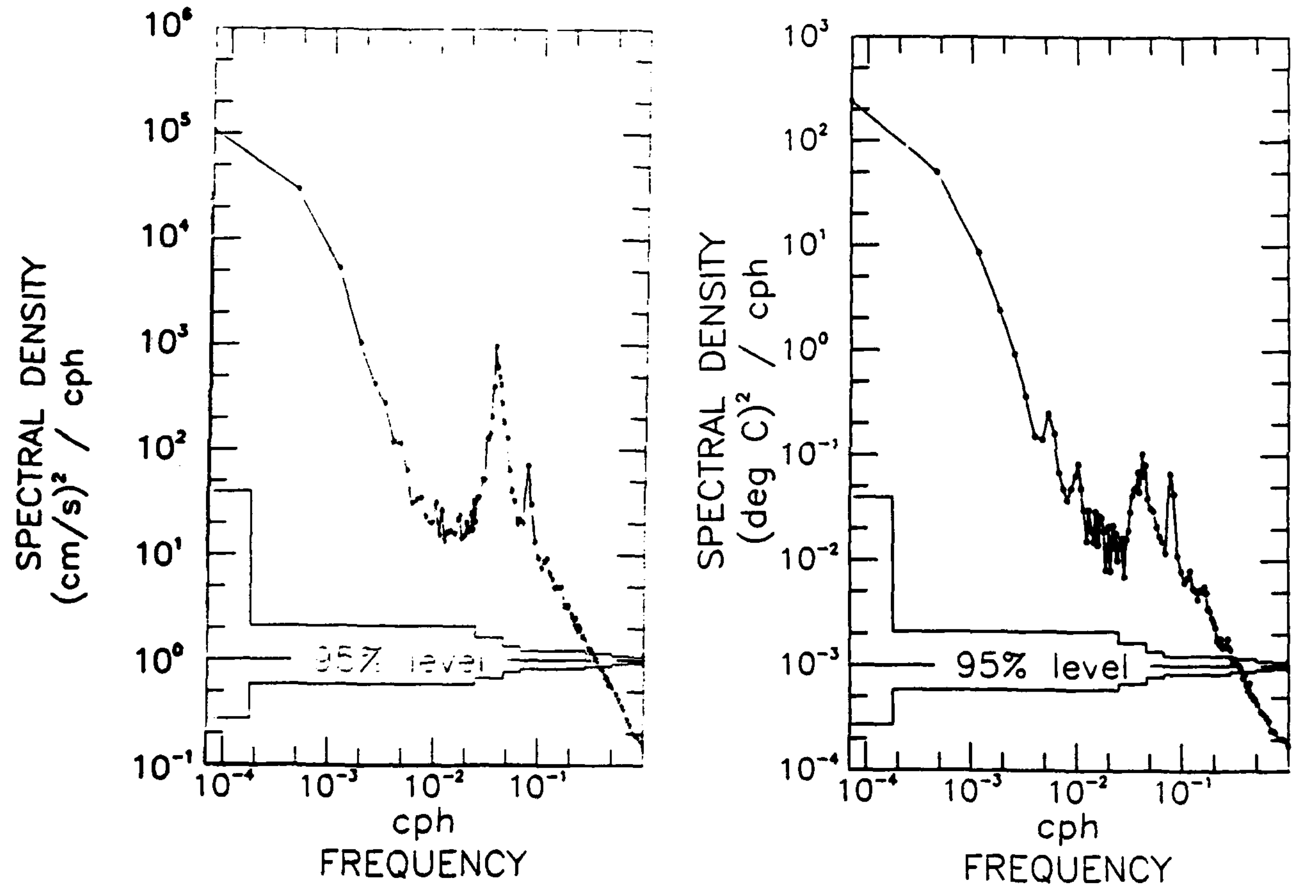
Velocity(6840) and Temperature(28566) Spectra for Mooring F1 637 m.



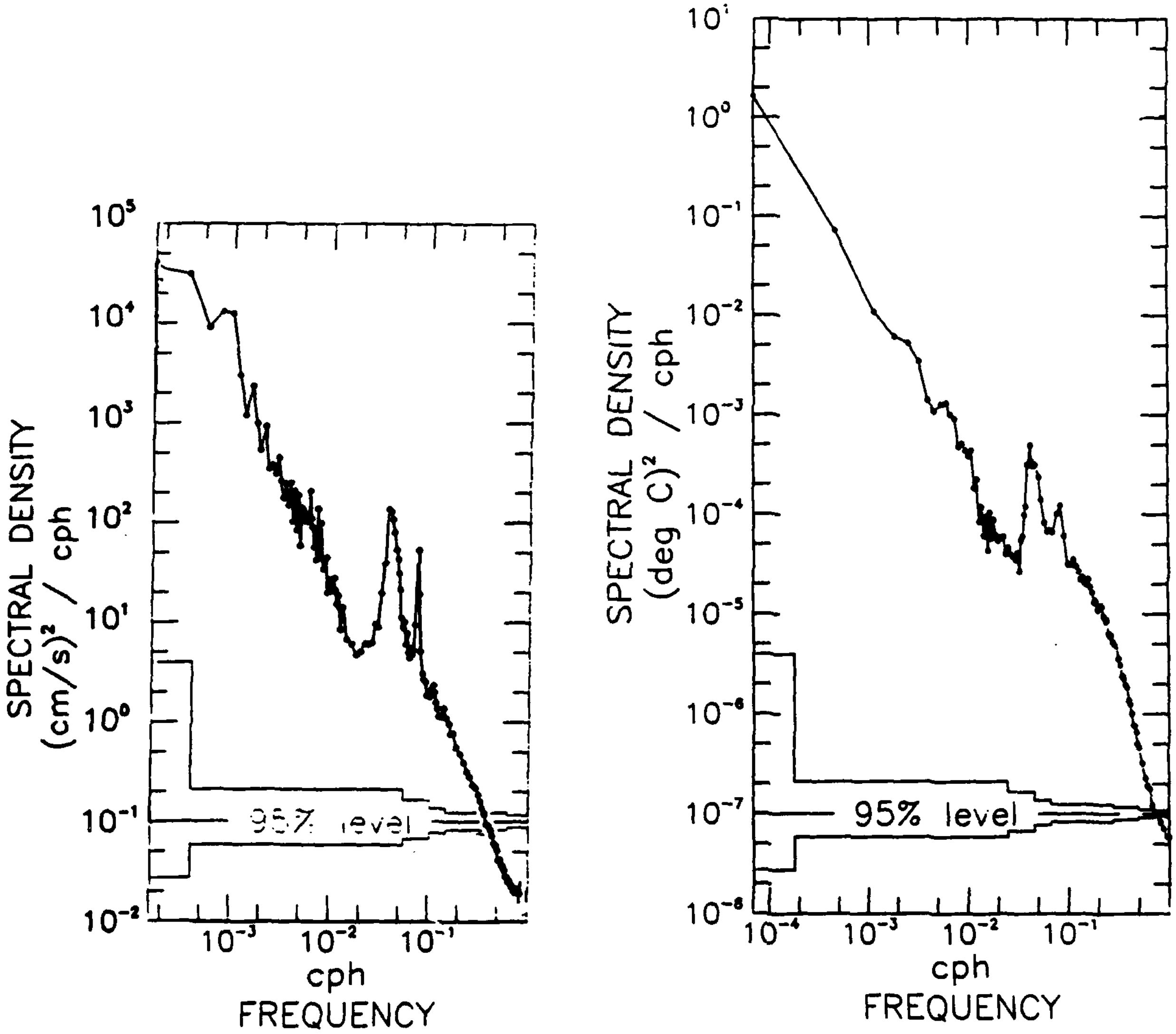
Velocity(28350) and Temperature(28350) Spectra for Mooring F12 634 m.



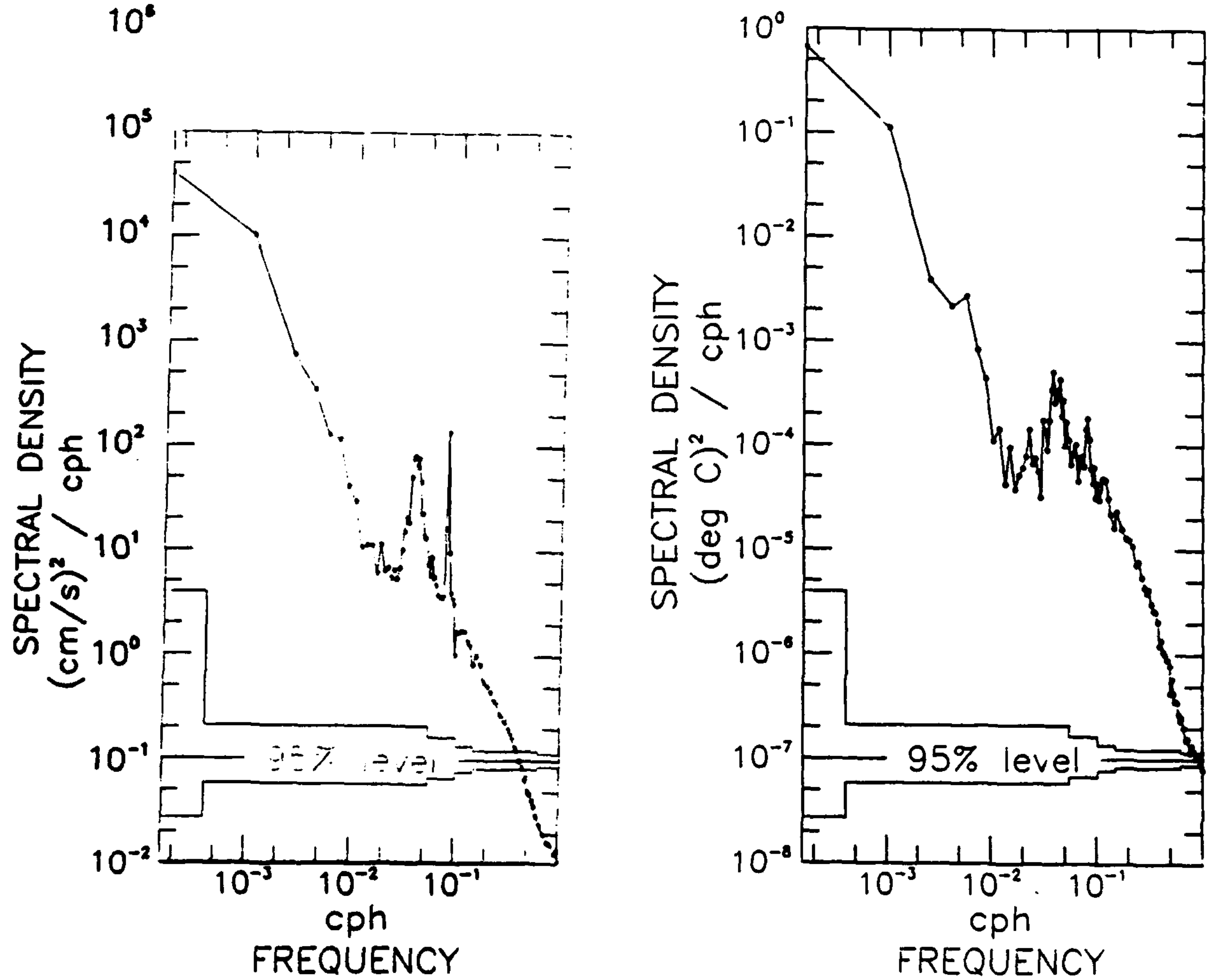
Velocity(28566) and Temperature(28566) Spectra for Mooring F1 1062 m.



Velocity(28350) and Temperature(28350) Spectra for Mooring F12 1059 m.



Velocity(28566) and Temperature(28566) Spectra for Mooring F1 4062 m.



Velocity(12800) and Temperature(12800) Spectra for Mooring F12 4059 m.

10. ARGOS Buoy Motion / Telemetered Data

The Meteorological Recorders (MRs)(Payne, 1988) on the five FASINEX surface buoys telemetered via ARGOS. This system consists of two TIROS satellites in orbit, equipped with data collection systems and several ground data processing centers. Each buoy transmitted data to the satellites, which was then transmitted to a telemetry station. The data were processed and available on line or stored for transmittal. Service ARGOS supplied a 9 track tape of this data at the end of each month. The ARGOS system on the buoy transmitted the meteorological and engineering parameter averages, and a buoy position, which was calculated by measuring the Doppler shift on the carrier frequency of incoming messages to the satellite. The time base of this data series was dependent on the number of satellite passes seen by the buoy. In the FASINEX area, there was a satellite pass about every 2 hours.

The information from these buoys was monitored daily to check that they remained on station and to review the variability of certain meteorological parameters in the area of the array. Figure 17 shows the movement of the five surface moorings during the six month deployment as determined by the ARGOS location system. (Buoy positions were measured with a manufacturer-specified, one standard deviation accuracy of 350 m.) Time series plots of the telemetered meteorological variables follow. The time base runs from January 20 to June 16 1986. This time base begins when correctly calibrated data are logged to tape by the ARGOS processing centers. The data have been editted and averaged to one point per pass. The time base is in real Julian days. The overplots show the variations between buoys.

During Phase Two, a secondary ARGOS transmitter was placed on F10 because of problems with the original transmitter. This second unit was placed in a watertight tube, which was attached to the tower of the buoy. This data set was not archived to tape by ARGOS, so only hard copies of the dialed-up listings were used to plot of the positions when F10 broke free about May 14, 1986.

(See Weller et al., 1989 for a discussion of the relative motion of the five surface buoys.)

	pages
Telemetered variables	263-268

FASINEX Surface Moorings with drifting F10

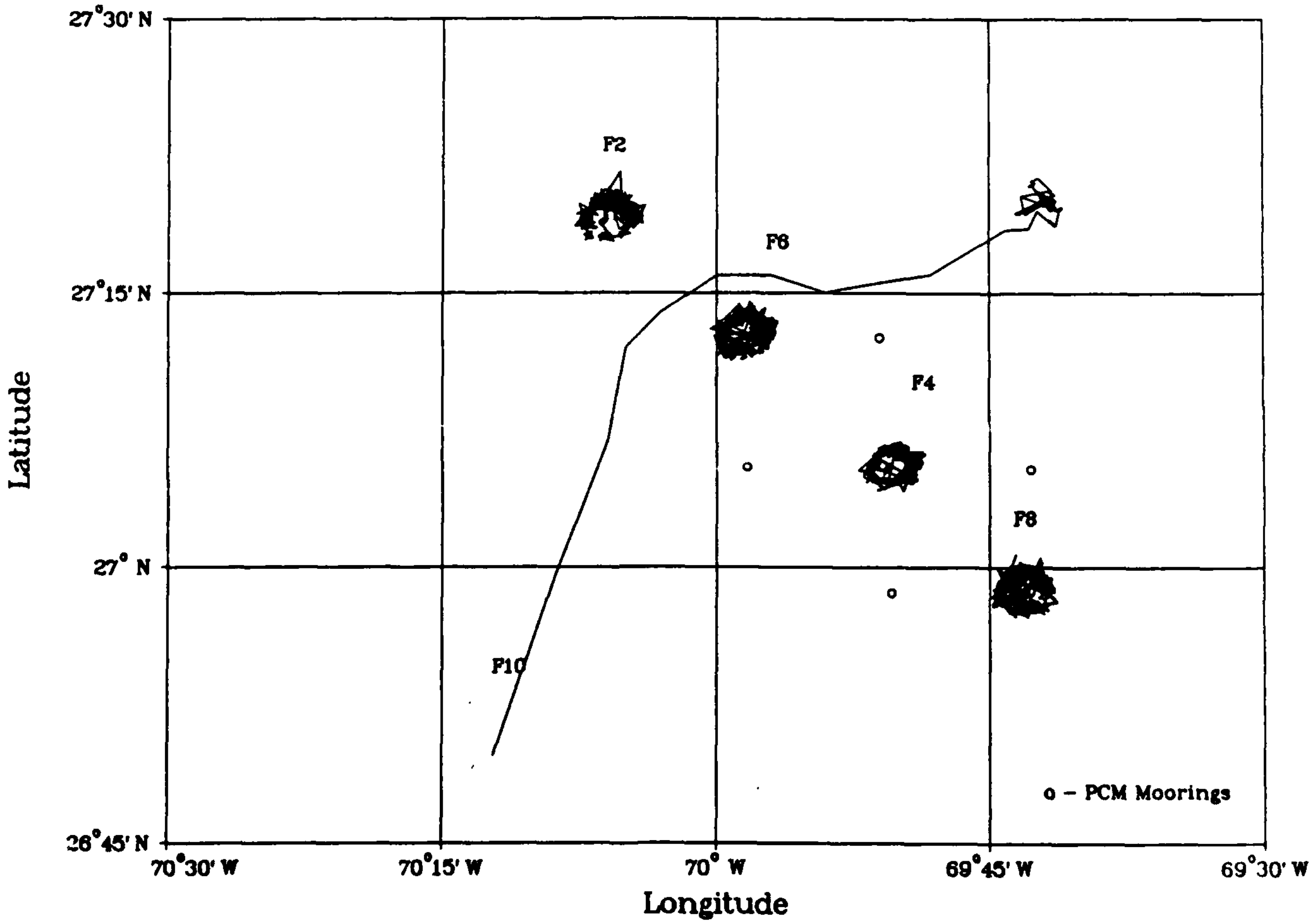
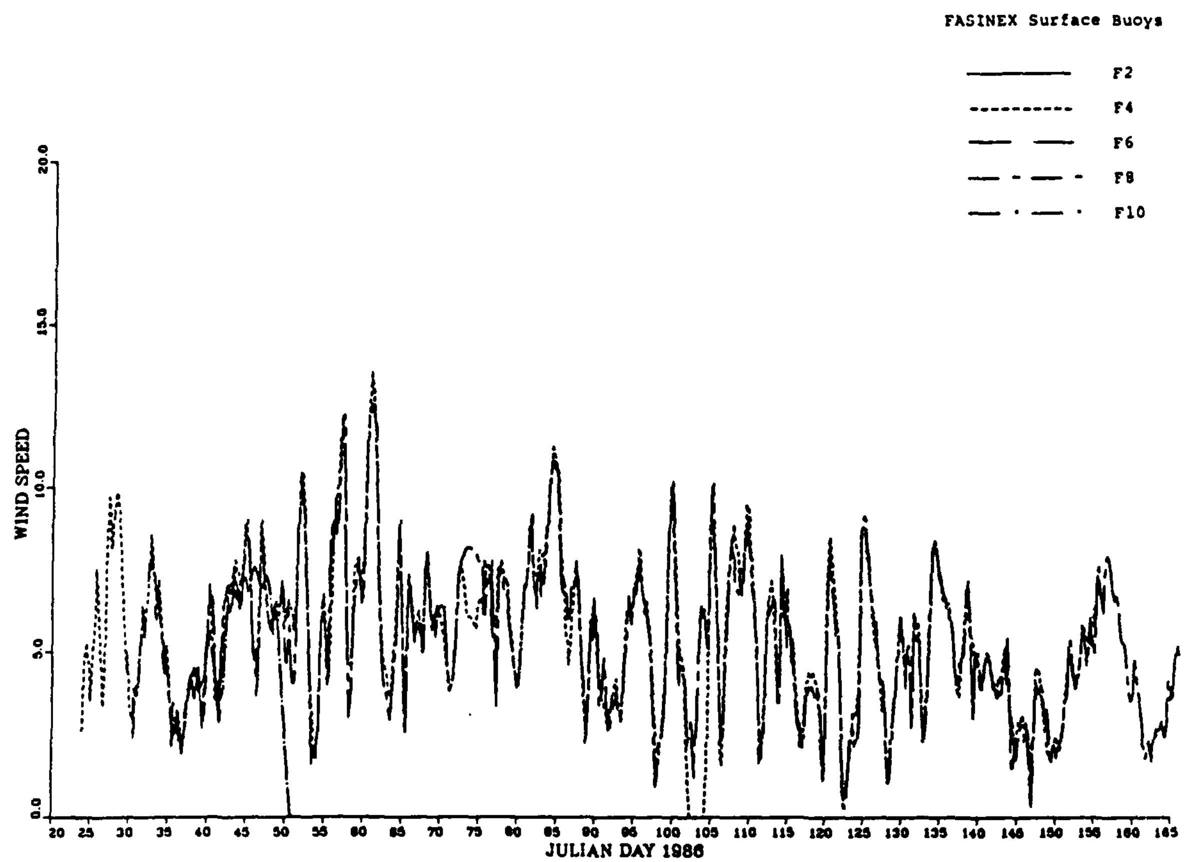
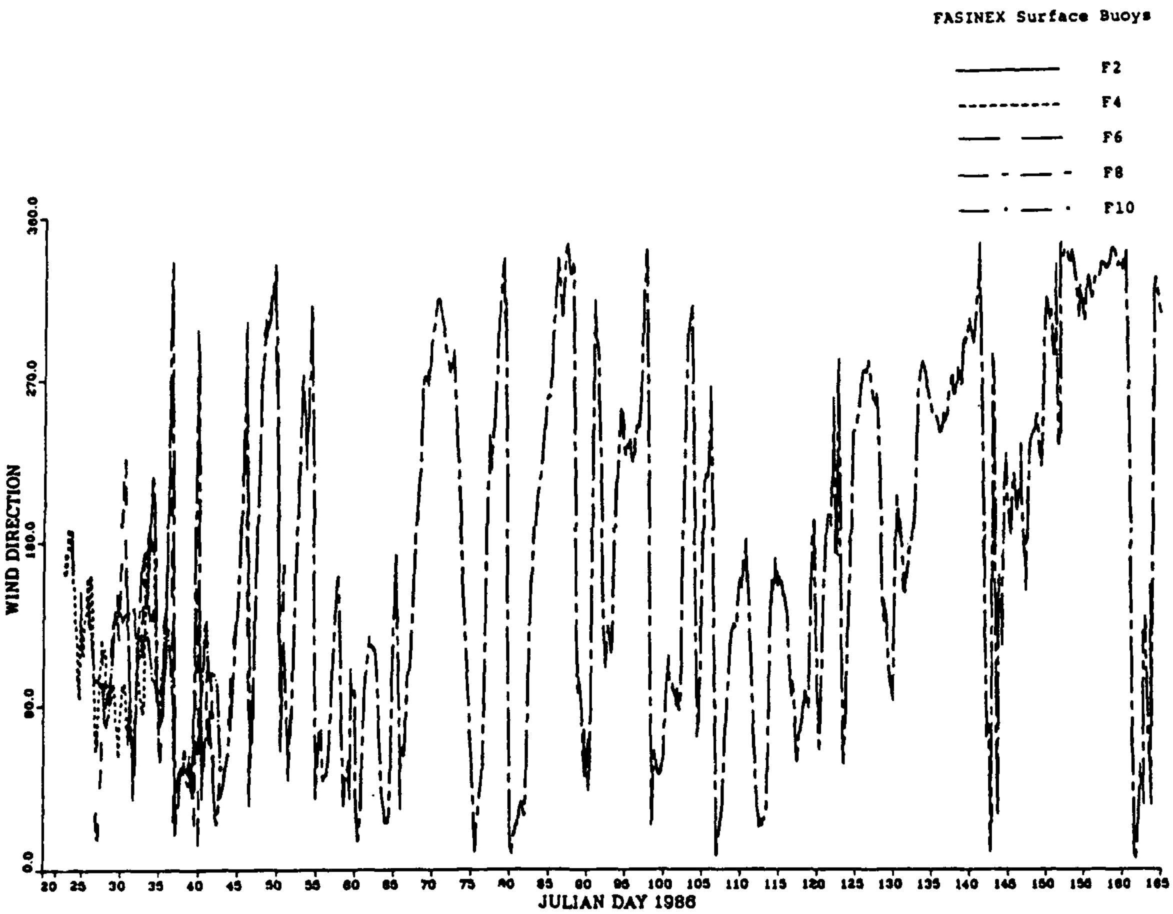


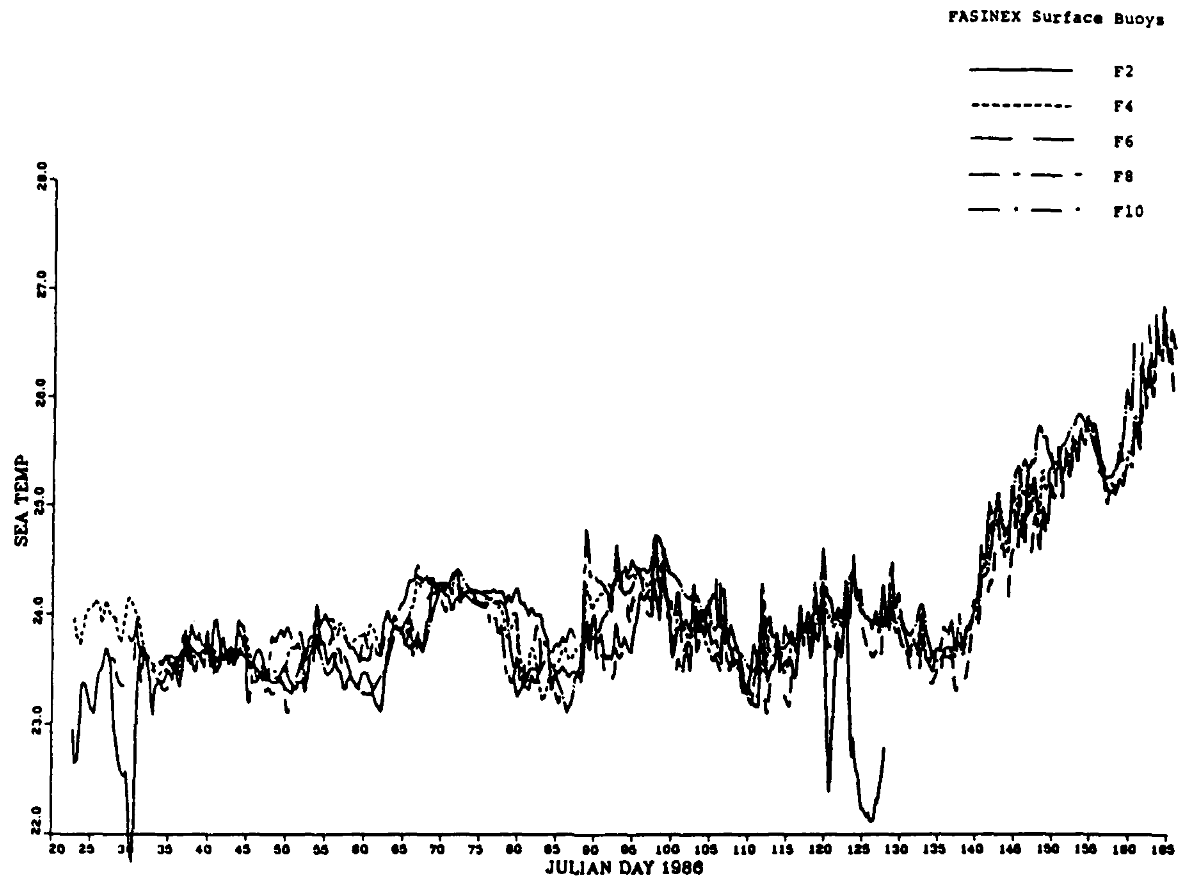
Figure 17. Buoy positions during the FASINEX.



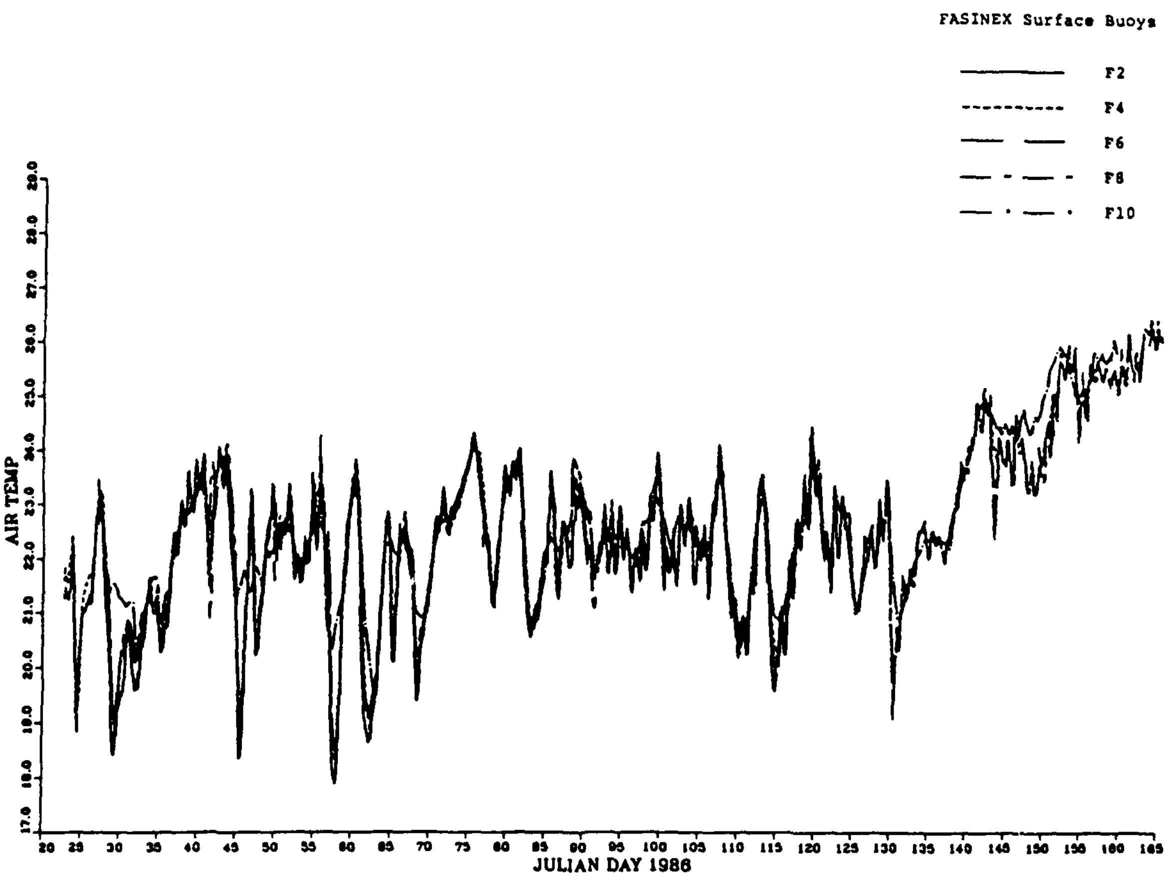
Telemetered Wind Speed.



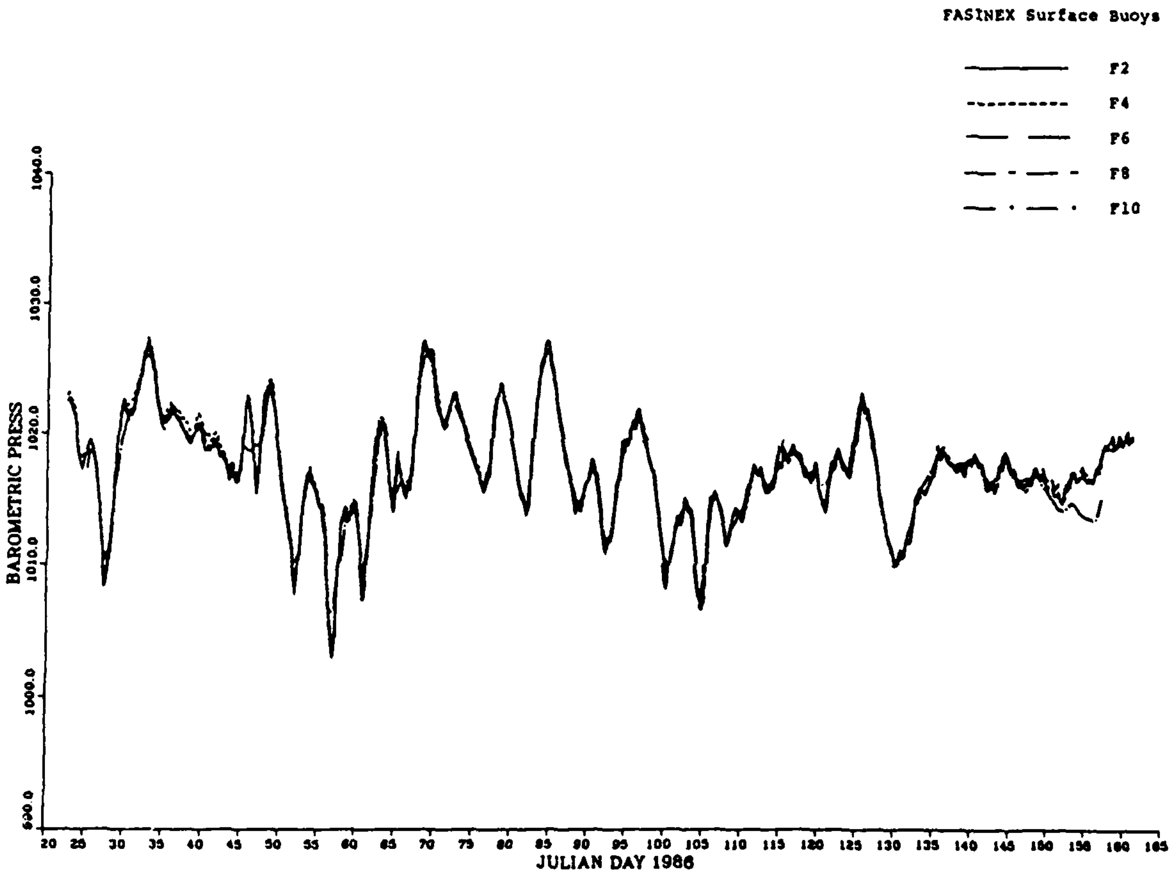
Telemetered Wind Direction



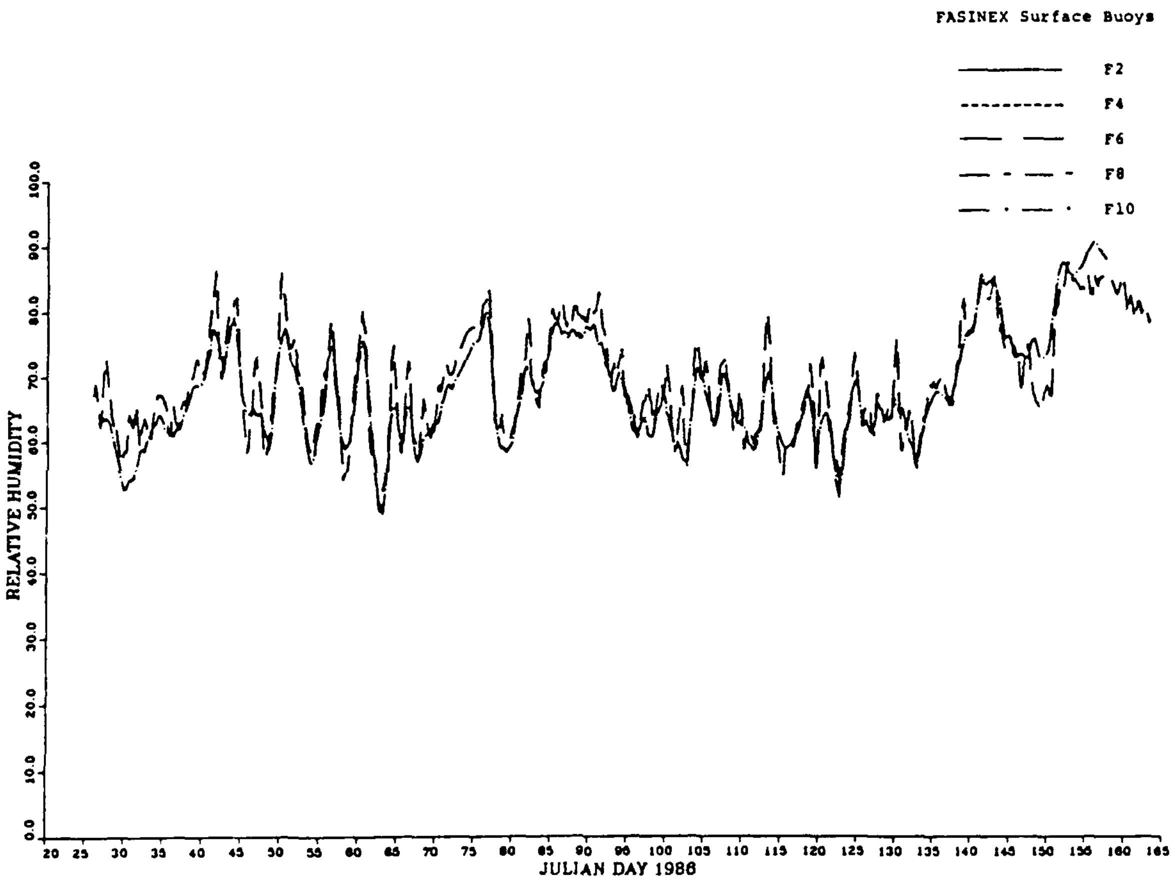
Telemetered Sea Temperature



Telemetered Air Temperature



Telemetered Barometric Pressure



Telemetered Relative Humidity

Acknowledgements

The people in the WHOI Buoy Group, including the operations group, the current meter group, and the data processing section and WHOI Ocean Engineering Department have contributed significantly to this project. We thank them for their time and committment in making the field program a success. The calibration and validation of the data involved many people in the Buoy Group. Their efforts are greatly appreciated.

We also thank the captain and crew of the R.V. KNORR and the R.V. ISELIN for their cooperation and skill on the deployment and recovery cruises.

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The FASINEX field program began in January 1986 and concluded late in June 1986. Several of the data sets have a Julian Day time base. This table is a conversion table from calendar days to Julian Days.

Jan 1 - 001	Feb 1 - 032	Mar 1 - 060	Apr 1 - 091	May 1 - 121	Jun 1 - 152
2 - 002	2 - 033	2 - 061	2 - 092	2 - 122	2 - 153
3 - 003	3 - 034	3 - 062	3 - 093	3 - 123	3 - 154
4 - 004	4 - 035	4 - 063	4 - 094	4 - 124	4 - 155
5 - 005	5 - 036	5 - 064	5 - 095	5 - 125	5 - 156
6 - 006	6 - 037	6 - 065	6 - 096	6 - 126	6 - 157
7 - 007	7 - 038	7 - 066	7 - 097	7 - 127	7 - 158
8 - 008	8 - 039	8 - 067	8 - 098	8 - 128	8 - 159
9 - 009	9 - 040	9 - 068	9 - 099	9 - 129	9 - 160
10 - 010	10 - 041	10 - 069	10 - 100	10 - 130	10 - 161
11 - 011	11 - 042	11 - 070	11 - 101	11 - 131	11 - 162
12 - 012	12 - 043	12 - 071	12 - 102	12 - 132	12 - 163
13 - 013	13 - 044	13 - 072	13 - 103	13 - 133	13 - 164
14 - 014	14 - 045	14 - 073	14 - 104	14 - 134	14 - 165
15 - 015	15 - 046	15 - 074	15 - 105	15 - 135	15 - 166
16 - 016	16 - 047	16 - 075	16 - 106	16 - 136	16 - 167
17 - 017	17 - 048	17 - 076	17 - 107	17 - 137	17 - 168
18 - 018	18 - 049	18 - 077	18 - 108	18 - 138	18 - 169
19 - 019	19 - 050	19 - 078	19 - 109	19 - 139	19 - 170
20 - 020	20 - 051	20 - 079	20 - 110	20 - 140	20 - 171
21 - 021	21 - 052	21 - 080	21 - 111	21 - 141	21 - 172
22 - 022	22 - 053	22 - 081	22 - 112	22 - 142	22 - 173
23 - 023	23 - 054	23 - 082	23 - 113	23 - 143	23 - 174
24 - 024	24 - 055	24 - 083	24 - 114	24 - 144	24 - 175
25 - 025	25 - 056	25 - 084	25 - 115	25 - 145	25 - 176
26 - 026	26 - 057	26 - 085	26 - 116	26 - 146	26 - 177
27 - 027	27 - 058	27 - 086	27 - 117	27 - 147	27 - 178
28 - 028	28 - 059	28 - 087	28 - 118	28 - 148	28 - 179
29 - 029		29 - 088	29 - 119	29 - 149	29 - 180
30 - 030		30 - 089	30 - 120	30 - 150	30 - 181
31 - 031		31 - 090		31 - 151	

Appendix A. FASINEX Julian Day Conversion Table

The FASINEX moorings have several different designations. FASINEX identified each mooring with a letter and number. There was a WHOI Buoy Group designation. There was a buoy identifier. And there was an ARGOS transmitter number. Of the eleven moorings, there were three different types of mooring. The following table summarizes the above-mentioned information:

DESIGNATION											
FASINEX	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F12
WHOI Mooring	829	845	-	846	-	847	-	848	-	849	830
BUOY Identifier		A	PCM-1	C	PCM-2	B	PCM-3	E	PCM-4	D	
ARGOS #		6430		6432		6431		6434		6433	
Mooring Type	subsurface	surface	near-surface	surface	near-surface	surface	near-surface	surface	near-surface	surface	subsurface
Latitude Longitude	27°58.90 69°58.80	27°18.95 70°05.86	27°05.34 69°42.75	27°05.35 69°50.30	26°58.58 69°50.40	27°12.59 69°58.48	27°12.53 69°51.03	26°58.66 69°43.19	27°05.45 69°58.33	27°19.63 69°42.52	25°29.10 70°00.70
Deployment	28 Oct 84 2238	15 Jan 86 2020	17 Jan 86 1811	16 Jan 86 1947	18 Jan 86 1840	26 Jan 86 1715	28 Jan 86 1852	27 Jan 86 1748	29 Jan 86 1806	1 Feb 86 1801	29 Oct 84 1724
Recovery	18 Jun 86 1721	14 Jun 86 0950	16 Jun 86 1352	15 Jun 86 2133	16 Jun 86 2011	14 Jun 86 2151	17 Jun 86 1108	15 Jun 86 1333	Lost	10 Jun 86 0545	13 Jun 86 1957
Data Days	598	150	150	150	149	139	139	139	0	103	592
Instrument Depths	225 325 550 625 700 1100 4100	met 10 20 30 40 80 120 160 700	20 ↓ 200	met 10 20 30 40 80 120 160 700 1000 4000	20 ↓ 200	met 10 20 30 40 80 120 160 700	20 ↓ 200	met 10 20 30 40 80 120 160 700 1000 4000	20 ↓ 200	met 10 20 30 40 80 120 160 700	225 325 550 625 700 1100 4100

All times are UTC.

Appendix B. FASINEX Mooring Designations

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August 9, 1988

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16. Abstract (Limit: 200 words)

The Frontal Air-Sea Interaction Experiment (FASINEX) examined air-sea interaction in the vicinity of sea surface temperature fronts in the Subtropical Convergence Zone (STCZ). Mooring measurements were made from five surface, four Profiling Current Meter (PCM) and two longer duration subsurface moorings. The surface and PCM moorings, which made up FASINEX central array, were set in January 1986 and remained on station for six months. The two outlying subsurface moorings, set 90 miles south and 30 miles north of the central array were deployed in October 1984 and were recovered with the central array moorings in June 1986.

The surface moorings collected oceanographic and meteorological data, using a 3-meter instrumented discus buoy and eight to ten Vector Measuring Current Meters (VMCMs) and Vector Averaging Current Meters (VACMs). The surface buoy carried a Vector Measuring Wind Recorder (VAWR) and a Meteorological Recorder (MR) which measured wind speed and direction, sea surface temperature (SST), air temperature, insolation, barometric pressure and relative humidity. The MR also transmitted meteorological and engineering data via ARGOS. The VMCMs and VACMs, placed from 10 to 4000 m, measured oceanic velocities and temperatures. The subsurface moorings measured oceanic velocities and temperature from 160 to 4060 m, carrying a total of seven VACMs and a WOTAN (Wind Observations Through Ambient Noise).

This report presents meteorological and oceanographic data from the seven WHOI moorings, with major emphasis on the surface mooring data. Details of the moored array and a statement of data return and quality are also included.

17. Document Analysis a. Descriptors

1. air-sea interaction
2. moored instruments
3. FASINEX

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