PRELIMINARY DATA SUMMARY

November 1986

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
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This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

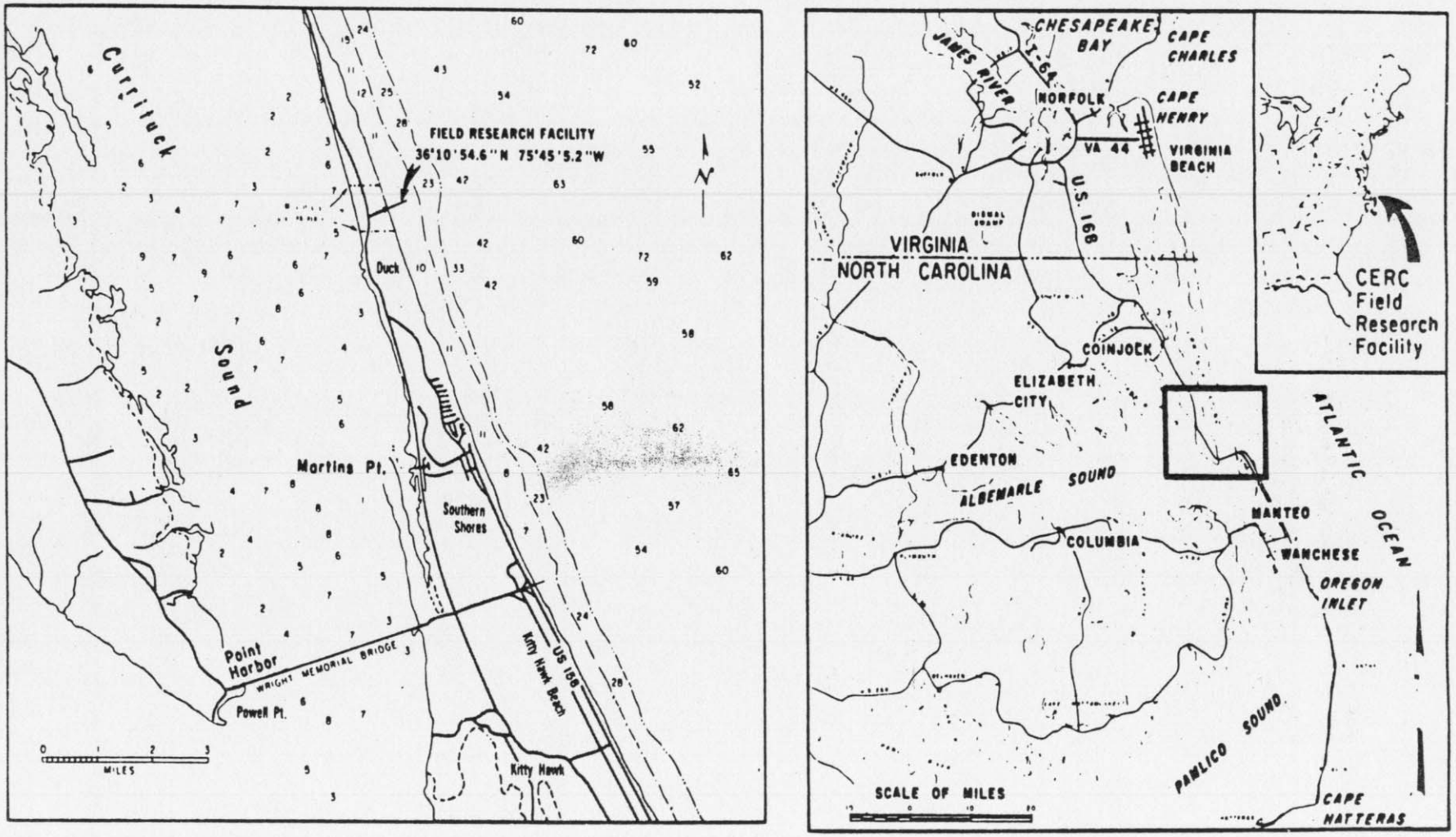


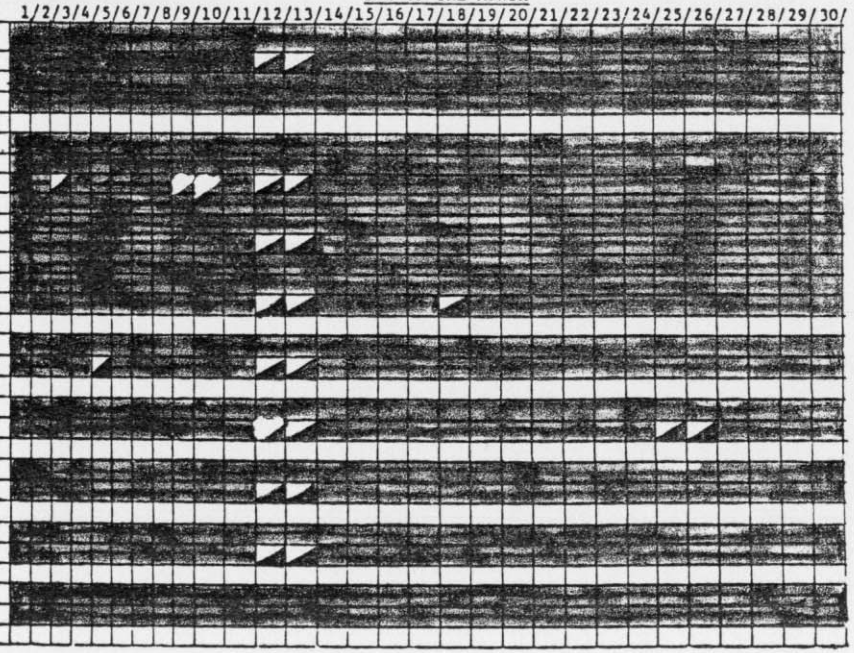
Figure 1. FRF Location Map

TABLE 1
INSTRUMENT STATUS/DATA AVAILABILITY

November 1986

DAY OF THE MONTH

GAGE NUMBER	DESCRIPTION/REMARKS	DEPTH AT SENSOR	
	Barometric Pressure		Instrument Status
			Data Collected
			Analog Record
	Precipitation		Instrument Status
			Data Collected
			Analog Record
	Air Temperature		Instrument Status
			Data Collected
			Maximum/Minimum
	Anemometer on Lab Bldg - Elevation 19m (MSL)		Instrument Status
			Data Collected
			Analog Record
645	Baylor staff located at station 7+80 on FRF pier	See profile data	Instrument Status
			Data Collected
625	Baylor staff located at station 19+00 on FRF pier	See profile data	Instrument Status
			Data Collected
640	Waverider buoy located 1.0 km from shore	Approx. 8.5 m. MSL	Instrument Status
			Data Collected
630	Waverider buoy located 6.0km from shore	Approx. 18 m. MSL	Instrument Status
			Data Collected
679	Current meter 500M south (0.5km offshore)	Approx. 6 m MSL	Instrument Status
			Data Collected
865-1370	NOAA primary tide station located at seaward end of FRF pier.		Instrument Status
			Data Collected



Instrument Status: Operational ■ - Daily Observation: YES ■

Data Collected: ALL ■ , SOME ◪

Analog Record: ALL ■ , PARTIAL ◪

Preliminary Analysis: ALL ■ , SOME ◪

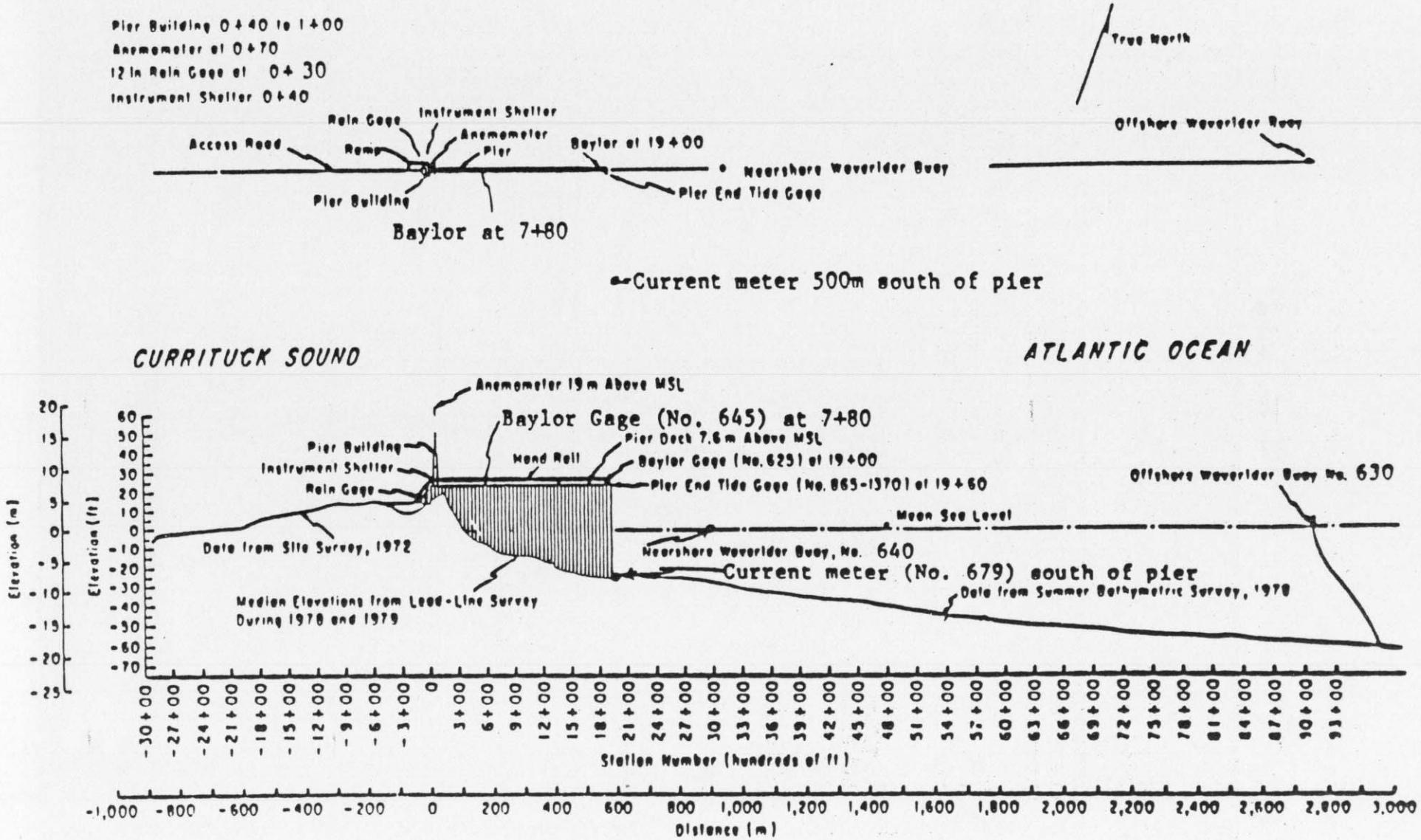


Figure 2. Instrument locations at FRF.

II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Data General NOVA-4 computer. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
   mm x .03937 = in

2. Millibars (mb) to inches of mercury (in Hg) -
   mb x 0.02953 = in Hg

3. Degrees Celcius (C) to degrees Fahrenheit (F) -
   (C x 9/5) + 32 = F

4. Meters per second (m/s) to knots (kn) -
   m/s x 1.943 = kn

TABLE 2: METEOROLOGICAL DATA

PART 1

NOVEMBER 1986

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
1	100	13	65	14.8	1033.8	0
	700	5	65	15.5	1033.1	0
	1300	4	68	17.8	1030.8	0
	1900	5	74	15.2	1029.6	0
2	100	2	85	14.3	1026.6	0
	700	3	90	14.5	1024.5	0
	1300	2	128	18.9	1021.0	0
	1900	9	16	14.2	1020.9	0
3	100	11	29	13.3	1020.5	0
	700	13	20	10.5	1022.6	0
	1300	0		*	*	0
	1900	5	39	10.5	1021.6	0
4	100	2	44	10.3	1020.3	0
	700	0		8.5	1020.8	0
	1300	3	83	14.5	1018.8	0
	1900	5	114	11.9	1020.2	0
5	100	7	74	11.3	1019.8	0
	700	8	82	11.5	1019.2	0
	1300	4	84	11.9	1017.1	0
	1900	2	241	11.8	1016.4	5
6	100	3	204	12.3	1014.5	0
	700	5	252	12.1	1016.9	0
	1300	5	22	10.3	1019.8	0
	1900	7	31	9.4	1024.0	0
7	100	8	60	9.1	1026.6	0
	700	8	54	9.9	1029.0	0
	1300	5	54	10.9	1028.2	0
	1900	6	93	11.0	1028.3	0
8	100	5	153	12.0	1027.1	0
	700	3	205	12.5	1027.0	0
	1300	4	262	14.6	1025.7	0
	1900	2	161	13.1	1025.3	0
9	100	4	197	15.8	1023.6	0
	700	5	212	17.1	1022.2	0
	1300	7	215		1019.2	0
	1900	5	210		1019.2	0
10	100	9	31	*	1024.6	0
	700	11	24		1028.3	0
	1300	9	23		1029.7	0
	1900	8	53	13.8	1030.0	0
11	100	9	82	15.3	1026.4	0
	700	4	150	17.6	1023.3	0
	1300	5	223	20.4	1019.1	8
	1900	6	337	13.4	1022.4	0
12	100	8	21	13.9	1023.9	5
	700	9	23	13.2	1024.9	0
	1300	8	23	13.3	1023.6	5
	1900					0
13	100		A/D Inoperative			0
	700					0
	1300	10	340	10.0	1024.6	0
	1900	10	334	5.3	1030.7	0
14	100	12	20	4.1	1034.1	0
	700	9	26	5.4	1035.8	0
	1300	3	34	6.9	1035.8	0
	1900	6	51	7.6	1033.1	0
15	100	6	79	11.3	1028.3	0
	700	7	17	13.3	1025.3	0
	1300	8	26	12.3	1021.6	0
	1900	6	33	14.1	1017.2	0
16	100	7	329	10.4	1014.4	5
	700	5	306	8.3	1016.1	0
	1300	4	249	11.2	1014.8	0
	1900	3	297	11.2	1015.8	0

*=Electronic problems

TABLE 2: METEOROLOGICAL DATA

PART 2

NOVEMBER 1986

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
17	100	4	228	10.5	1016.1	0
	700	2	213	8.5	1015.8	0
	1300	3	199	12.3	1013.4	0
	1900	4	334	12.1	1012.8	0
18	100	4	342	12.8	1013.4	0
	700	4	12	13.1	1014.4	0
	1300	2	9	15.4	1012.8	0
	1900	5	165	14.3	1008.4	0
19	100	7	256	14.7	1006.6	0
	700	10	336	9.4	1016.3	0
	1300	13	2	9.6	1021.1	0
	1900	7	23	9.0	1024.9	0
20	100	8	49	9.9	1024.3	0
	700	10	81	12.9	1021.7	0
	1300	7	147	16.0	1013.6	0
	1900	7	171	16.9	1007.6	0
21	100	8	274	11.2	1005.2	8
	700	7	279	7.8	1011.2	0
	1300	8	310	12.8	1013.4	0
	1900	6	289	10.1	1017.1	0
22	100	6	336	6.9	1019.4	0
	700	7	10	8.4	1022.5	0
	1300	5	15	10.0	1024.0	0
	1900	3	73	9.2	1024.7	0
23	100	5	81	10.0	1025.5	0
	700	4	95	11.9	1025.8	0
	1300	2	71	15.2	1024.4	0
	1900	2	84	14.5	1024.1	0
24	100	4	188	16.8	1023.0	0
	700	4	198	16.9	1022.0	0
	1300	4	248	18.2	1020.8	0
	1900	5	210	17.6	1019.8	4
25	100	10	15	13.9	1022.3	0
	700	10	31	11.7	1025.5	0
	1300	7	52	12.1	1026.7	0
	1900	7	50	13.3	1025.9	0
26	100	8	83	14.5	1023.0	0
	700	4	154	17.0	1019.9	6
	1300	7	186	21.7	1016.5	0
	1900	7	187	19.6	1014.2	0
27	100	7	214	19.4	1013.4	0
	700	4	326	16.1	1015.7	0
	1300	9	28	14.8	1018.2	0
	1900	9	35	12.7	1020.9	0
28	100	8	41	13.3	1021.5	0
	700	8	43	13.0	1022.0	0
	1300	8	39	13.6	1021.4	0
	1900	8	19	13.0	1022.2	0
29	100	7	15	12.9	1019.4	0
	700	5	341	11.1	1019.6	0
	1300	4	13	14.5	1018.8	0
	1900	9	10	13.5	1020.4	0
30	100	10	37	13.1	1021.3	0
	700	12	42	12.2	1022.3	0
	1300	7	307	9.4	1008.9	0
	1900	9	314	6.8	1013.8	0

III. WAVE DATA

Wave data were collected from two Baylor staff gages (CERC gage Nos. 625 and 645) and Waverider buoys (CERC gage Nos. 630 and 640, Table 1 and Figure 2). The data were collected, analyzed, and stored on magnetic tape using a Data General NOVA-4 computer.

The NOVA-4 is programmed to sample the wave gages every 6 hours near 0100, 0700, 1300, and 1900 EST at a sampling rate of four times per second, collecting data in 20- minute records.

Wave height (Hmo) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. The wave period is identified from the computation of a variance (energy) spectrum using a Fast Fourier Transform of 4096 data points (1024 sec). The period (Tp) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape and entered into the CERC data base.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means shown in Table 3 are an average of the values computed for all data records collected. The monthly standard deviations are standard deviations from the monthly mean of values for each record.

Figure 3 is a time history of the Hmo and Tp values for the Waveriders, 6 km from shore (630) and 1 km from shore (640).

Differences in wave periods between wave gages (Table 4 and Figure 3) may be due to wave breaking or reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA PART 1

NOVEMBER 1986

GAGE		645		625		640		630	
		Baylor at 7+80		Baylor at 19+00		Nearshr Wvrdr		Farshr Wvrdr	
DAY	TIME	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)
1	1	1.33	6.40	1.80	6.40	2.01	5.99	1.95	6.40
	7	1.06	6.40	1.39	6.40	1.53	6.87	1.77	7.42
	13	1.00	6.87	1.34	7.42	1.48	7.42	1.55	8.06
	19	.85	6.40	1.32	7.42	1.39	7.42	1.55	8.06
2	1	.75	8.06	.98	7.42	1.06	6.87	1.28	7.42
	7	.61	5.63	.93	5.63	.99	7.42	1.26	6.87
	13	.48	8.06	.73	8.06	.79	8.06	1.04	8.06
	19	.65	2.78	.91	8.06	.88	6.40	1.11	7.42
3	1	1.01	4.32	1.07	5.02	1.19	4.32	1.33	4.32
	7	1.75	6.87	1.85	6.40	1.91	6.87	2.35	6.87
	13	1.12	6.40	1.31	6.87	1.34	6.87	1.49	6.40
	19	.95	6.40	1.16	7.42	1.09	6.40	1.38	6.87
4	1	.75	6.40	.94	8.06	.93	6.40	1.13	6.87
	7	.61	7.42	1.01	8.06	.97	8.06	1.02	7.42
	13	.43	10.89	.79	10.89	.82	8.83	.94	7.42
	19	.52	12.34	.84	5.99	.90	10.89	.93	7.42
5	1	.53	3.26	.88	14.22	.89	7.42	.93	6.87
	7	.75	4.53	*		1.15	4.76	1.19	4.53
	13	.82	5.02	1.15	14.22	1.25	5.63	1.43	5.31
	19	.93	5.31	1.14	12.34	1.14	12.34	1.26	5.63
6	1	.73	6.40	1.00	6.87	1.01	6.87	1.12	6.40
	7	.63	7.42	1.03	6.87	.98	7.42	1.07	7.42
	13	.75	7.42	1.05	8.83	1.04	8.06	1.14	7.42
	19	.85	7.42	1.08	8.83	1.10	7.42	1.27	8.06
7	1	.85	3.95	1.07	10.89	1.09	10.89	1.08	9.75
	7	.77	4.32	1.01	4.13	.97	7.42	1.10	8.83
	13	.71	4.53	.94	4.53	.93	4.53	1.07	4.53
	19	.72	4.32	.89	4.53	.90	4.32	.97	3.95
8	1	.52	5.63	.76	8.83	.76	7.42	.90	8.06
	7	.45	4.13	.83	9.75	.84	9.75	1.00	9.75
	13	.41	10.89	.76	9.75	.77	8.83	.81	8.06
	19	.35	10.89	.58	10.89	.68	8.83	.76	8.83
9	1	.42	8.06	.63	10.89	.70	9.75	.83	8.06
	7	.32	8.06	.56	9.75	.57	8.06	.74	8.06
	13	.38	10.89	.57	7.42	.63	8.06	.84	5.63
	19	.36	6.87	.48	8.83	.52	9.75	.72	6.87
10	1	.96	4.53	.95	4.53	1.08	3.51	1.13	5.02
	7	1.25	5.63	1.34	5.63	1.38	5.02	1.52	5.99
	13	1.28	6.40	1.23	6.40	1.38	5.63	1.46	5.99
	19	.92	5.31	1.05	6.40	1.04	6.40	1.18	6.40
11	1	.99	5.31	1.18	5.31	1.20	5.63	1.36	5.63
	7	.63	4.32	.88	4.76	.89	4.76	.95	5.63
	13	.64	5.31	.78	8.06	.84	6.87	1.07	6.87
	19	.74	6.87	.99	6.87	1.02	6.87	1.22	6.40
12	1	.83	3.26	.91	5.02	.93	8.83	1.03	6.40
	7	1.13	4.76	1.13	4.13	*		1.34	5.02
	13	1.06	4.76	1.15	5.99			1.34	5.99
	19								
13	1			A/D Inoperative					
	7								
	13	1.26	5.69	1.43	5.56	1.43	5.56	1.52	5.95
	19	1.73	6.74	1.79	6.56	1.94	6.57	1.95	6.56
14	1	1.40	6.92	2.01	6.74	1.89	6.92	2.24	7.11
	7	1.49	6.92	1.51	7.11	1.57	7.53	1.67	7.53
	13	1.13	5.56	1.21	8.26	1.21	8.26	1.40	7.11
	19	.88	6.92	.88	6.57	.95	7.11	1.07	7.11
15	1	.72	6.92	.94	6.57	.97	8.53	1.04	7.53
	7	.63	5.12	.86	9.14	.92	9.14	.97	9.14
	13	1.07	4.49	1.09	9.14	1.19	4.41	1.24	4.66
	19	.88	4.83	1.13	5.02	1.16	4.83	1.21	4.83
16	1	1.07	4.49	1.20	4.57	1.27	4.74	1.56	4.66
	7	1.04	5.45	1.04	5.69	1.12	5.45	1.34	5.95
	13	.86	5.02	.80	5.82	1.02	5.82	1.08	5.82
	19	.52	5.02	.70	5.69	.75	5.82	.83	5.95

*=Electronic Problems

TABLE 3: WAVE DATA PART 2

NOVEMBER 1986

GAGE		645		625		640		630	
		Baylor at 7+80		Baylor at 19+00		Nearshr Wvrdr		Farshr Wvrdr	
DAY	TIME	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)
17	1	.49	4.41	.60	8.83	.65	8.53	.74	9.14
	7	.36	9.14	.58	8.83	.64	8.83	.70	9.14
	13	.34	8.83	.50	6.09	.53	9.48	.59	8.83
	19	.38	8.83	.57	8.00	.61	8.00	.67	9.14
18	1	*		.56	8.00	.63	8.83	.66	7.76
	7	.51	16.00	.70	9.48	.74	9.48	.76	9.48
	13	.46	16.00	.70	8.53	.72	8.26	.79	7.76
	19	.54	16.79	.77	8.06	.72	8.83	.86	8.06
19	1	.36	10.89	.61	9.75	.66	8.83	.78	8.83
	7	1.51	5.31	1.50	6.40	1.58	5.99	1.84	5.99
	13	1.47	6.87	1.56	7.42	1.77	5.63	1.99	6.87
	19	1.31	8.83	1.37	9.75	1.41	5.99	1.65	9.75
20	1	1.17	10.89	1.37	10.89	1.43	10.89	1.58	10.89
	7	1.18	10.89	1.49	10.89	1.45	12.34	1.57	10.89
	13	1.12	12.34	1.44	10.89	1.44	10.89	1.54	10.89
	19	1.13	14.22	1.81	14.22	1.88	12.34	2.07	14.22
21	1	1.23	14.22	1.64	12.34	1.74	10.89	1.99	7.42
	7	.88	14.22	1.21	12.34	1.32	14.22	1.34	9.75
	13	.81	14.22	1.03	14.22	.99	8.83	1.12	12.34
	19	.85	6.40	1.00	10.89	1.05	12.34	1.29	5.99
22	1	1.06	5.63	1.28	5.63	1.23	5.63	1.38	5.99
	7	1.08	6.40	1.37	6.87	1.46	6.40	1.50	6.87
	13	1.10	6.40	1.13	5.99	1.22	5.99	1.38	5.99
	19	.82	6.40	.92	6.87	.94	5.99	1.07	7.42
23	1	.69	6.40	.75	6.87	.84	6.87	.92	6.87
	7	.58	10.89	.74	12.34	.76	12.34	.81	10.89
	13	.52	12.34	.69	10.89	.73	10.89	.75	10.89
	19	.48	9.75	.72	10.89	.67	10.89	.78	10.89
24	1	.48	9.75	.71	10.89	.71	9.75	.79	9.75
	7	.51	5.31	.76	9.75	.81	9.75	1.04	5.31
	13	.52	9.75	.68	10.89	.72	10.89	.90	9.75
	19	.41	5.99	.60	9.75	.63	9.75	.79	9.75
25	1	.60	3.05	.76	9.75	.72	2.95	.84	8.83
	7	.92	5.31	1.15	3.79	1.09	5.02	1.30	5.31
	13	1.04	5.63	1.09	5.99	1.10	5.99	1.20	5.99
	19	.83	5.31	.88	9.75			.97	5.31
26	1	.94	4.76	1.11	4.53	*		1.12	4.53
	7	.65	5.02	.84	5.31			1.05	4.76
	13	.87	5.63	.96	5.99	1.03	5.63	1.29	5.99
	19	.77	6.87	1.03	6.87	.99	6.87	1.45	6.87
27	1	.73	5.99	.78	6.87	.83	7.42	1.13	6.40
	7	.44	9.75	.60	10.89	.65	7.42	.79	8.83
	13	.82	3.79	1.02	3.79	1.02	4.13	1.13	3.95
	19	.91	5.63	1.22	5.63	1.24	5.99	1.35	5.02
28	1	1.00	4.76	1.13	5.99	1.06	5.99	1.26	5.63
	7	.91	5.31	1.04	4.53	1.08	5.99	1.16	7.42
	13	.75	5.63	1.01	5.02	1.01	4.76	1.18	5.63
	19	.71	4.13	.91	5.31	.90	9.75	1.03	4.13
29	1	.68	4.32	.90	9.75	.86	6.40	1.06	4.76
	7	.55	5.31	.72	4.32	.73	5.02	.87	5.02
	13	.54	3.51	.70	7.42	.71	8.83	.78	6.87
	19	.64	3.15	.75	8.83	.77	8.83	.88	6.87
30	1	.74	4.76	1.05	4.53	1.04	4.13	1.07	4.32
	7	1.23	5.31	1.52	5.31	1.56	5.63	1.78	5.63
	13	.85	6.40	1.50	6.40	1.53	6.87	1.72	6.40
	19	1.17	6.40	1.59	6.40	1.59	5.99	1.91	6.87
	MEAN	.82	6.96	1.02	7.76	1.06	7.51	1.20	7.14
	STD	.31	2.98	.32	2.50	.34	2.22	.36	1.90

*=Electronic Problems

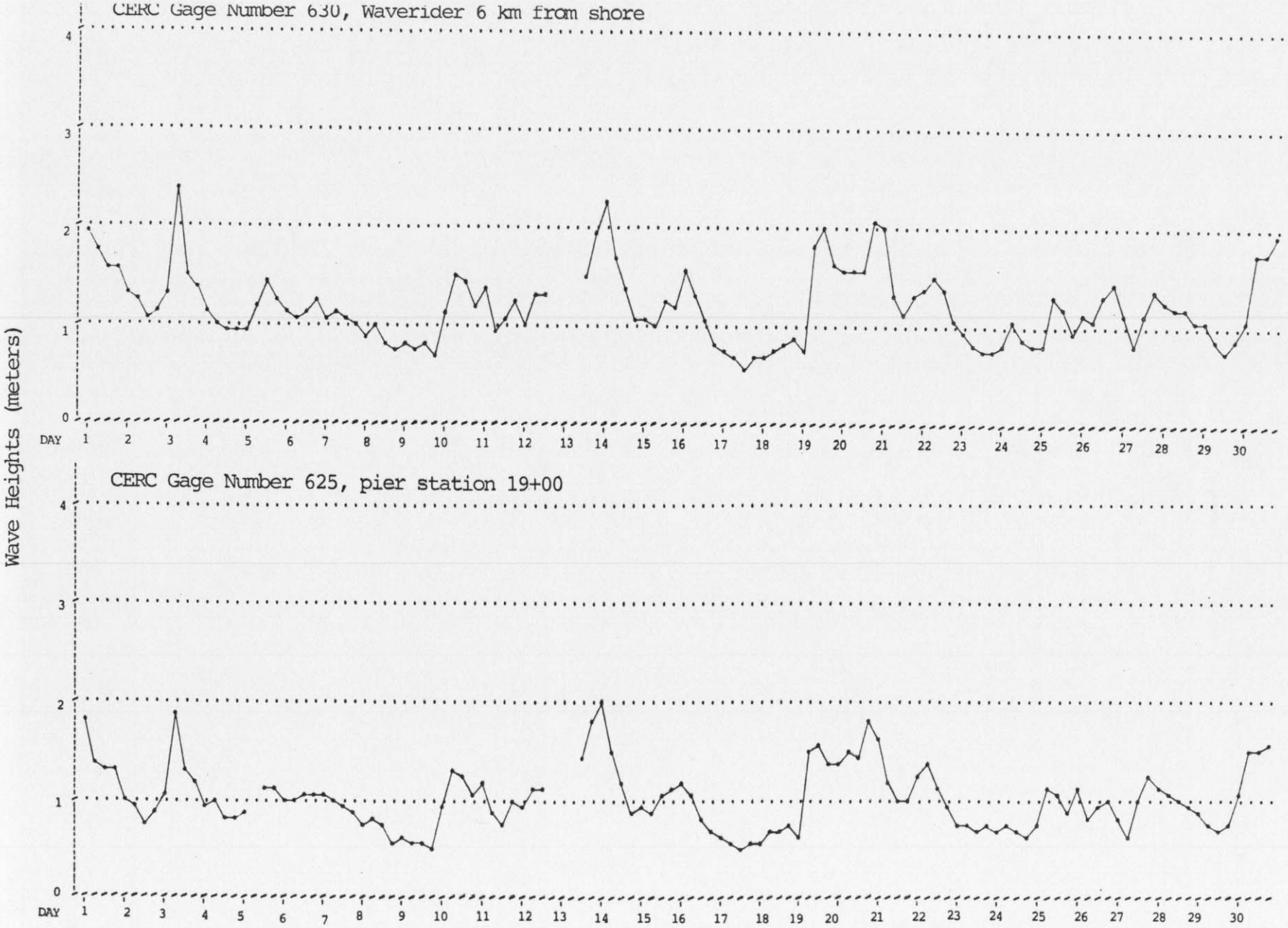


FIGURE 3. Time History of Wave Heights and Periods - November 1986 Part I:Heights

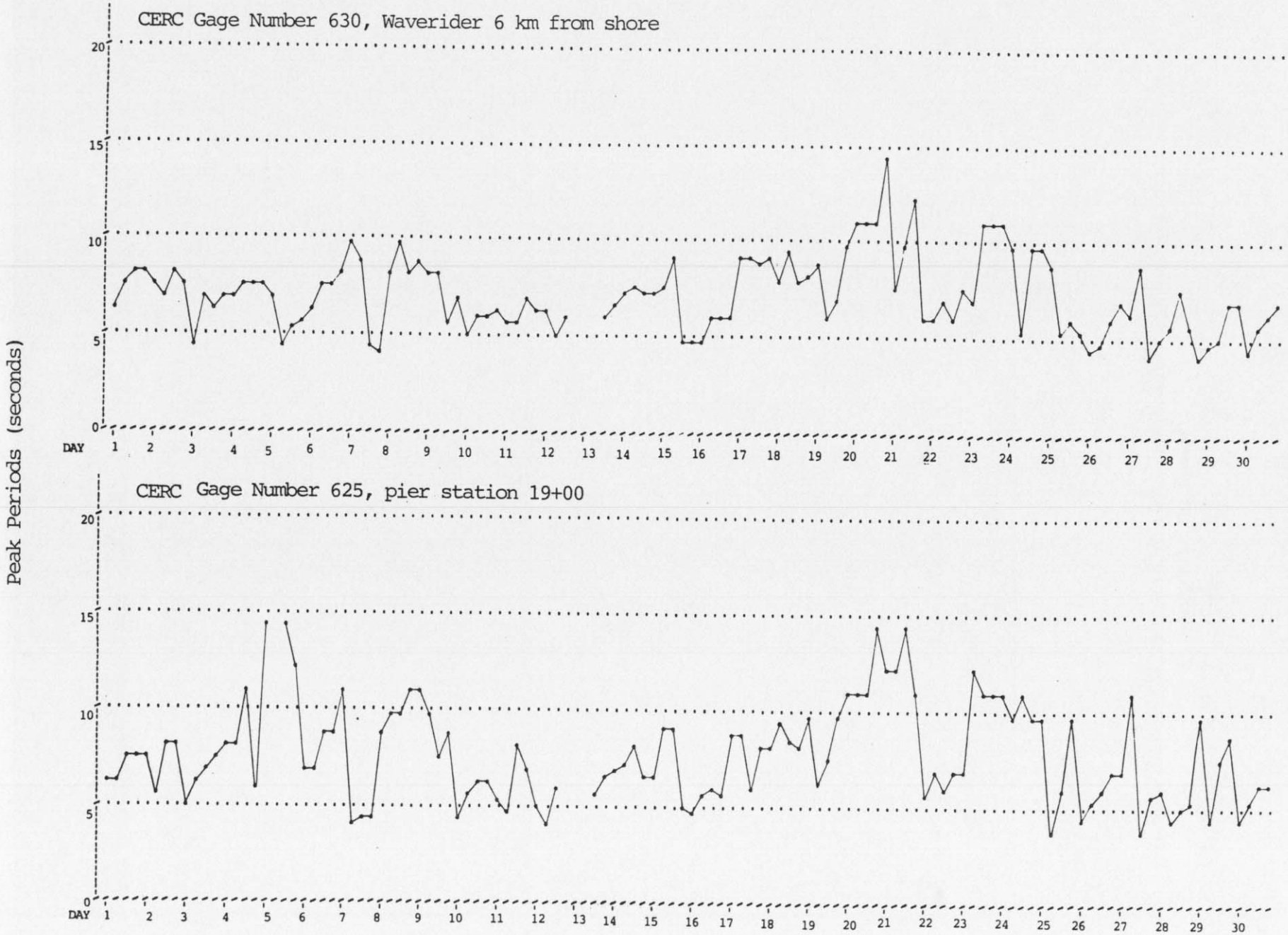


FIGURE 3. Time History of Wave Heights and Periods - November 1986 Part II: Periods

IV. CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: CURRENT DATA
(SPEEDS IN CM/SEC)

November 1986

		PIER MEASUREMENTS					BEACH MEASUREMENTS (500' UPDRIFT)					
		DYE AT 19400 (579m) (SURFACE)		DYE AT MID-SURF ZONE (SURFACE) DIST. FROM			DYE 12M OFFSHORE (SURFACE)			CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679		
DAY	TIME	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
1	0100-Alongshore									15	S
	Cross-shore									5	OF
	Resultant									18	143
1	0700-Alongshore	22	S		36	N		30	N	19	S
	Cross-shore	7	On	152	36	Off	North			3	OF
	Resultant	23	177		51	25				19	150
1	1300-Alongshore									8	S
	Cross-shore									4	OF
	Resultant									9	133
1	1900-Alongshore									20	S
	Cross-shore									14	OF
	Resultant									24	125
2	0100-Alongshore									23	S
	Cross-shore									14	OF
	Resultant									26	129
2	0700-Alongshore	12	S		61	N		47	N	1	S
	Cross-shore	9	On	140	0	0	South			1	ON
	Resultant	15	197		61	340				1	205
2	1300-Alongshore									9	S
	Cross-shore									1	OF
	Resultant									9	154
2	1900-Alongshore									3	N
	Cross-shore									8	OF
	Resultant									8	50
3	0100-Alongshore									28	S
	Cross-shore									4	OF
	Resultant									28	152
3	0700-Alongshore	68	S		152	S		102	S	39	S
	Cross-shore	10	On	140	38	On	North			2	OF
	Resultant	68	169		157	174				39	156
3	1300-Alongshore									226	N
	Cross-shore									458	ON
	Resultant									510	276
3	1900-Alongshore									21	S
	Cross-shore									2	OF
	Resultant									21	156
4	0100-Alongshore									20	S
	Cross-shore									2	OF
	Resultant									20	153
4	0700-Alongshore	5	S		27	N		53	N	5	S
	Cross-shore	1	On	140	8	Off	South			3	ON
	Resultant	5	171		28	357				6	189
4	1300-Alongshore									11	S
	Cross-shore									3	OF
	Resultant									12	147
4	1900-Alongshore									1	S
	Cross-shore									2	ON
	Resultant									2	235
5	0100-Alongshore									14	S
	Cross-shore									2	OF
	Resultant									14	151
5	0700-Alongshore	13	N		34	N		40	N	7	N
	Cross-shore	8	On	140	0	0	South			0	
	Resultant	15	309		34	340				7	340
5	1300-Alongshore									19	S
	Cross-shore									3	OF
	Resultant									19	157
5	1900-Alongshore									18	S
	Cross-shore									2	OF
	Resultant									19	153
6	0100-Alongshore									18	S
	Cross-shore									0	
	Resultant									18	160
6	0700-Alongshore	0	0		28	S		18	S	2	S
	Cross-shore	5	Off	152	17	Off	North			3	ON
	Resultant	5	115		32	129				4	210
6	1300-Alongshore									15	S
	Cross-shore									4	OF
	Resultant									15	145
6	1900-Alongshore									24	S
	Cross-shore									5	OF
	Resultant									25	147

KEY = ALL SPEEDS IN CM/SEC
N =NORTHWARD, SHORE PARALLEL
S =SOUTHWARD, SHORE PARALLEL
ON=ONSHORE
OF=OFFSHORE

		PIER MEASUREMENTS					BEACH MEASUREMENTS (500 UPDRIFT)			CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679	
		DYE AT 19+00 (579m) (SURFACE)		DYE AT MID SURF ZONE (SURFACE) DIST. FROM			DYE 12M OFFSHORE (SURFACE)				
DAY	TIME	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
7	0100-Alongshore									21	S
	Cross-shore									5	OF
	Resultant									22	147
7	0700-Alongshore	5	S		25	S		15	N	13	S
	Cross-shore	11	On	167	0	0	North			3	OF
	Resultant	12	224		25	160				13	148
7	1300-Alongshore									10	S
	Cross-shore									6	OF
	Resultant									12	131
7	1900-Alongshore									13	S
	Cross-shore									2	OF
	Resultant									14	151
8	0100-Alongshore									15	S
	Cross-shore									2	OF
	Resultant									15	150
8	0700-Alongshore	16	N		44	N		38	N	11	S
	Cross-shore	12	Off	152	7	Off	South			1	OF
	Resultant	20	17		44	349				11	157
8	1300-Alongshore									10	S
	Cross-shore									2	OF
	Resultant									10	152
8	1900-Alongshore									7	S
	Cross-shore									2	ON
	Resultant									7	174
9	0100-Alongshore									7	S
	Cross-shore									1	ON
	Resultant									7	166
9	0700-Alongshore	28	N		36	N		19	N	6	S
	Cross-shore	12	Off	152	39	Off	South			3	ON
	Resultant	30	40		53	28				6	189
9	1300-Alongshore									5	N
	Cross-shore									5	ON
	Resultant									6	295
9	1900-Alongshore									0	
	Cross-shore									3	ON
	Resultant									3	250
10	0100-Alongshore									22	S
	Cross-shore									6	OF
	Resultant									23	145
10	0700-Alongshore	38	S		102	S		38	S	26	S
	Cross-shore	6	On	164	0	0	North			4	OF
	Resultant	39	169		102	160				26	150
10	1300-Alongshore									22	S
	Cross-shore									4	OF
	Resultant									23	150
10	1900-Alongshore									19	S
	Cross-shore									4	OF
	Resultant									19	147
11	0100-Alongshore									6	S
	Cross-shore									1	OF
	Resultant									7	148
11	0700-Alongshore	41	N		51	N		58	N	6	S
	Cross-shore	0	0	164	0	0	South			4	OF
	Resultant	41	340		51	340				8	124
11	1300-Alongshore									7	N
	Cross-shore									2	ON
	Resultant									7	325
11	1900-Alongshore									14	S
	Cross-shore									2	OF
	Resultant									15	150
12	0100-Alongshore									18	S
	Cross-shore									3	OF
	Resultant									18	152
12	0700-Alongshore	41	S		55	S		94	S	29	S
	Cross-shore	0	0	164	0	0	North			5	OF
	Resultant	41	160		55	160				29	150
12	1300-Alongshore									22	S
	Cross-shore									4	OF
	Resultant									22	149
12	1900-Alongshore										
	Cross-shore										
	Resultant										

KEY = ALL SPEEDS IN CM/SEC
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ON=ONSHORE
OF=OFFSHORE

DAY	TIME	DYE AT 19+00 (579m) (SURFACE) SPEED	DIR	PIER MEASUREMENTS: DYE AT MID-SURF ZONE (SURFACE) DIST. FROM BASELINE(M)	SPEED	DIR	BEACH MEASUREMENTS (500 UPDRIFT): DYE 12M OFFSHORE (SURFACE) LOCATION	SPEED	DIR	CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679 SPEED	DIR
13	0100-Alongshore										
	Cross-shore										
	Resultant										
13	0700-Alongshore	51	S		76	S		62	S		
	Cross-shore	0	0	164	4	On	North				
	Resultant	51	160		76	163					
13	1300-Alongshore									28	S
	Cross-shore									1	OF
	Resultant									28	158
13	1900-Alongshore									37	S
	Cross-shore									2	OF
	Resultant									37	157
14	0100-Alongshore									39	S
	Cross-shore									3	OF
	Resultant									39	156
14	0700-Alongshore	36	S		51	S		64	S	29	S
	Cross-shore	11	On	199	13	On	North			3	OF
	Resultant	37	177		52	174				29	154
14	1300-Alongshore									12	S
	Cross-shore									2	OF
	Resultant									12	151
14	1900-Alongshore									1	N
	Cross-shore									2	OF
	Resultant									2	43
15	0100-Alongshore									4	N
	Cross-shore									2	ON
	Resultant									4	313
15	0700-Alongshore	0	0		32	S		58	S	1	N
	Cross-shore	2	On	164	2	On	North			4	ON
	Resultant	2	163		32	163				4	264
15	1300-Alongshore									18	S
	Cross-shore									1	ON
	Resultant									18	163
15	1900-Alongshore									13	S
	Cross-shore									1	ON
	Resultant									13	164
16	0100-Alongshore									24	S
	Cross-shore									0	
	Resultant									24	160
16	0700-Alongshore	17	S		17	S		41	S	9	S
	Cross-shore	11	Off	152	3	Off	North			2	ON
	Resultant	21	127		17	149				9	173
16	1300-Alongshore									6	S
	Cross-shore									0	
	Resultant									6	160
16	1900-Alongshore									2	N
	Cross-shore									0	
	Resultant									2	340
17	0100-Alongshore									7	S
	Cross-shore									3	OF
	Resultant									8	137
17	0700-Alongshore	10	N		19	N		8	N	0	
	Cross-shore	8	Off	152	7	Off	South			1	ON
	Resultant	13	17		20	359				1	250
17	1300-Alongshore									3	N
	Cross-shore									4	ON
	Resultant									5	287
17	1900-Alongshore									5	N
	Cross-shore									4	ON
	Resultant									6	301
18	0100-Alongshore									4	N
	Cross-shore									1	ON
	Resultant									4	326
18	0700-Alongshore	16	S		0	0		9	N	3	S
	Cross-shore	0	0	152	3	Off	North			1	ON
	Resultant	16	160		3	133				3	178
18	1300-Alongshore									10	S
	Cross-shore									1	OF
	Resultant									10	154
18	1900-Alongshore									13	S
	Cross-shore									1	ON
	Resultant									13	164

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ON=ONSHORE
OF=OFFSHORE

		PIER MEASUREMENTS						BEACH MEASUREMENTS (500 UPDRIFT)				
		DYE AT 19+00 (579m) (SURFACE)			DYE AT MID-SURF ZONE (SURFACE) DIST. FROM				DYE 12M OFFSHORE (SURFACE)		CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679	
DAY	TIME	SPEED	DIR		BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
19	0100-Alongshore										10	S
	Cross-shore										3	ON
	Resultant										10	177
19	0700-Alongshore	102	S			152	S		145	S	26	S
	Cross-shore	0	0		164	0	0	North			4	OF
	Resultant	102	160			152	160				26	152
19	1300-Alongshore										41	S
	Cross-shore										6	OF
	Resultant										42	152
19	1900-Alongshore										27	S
	Cross-shore										3	OF
	Resultant										28	154
20	0100-Alongshore										23	S
	Cross-shore										5	OF
	Resultant										23	148
20	0700-Alongshore	9	N			41	N		23	S	6	S
	Cross-shore	4	On		164	0	0	South			2	OF
	Resultant	10	313			41	340				7	141
20	1300-Alongshore										5	N
	Cross-shore										4	ON
	Resultant										6	302
20	1900-Alongshore										3	N
	Cross-shore										2	ON
	Resultant										4	305
21	0100-Alongshore										9	S
	Cross-shore										1	ON
	Resultant										9	168
21	0700-Alongshore	17	S			47	N		40	S	3	N
	Cross-shore	8	Off		152	35	Off	South			3	OF
	Resultant	19	133			59	17				4	30
21	1300-Alongshore										13	S
	Cross-shore										2	OF
	Resultant										13	150
21	1900-Alongshore										12	S
	Cross-shore										2	OF
	Resultant										12	150
22	0100-Alongshore										20	S
	Cross-shore										4	OF
	Resultant										21	150
22	0700-Alongshore	11	S			76	S		43	S	18	S
	Cross-shore	0	0		164	0	0	North			3	OF
	Resultant	11	160			76	160				18	152
22	1300-Alongshore										12	S
	Cross-shore										7	OF
	Resultant										14	132
22	1900-Alongshore										0	
	Cross-shore										0	
	Resultant										1	0
23	0100-Alongshore										1	S
	Cross-shore										1	OF
	Resultant										2	131
23	0700-Alongshore	3	N			47	N		46	N	2	S
	Cross-shore	6	On		152	12	Off	South			1	OF
	Resultant	7	277			48	354				2	124
23	1300-Alongshore										3	S
	Cross-shore										1	OF
	Resultant										3	149
23	1900-Alongshore										8	S
	Cross-shore										2	OF
	Resultant										9	146
24	0100-Alongshore										11	S
	Cross-shore										2	OF
	Resultant										12	149
24	0700-Alongshore	5	N			38	N		14	N	4	S
	Cross-shore	12	Off		140	23	Off	South			3	ON
	Resultant	13	48			44	11				5	203
24	1300-Alongshore										1	S
	Cross-shore										4	ON
	Resultant										4	232
24	1900-Alongshore										3	S
	Cross-shore										2	ON
	Resultant										4	205

KEY = ALL SPEEDS IN CM/SEC
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ON=ONSHORE
OF=OFFSHORE

DAY	TIME	DYE AT 19+00 (579m) (SURFACE) SPEED	DIR	PIER MEASUREMENTS: DYE AT MID-SURF ZONE (SURFACE) DIST. FROM BASELINE(M)	SPEED	DIR	BEACH MEASUREMENTS (500 UPDRIFT): DYE 12M OFFSHORE (SURFACE) LOCATION	SPEED	DIR	CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679 SPEED	DIR
25	0100-Alongshore									14	S
	Cross-shore									5	OF
	Resultant									15	142
25	0700-Alongshore	29	S		47	S		44	S	24	S
	Cross-shore	4	On	164	0	0	North			4	OF
	Resultant	29	169		47	160				24	151
25	1300-Alongshore									17	S
	Cross-shore									4	OF
	Resultant									17	148
25	1900-Alongshore									11	S
	Cross-shore									3	OF
	Resultant									12	147
26	0100-Alongshore									8	S
	Cross-shore									1	OF
	Resultant									8	155
26	0700-Alongshore	17	N		61	N		46	N	8	S
	Cross-shore	0	0	164	0	0	South			2	ON
	Resultant	17	340		61	340				8	172
26	1300-Alongshore									8	N
	Cross-shore									2	ON
	Resultant									8	327
26	1900-Alongshore									7	N
	Cross-shore									2	ON
	Resultant									7	326
27	0100-Alongshore									13	N
	Cross-shore									4	ON
	Resultant									13	324
27	0700-Alongshore	8	S		44	N		15	S	1	N
	Cross-shore	2	On	164	0	0	South			2	ON
	Resultant	8	174		44	340				2	281
27	1300-Alongshore									13	S
	Cross-shore									1	OF
	Resultant									13	154
27	1900-Alongshore									24	S
	Cross-shore									4	OF
	Resultant									25	150
28	0100-Alongshore									20	S
	Cross-shore									1	OF
	Resultant									20	156
28	0700-Alongshore	32	S		36	S	No reading			22	S
	Cross-shore	0	0	164	0	0				4	OF
	Resultant	32	160		36	160				23	151
28	1300-Alongshore									15	S
	Cross-shore									2	OF
	Resultant									16	151
28	1900-Alongshore									18	S
	Cross-shore									3	OF
	Resultant									18	150
29	0100-Alongshore									14	S
	Cross-shore									2	OF
	Resultant									14	154
29	0700-Alongshore	19	S		0	0		11	S	12	S
	Cross-shore	3	On	164	10	On	South			2	OF
	Resultant	19	169		10	205				12	149
29	1300-Alongshore									10	S
	Cross-shore									4	OF
	Resultant									11	137
29	1900-Alongshore									17	S
	Cross-shore									2	OF
	Resultant									17	152
30	0100-Alongshore									17	S
	Cross-shore									2	OF
	Resultant									17	154
30	0700-Alongshore									25	S
	Cross-shore	No observations								5	OF
	Resultant									26	150
30	1300-Alongshore									15	N
	Cross-shore									1	ON
	Resultant									15	338
30	1900-Alongshore									18	N
	Cross-shore									1	OF
	Resultant									18	342

KEY = ALL SPEEDS IN CM/SEC
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ON=ONSHORE
OF=OFFSHORE

V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

TABLE 5

SUPPLEMENTAL OBSERVATIONS

NOV 1986

DAY	TIME	WAVE APPROACH ANGLE AT PIER END deg from True N Primary	Secondary	RADAR WAVE ANGLE deg from True N	WIDTH OF SURF ZONE(m)	WATER CHARACTERISTICS AT PIER END TEMP(C)	DENSITY (g/cc)	SECCI VIS(m)
1	855	80	60	80	131	17.0	1.0223	0.6
2	901	100		80	84	17.5	1.0208	1.5
3	732	40	55	40	177	17.6	1.0210	0.6
4	723	60		80	46	17.1	1.0204	0.9
5	728	90		80	107	17.5	1.0208	0.9
6	808	60		60	107	17.1	1.0222	1.2
7	710	35			101	17.0	1.0215	1.2
8	930	80			64		1.0210	1.2
9	845	80	120		61	17.7	1.0228	1.2
10	812	25		40	133	16.8	1.0232	0.6
11	844	90		80	104	16.8	1.0232	1.2
12	803	40		50	122	16.3	1.0232	0.9
13	843	30		50	96	15.8	1.0218	2.7
14	714	50		50	198	13.4	1.0213	0.9
15	915	none visible			107	13.8	1.0215	1.5
16	835	25	85		79	13.8	1.0222	0.6
17	828	80			76	14.0	1.0226	0.9
18	826	90		80	85	14.5	1.0230	0.6
19	833	30		40	128	14.0	1.0230	0.6
20	824	40		55	157	13.6	1.0231	0.6
21	843	80		75	94	14.4	1.0238	0.6
22	1036	40		60	119	13.5	1.0238	2.1
23	917	80		80	85	13.7	1.0238	0.6
24	824	90		80	87	14.6	1.0237	0.9
25	835	45		50	110	14.1	1.0238	0.6
26	826	95		90	125	14.0	1.0237	0.6
27	816	100		80	73	14.7	1.0242	0.6
28	748	50		inoperative	128	14.0		0.9
29	1136	80		80	101	13.9	1.0237	0.9
30	no observations made							

VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865- 1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

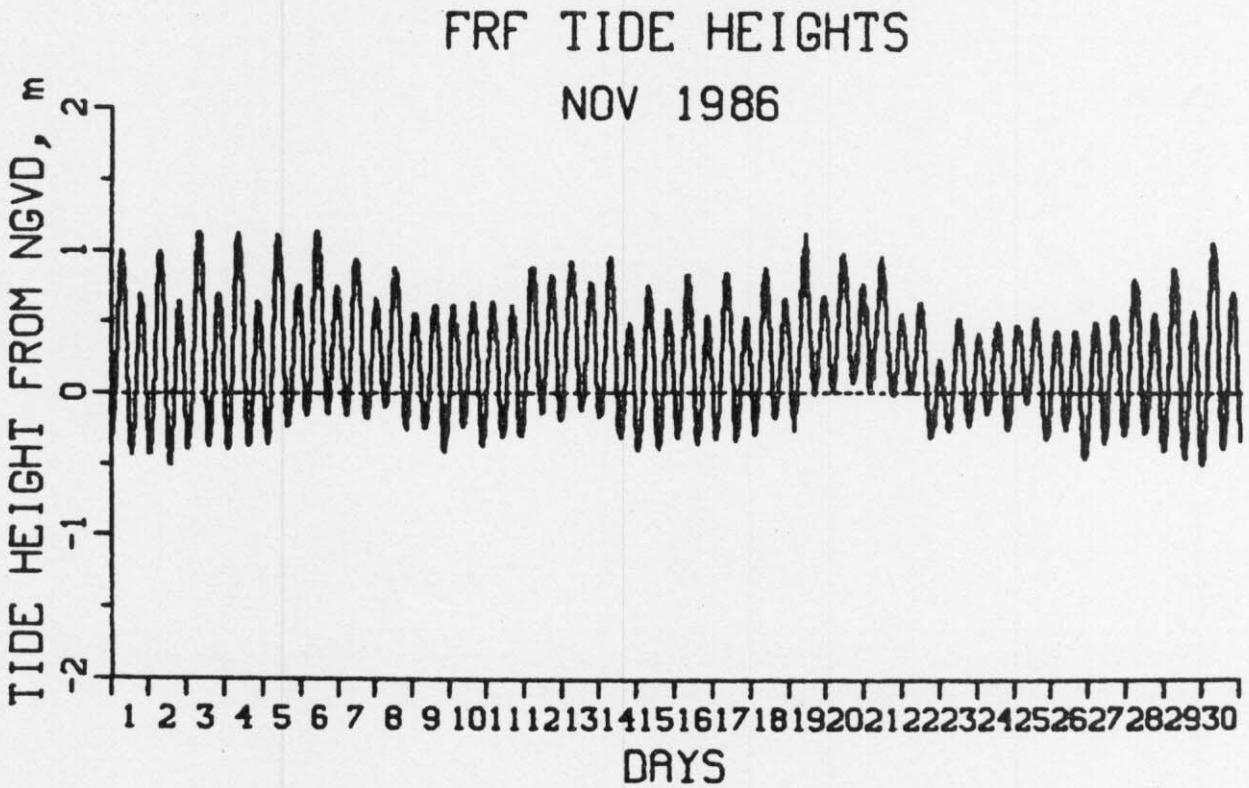

FIGURE 4. Time History of Mean Water Levels, November 1986 (Gage No. 865-1370)

MONTHLY MEAN WATER LEVELS (METERS MSL)

Extreme Low -	-0.51 on 2 November at 1324 hrs.
Extreme High -	1.13 on 3 November at 0736 hrs.
Monthly Mean -	0.23
Mean Low Water -	-0.29
Mean High Water -	0.72
Mean Range	1.01

TABLE 6

WATER LEVELS (METERS MSL)
Tidal Characteristics

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-0.44	0.99	0.33	1.43
1	1837	-0.43	0.69	0.12	1.12
2	703	-0.48	0.99	0.30	1.48
2	1928	-0.51	0.64	0.07	1.15
3	753	-0.38	1.13	0.41	1.51
3	2018	-0.40	0.70	0.15	1.09
4	843	-0.37	1.12	0.40	1.49
4	2109	-0.36	0.64	0.13	1.00
5	934	-0.33	1.10	0.44	1.43
5	2159	-0.23	0.75	0.26	0.98
6	1024	-0.13	1.13	0.52	1.26
6	2249	-0.15	0.76	0.29	0.91
7	1115	-0.16	0.94	0.41	1.09
7	2340	-0.19	0.66	0.23	0.84
8	1205	-0.17	0.87	0.38	1.05
9	30	-0.25	0.55	0.16	0.80
9	1255	-0.34	0.62	0.18	0.95
10	121	-0.41	0.61	0.12	1.02
10	1346	-0.30	0.62	0.18	0.93
11	211	-0.37	0.64	0.16	1.00
11	1436	-0.30	0.61	0.12	0.91
12	301	-0.31	0.87	0.31	1.18
12	1527	-0.15	0.82	0.31	0.97
13	352	-0.19	0.91	0.38	1.11
13	1617	-0.16	0.77	0.28	0.93
14	442	-0.22	0.95	0.37	1.16
14	1707	-0.36	0.49	0.04	0.85
15	532	-0.41	0.75	0.18	1.15
15	1758	-0.39	0.58	0.09	0.97
16	623	-0.32	0.83	0.26	1.16
16	1848	-0.37	0.54	0.07	0.90
17	713	-0.34	0.84	0.28	1.18
17	1938	-0.31	0.53	0.10	0.84
18	804	-0.27	0.87	0.33	1.15
18	2029	-0.19	0.66	0.22	0.85
19	854	-0.27	1.11	0.45	1.38
19	2119	-0.01	0.67	0.32	0.69
20	944	0.05	0.97	0.51	0.92
20	2210	0.00	0.76	0.38	0.76
21	1035	0.01	0.95	0.50	0.94
21	2300	-0.03	0.54	0.23	0.57
22	1125	-0.31	0.63	0.23	0.94
22	2350	-0.29	0.23	-0.06	0.52
23	1216	-0.23	0.52	0.16	0.75
24	41	-0.22	0.41	0.10	0.63
24	1306	-0.26	0.49	0.16	0.75
25	131	-0.23	0.47	0.17	0.70
25	1356	-0.32	0.53	0.17	0.85
26	222	-0.30	0.44	0.09	0.74
26	1447	-0.46	0.44	0.05	0.89
27	312	-0.43	0.49	0.06	0.92
27	1537	-0.31	0.54	0.12	0.85
28	402	-0.28	0.80	0.27	1.09
28	1628	-0.40	0.56	0.09	0.97
29	453	-0.39	0.87	0.26	1.26
29	1718	-0.51	0.57	0.01	1.08
30	543	-0.48	1.05	0.35	1.54

VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in October and the only survey taken during November on profile line 188, located 517 m south of the pier. On the foreshore (60 to 80 m), the berm built during October was removed while a prominent nearshore bar (120 to 200 m) reappeared. Offshore, the barely visible storm bar (240 to 360 m) also intensified.

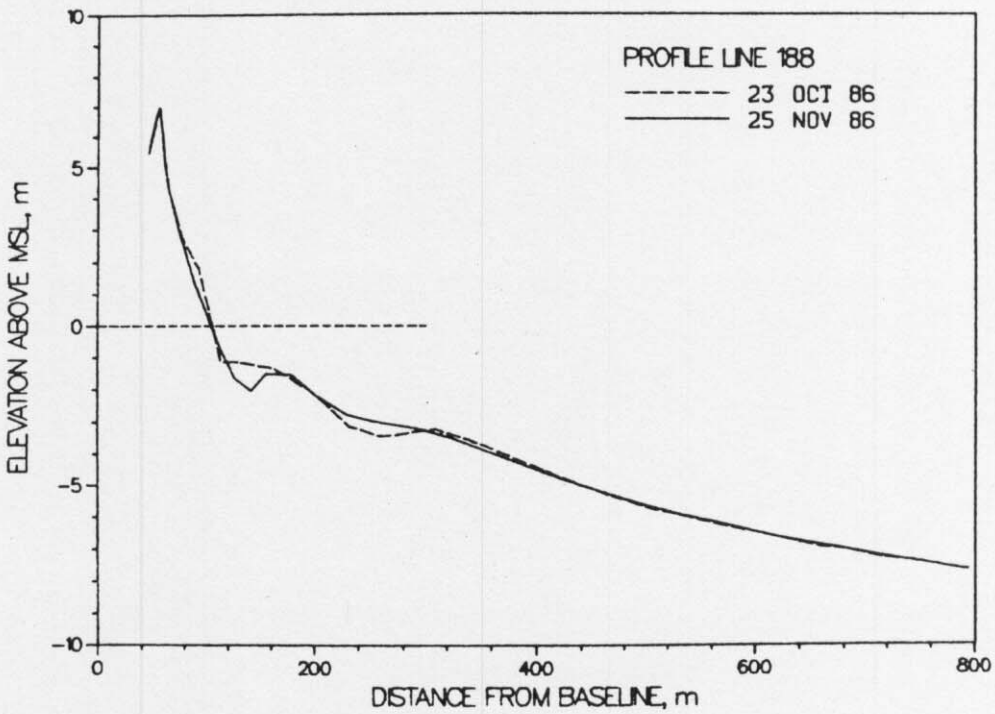

Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes which occurred on the profile between January and November. The only visible change to the envelope (200 m) is a result of the deep trough between the nearshore and offshore bars.

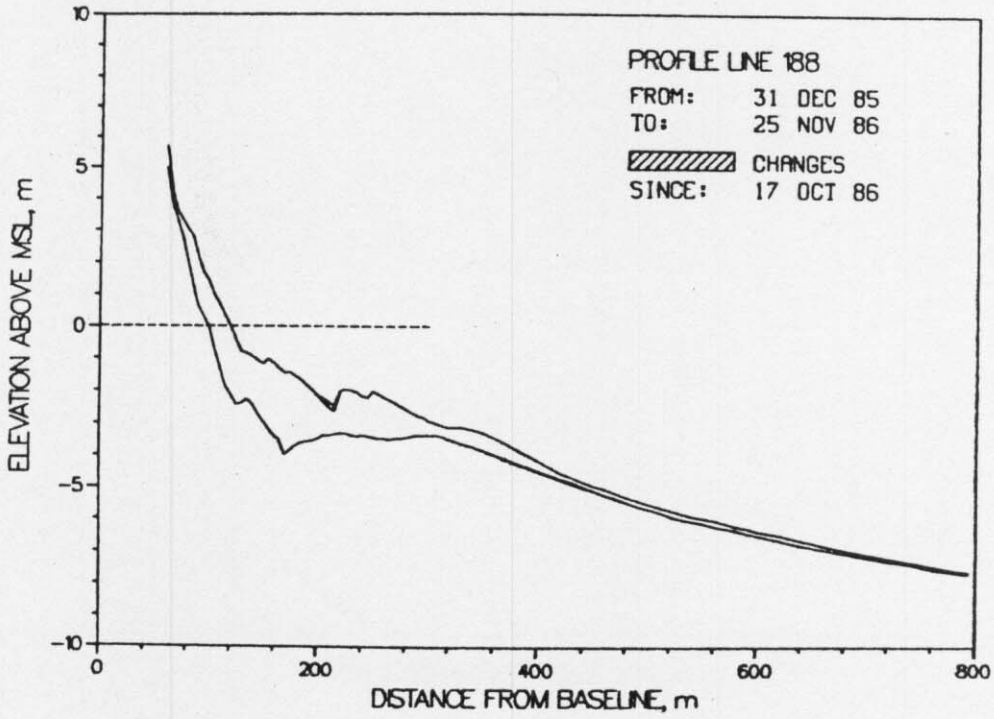

Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. No bathymetric survey was conducted in November. The September bathymetric survey is given for reference.

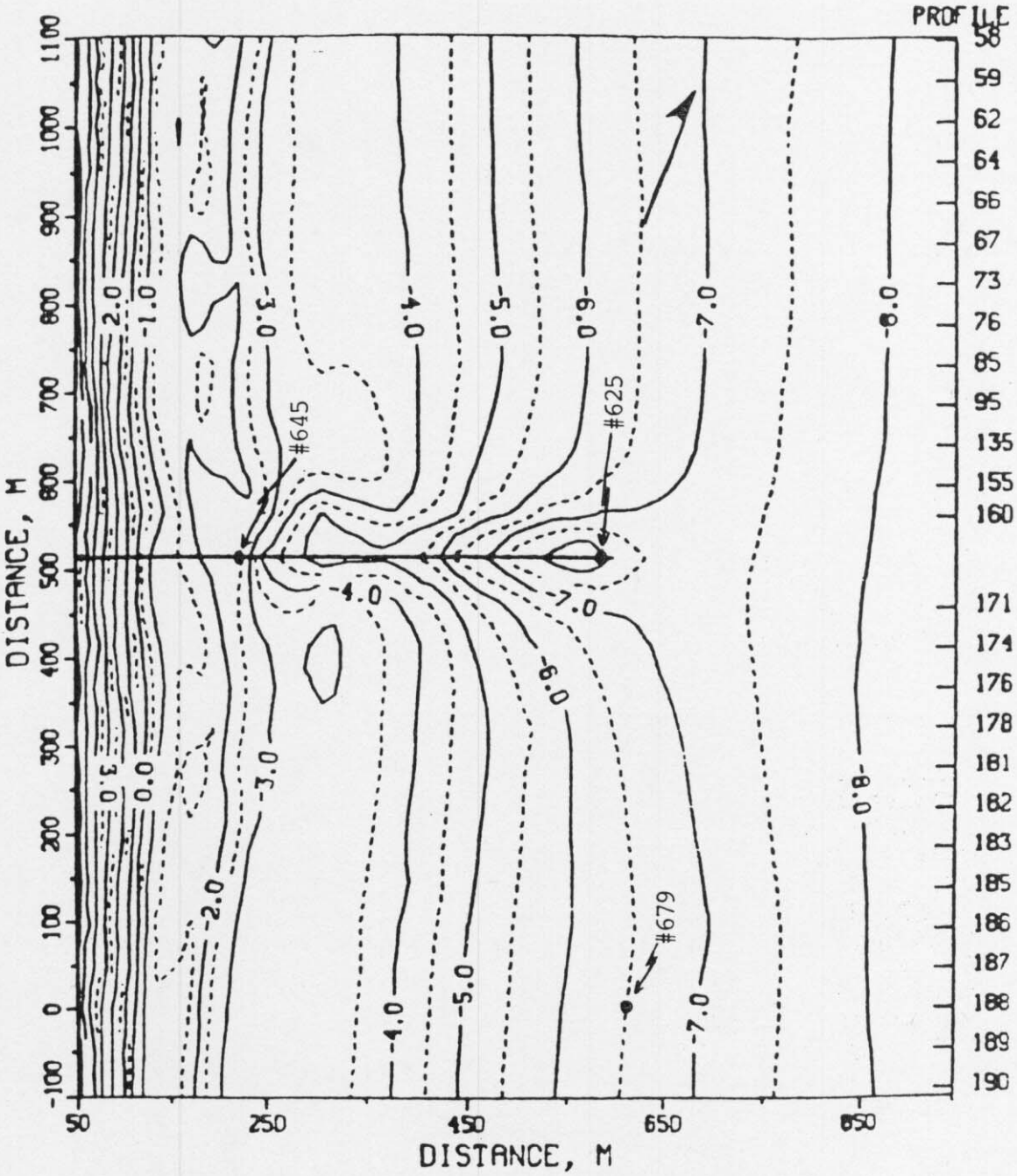

Figure 7. FRF BATHYMETRY 3 SEP 86
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