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Currents Observed in Juan de Fuca Submarine Canyon and Vicinity, 1971

G.A. CANNON
N.P. LAIRD
T.V. RYAN

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CURRENTS OBSERVED IN JUAN DE FUCA SUBMARINE CANYON AND VICINITY, 1971

G.A. Cannon, N.P. Laird, and T.V. Ryan

Description is given of the experiment and of the current measurements and related data made in the Juan de Fuca submarine canyon, on the surrounding continental shelf, and in the mouth of the Strait of Juan de Fuca during October-November 1971. Flow in the canyon, in general, substantiated speculations in Cannon (1972). Inertial oscillations were observed in the surface layer over the shelf. Outflow was observed in the mid to bottom waters in the mouth of the Strait for periods of several days corresponding with out-canyon flow. Bottom currents on the shelf flowed toward the canyon from north and south.

1. INTRODUCTION

The Pacific Oceanographic Laboratories (POL) conducted an oceanographic survey off the Washington coast during October-November 1971. Part of this survey was designed to extend exploratory observations made in the Juan de Fuca submarine canyon in winter 1970 (Cannon, 1972). This canyon is unique in that it intersects what is thought to be a glacial trough, and depths exceeding 125 fathoms (229 m) extend across the continental shelf and into the Strait of Juan de Fuca (fig. 1). This intersection forms a sill-like feature of about 229 m depth near the outer edge of the shelf at the B_0 station in figure 1. The previous studies were limited to observations of currents on the sill and 50 m above the sill, and they showed relatively large excursions both in- and out-canyon.

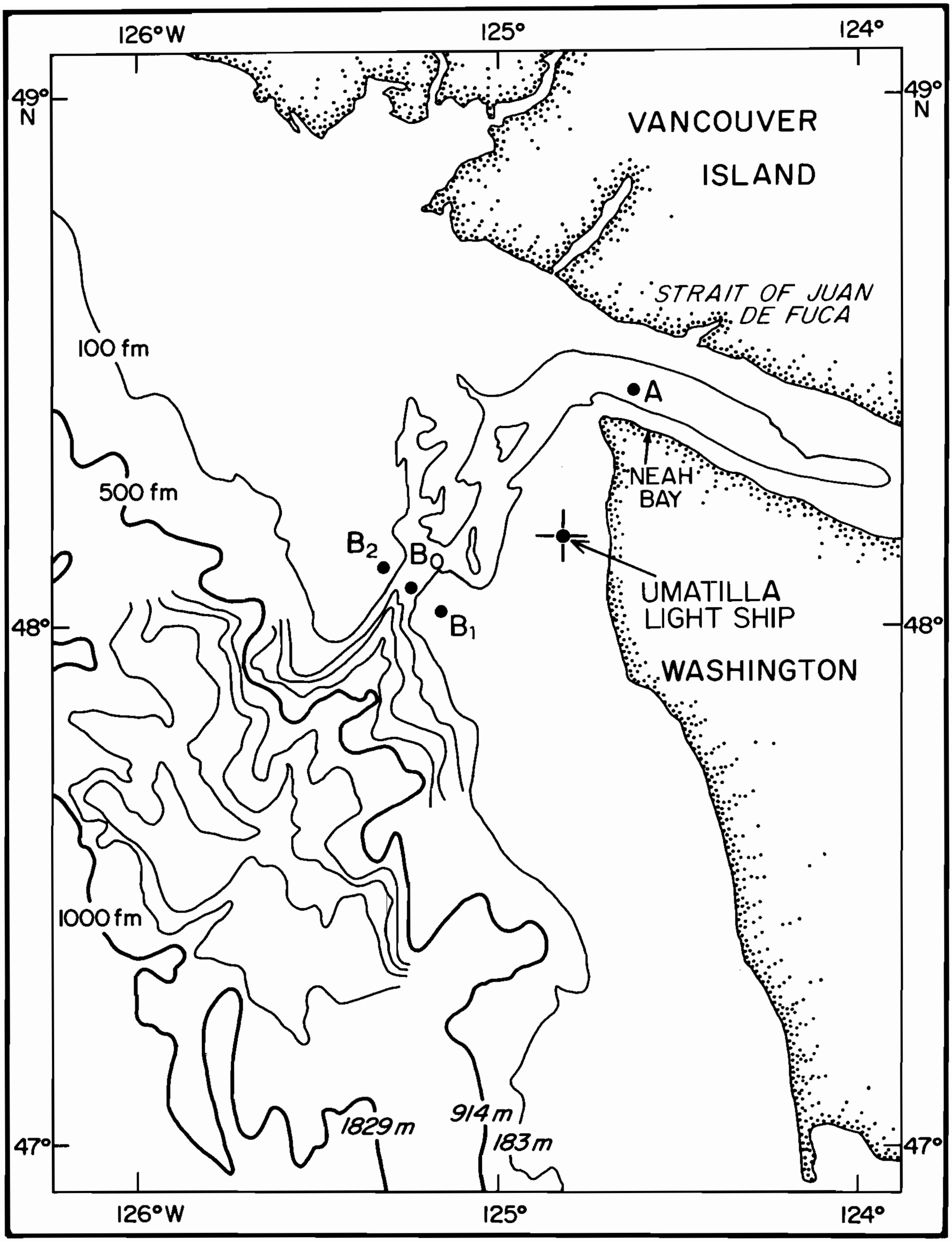

Figure 1. Chart of Juan de Fuca submarine canyon and vicinity. Two closed contours in the canyon are shoal areas. The moorings are labeled B0, B1, B2, and A.

Major flow reversals primarily appeared related to major wind reversals observed at Umatilla Light Ship 40 km northeasterly from the mooring. This report is intended to provide an initial summary of the 1971 current-meter observations and of some of the other related data. Minimal discussion is given in order that the observations may be made available to others. A general description of the entire survey and a presentation of the hydrographic observations is given elsewhere (Ryan _et al_., 1972).

2. EXPERIMENT DESCRIPTION

Subsurface current-meter moorings were deployed in the mouth of the Strait of Juan de Fuca (fig. 1, Site A), on the sill in the Juan de Fuca Canyon (Site B_0), and on the shelf on either side of the Canyon (Sites B_1, south, and B_2, north) on 14-15 October 1971, and they were retrieved on 14 November. Figure 2 (from Ryan _et al_., 1972) shows the distribution of instrumentation on the moorings. The components of the moorings and deployment techniques were the same as those used in a subsequent Puget Sound experiment (Cannon and Laird, 1972) with the following exceptions. Two Geodyne current meters (model 102), which record on film 60-sec averages of speed and 5-sec samples of direction during the 60-sec interval, were used. Two Braincon meters had 20-min sampling intervals, and all other meters sampled at 10-min intervals. The thermistor instrumentation on mooring B_0 is described in Ryan _et al_. One meter had an internal malfunction resulting in no data, but all other meters had complete records except for some fogging at the beginning of some of the data films. Table 1 summarizes the mooring instrumentation and data return. Some of the

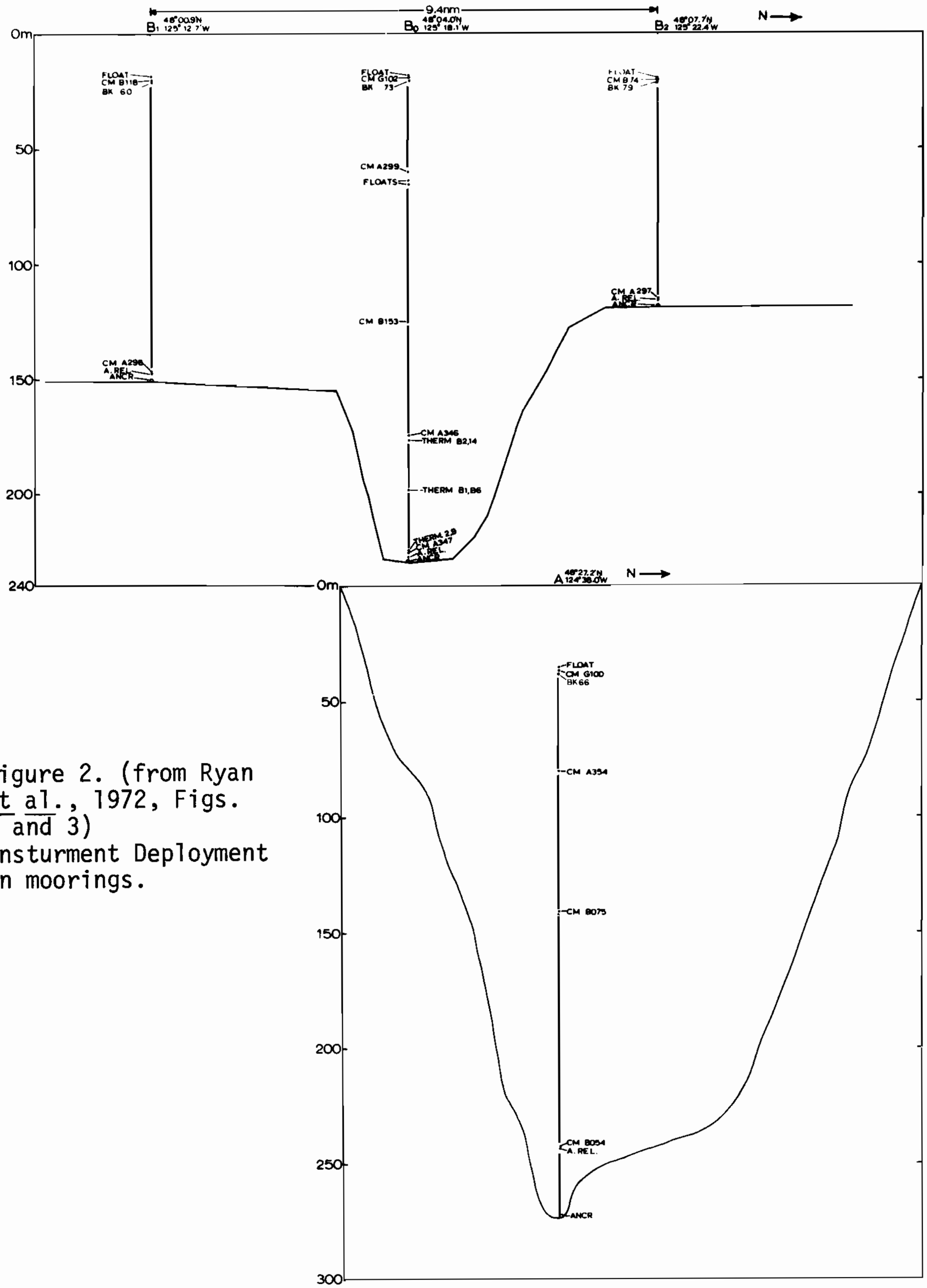

Figure 2. (from Ryan *et al.*, 1972, Figs. 2 and 3) Insturment Deployment on moorings.

Table 1 Summary of Mooring Instrumentation (Local Time +8 Is Used

= 696hrs

Meter (#)	Depth (m)	Variables	Sampling (min)	Record Length (samples)	(hrs)	Start Time (hr day mo)
		Mooring B_0: 48° 04.0'N 125° 18.1'W, 230 m				
G102	20	C	10	3803	634	0830 19 X
A299	63	C,T,P	10	4364	727	0920 15 X
B153	125	C	20	2169	723	1340 15 X
A346	175	C,T	10	4365	727	0920 15 X
A347	225	C,T	10	4358	726	0920 15 X
		Mooring B_1: 48° 00.9'N 125° 12.7'W, 152 m				
B118	20	C	10	3626	604	1040 15 X
A298	148	C,T	10	4361	727	1040 15 X
		Mooring B_2: 48° 07.7'N 125° 22.4'W, 112 m				
B074	22	C	10	3989	665	1740 14 X
A297	108	C,T	10	4450	742	1740 14 X
		Mooring A: 48° 27.2'N 124° 38.0'W, 272 m				
G100	37	C	10	4163	694	0200 17 X
A354	81	C,T,P	10	----	----	---- -- -
B075	142	C	10	3768	628	0925 14 X
B054	245	C	20	2269	756	0925 14 X

information is duplicated from Ryan et al. Variables C, T, and P signify currents, temperature, and pressure, respectively. A, B, or G with meter numbers signifies Aanderaa, Braincon, or Geodyne, respectively.

Auxiliary tide and wind data were obtained at Neah Bay by the National Ocean Survey and at Umatilla Light Ship by the U.S. Coast Guard (fig.1), respectively, and were made available to us. Temperature-salinity sections along the canyon are reproduced in plate 8 of the data summaries. Other STD data obtained during the survey are described in Ryan et al. Two additional current-meter moorings were deployed further south on the Washington coast for the University of Washington. One was about halfway across the continental shelf, and the other was at the edge of the shelf. These records will not be presented or discussed here.

3. DATA REDUCTION AND PRESENTATION

The Geodyne current-meter records were read from the films, digitized, and initially processed by the National Bureau of Standards. Subsequent processing of these records and all processing of the other current-meter records were carried out as outlined in Cannon and Laird (1972). In addition, the individual speed and direction records from the Braincon and Aanderaa meters were smoothed point-by-point over 90-100 min to form new series prior to plotting the progressive vector diagrams. Geodyne records were not smoothed in this manner, because it was thought sufficient direction smoothing was done by the sampling process. All data are presented as plates in section 7, data summaries, at the end of the report. The data are grouped so the user may assess variations throughout the water column by examining one kind of information from all instruments.

3.1 Histograms

The current-meter data have been displayed as histograms of direction (plates 1, a-d) and speed (plates 2, a-d). Directions were grouped in 3° intervals, and speeds were grouped in 1 or 2 cm/s intervals for Braincon and Geodyne or for Aanderaa meters, respectively. The data are presented as actual numbers of observations in each group and as a percentage of the maximum number of observations in any one group. The percentage distribution is represented by 100 *'s for the group with the maximum number of observations and by a number of *'s for each of the other groups equal to the ratio of the number of observations in the group to the maximum number. The middle direction or speed is given in the right-hand column, and the number of observations is given in the next column to the left.

3.2 Progressive Vector Diagrams

Progressive vector diagrams (plates 3, a-d) were constructed by vector addition of hourly vector averages of currents. The diagrams do not represent real particle trajectories, but they give an indication of the longer period fluctuations in the motion at a single point. Because of the complexity of some of the diagrams, the scales vary at 5, 10, or 20 km per division. Start times are given in table 1, and the axes are north and east. Geodyne meters have *'s at 24-hr intervals, and all other meters have +'s at 12-hr intervals.

The vector mean currents (plate 4) are presented to summarize all the observations in one figure. They represent vectors drawn from the start to the end of each progressive vector diagram. Note that a small vector mean current does not necessarily imply small currents.

The winds also are presented as a progressive vector diagram (plate 5 a) with directions representing flow toward that direction (opposite to conventional weather direction). The winds were recorded six times daily (0300, 0700, 0900, 1500, 1900, and 2100 PST) at Umatilla Light Ship. Each speed and direction was assumed constant until the time of the subsequent observation. This diagram was found more useful than the plotting of time-series of speed and direction as in Cannon (1972, fig. 3), which is redrawn here as a progressive vector diagram (plate 5 b).

3.3 Time Series

The original time-series data at the moorings and the tides at Neah Bay have been plotted on a common time scale (plates 7, a-d). The origin is 1000 on 14 October. At mooring A the +u direction was taken, roughly, along the axis into the estuary (easterly). At the B_0 mooring the deeper three current meters were in the canyon (fig. 2), and the +u direction at those meters was taken, roughly, along the axis into the canyon toward the coast (northeasterly). For these instruments the u axis was chosen along the direction of maximum variance (Cannon, 1969). The +u direction at all other meters, which were at or above the level of the continental shelf, was taken to be 90°. The +v direction was 90° to the left of +u for all cases. Table 2 summarizes some of the statistics. The means ($\bar{u}$ and $\bar{v}$) and variances were calculated for the maximum number of lunar days in the records. VMC is vector mean current.

The Aanderaa pressure gauge malfunctioned causing the flattening of the extremes, thus this pressure data should be used with caution. Because of an error in data reduction, 1.5 °C should be added to the Aanderaa temperatures in plate 7.

3.4 Fourier Representations

A fast Fourier transform algorithm (FFT) was used to compute the Fourier coefficients for the time-series of u and v components of velocity

Table 2. Statistics over the maximum number of lunar days in the current-meter records.

Depth	Directions of		$\bar{u}$	$\bar{v}$	Variance		Lunar
	+u	VMC			u	Total	Days
(m)	(°T)	(°T)	(cm/s)	(cm/s)	(cm^2/s^2)	(cm^2/s^2)	(#)
			Mooring B_0				
20	90	78	8.3	1.8	342	686	25
63	90	78	6.8	1.4	168	282	29
125	60	56	9.6	.6	355	427	28
175	43	36	10.7	1.3	588	607	29
225	36	40	3.6	- .3	387	405	29
			Mooring B_1				
20	90	89	8.6	.1	361	746	24
148	90	0	0.	2.6	50	85	29
			Mooring B_2				
22	90	112	12.6	-4.9	472	991	26
108	90	165	.9	-3.2	74	126	29
			Mooring A				
37	117	104	-10.3	-2.3	2403	2570	27
142	97	101	10.4	- .8	2176	2273	25
245	99	140	1.3	-1.1	1466	1545	30

(plates 6, a-d) using programs outlined in Cannon (1969, 1971). The calculations were made using record lengths of 30 days (58 M_2 cycles) where possible and of 15 days (29 M_2 cycles) for the shorter series. The shorter series were about 3 weeks long, and the coefficients also have been computed for the last 15 days, but are not reported here. Magnitudes of the major coefficients were about the same. There actually were 2160 and 1080 coefficients, respectively for the long and short series, but only the first 90 or first 45 coefficients are given in plate 6. Periods less than 8.0 hrs have been omitted, because they were small. If all of the amplitudes for any component were squared and divided by two, the resulting series would be a representation called the periodogram. The sum of all of the values in the periodogram equals the variance (table 2). Amplitudes are in cm/s, and phases for each mooring are in degrees relative to the earliest start time for a current-meter on the mooring (underlined in table 1).

The phases between moorings can be compared by converting them to a common reference, e.g., the earliest start time, 0925 14 October for mooring A. The new phase ϕ_n', for each period, Tn, is

$$\phi_n' = \phi_n + \tau_i \frac{360°}{T_n} ; \quad i = 0, 1, 2$$

where: ϕ_n is the phase (deg) given in any of plates 6, a-c; Tn is the corresponding period (hr); and τ_i is the number of hours between the reference start times (underlined in table 1) for mooring A and mooring Bi (i = 0, 1, 2). These times are: τ_0 = 23.92 hr, τ_1 = 25.25 hr, and τ_2 = 8.25 hr. Finally, an integral number times 360° may have to be subtracted from ϕ_n' to get the phases in a common one-cycle interval.

Because of some uncertainty to the beginning of records with fogged films, phases were used to determine the best start times for meters G100, G102, and B153. This was done by comparing phases of similar records for the two predominate Fourier coefficients. Table 3 summarizes the phases (hr and min) of inertial, semidiurnal, and diurnal coefficients used in the comparisons. The phases all have been advanced to 19 October, the data of the latest starting current meter. There are four groups in the table. The first compares the three near-surface meters at the B moorings (fig. 2) where a relatively large inertial oscillation with approximately equal u and v components was observed. Because the phases were comparable

Table 3. Summary of phases to the nearest 5 min giving times of maximum current for the indicated Fourier coefficient and velocity component on 19 October.

Fourier Coefficient	Velocity Component		Meter Numbers			Time Range
			G102	B118	B074	
16.36 hr	u		1555	1535	1450	0105
	v		1140	1130	1140	0010
12.41	u		1020	1035	1045	0025
	v		0755	0810	0745	0025
			A299	A298	A297	
12.41	v		1220	1155	1205	0025
24.00	v		0225	0305	0305	0040
		A299(40°)	B153(40°)	A346	A347	
12.41	u	1320	1305	1300	1230	0050
24.00	u	0440	0445	0915	0925	----
			G100	B075	B054	
12.41	u		1425	1405	1410	0020
24.00	u		0705	0725	0720	0020

to the north and south, there was no reason to expect them to be different at the center mooring (G102). The second group is for reference and compares the north component (v) of the next deeper meters which are still above the depth of the surrounding shelf at each of the B moorings. No changes in start times were involved. The third group compares the u-components, all rotated to 40°, of the meters in and above the canyon at mooring B_O. Because the phases of the semidiurnal coefficients were comparable at meters above and below, there was no reason to expect them to be different at B153. There was a discrepancy for the diurnal coefficients where the two deeper meters agreed as did the two shallower meters.

However, because the semidiurnal coefficient was consistent, the diurnal was ignored as possibly being a special effect of the canyon. Finally, the fourth group compares the u-component of the three meters at mooring A. Because the phases were comparable for both coefficients, at the deeper two meters it was assumed that they would be the same at the shallower meter. For comparison the tide and tidal current tables give 1217 and 1336 for the times of high water at Neah Bay and of the maximum flood at the entrance of the Strait of Juan de Fuca, respectively. Maximum amplitudes of the semidiurnal and diurnal tides at the B_0 mooring occurred at 1320 and 1050, respectively, as indicated by the pressure guage on meter A299.

4. DISCUSSION

The following observations are noted:

1) Four major events can be observed in most of the progressive vector diagrams of the current-meter records with the changes occurring about 19 October, 24 October, and 7 November (plates 3, a-d). The large excursions in-canyon from 24 October to 7 November at the bottom two meters in the canyon are comparable to those reported in Cannon (1972). The excursions out-canyon during 19-24 October equal the distance following the canyon-trough across the shelf.

2) Southerly winds commencing early on 17 October and on 7 November occurred at the same time as the out-canyon excursions (plate 5 a). The 17-24 October southerly winds consisted of three relatively intense low-pressure systems of less than 1000 mb moving through the region. The

7-11 November period was one low-pressure system of less than 1000 mb relatively stationary in the northeastern Pacific. The in-canyon excursions occur during periods of northerly to variable winds. Some smaller scale events also are visible, e.g., a weather system passed through the region on 2-3 November as relatively strong southerly winds (plate 5 a) and appears as a reversal of currents in the canyon (plate 3 a).

3) The currents in the canyon appear relatively steady during much of each of the major excursions (plate 3 a).

4) Bottom currents on the shelf north and south of the canyon have flow components toward the canyon (plates 3, a and b). During storms which are quite evident at both locations, westerly (offshore) flow occurs at mooring B_2 and northwesterly flow (along the shelf) occurs at B_1.

5) Flow out of the Strait of Juan de Fuca at the bottom and at mid depths occurs during the two major out-canyon excursions (plate 3 a). This is a reversal of the normal estuarine circulation, and apparently it can persist for several days.

6) Near-surface currents show less direction preference in the histograms (plates 1, a-c), although there is a general shoreward drift at all moorings (plates 3, a-c, and 4). These meters were above the halocline (plate 8). Periods of inertial motion of comparable magnitude were observed near the surface at all three B moorings and of smaller amplitude at deeper depths at mooring B_0 (plates 3, a-c, and 6, a-c). There were no periods of offshore flow, particularly none during the large in-canyon excursion. Rather, it appears that the in-canyon excur-

sions occur as suggested in Cannon (1972) as an estuarine-like flow (plate 8).

7) Bottom temperatures (plate 7 a) show a period of gradual warming between the times of the first two temperature-salinity sections in plate 8. This period included the out-canyon flow of 19-23 October, suggesting flushing of bottom water in the canyon. Colder water appears to enter again during the long period of in-canyon flow. The second major out-canyon excursion starting about 7 November also shows up as a warming in the bottom water. The last section in plate 8 was made following the retrieval of the mooring and shows colder water again in the canyon.

8) A series of small temperature inversions shown by the spreading isotherms at about 7.5 C was observed on all STD sections (Ryan _et al_., 1972; and plate 8 here). The meter at 63 m on mooring B_0 was just at the top of this inversion layer which also was in the halocline. The progressive vector diagrams show this meter had characteristics like the near-surface observations (plate 3 a), and the temperature record for that meter is relatively constant and unlike the ones in the canyon (plate 7 a).

9) Bottom temperatures on the shelf at both B_1 and B_2 were relatively constant when compared with those observed in the canyon (plates 7, a-c).

10) Drogue measurements made during 4-6 November in the canyon near the inner most shoal region in figure 1 agree with the current measurements made at B_0 during the same time (plate 3 a; and Ryan _et al_., 1972, figs. 12-15).

Analysis and further discussion of this data will be presented in a later paper.

5. ACKNOWLEDGEMENTS

We thank the Department of Oceanography at UW for loan of the current meters. Considerable assistance by Mr. Jim Stephens at POL in preparation of equipment and in carrying out the field work at sea is gratefully acknowledged. We were very pleased with the support and cooperation provided by the Pacific Marine Center of NOS and the officers and crew of the NOAA Ship OCEANOGRAPHER.

One of us (GAC) is particularly grateful to Dr. Clifford Barnes at UW for many fruitful discussions concerning this experiment and local coastal circulation in general.

Note added to text: Ryan *et al*. indicated considerable tilts of mooring A. At maximum speeds of 2.0-2.75 knots at 37 m, tilts were 25°-50°. At the deeper meters the tilts were 25°-30° at speeds up to about 2.0 knots. A better mooring design is required in these regions of relatively high speeds. The floatation used here was spherical with buoyancy of about 325-350 pounds. Tilts were insignificant (less than 6°) at all B moorings.

6. REFERENCES

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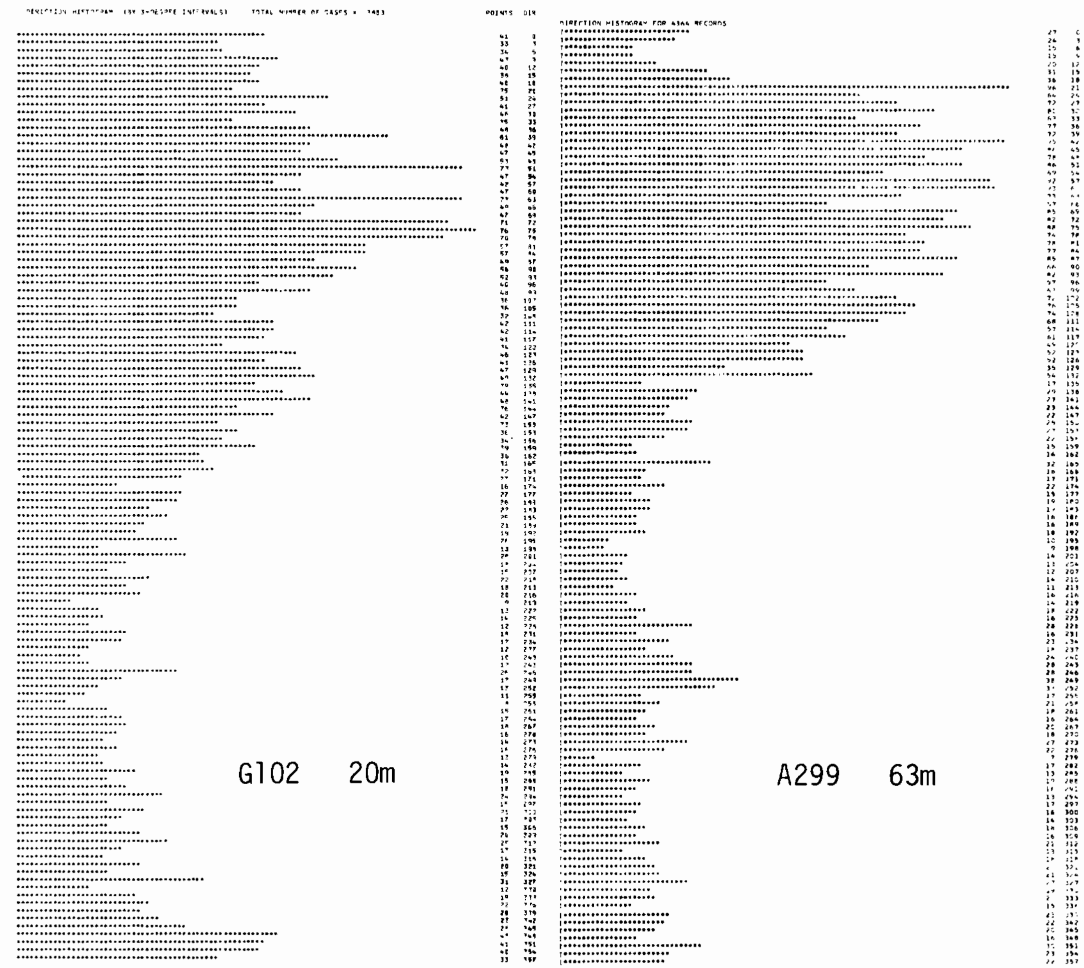
Ryan, T.V., G.A. Cannon, and N.P. Laird, 1972: Data Report: Oceanographic conditions off the Washington coast October-November, 1971. Nat. Oceanic Atmos. Admin., Environmental Res. Labs., Pacific Oceanogr. Labs., Tech. Rep. ERL, (In preparation).

7. DATA SUMMARIES

Plates 1-8

(See appropriate subsection of section 3 for complete description.)

Plate 1a. Direction Histogram
for mooring BO.



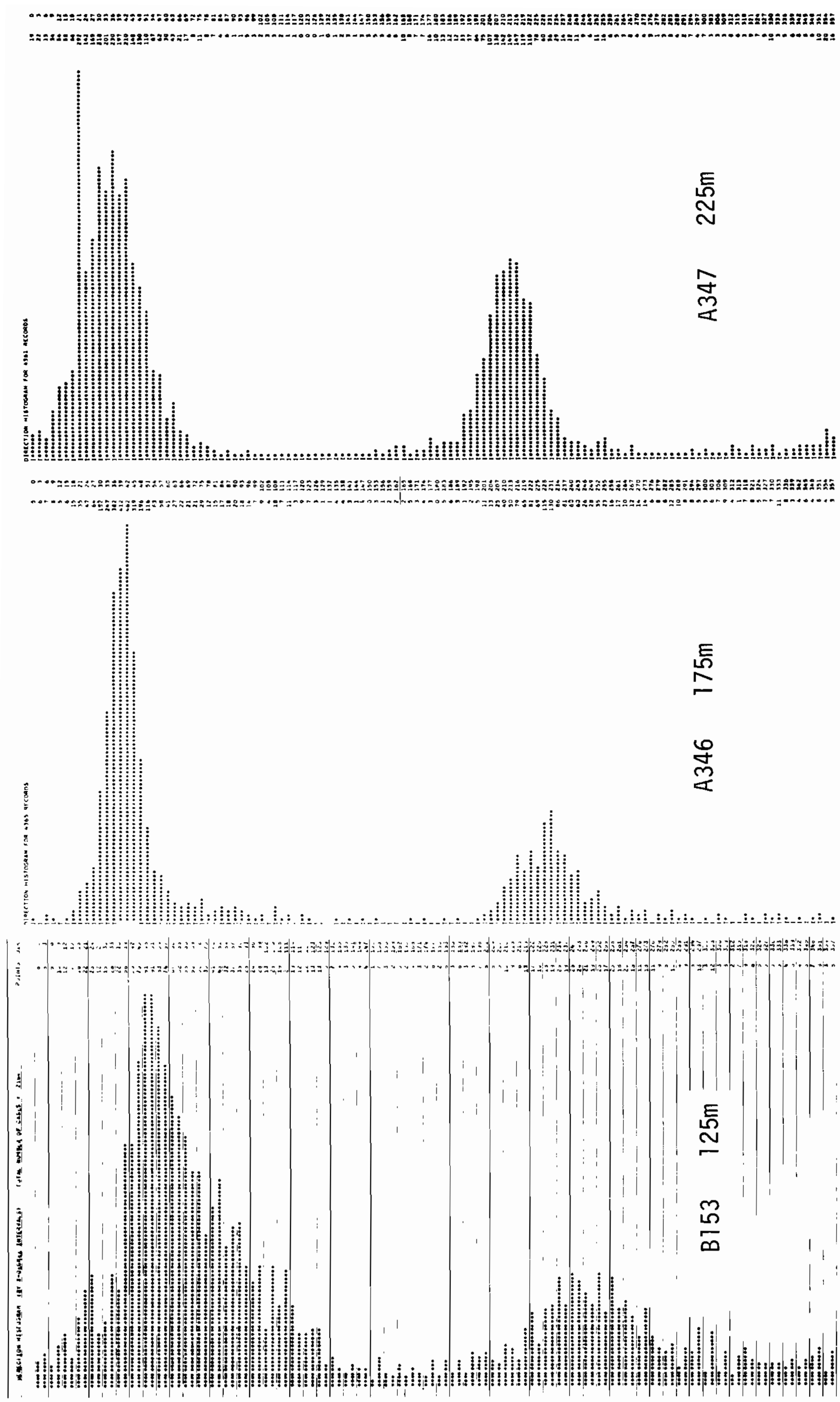


Plate 1a. (continued)

Plate 1b. Direction Histogram
for mooring B1.

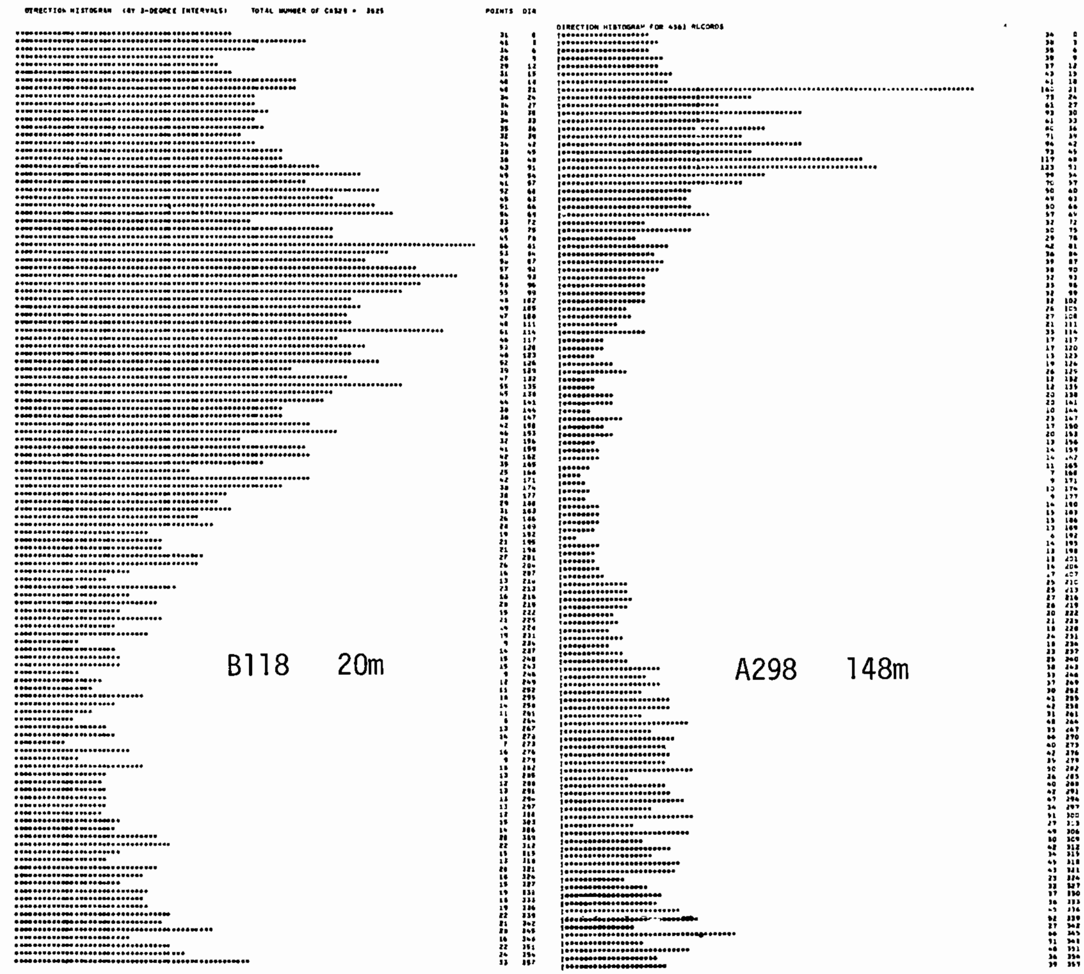
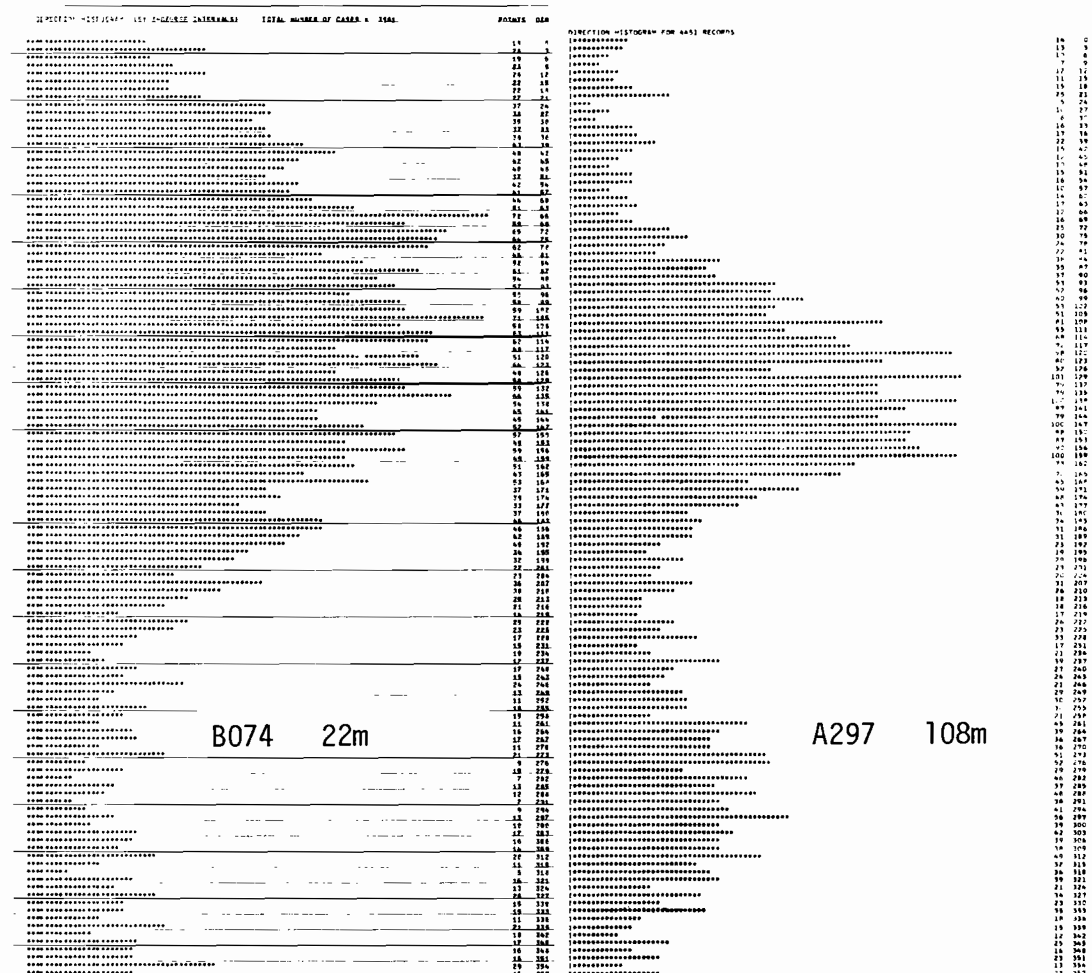


Plate 1c. Direction Histogram for mooring B2.



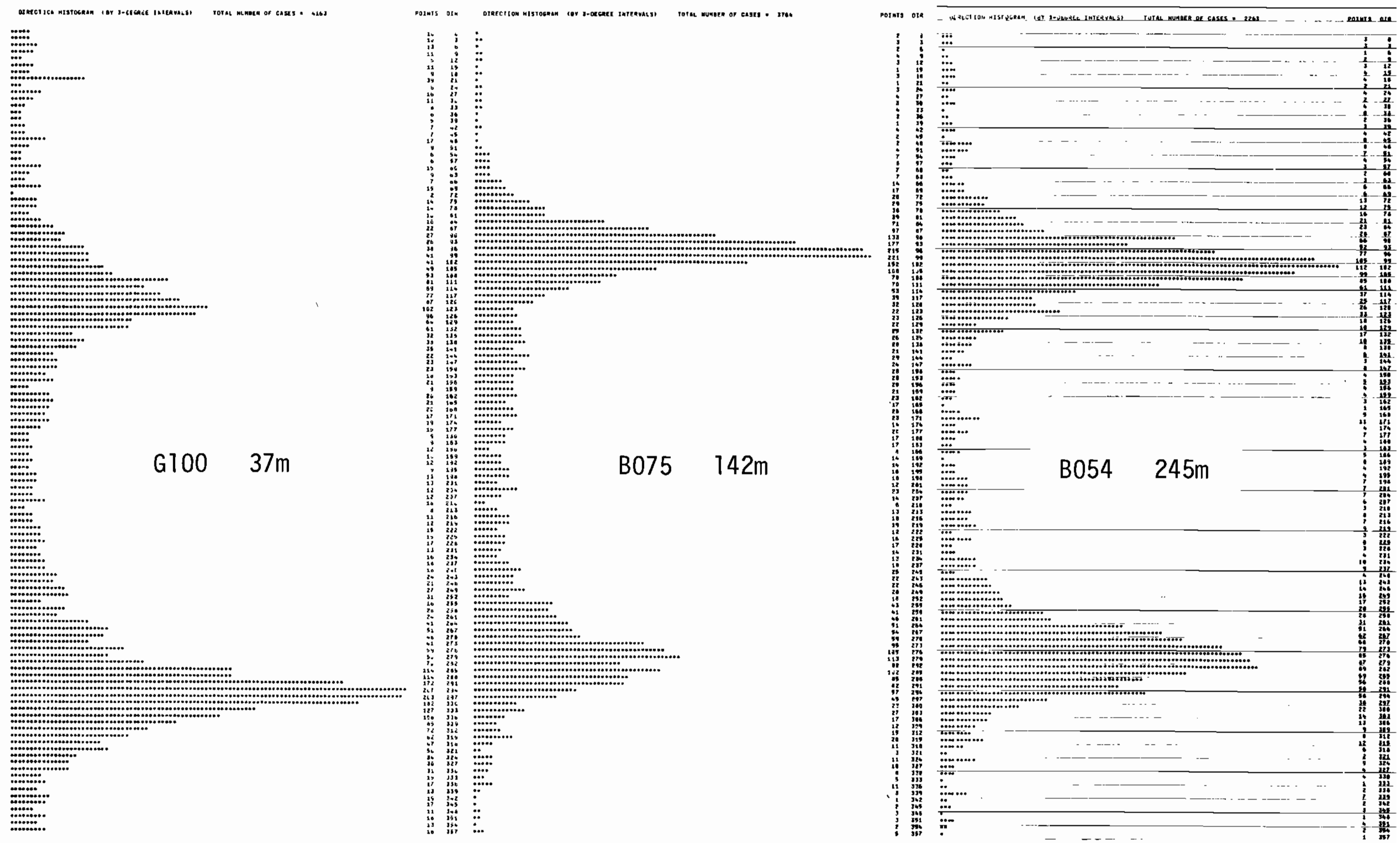
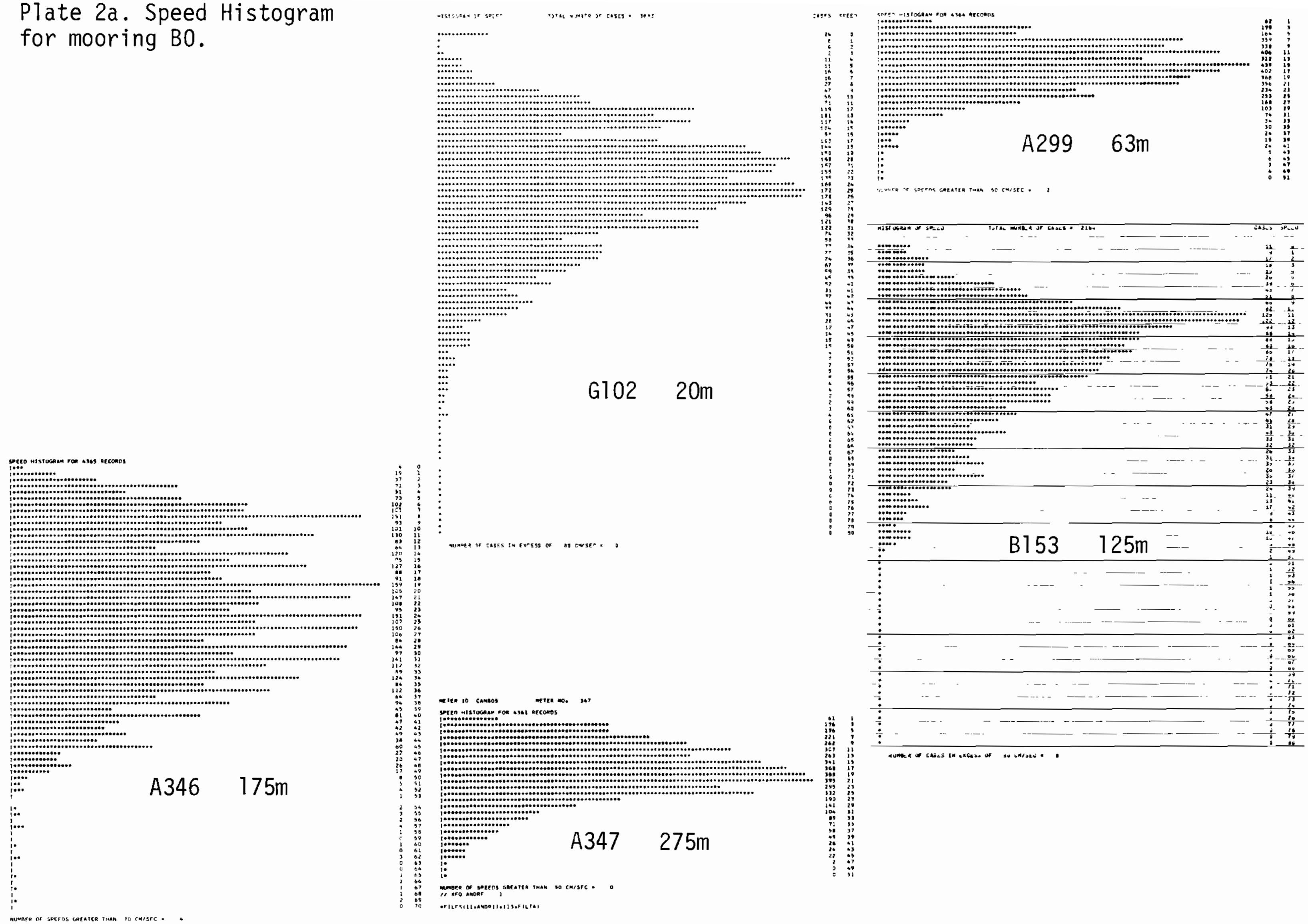


Plate 1d. Direction Histogram for mooring A.

Plate 2a. Speed Histogram
for mooring BO.



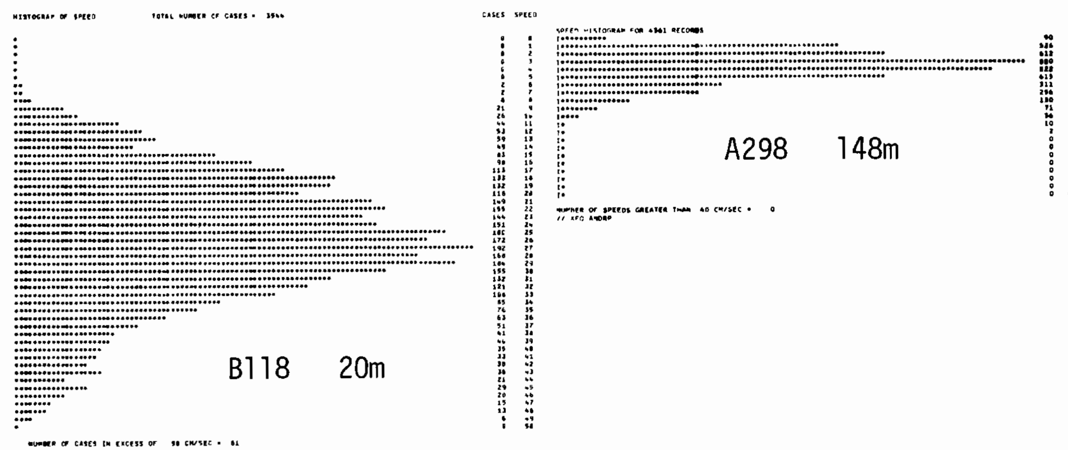


Plate 2b. Speed Histogram
for mooring B1.

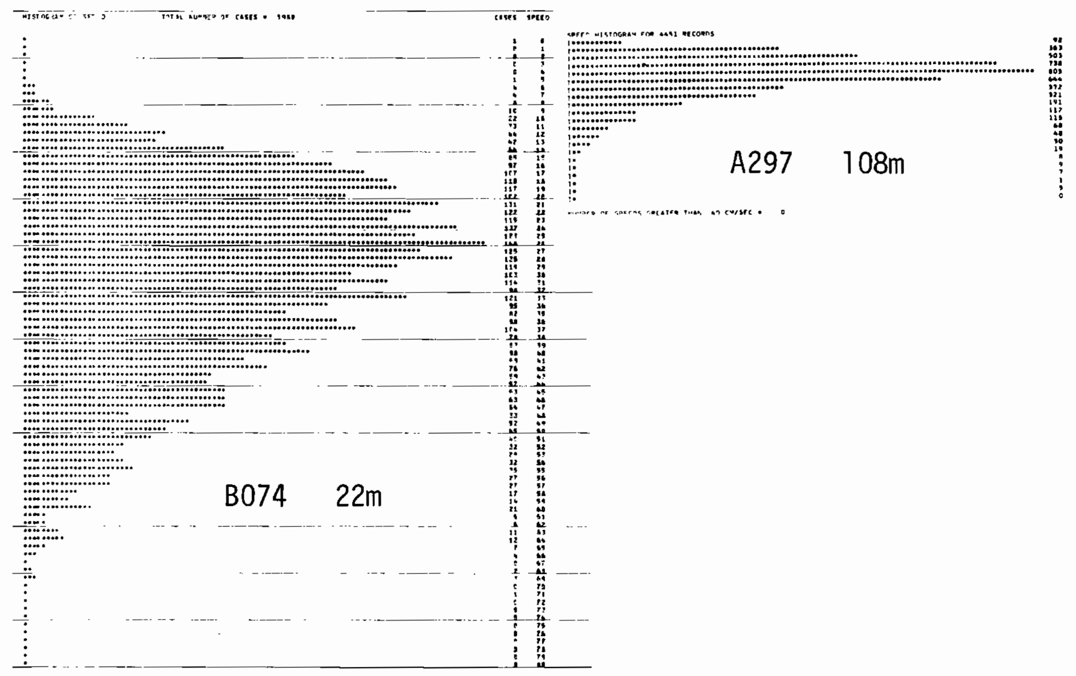


Plate 2c. Speed Histogram
for mooring B2.

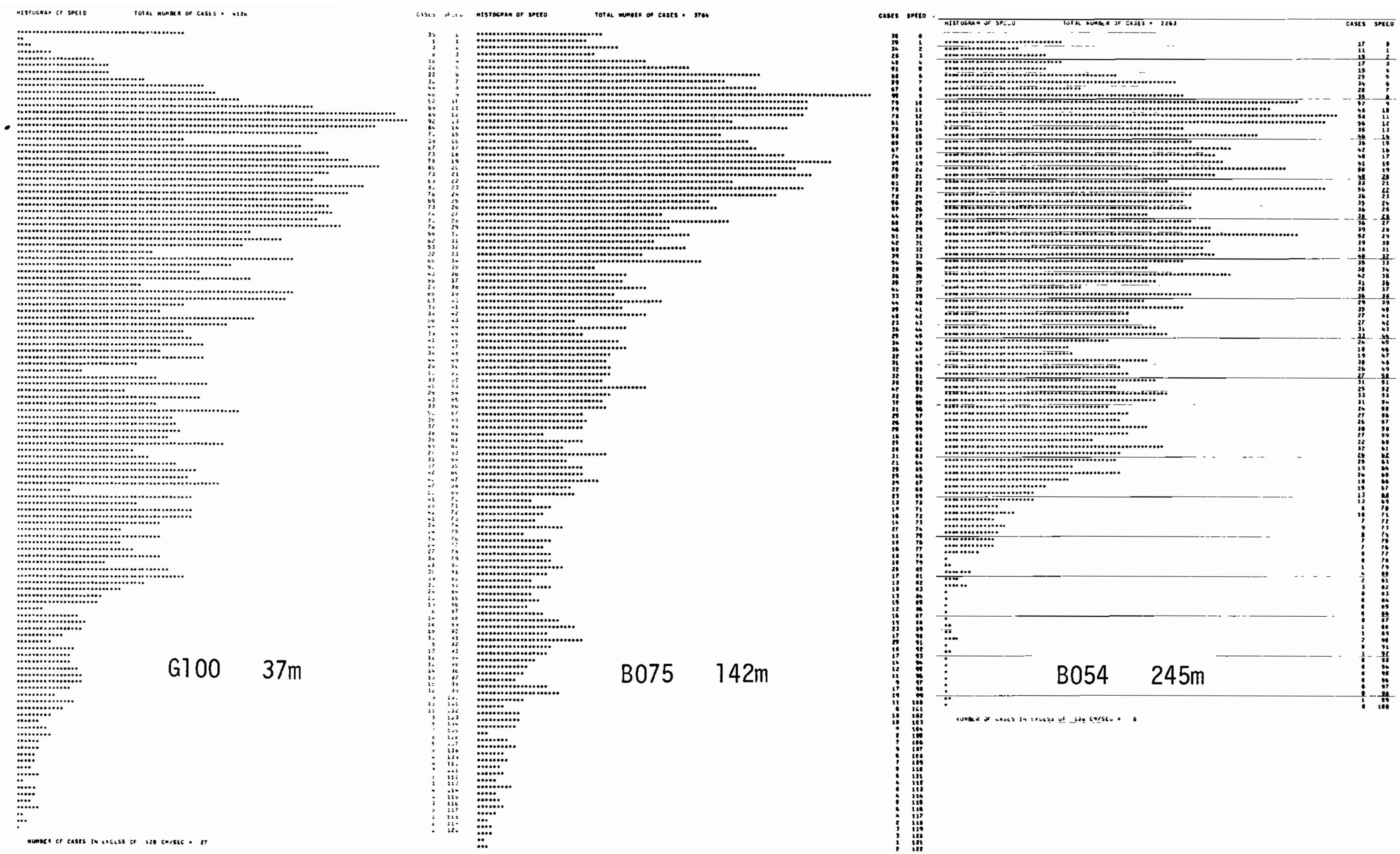


Plate 2d. Speed Histogram for mooring A.

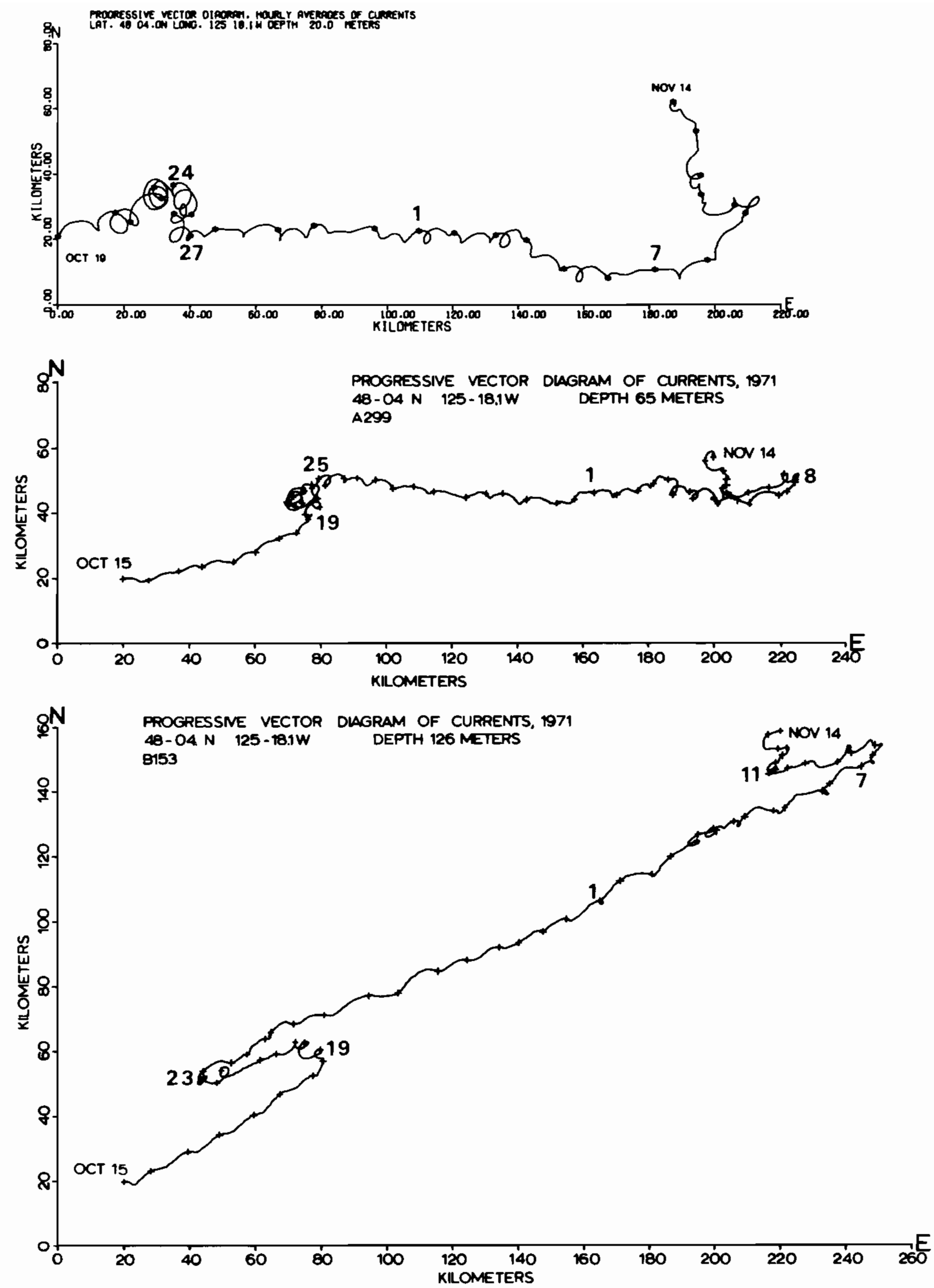
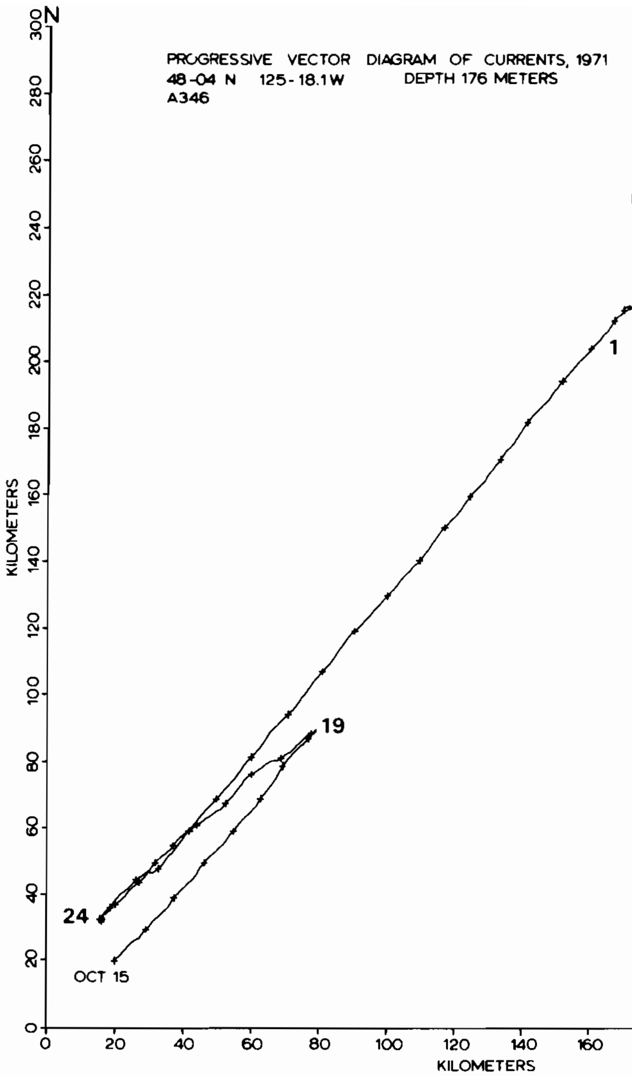


Plate 3a. Progressive Vector Diagrams for mooring B0.



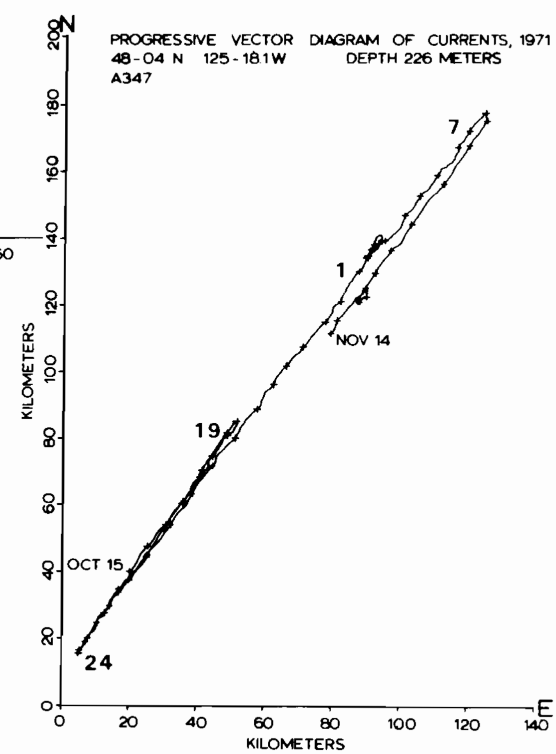
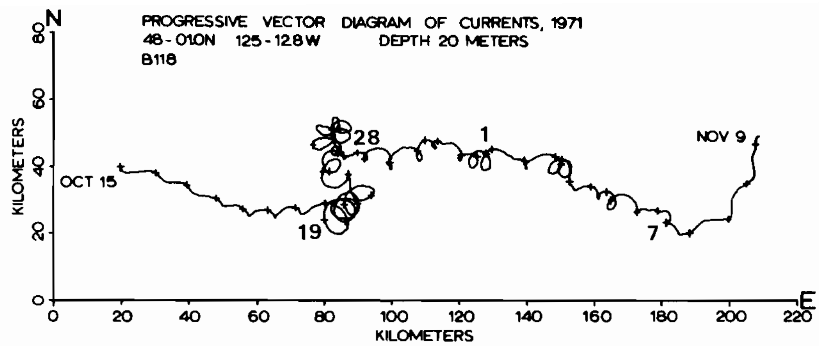


Plate 3a. (continued)



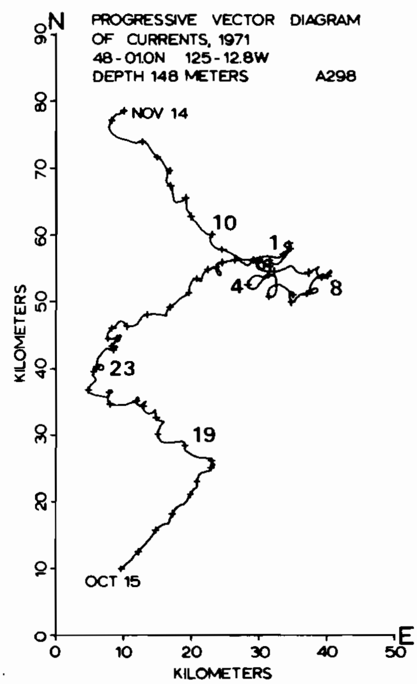
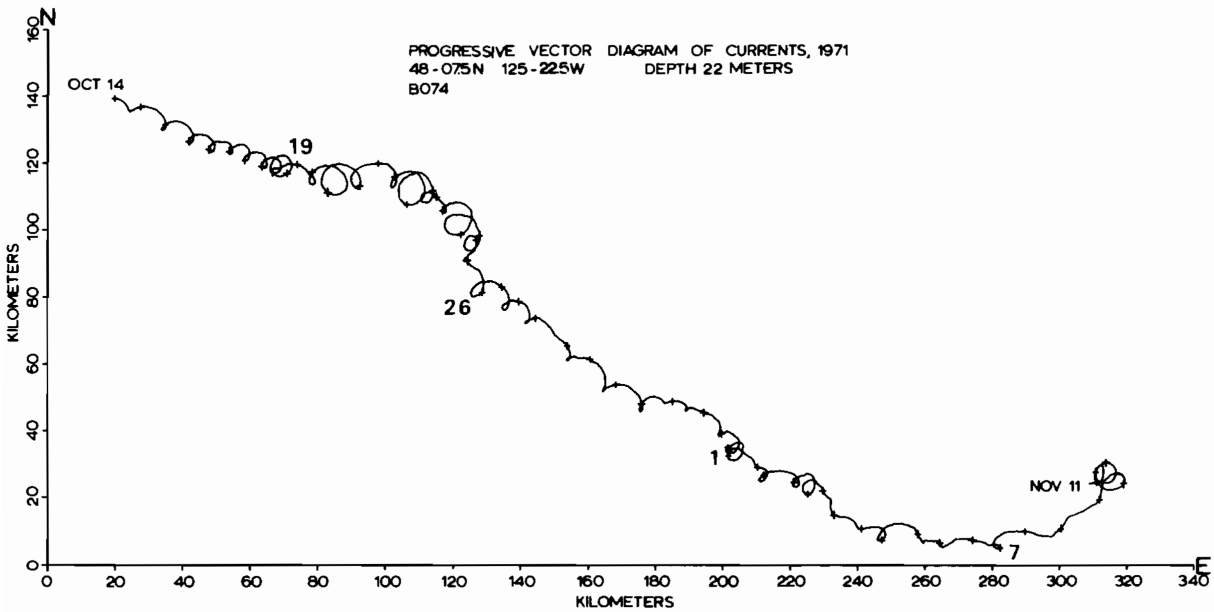


Plate 3b. Progressive Vector Diagrams for mooring B1.



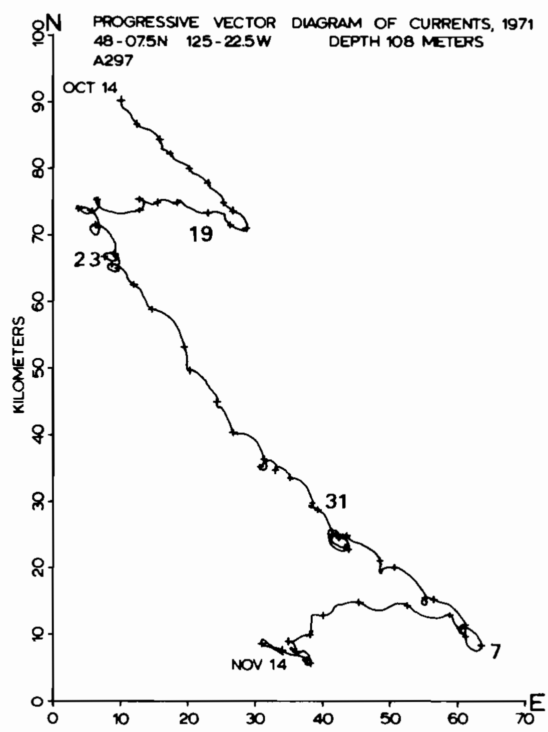


Plate 3c. Progressive Vector Diagrams for mooring B2.

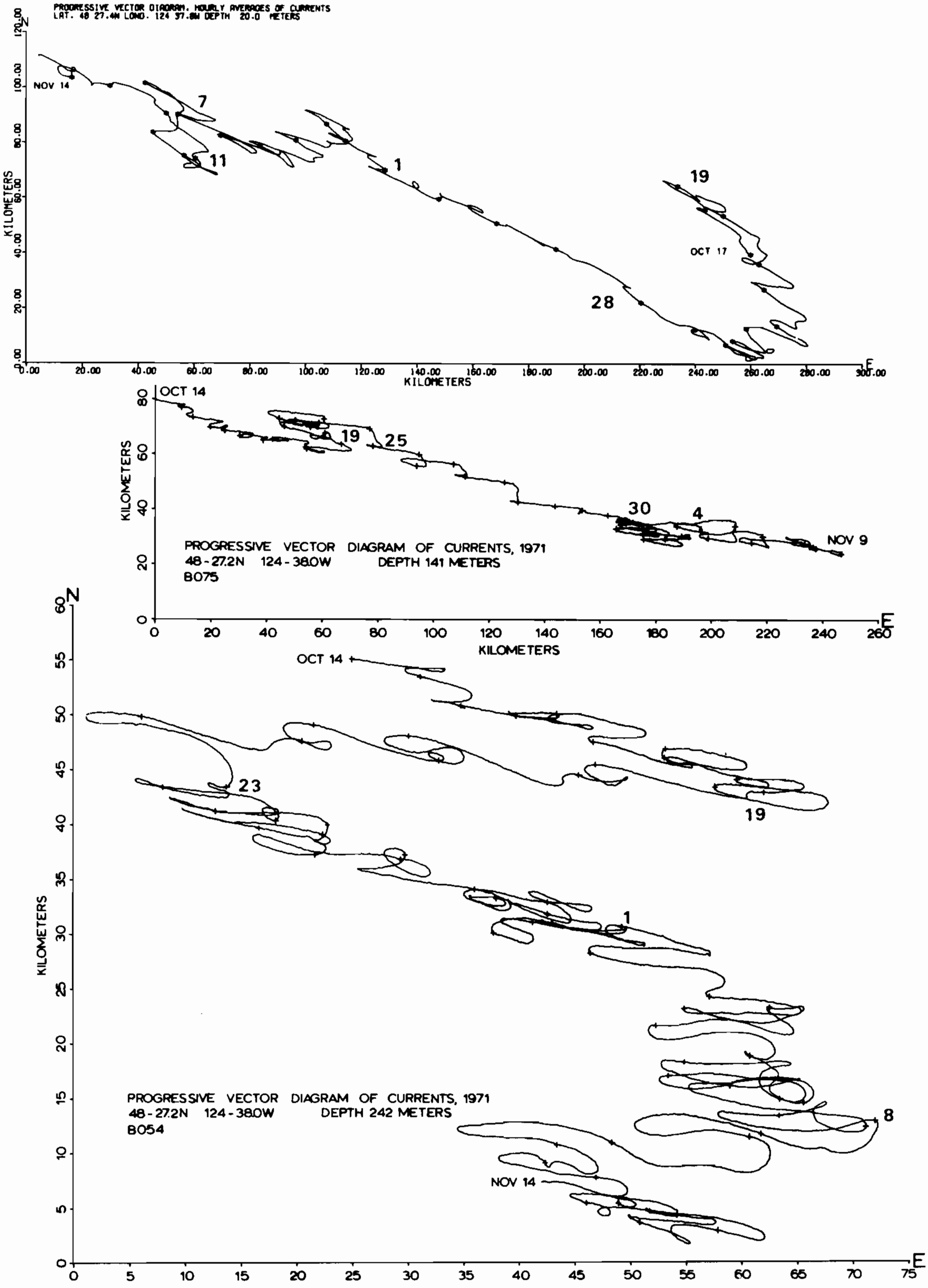


Plate 3d. Progressive Vector Diagrams for mooring A.

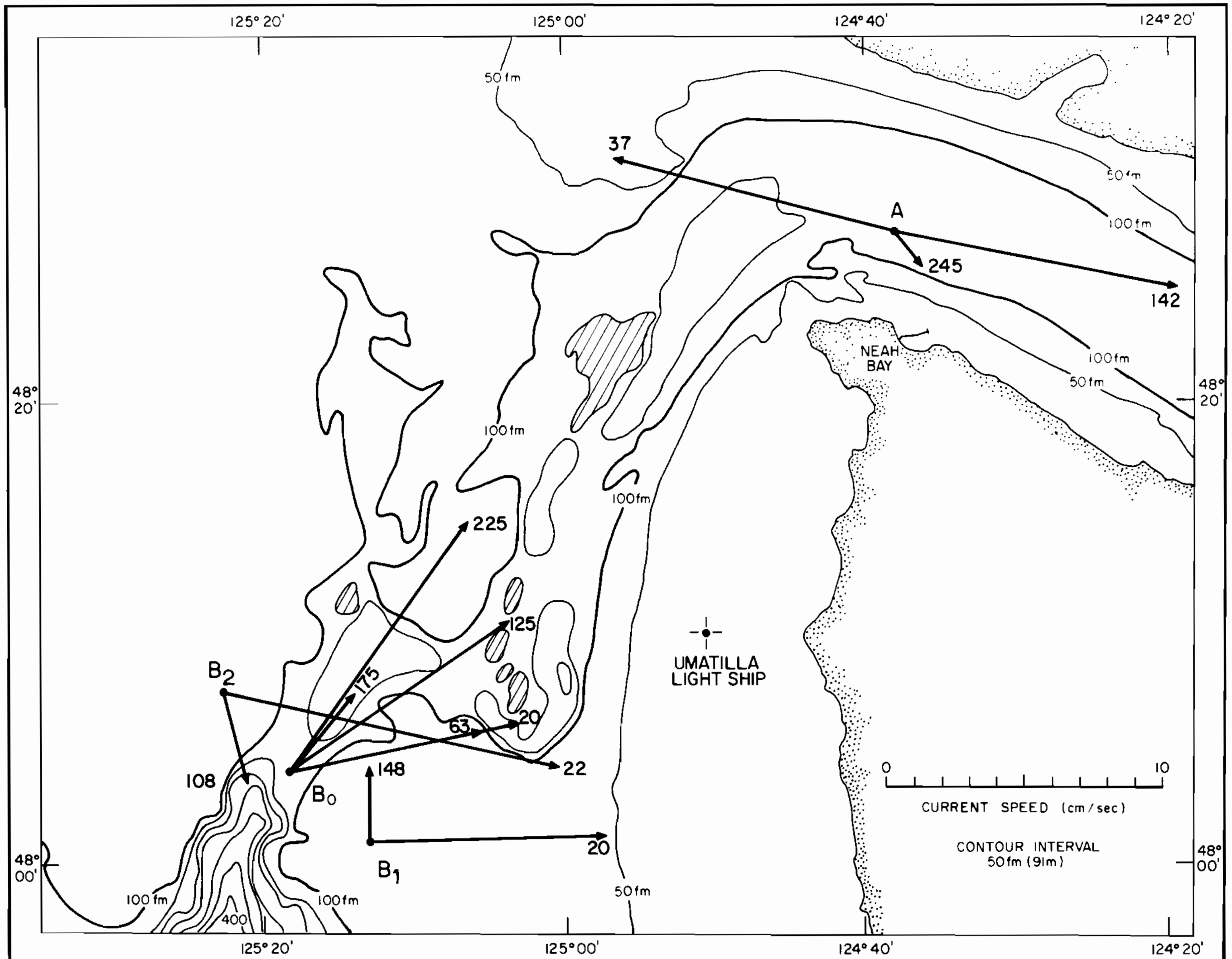


Plate 4. Vector Mean Currents. Depths (m) of observations given near arrowheads.

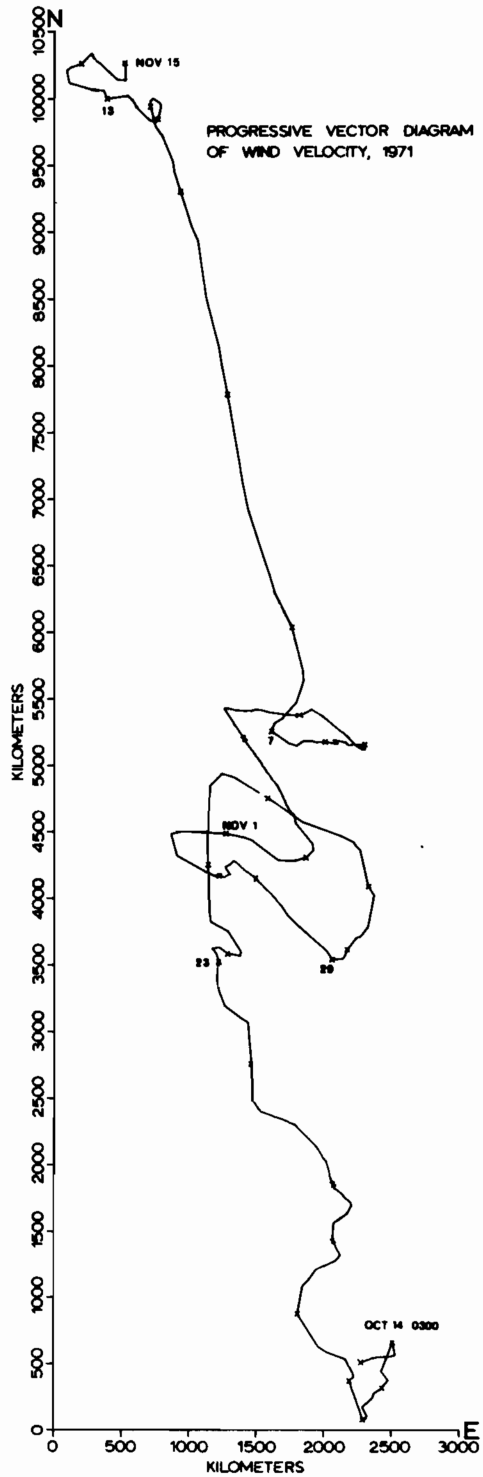


Plate 5a. Progressive Vector Diagram for Umatilla winds, 1971.

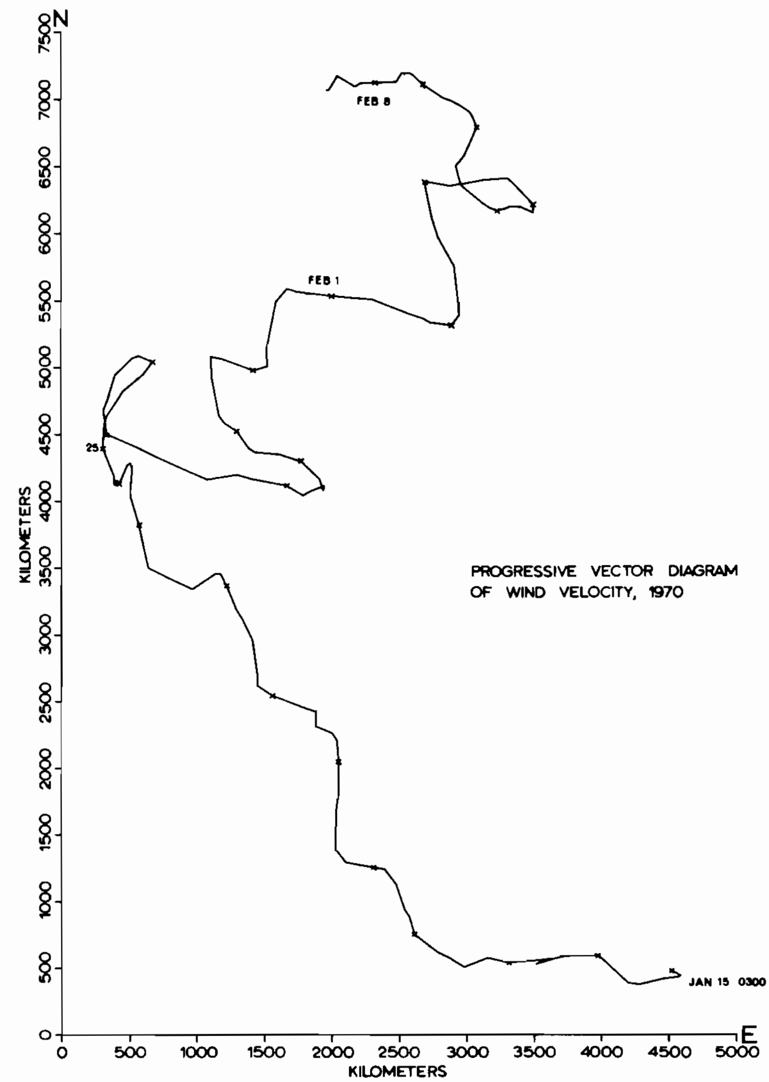


Plate 5b. Progressive Vector Diagram for Umatilla winds, 1970.

Plate 6a. Fourier Coefficients for mooring BO.

U-components

HRS	20m AMP	20m PHASE	63m AMP	63m PHASE	125m AMP	125m PHASE	175m AMP	175m PHASE	225m AMP	225m PHASE
7.20000E+02			5.26	172.55	7.95	-179.30	15.14	-170.53	12.30	-176.63
3.60000E+02	6.54	35.86	6.76	37.21	6.36	14.57	13.69	8.92	9.39	1.19
2.40000E+02			6.61	58.53	11.72	56.05	18.30	54.65	15.04	51.61
1.80000E+02	2.47	-58.79	3.29	52.01	4.61	63.72	7.63	43.40	6.04	31.08
1.44000E+02			1.19	-129.92	3.67	-147.11	7.01	-140.37	6.45	-155.79
1.20000E+02	3.07	-78.61	2.30	-178.06	6.04	178.46	9.17	177.11	7.48	156.05
1.02857E+02			2.29	111.09	1.00	89.98	2.42	100.00	2.15	105.58
9.00000E+01	2.58	126.34	2.25	99.61	4.28	114.01	4.57	120.51	3.98	142.45
8.00000E+01			1.25	84.92	.64	37.76	1.99	18.41	1.24	2.03
7.20000E+01	1.22	44.23	.80	44.86	1.21	-15.12	3.33	7.59	1.83	-22.90
6.54545E+01			1.16	43.63	1.18	103.93	2.92	86.30	3.22	109.01
6.00000E+01	2.25	-179.28	1.67	49.59	1.21	86.37	1.46	108.36	3.52	102.44
5.53846E+01			.59	18.95	2.33	45.12	2.42	92.34	3.13	78.70
5.14286E+01	.88	8.29	1.91	119.12	1.31	125.42	2.11	132.36	2.91	119.00
4.80000E+01			.61	-107.36	.59	66.16	.45	-110.91	.75	58.08
4.50000E+01	2.01	129.94	1.85	48.01	.74	-123.48	.42	30.09	1.30	33.42
4.23529E+01			.57	15.57	.35	8.47	1.13	23.65	.98	8.69
4.00000E+01	1.50	-102.79	1.02	55.45	1.29	12.23	2.26	54.54	2.64	59.52
3.78947E+01			1.18	-35.99	.73	72.17	2.43	54.77	2.29	44.86
3.60000E+01	1.84	43.96	.82	77.73	.95	-74.52	.22	12.31	.59	26.23
3.42857E+01			.17	-31.14	.69	84.44	.30	83.19	1.26	66.36
3.27273E+01	2.15	125.83	.35	53.25	.68	-18.68	.95	58.04	1.88	41.42
3.13043E+01			.33	56.33	1.50	-99.27	.25	16.97	.75	-33.36
3.00000E+01	.76	-79.52	.12	100.13	.92	155.39	1.07	164.31	.39	-176.08
2.88000E+01			.74	-53.26	.95	-105.38	.62	-80.55	1.35	-35.55
2.76923E+01	1.85	-174.57	1.55	-50.27	.24	29.73	1.17	26.51	.56	45.84
2.66667E+01			.64	-93.74	2.05	-23.95	3.47	42.07	2.10	41.66
2.57143E+01	2.05	58.17	2.49	149.08	3.06	158.46	1.37	-136.96	1.57	-139.73
2.48276E+01			.55	-146.80	.09	164.30	1.84	169.39	1.05	121.42
2.40000E+01	2.59	-51.52	5.11	-34.55	7.46	-47.79	4.42	-1.13	5.55	1.13
2.32258E+01			.31	-40.97	2.72	-168.99	1.33	-103.79	1.65	-87.85
2.25000E+01	2.14	-87.13	.58	126.93	1.20	95.56	1.42	128.25	.68	-169.30
2.18182E+01			.49	-123.10	2.26	145.41	.80	116.06	.67	-150.38
2.11765E+01	1.50	-24.74	1.16	-155.03	.68	-133.09	.66	134.48	.37	153.75
2.05714E+01			1.19	89.89	.45	-2.13	.98	5.57	.43	-12.24
2.00000E+01	2.49	97.58	.47	102.85	.66	99.08	.49	-86.15	.40	4.42
1.94595E+01			.25	91.13	.68	141.19	1.23	-175.28	1.15	-170.53
1.89474E+01	.59	94.11	1.34	-39.64	.62	142.45	.63	156.19	.79	152.67
1.84615E+01			1.42	-65.21	1.08	-93.70	.40	88.59	.26	-140.60
1.80000E+01	5.12	-174.23	1.63	174.25	1.51	45.60	1.13	35.47	.58	56.91
1.75610E+01			1.97	136.93	.74	75.02	.65	-23.87	.26	68.60
1.71429E+01	7.19	-85.13	.26	27.97	1.55	179.97	.43	179.21	.81	-149.87
1.57442E+01			3.94	-121.45	2.12	-141.30	.64	-146.51	.59	-166.59
1.63636E+01	16.08	95.81	3.81	-24.07	2.06	-92.63	.60	-96.65	.65	17.05
1.60000E+01			3.61	109.44	6.14	80.58	1.75	74.71	.69	126.30
1.56522E+01	5.81	-49.74	2.22	154.42	1.45	158.45	1.18	133.24	.49	-106.06
1.53191E+01			2.40	-124.17	1.59	71.00	.48	136.47	.38	138.23
1.50000E+01	3.59	57.13	1.42	9.34	.64	-33.86	.93	-13.52	.59	100.00
1.46939E+01			.41	129.25	.45	-14.76	1.25	-8.01	.55	-114.57
1.44000E+01	4.28	105.60	1.03	-12.03	2.47	-101.93	.77	123.38	.43	100.14
1.41176E+01			1.27	143.57	.29	107.45	.39	109.59	.32	-90.55
1.38462E+01	1.28	-83.73	.50	55.96	2.79	46.46	.21	-176.77	.83	145.24
1.35849E+01			.73	-171.70	1.43	27.96	.83	-14.34	.24	-177.83
1.33333E+01	1.60	-86.64	.51	108.00	.30	-48.85	.77	-22.53	.69	-13.90
1.30909E+01			.88	131.07	1.71	-138.17	.78	-172.02	.11	58.43
1.28571E+01	2.37	50.06	.58	-152.08	1.26	-127.84	1.11	-124.25	.34	40.34
1.26316E+01			2.59	156.83	1.55	127.37	2.26	146.64	.81	145.82
1.24138E+01	9.43	-69.09	3.07	57.55	9.26	22.33	7.10	8.96	3.54	-5.03
1.22034E+01			.81	-33.41	.71	54.15	1.80	50.16	1.13	22.59
1.20000E+01	1.58	-21.52	2.17	178.01	4.87	95.91	2.86	79.54	1.37	117.61
1.18033E+01			.63	-47.50	1.96	172.64	1.03	135.60	.02	47.66
1.16129E+01	1.33	71.23	.11	-34.53	.40	-157.57	.74	-19.97	.46	-87.51
1.14286E+01			1.21	-77.01	.51	82.68	.67	28.06	.25	31.10
1.12500E+01	.55	-107.59	.47	50.29	.43	111.82	.74	105.32	.80	-4.04
1.10769E+01			.76	170.13	.98	-81.54	.92	-148.16	.39	21.43
1.09091E+01	1.02	176.14	.91	65.85	.27	-86.38	.36	109.47	.35	124.40
1.07463E+01			.84	24.46	.55	-130.09	.64	76.27	.49	-134.75
1.05882E+01	1.29	-73.76	.88	-1.58	.72	-168.07	.94	87.45	.41	69.27
1.04348E+01			.80	-152.04	.46	-107.90	.18	117.66	.39	28.48
1.02857E+01	1.14	29.93	.26	77.06	.09	-75.69	.35	-38.81	.01	5.35
1.01408E+01			.63	-156.26	.73	51.11	.43	32.89	.53	-97.65
1.00000E+01	1.04	9.04	.09	-94.94	.71	-115.77	.44	170.26	.27	61.63
9.86301E+00			1.12	1.19	.29	84.50	.58	74.41	.68	59.65
9.72973E+00	1.79	100.81	.40	-72.02	.86	-85.48	.54	172.58	.31	153.60
9.60000E+00			.39	162.53	.70	96.36	.18	21.43	.37	.30
9.47368E+00	1.37	7.18	.62	-82.93	.67	-77.26	.12	-9.25	.26	139.09
9.35065E+00			.54	14.11	.19	-47.34	.97	-20.61	.21	-143.04
9.23077E+00	1.17	67.05	.95	136.79	.48	-92.12	.89	117.68	.32	150.38
9.11392E+00			.41	-107.99	.26	67.35	.58	146.02	.26	38.75
9.00000E+00	1.31	74.54	.84	43.36	.21	15.54	.37	-96.12	.45	112.54
8.88889E+00			.60	170.37	.03	127.48	.15	59.84	.39	-167.63
8.78049E+00	.81	-155.18	.51	-98.13	.19	10.72	.09	108.49	.14	-167.46
8.67470E+00			.50	116.36	1.04	-169.04	.51	-73.60	.06	87.88
8.57143E+00	.68	26.27	.47	-131.49	.54	-0.62	.58	-119.20	.23	-171.15
8.47059E+00			.41	-127.61	.42	-43.05	.40	-113.95	.34	167.69
8.37209E+00	1.47	126.25	.50	-11.14	.35	30.27	.83	62.53	.54	55.93
8.27586E+00			.29	-127.04	.60	29.79	.30	45.10	.38	-5.38
8.18182E+00	1.90	-54.21	1.05	146.63	1.03	178.58	.49	-169.57	.40	-3.90
8.08989E+00			.43	43.55	.55	-109.98	.56	-143.99	.76	161.29
8.00000E+00	1.20	119.73	1.41	-93.54	.46	19.94	.58	12.87	.33	-79.46

Plate 6a. (continued)

V-components

HRS	20m AMP	20m PHASE	63m AMP	63m PHASE	125m AMP	125m PHASE	175m AMP	175m PHASE	225m AMP	225m PHASE
7.20000E+02			2.51	24.40	2.67	2.15	.42	31.26	.21	87.25
3.60000E+02	3.18	105.83	1.37	62.67	.64	147.69	.55	2.42	.43	1.91
2.40000E+02			.41	34.70	1.96	-134.24	1.48	152.87	.23	-29.65
1.80000E+02	3.10	-64.80	1.45	89.12	1.01	132.20	.58	53.46	.31	108.19
1.44000E+02			2.11	-91.78	1.06	-79.78	1.07	-24.18	.14	-58.70
1.20000E+02	.93	-164.46	1.98	-113.79	1.40	-71.30	.34	-31.61	.29	-155.62
1.02857E+02			.48	113.97	.50	-80.40	.63	-51.42	.38	4.12
9.00000E+01	.39	86.39	.84	138.84	.64	-57.50	.24	-92.91	.69	-94.23
8.00000E+01			.36	93.73	.41	-26.12	.49	-89.44	.56	-95.13
7.20000E+01	.58	39.00	.83	-52.63	.72	-165.67	.16	87.64	.09	-132.43
6.54545E+01			.84	-61.60	1.18	-106.83	.42	-49.60	.31	133.11
6.00000E+01	.48	-30.68	.27	-174.32	.22	-169.40	1.09	-55.74	.36	-106.53
5.53846E+01			.06	-125.92	1.13	-123.02	1.12	-69.32	.18	160.02
5.14286E+01	2.39	-45.45	1.54	-158.20	.68	-52.40	.52	-118.60	.45	-119.26
4.80000E+01			.40	58.86	.54	30.04	.62	-173.23	.28	114.29
4.50000E+01	1.97	73.31	.89	-71.64	1.03	-123.69	.85	175.79	.12	-4.34
4.23529E+01			1.19	142.76	.83	-169.65	.13	-161.54	.23	59.96
4.00000E+01	1.42	176.92	.77	-164.83	.88	-129.37	.82	-84.25	.20	-127.23
3.78947E+01			1.08	-135.00	1.03	136.74	.67	-150.60	.70	127.90
3.60000E+01	.89	-14.78	.29	-159.63	.50	-82.91	.45	-63.13	.55	97.15
3.42857E+01			.70	-94.74	.65	-146.62	.19	35.90	.26	-91.31
3.27273E+01	.72	-123.38	.57	-160.64	.80	-122.66	.29	104.84	.34	-164.06
3.13043E+01			.37	-123.93	1.61	-153.68	.36	-144.82	.18	51.70
3.00000E+01	.40	-63.01	.20	91.27	.70	71.77	.77	-133.08	.51	42.19
2.88000E+01			.71	-99.51	.65	4.71	.35	84.76	.27	58.11
2.76923E+01	1.42	118.76	.84	-144.86	.63	92.37	.70	23.26	.35	119.49
2.66667E+01			1.16	-101.77	1.85	-142.96	.22	-70.91	.43	141.25
2.57143E+01	1.86	-31.14	2.45	104.51	1.49	73.60	.56	-150.92	.27	-97.06
2.48276E+01			.33	164.73	.53	-23.47	1.08	-135.67	.56	77.49
2.40000E+01	2.25	-106.65	3.71	-103.15	3.88	-138.89	.44	-115.94	.61	42.71
2.32258E+01			.13	90.01	1.17	124.02	.29	49.93	.49	-42.14
2.25000E+01	2.44	-153.08	.31	75.46	.76	-9.07	.49	92.87	.45	-136.98
2.18182E+01			.89	145.06	1.57	23.33	1.08	124.35	.12	-98.72
2.11765E+01	.57	-64.49	1.12	148.85	.37	-149.31	.22	-6.40	.29	-154.37
2.05714E+01			.17	-56.52	.59	155.92	.58	-38.49	.56	94.80
2.00000E+01	2.15	0.49	.94	-37.44	.55	40.14	.21	137.64	.50	.76
1.94595E+01			.91	179.86	.56	-54.54	.16	-60.18	.17	-94.43
1.89474E+01	.80	-29.13	1.81	-158.45	.79	119.98	.53	-165.10	.08	-3.41
1.84615E+01			1.69	-148.70	.54	-128.92	.14	9.35	.21	46.12
1.80000E+01	3.14	82.14	1.52	17.86	1.17	-4.75	.36	-37.94	.35	148.41
1.75610E+01			1.49	46.25	.60	2.60	.46	102.82	.29	-112.39
1.71429E+01	8.63	-177.59	.33	-46.87	.56	60.60	.43	-39.15	.27	157.42
1.67442E+01			4.22	150.82	1.95	136.33	.33	148.59	.70	60.92
1.63636E+01	19.52	3.17	3.62	-110.47	1.64	-149.42	.61	-173.51	.14	-127.40
1.60000E+01			4.01	22.51	3.17	11.92	.57	-8.99	.21	103.16
1.56522E+01	6.46	-145.27	3.29	96.32	.30	23.56	.55	60.26	.44	-61.58
1.53191E+01			1.86	147.09	1.70	-10.29	.36	75.99	.26	-168.39
1.50000E+01	2.91	-34.05	1.53	-66.47	.68	-55.50	.64	-111.25	.52	44.73
1.46939E+01			.10	-119.21	.21	-73.25	.31	-61.08	.35	170.13
1.44000E+01	4.52	10.25	.82	-103.79	1.59	171.23	.71	140.94	.90	-57.23
1.41176E+01			1.84	67.99	.26	115.39	.30	116.03	.38	55.77
1.38462E+01	.74	-175.43	.59	-36.57	2.15	-43.90	.22	-48.78	.21	-132.94
1.35849E+01			.33	27.92	.92	-55.46	.33	-121.09	.56	-22.53
1.33333E+01	2.51	174.39	.09	76.55	.25	23.41	.46	116.01	.11	-39.95
1.30909E+01			1.03	18.57	1.14	140.28	.22	98.60	.54	73.92
1.28571E+01	4.70	-68.49	.88	166.66	1.09	152.84	.85	-161.90	.07	-23.00
1.26316E+01			3.01	99.95	.41	89.00	.97	74.61	.58	-107.91
1.24138E+01	10.57	-135.97	6.20	-9.15	4.23	-16.34	1.52	-55.44	1.93	131.76
1.22034E+01			.80	-179.12	.54	35.96	.30	-30.31	.64	-88.45
1.20000E+01	2.84	-81.49	3.01	92.98	2.56	-127.78	.72	15.07	.41	-144.67
1.18033E+01			.76	-133.15	1.83	98.94	.67	2.19	1.09	-149.62
1.16129E+01	2.02	-9.20	.59	-140.81	.68	161.55	.18	69.53	.52	-162.03
1.14286E+01			.46	161.27	.46	21.90	.55	-77.77	.23	-36.86
1.12500E+01	1.17	78.85	.47	-104.20	.29	-178.02	.40	172.22	.23	-113.69
1.10769E+01			.91	97.38	.24	-99.85	.91	130.52	.48	-91.30
1.09091E+01	1.47	147.46	.50	-31.59	.38	137.74	.42	99.16	.36	66.82
1.07463E+01			.94	-48.43	.14	-130.73	.27	-32.14	.32	105.58
1.05882E+01	.66	-141.19	1.23	-75.66	.32	84.80	.52	26.74	.45	-49.14
1.04348E+01			.50	153.14	.32	173.93	.19	173.83	.31	-107.53
1.02857E+01	.99	-21.74	.86	-172.98	.14	97.52	.09	154.29	.30	-92.17
1.01408E+01			.49	123.45	.31	-24.64	.32	36.04	.38	-176.33
1.00000E+01	.19	155.32	.38	52.18	.40	-154.56	.08	118.37	.43	-31.48
9.86301E+00			.68	-106.52	.31	129.35	.19	-161.32	.37	-108.43
9.72973E+00	1.10	-11.52	.34	166.57	.51	-176.99	.30	154.15	.52	-17.01
9.60000E+00			.46	30.60	.45	46.64	.47	104.20	.40	-109.64
9.47368E+00	.52	-92.76	.49	155.37	.74	-128.87	.13	-24.48	.15	-143.92
9.35065E+00			.46	-157.35	.15	-131.14	.64	-79.89	.52	-170.94
9.23077E+00	1.21	-13.36	.88	46.16	.06	173.83	.27	-16.31	.38	151.40
9.11392E+00			.24	158.25	.56	26.08	.53	119.47	.51	-134.43
9.00000E+00	1.20	-17.98	.47	-44.11	.40	-12.59	.62	-166.17	.41	35.87
8.88889E+00			.84	70.34	.62	-84.59	.15	-68.64	.39	173.79
8.78049E+00	.61	143.95	.58	112.97	.25	127.15	.08	95.84	.34	-87.41
8.67470E+00			.41	41.22	1.01	117.60	.24	-162.52	.13	-39.91
8.57143E+00	.57	-52.31	.44	-158.68	.75	-23.33	.21	98.81	.50	115.54
8.47059E+00			.80	178.37	1.22	-86.39	.16	149.05	.69	110.86
8.37209E+00	1.06	33.70	.52	101.31	.64	-102.00	.33	-19.79	.26	27.50
8.27586E+00			.26	128.55	.50	180.00	.37	-120.37	.46	-42.05
8.18182E+00	.89	-106.99	.38	56.38	1.01	48.16	.47	150.75	.52	-166.03
8.08989E+00			.18	7.63	.79	-115.34	.29	88.87	.66	58.68
8.00000E+00	1.21	-37.30	.25	-166.83	.19	-6.05	.29	-118.35	.54	-135.96

Plate 6b. Fourier Coefficients for mooring B1.

HRS	U-components 20m AMP	U-components 20m PHASE	U-components 148m AMP	U-components 148m PHASE	V-components 20m AMP	V-components 20m PHASE	V-components 148m AMP	V-components 148m PHASE
7.20000E+02			2.88	162.66			2.68	26.23
3.60000E+02	11.32	24.37	2.25	16.02	4.73	176.81	1.66	-47.72
2.40000E+02			3.39	45.94			.50	142.63
1.80000E+02	2.53	69.03	1.72	11.04	2.91	-20.39	.38	16.52
1.44000E+02			1.23	167.97			.11	-178.32
1.20000E+02	1.34	-122.35	2.51	125.15	3.16	-93.10	.60	165.38
1.02857E+02			.89	33.65			1.12	17.24
9.00000E+01	1.87	140.72	1.92	101.74	.90	-78.44	.39	86.99
8.00000E+01			.47	-38.42			.13	-129.33
7.20000E+01	3.62	-5.19	.82	-68.43	1.29	-16.23	1.06	-147.23
6.54545E+01			1.23	68.05			.31	117.80
6.00000E+01	3.07	135.99	1.14	31.61	1.35	-38.91	.57	-17.44
5.53846E+01			.97	38.58			.47	-161.18
5.14286E+01	1.49	-128.70	.68	96.73	1.69	-3.02	.36	8.70
4.80000E+01			.28	-39.89			.17	88.67
4.50000E+01	1.77	110.99	.18	88.11	1.26	98.54	.15	-91.25
4.23529E+01			.79	-53.59			.01	137.28
4.00000E+01	1.83	-111.68	.69	-25.90	1.33	-92.89	.38	-112.14
3.78947E+01			.96	-30.07			.16	-157.98
3.60000E+01	2.47	76.33	.18	35.70	2.70	-54.88	.12	-136.48
3.42857E+01			.64	-17.96			.47	-148.09
3.27273E+01	2.51	149.60	.54	55.05	1.63	81.69	.37	175.48
3.13043E+01			.13	-93.56			.36	86.03
3.00000E+01	.88	-153.59	.40	-112.58	.51	-135.80	.22	-39.88
2.88000E+01			.47	-109.45			.41	139.85
2.76923E+01	1.37	128.07	.21	-74.82	.95	103.68	.14	54.54
2.66667E+01			.88	-22.50			.95	-84.89
2.57143E+01	4.48	47.65	.93	157.17	2.46	-46.15	1.02	112.81
2.48276E+01			.25	64.09			.20	81.64
2.40000E+01	2.32	-160.00	3.27	-49.79	.44	-47.50	2.18	-113.41
2.32258E+01			1.01	-150.79			.77	137.05
2.25000E+01	3.26	-142.32	.89	112.32	3.38	122.15	.73	43.48
2.18182E+01			.59	-154.91			.36	125.30
2.11765E+01	2.69	102.49	.59	-171.41	1.27	-82.81	.47	109.77
2.05714E+01			.27	55.62			.47	-2.70
2.00000E+01	2.83	66.62	.17	-70.02	1.85	-7.42	.22	107.10
1.94595E+01			.53	150.68			.25	103.25
1.89474E+01	1.55	43.23	.09	94.71	2.79	-41.85	.43	-95.02
1.84615E+01			.51	-126.87			.66	116.29
1.80000E+01	6.15	164.57	.73	104.63	7.33	80.48	.33	81.66
1.75610E+01			1.15	124.66			.89	51.24
1.71429E+01	4.93	-95.37	.84	-173.18	4.50	-164.77	.67	132.30
1.67442E+01			.62	-32.57			.43	-172.37
1.63636E+01	18.26	63.79	.82	-108.62	18.41	-26.60	.85	122.12
1.60000E+01			2.14	65.29			1.59	-20.02
1.56522E+01	7.33	-111.71	.77	-153.07	7.45	159.88	1.43	99.63
1.53191E+01			.24	50.68			.03	71.58
1.50000E+01	3.65	-85.91	.65	116.28	3.67	-161.27	.58	14.42
1.46939E+01			.09	107.04			.21	-45.63
1.44000E+01	7.99	19.86	.99	-117.38	9.54	-86.18	1.08	150.39
1.41176E+01			.71	177.20			.63	90.53
1.38462E+01	3.03	131.34	1.33	36.62	3.05	31.90	.88	-52.90
1.35849E+01			.78	-28.38			.31	-115.81
1.33333E+01	2.26	-134.81	.59	116.79	2.82	161.24	.51	41.62
1.30909E+01			.38	128.70			.37	-170.90
1.28571E+01	2.79	-48.38	1.71	127.23	4.63	-124.33	.53	80.97
1.26316E+01			.69	57.03			1.35	54.34
1.24138E+01	4.20	-99.59	1.64	-43.77	8.13	-167.21	4.00	-74.80
1.22034E+01			1.32	-11.30			.84	-101.08
1.20000E+01	2.43	-147.44	1.42	97.50	1.28	173.14	1.67	28.23
1.18033E+01			1.16	-144.77			.77	145.59
1.16129E+01	1.28	-31.52	.37	-61.06	2.83	-92.80	.29	-116.17
1.14286E+01			.32	-65.07			.37	164.37
1.12500E+01	1.56	66.10	.08	.24	.92	-19.04	.45	111.91
1.10769E+01			.44	12.18			.37	-61.69
1.09091E+01	.67	61.42	.44	173.21	.38	-32.61	.59	75.53
1.07463E+01			.22	-16.78			.19	109.50
1.05882E+01	1.45	-152.66	.38	-40.56	.83	174.56	.17	-133.27
1.04348E+01			.13	45.25			.08	-18.22
1.02857E+01	.97	-56.63	.13	-97.88	.43	8.33	.37	2.38
1.01408E+01			.13	-151.23			.55	.71
1.00000E+01	.39	8.15	.55	-34.82	1.60	-165.94	.33	-108.35
9.86301E+00			.10	50.33			.22	-50.33
9.72973E+00	.30	-83.65	.69	-50.01	.71	-1.64	.78	-153.60
9.60000E+00			.35	136.53			.27	20.38
9.47368E+00	.99	8.42	.45	-5.29	.90	-70.58	.23	-136.60
9.35065E+00			.30	44.58			.47	5.57
9.23077E+00	1.13	-136.49	.25	-170.39	1.45	159.57	.18	12.10
9.11392E+00			.17	-95.66			.15	155.19
9.00000E+00	.11	-58.25	.17	136.30	.77	-116.43	.27	-16.07
8.88889E+00			.05	124.79			.20	-15.78
8.78049E+00	1.52	-74.03	.16	-114.01	1.45	139.09	.23	138.18
8.67470E+00			.22	-110.74			.10	120.04
8.57143E+00	1.66	79.76	.29	-33.34	1.31	-27.25	.21	-123.26
8.47059E+00			.42	149.92			.07	129.72
8.37209E+00	1.54	148.65	.13	94.20	.42	65.27	.17	-9.91
8.27586E+00			.33	52.21			.03	-39.56
8.18182E+00	2.62	-75.76	.32	138.45	1.25	-166.22	.46	35.80
8.08989E+00			.08	-57.37			.46	-106.92
8.00000E+00	.54	124.40	.39	-48.74	.57	-129.19	.38	-141.53

Plate 6c. Fourier Coefficients for mooring B2.

HRS	U-components 22m AMP	U-components 22m PHASE	U-components 108m AMP	U-components 108m PHASE	V-components 22m AMP	V-components 22m PHASE	V-components 108m AMP	V-components 108m PHASE
7.20000E+02			7.39	-169.38			1.94	-5.21
3.50000E+02	4.04	33.81	2.97	30.04	5.76	135.58	2.10	157.94
2.40000E+02			5.03	55.03			2.05	-109.76
1.80000E+02	5.17	-14.98	2.26	14.95	.43	141.87	.91	167.86
1.44000E+02			1.86	-133.97			1.10	-11.45
1.20000E+02	.25	147.24	2.44	-155.92	1.40	150.47	2.27	2.34
1.02857E+02			.74	159.06			1.57	-112.42
9.00000E+01	1.73	-160.19	1.56	172.42	.65	158.88	.45	36.72
8.00000E+01			.50	90.73			1.20	-162.53
7.20000E+01	1.73	76.65	1.58	29.79	1.46	75.92	1.04	-174.02
6.54545E+01			1.03	122.75			.84	-8.71
6.00000E+01	2.05	-1.01	.90	-179.76	.29	87.22	.55	12.25
5.53846E+01			.40	152.49			1.11	-57.19
5.14286E+01	1.78	143.79	.68	-119.77	2.74	7.16	.44	118.98
4.80000E+01			.90	97.59			.58	-39.61
4.50000E+01	3.27	-90.84	.67	90.42	.98	96.00	.46	-154.31
4.23529E+01			.72	94.12			.83	-56.75
4.00000E+01	2.77	91.91	.21	-176.11	.52	15.63	.17	-94.97
3.78947E+01			.60	118.42			.79	-58.73
3.50000E+01	1.61	-160.20	.18	78.56	1.68	127.94	.31	145.14
3.42857E+01			.64	-157.71			.47	105.41
3.27273E+01	.89	-71.77	.48	-168.48	2.20	.54	.04	59.08
3.13043E+01			.53	91.82			.27	-71.20
3.00000E+01	.51	56.24	.53	72.03	.80	-105.08	.95	-95.71
2.88000E+01			.61	106.36			.74	-103.82
2.76923E+01	.89	118.62	.60	-82.19	.92	33.25	.45	-158.92
2.66667E+01			.88	-138.59			1.24	92.04
2.57143E+01	3.59	-63.97	1.95	51.82	1.91	-170.58	1.63	-68.33
2.48276E+01			.82	81.57			.91	-59.78
2.40000E+01	4.29	173.15	4.75	-115.16	3.63	69.49	4.09	141.77
2.32258E+01			1.20	83.53			1.19	-41.30
2.25000E+01	1.98	149.45	.98	56.20	1.64	55.23	.73	-62.56
2.18182E+01			.80	140.72			.20	-12.45
2.11765E+01	.99	-166.34	.26	149.58	.64	92.38	.40	-179.03
2.05714E+01			.43	110.01			.48	20.30
2.00000E+01	.66	-71.17	.36	162.70	2.04	22.60	.35	-15.52
1.94595E+01			.78	107.38			.26	-53.16
1.89474E+01	.78	99.79	.41	49.50	.45	53.94	.56	-54.08
1.84615E+01			.11	39.25			.19	-156.27
1.80000E+01	4.13	160.65	1.20	41.93	3.27	66.15	1.03	-100.62
1.75610E+01			.41	117.94			.37	.57
1.71429E+01	6.29	-116.48	.73	152.45	5.84	152.60	.41	-11.64
1.67442E+01			.53	-168.87			.56	42.04
1.63636E+01	17.66	83.40	1.55	-40.68	19.80	-7.27	1.92	-169.12
1.60000E+01			2.77	108.28			2.58	-1.45
1.56522E+01	13.01	-75.51	.86	111.79	13.61	-160.51	.13	89.70
1.53191E+01			.20	153.49			.65	-46.23
1.50000E+01	3.10	14.92	.57	-7.42	3.50	-76.27	.21	-105.29
1.46939E+01			.29	-6.13			.17	-134.41
1.44000E+01	1.38	142.52	.12	-10.58	1.32	44.72	.51	-171.79
1.41176E+01			.87	165.94			.48	31.76
1.38462E+01	3.04	-40.57	.61	135.39	2.82	-144.86	.59	38.13
1.35849E+01			.94	60.94			1.06	-52.08
1.33333E+01	2.17	-32.94	.24	130.18	3.49	-105.01	.40	-118.94
1.30909E+01			.63	-156.79			.66	179.14
1.28571E+01	8.69	56.42	.91	-28.31	8.53	-18.89	1.28	-154.90
1.26316E+01			1.04	-7.90			1.27	-135.01
1.24138E+01	14.99	37.34	1.46	172.84	16.67	-48.25	2.56	77.32
1.22034E+01			.89	14.55			.72	-99.50
1.20000E+01	3.83	178.44	1.40	-90.89	4.78	73.27	1.83	159.61
1.18033E+01			.41	-128.66			.33	-96.43
1.16129E+01	1.98	-114.25	.18	39.03	3.42	144.17	.24	-134.17
1.14286E+01			.48	171.25			.27	57.68
1.12500E+01	2.50	-36.26	.08	177.69	2.77	-106.45	.66	-156.94
1.10769E+01			.59	29.64			.26	-4.53
1.09091E+01	2.25	-135.52	.68	94.98	1.30	127.77	.26	.58
1.07463E+01			.41	160.39			.36	26.86
1.05882E+01	1.27	-53.51	.22	-77.05	.47	-130.92	.23	-152.03
1.04348E+01			.39	128.75			.84	7.91
1.02857E+01	.98	-150.20	.24	104.87	1.83	178.81	.24	30.01
1.01408E+01			.49	136.16			.22	151.09
1.00000E+01	.46	-53.49	.20	-50.84	1.81	-65.81	.35	-95.22
9.86301E+00			.29	109.87			.42	17.72
9.72973E+00	1.25	-40.94	.34	90.16	1.29	-166.76	.09	101.28
9.60000E+00			.42	2.34			.42	-134.85
9.47368E+00	.64	-164.21	.24	49.81	1.10	-34.79	.05	143.18
9.35065E+00			.03	6.05			.02	137.70
9.23077E+00	.67	172.06	.18	17.88	.43	177.04	.21	-122.53
9.11392E+00			.30	37.17			.23	-13.40
9.00000E+00	1.99	-87.68	.26	-170.03	1.02	-171.25	.10	-55.91
8.88889E+00			.57	163.45			.41	70.13
8.78049E+00	.80	46.15	.30	-3.04	.49	-66.26	.29	-112.62
8.67470E+00			.29	161.03			.29	-105.10
8.57143E+00	1.03	-114.03	.45	53.43	.56	-156.31	.56	-30.58
8.47059E+00			.16	75.02			.11	-111.76
8.37209E+00	.60	166.32	.14	-52.80	1.01	17.87	.25	-136.83
8.27586E+00			.38	-34.10			.19	-143.92
8.18182E+00	.54	-80.45	.64	132.62	2.00	-169.22	.58	70.16
8.08989E+00			.31	-113.87			.07	-146.54
8.00000E+00	1.47	-141.44	.25	-45.11	1.44	138.27	.38	-99.18

Plate 6d. Fourier Coefficients for mooring A.

U-components

	37m		142m		245m	
HRS	AMP	PHASE	AMP	PHASE	AMP	PHASE
7.20000E+02					2.50	-117.92
3.60000E+02	25.25	175.38	12.89	-28.79	7.78	10.36
2.40000E+02					7.30	49.20
1.80000E+02	5.90	-100.58	4.91	152.67	2.25	89.87
1.44000E+02					1.60	-70.05
1.20000E+02	9.35	83.50	5.02	-59.34	5.03	-91.60
1.02857E+02					1.02	144.29
9.00000E+01	4.50	112.85	2.82	-70.73	1.40	-128.68
8.00000E+01					2.01	61.64
7.20000E+01	4.52	-66.27	3.96	112.44	3.30	83.23
6.54545E+01					1.15	153.30
6.00000E+01	5.96	60.74	3.48	-59.72	2.03	-62.82
5.53846E+01					1.68	20.47
5.14286E+01	.31	-49.83	1.25	47.11	2.23	13.46
4.80000E+01					1.76	-175.36
4.50000E+01	1.43	116.77	1.65	-151.79	.45	80.23
4.23529E+01					.66	5.53
4.00000E+01	3.66	-38.67	2.64	123.56	2.03	153.59
3.78947E+01					1.14	-54.75
3.60000E+01	3.07	-80.52	1.57	-43.36	1.04	29.29
3.42857E+01					2.16	29.90
3.27273E+01	1.47	-108.71	3.42	104.18	2.44	26.21
3.13043E+01					1.64	3.52
3.00000E+01	5.03	68.15	.69	10.07	2.96	-63.66
2.88000E+01					2.69	-69.92
2.76923E+01	2.10	159.23	2.17	37.60	1.02	-131.79
2.66667E+01					1.14	162.35
2.57143E+01	16.87	96.64	21.54	86.35	14.35	100.97
2.48276E+01					2.64	110.63
2.40000E+01	33.23	-34.68	31.61	-29.78	25.68	-31.94
2.32258E+01					1.23	-177.23
2.25000E+01	4.53	79.61	.82	-12.49	1.65	-91.71
2.18182E+01					2.37	-96.22
2.11765E+01	2.43	-99.06	.15	109.75	3.02	-168.68
2.05714E+01					1.60	164.95
2.00000E+01	3.18	93.00	2.78	-139.02	2.89	172.48
1.94595E+01					.32	61.30
1.89474E+01	2.08	-155.70	1.10	-105.85	1.27	87.06
1.84615E+01					.40	46.04
1.80000E+01	1.36	-123.45	2.09	48.49	.53	18.78
1.75610E+01					.37	112.81
1.71429E+01	2.10	-144.19	3.10	-146.24	1.58	173.30
1.67442E+01					.49	-145.06
1.63636E+01	2.45	-60.58	1.89	-50.49	.66	-44.41
1.60000E+01					1.16	92.46
1.56522E+01	1.94	24.00	2.58	123.25	1.08	-118.46
1.53191E+01					.85	154.93
1.50000E+01	3.22	-175.95	1.74	-41.85	.41	172.24
1.46939E+01					.89	151.55
1.44000E+01	1.07	-55.50	1.33	-45.06	.33	6.65
1.41176E+01					.45	70.08
1.38462E+01	2.46	27.32	1.85	100.68	1.30	92.37
1.35849E+01					1.33	10.27
1.33333E+01	.52	-154.80	2.39	-11.65	1.91	-51.08
1.30909E+01					1.71	-121.32
1.28571E+01	6.95	-7.30	7.40	47.96	1.49	19.08
1.26316E+01					9.71	133.67
1.24138E+01	42.15	23.40	37.44	14.11	37.70	15.66
1.22034E+01					5.96	86.78
1.20000E+01	10.29	168.34	13.87	156.70	9.56	107.30
1.18033E+01					.12	-51.49
1.16129E+01	3.91	26.31	2.25	171.55	1.33	130.44
1.14286E+01					1.31	-73.41
1.12500E+01	5.47	114.81	1.64	-99.80	2.24	-91.09
1.10769E+01					1.15	123.06
1.09091E+01	2.42	159.91	1.77	90.49	.53	124.39
1.07463E+01					.97	126.18
1.05882E+01	1.95	-82.34	1.13	-100.44	1.43	80.40
1.04348E+01					.56	119.93
1.02857E+01	.91	-154.55	1.11	-176.64	1.32	-65.67
1.01408E+01					.53	67.40
1.00000E+01	2.91	-77.44	1.39	21.85	1.13	94.87
9.86301E+00					.60	-108.84
9.72973E+00	1.89	11.84	1.92	-147.36	.81	30.77
9.60000E+00					.95	-14.69
9.47368E+00	2.92	113.77	.62	-8.67	.62	176.95
9.35065E+00					1.20	176.33
9.23077E+00	1.43	-132.93	.22	-53.90	.94	8.61
9.11392E+00					.62	130.42
9.00000E+00	1.79	8.22	.96	-121.18	.77	83.49
8.88889E+00					1.64	-12.71
8.78049E+00	.13	52.58	1.31	34.16	1.70	-63.08
8.67470E+00					1.20	-179.44
8.57143E+00	3.15	37.58	1.86	-153.89	.94	-171.58
8.47059E+00					2.49	50.66
8.37209E+00	1.14	-179.47	1.98	108.51	3.05	-81.58
8.27586E+00					1.68	-143.72
8.18182E+00	1.03	60.58	.73	-147.81	4.78	87.46
8.08989E+00					1.21	24.44
8.00000E+00	.85	-70.12	.78	-47.05	1.59	-78.99

Plate 6d. (continued)

V-components

HRS	37m AMP	37m PHASE	142m AMP	142m PHASE	245m AMP	245m PHASE
7.20000E+02					.43	105.09
3.60000E+02	5.79	22.24	3.62	139.42	.10	105.30
2.40000E+02					.66	169.55
1.80000E+02	3.33	-163.48	1.53	-45.24	.62	-12.63
1.44000E+02					.66	-34.55
1.20000E+02	2.87	-94.54	.19	60.26	.41	127.26
1.02857E+02					.23	170.43
9.00000E+01	1.47	-2.73	.17	39.59	.70	-45.73
8.00000E+01					.08	1.62
7.20000E+01	.16	50.46	2.28	-44.23	.21	159.85
6.54545E+01					.10	10.55
6.00000E+01	.53	-171.36	1.11	-76.56	.98	-33.13
5.53846E+01					.92	-161.43
5.14286E+01	2.25	136.68	.63	170.92	.24	16.04
4.80000E+01					.31	-37.24
4.50000E+01	1.86	-135.79	1.55	-146.88	.15	-46.65
4.23529E+01					.60	-161.27
4.00000E+01	1.79	86.50	1.51	-14.92	.82	-18.28
3.78947E+01					.59	65.91
3.60000E+01	.79	10.36	1.10	123.20	.15	-84.00
3.42857E+01					.41	39.55
3.27273E+01	.35	165.51	.63	95.10	.45	62.54
3.13043E+01					.58	18.91
3.00000E+01	1.05	108.00	.53	-79.19	.60	170.59
2.88000E+01					1.25	53.20
2.76923E+01	1.24	-30.64	1.86	100.71	.93	34.10
2.66667E+01					1.53	-83.42
2.57143E+01	.98	-47.82	3.86	5.57	1.29	-77.15
2.48276E+01					1.15	54.47
2.40000E+01	1.97	-39.09	4.65	-116.86	.54	-39.66
2.32258E+01					.93	-117.81
2.25000E+01	1.31	37.07	.87	153.70	1.40	49.91
2.18182E+01					.77	133.26
2.11765E+01	1.08	136.08	.44	-129.50	1.22	73.99
2.05714E+01					.65	-33.72
2.00000E+01	2.43	10.25	.69	72.79	.94	-50.16
1.94595E+01					1.32	-120.82
1.89474E+01	2.84	-142.98	1.69	137.96	.11	-159.52
1.84615E+01					.49	106.62
1.80000E+01	2.58	157.70	.18	-140.29	1.04	162.65
1.75610E+01					.36	-25.83
1.71429E+01	2.57	83.28	1.14	128.16	.70	-30.03
1.67442E+01					.50	-141.69
1.63636E+01	1.50	-127.52	.96	165.82	.52	-164.36
1.60000E+01					.49	17.10
1.56522E+01	1.25	43.74	.98	-36.23	.60	113.26
1.53191E+01					.70	-49.41
1.50000E+01	2.16	40.29	.95	-123.87	.99	-142.74
1.46939E+01					.59	-116.93
1.44000E+01	.84	-80.04	.87	142.77	.71	26.57
1.41176E+01					.50	-158.68
1.38462E+01	3.84	-135.80	.99	54.20	1.53	29.22
1.35849E+01					.60	5.19
1.33333E+01	.58	162.03	.53	-109.24	1.16	-129.59
1.30909E+01					2.03	-119.51
1.28571E+01	4.06	-167.21	1.71	-22.55	.78	-155.34
1.26316E+01					2.63	86.55
1.24138E+01	3.24	-29.56	2.89	88.12	.80	-6.70
1.22034E+01					1.67	-48.43
1.20000E+01	1.09	21.68	1.07	-11.35	1.90	-128.04
1.18033E+01					1.80	16.30
1.16129E+01	2.00	-78.75	1.67	59.70	.69	-81.71
1.14286E+01					1.27	159.54
1.12500E+01	2.64	70.93	2.13	-151.64	1.57	-177.57
1.10769E+01					.62	66.28
1.09091E+01	1.57	108.62	1.58	-55.86	.34	-159.01
1.07463E+01					.13	-102.55
1.05882E+01	1.77	52.45	.89	-107.12	.65	-77.15
1.04348E+01					.25	132.94
1.02857E+01	1.46	-165.55	.72	-59.47	1.03	-154.79
1.01408E+01					.28	-85.49
1.00000E+01	.88	4.09	1.36	-42.16	.66	31.06
9.86301E+00					1.02	152.61
9.72973E+00	1.84	-128.71	1.15	74.21	.54	-6.41
9.60000E+00					.68	-98.07
9.47368E+00	.75	-14.54	1.01	153.41	1.00	80.55
9.35065E+00					.46	29.07
9.23077E+00	1.65	4.32	.34	87.00	1.01	-123.48
9.11392E+00					.34	30.04
9.00000E+00	.51	169.06	1.60	-162.91	.68	-15.42
8.88889E+00					1.03	-152.91
8.78049E+00	2.45	63.91	1.03	177.64	1.15	-174.83
8.67470E+00					1.00	93.59
8.57143E+00	.79	67.16	.50	-103.05	.38	-136.42
8.47059E+00					1.91	-100.46
8.37209E+00	2.91	-65.10	1.28	53.05	2.85	122.33
8.27586E+00					1.03	130.12
8.18182E+00	.81	-162.41	.36	105.33	2.76	-20.85
8.08989E+00					.98	14.25
8.00000E+00	2.50	-91.44	1.39	-114.93	.42	-162.04

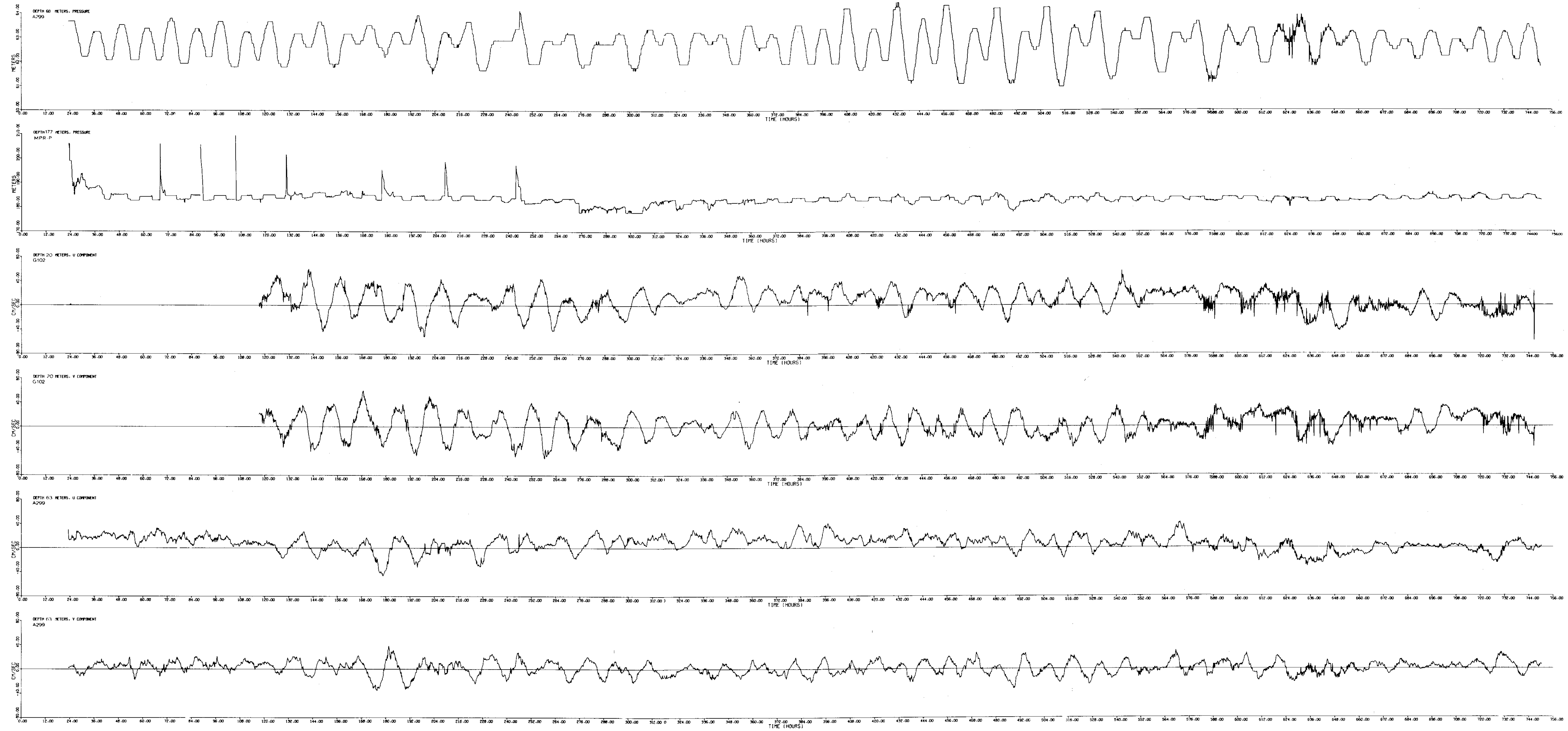


Plate 7a. Time Series for mooring BO.

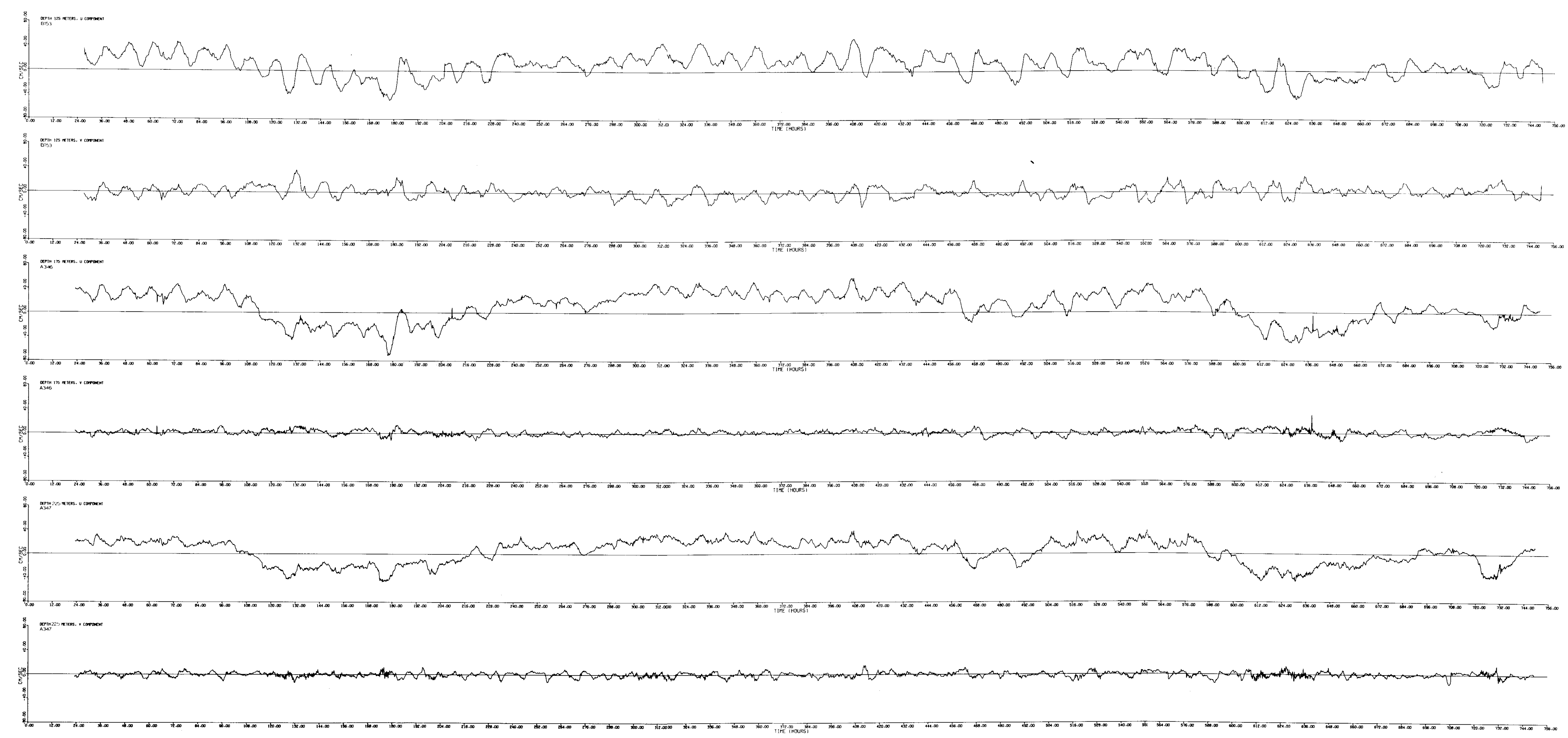


Plate 7a. (continued)

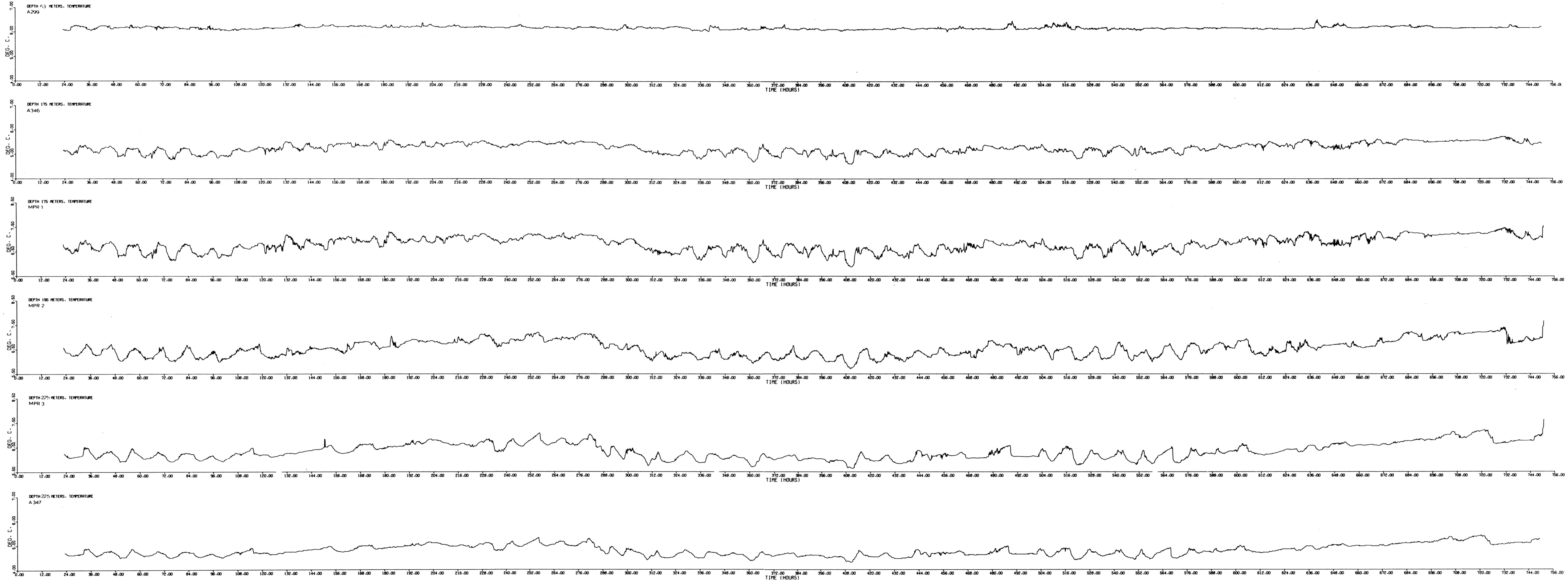


Plate 7a. (continued)

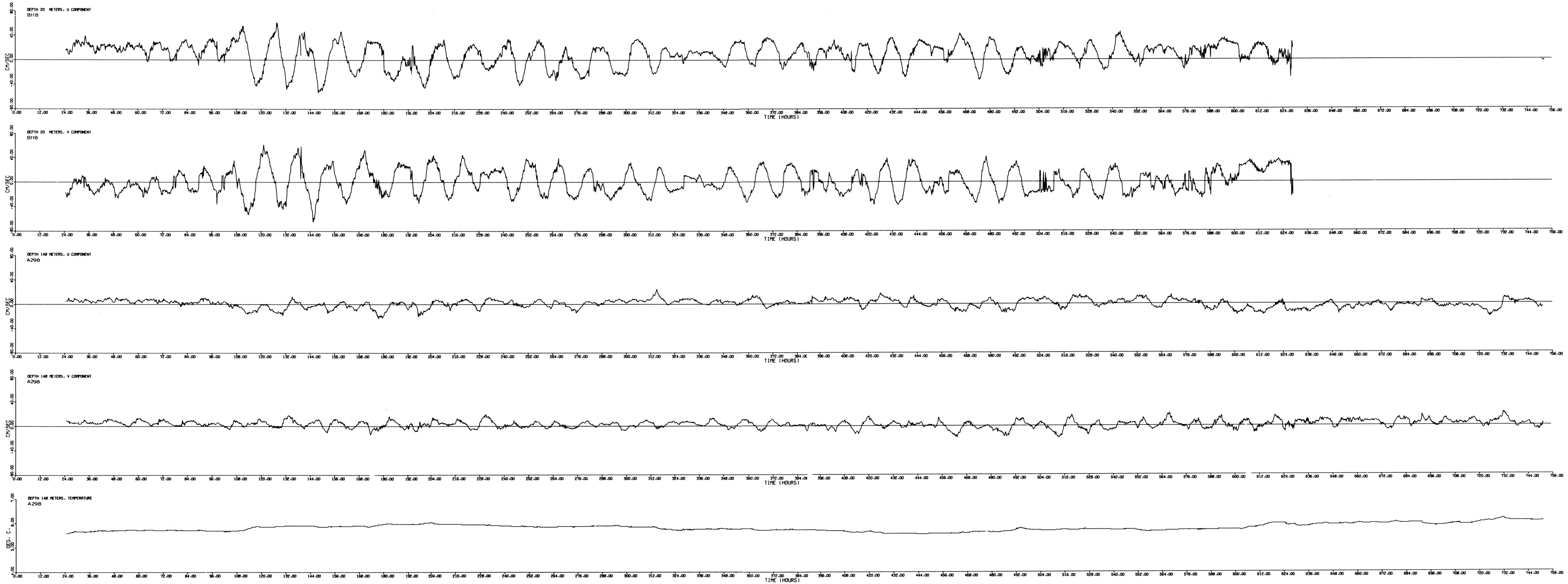


Plate 7b. Time Series
for mooring Bl.

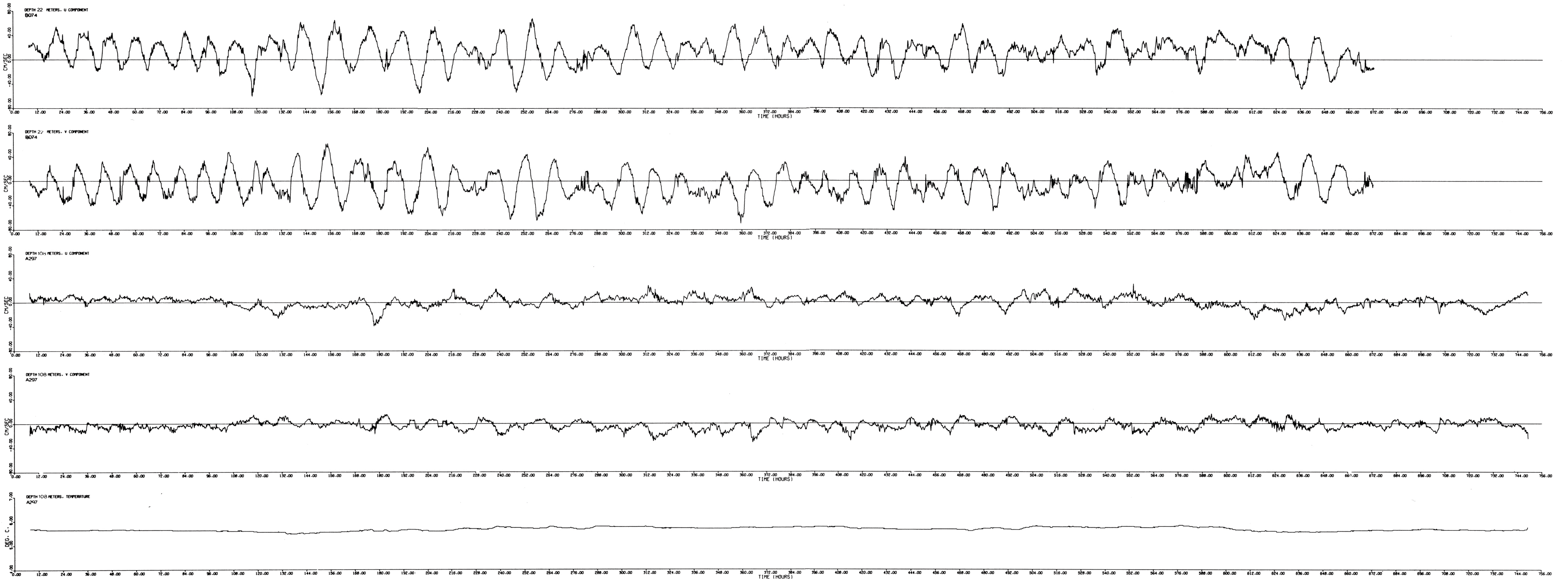


Plate 7c. Time Series
for mooring B2.

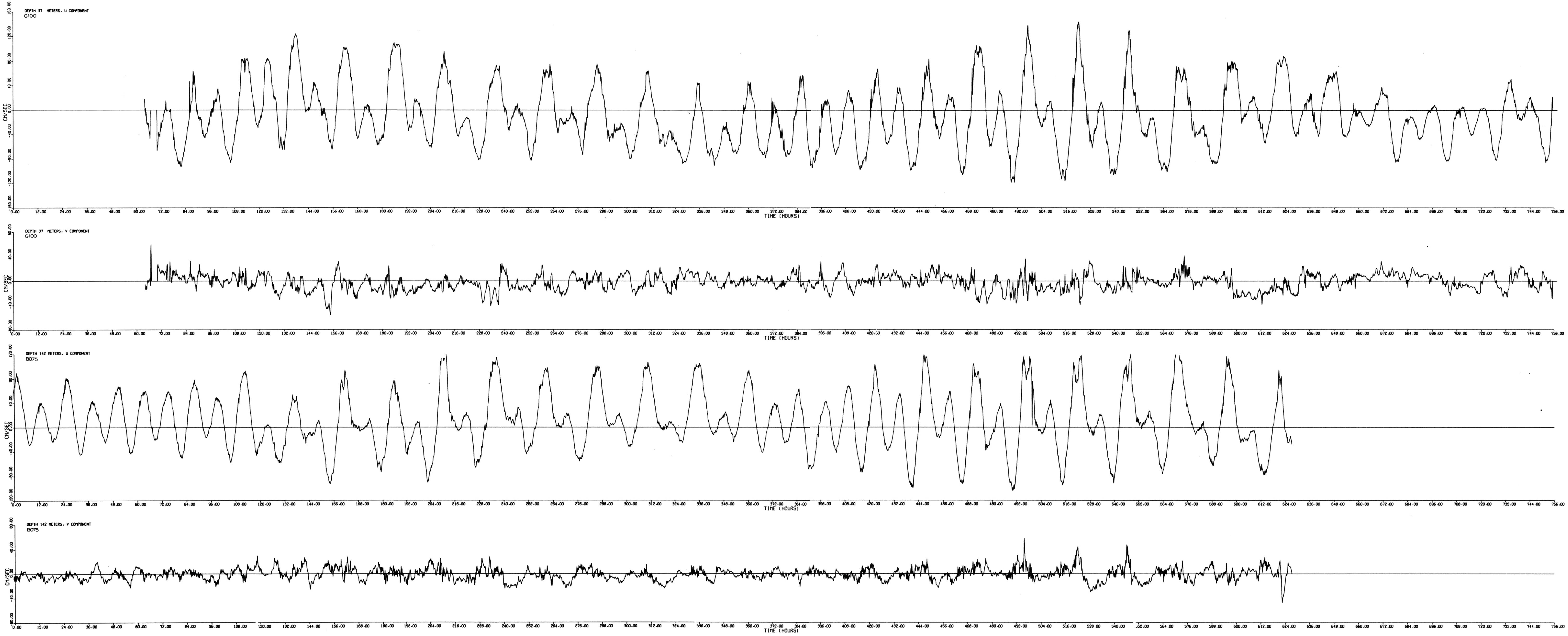


Plate 7d. Time Series for mooring A.

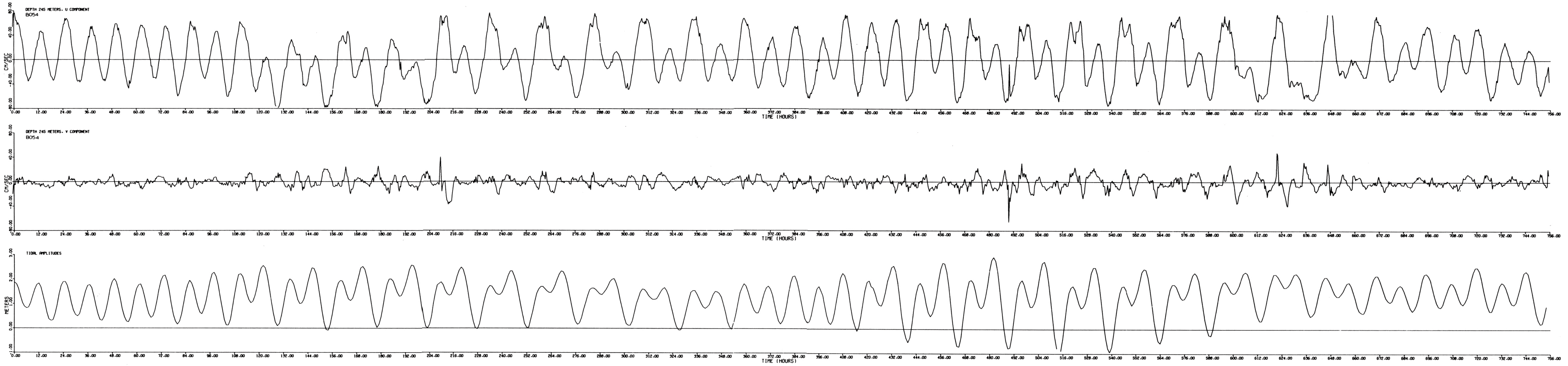


Plate 7d. (continued)

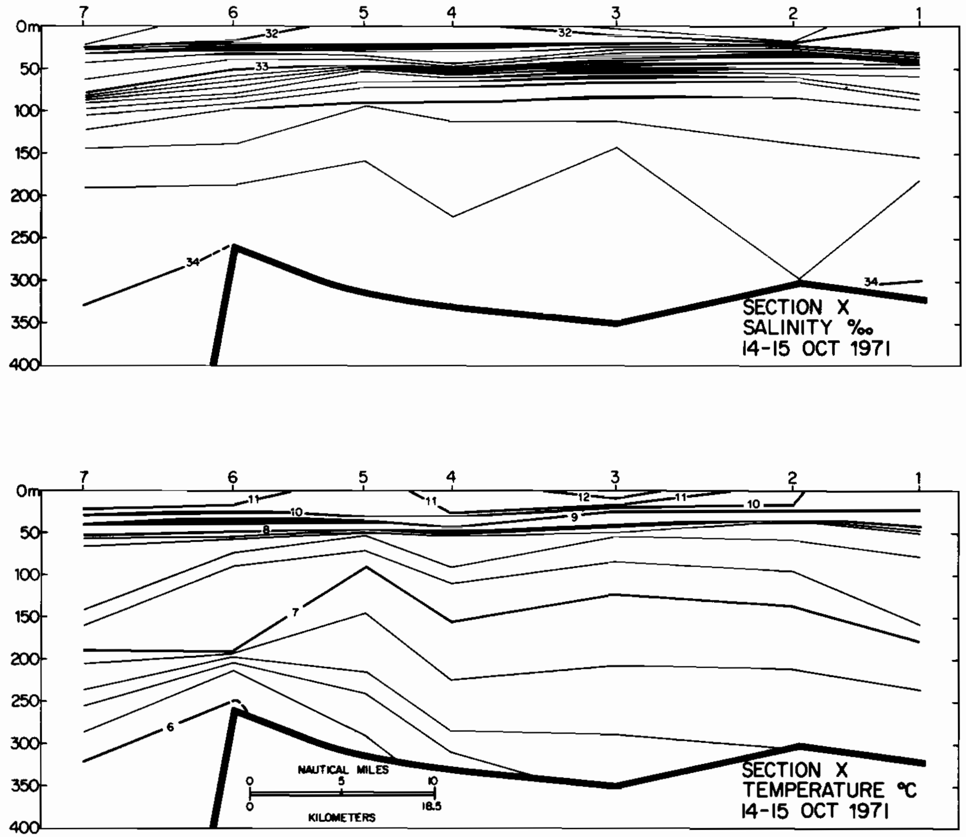
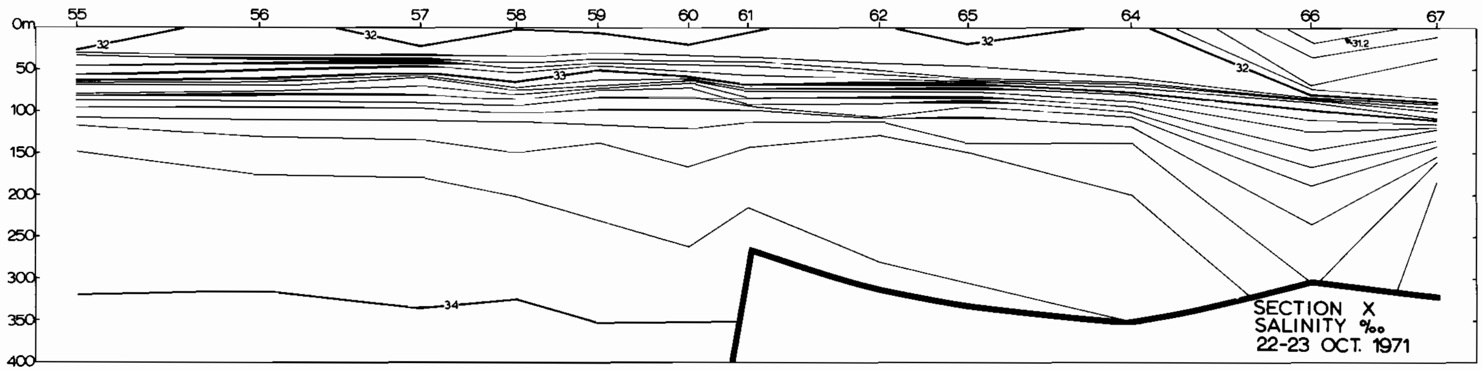


Plate 8. Temperature-Salinity Sections along the canyon. Mooring B_0 was at the left-hand end of the shoal section; mooring A was just to the right of the last station on the right. Sections for 22-23 October and 18-19 November are from Ryan _et_. _al_. (1972).



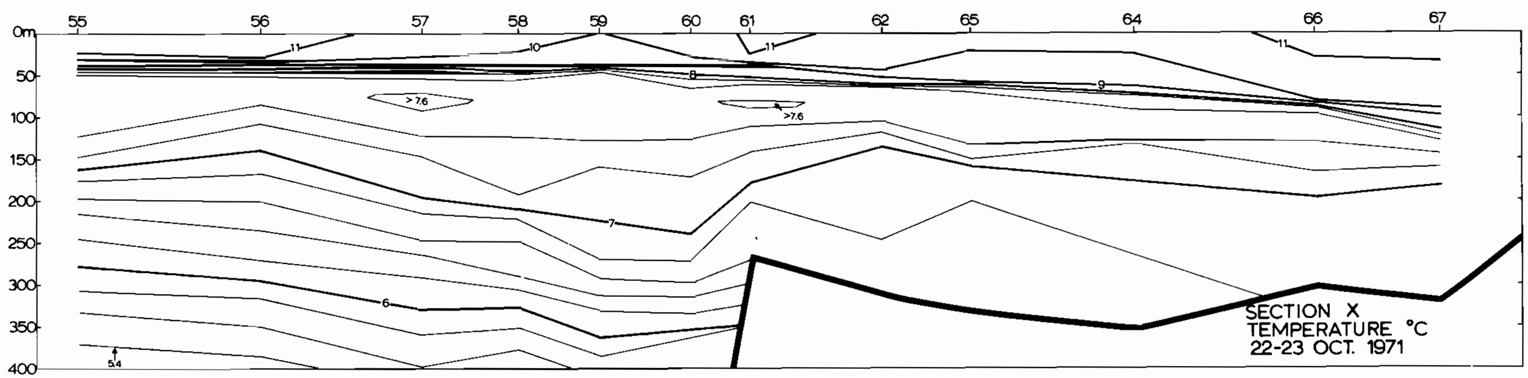
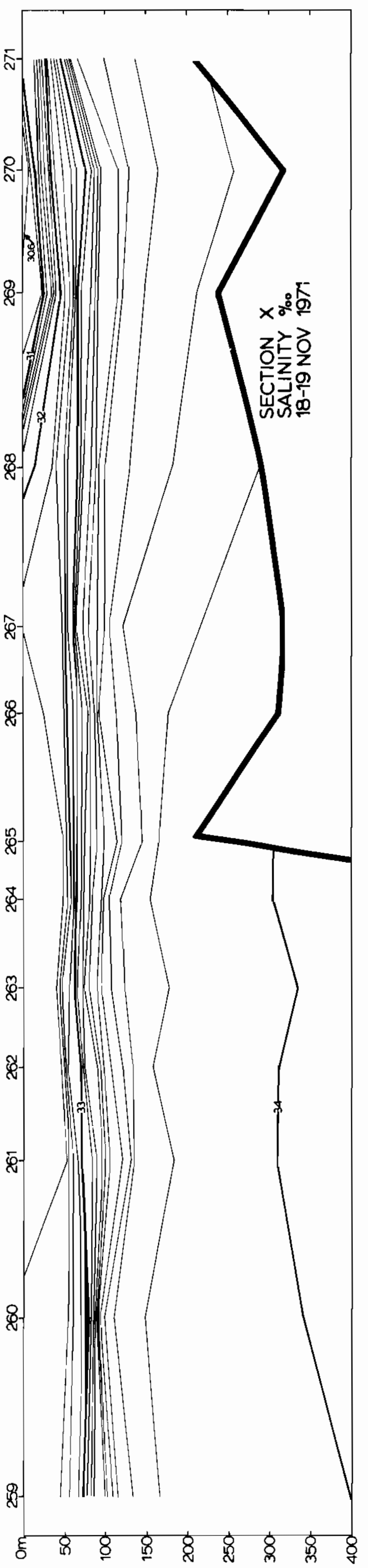


Plate 8. (Continued)



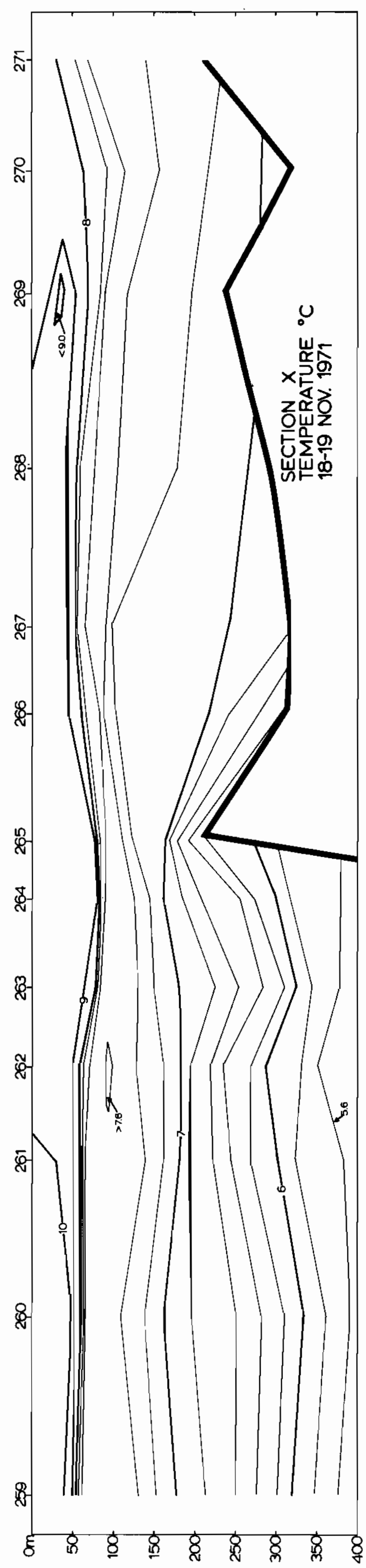


Plate 8. (Continued)