PRELIMINARY DATA SUMMARY

November 1985

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.

CONTENTS

		Page
	COVER	
	TITLE PAGE	1
	TABLE OF CONTENTS	2
I	INTRODUCTION	6
II	METEOROLOGICAL DATA	9
III	WAVE DATA	14
IV	CURRENT DATA	20
V	SUPPLEMENTAL OBSERVATIONS	22
VI	WATER LEVELS	26
VII	NEARSHORE PROFILES AND BATHYMETRY	29
VIII	SPECIAL EVENTS	

FIGURES

1	LOCATION MAP	3
2	INSTRUMENT LOCATIONS	5
3	TIME HISTORY OF WAVE HEIGHTS AND PERIODS	12
4	TIDE RANGE TIME HISTORY	23
5	WATER LEVEL TIME HISTORY	24
6	CRAB PROFILES	26
7	CRAB PROFILE ENVELOPE	27
8	FRF CONTOUR DIAGRAM	28

TABLES

1	INSTRUMENT STATUS/DATA AVAILABILITY	4
2	METEOROLOGICAL DATA	7
3	WAVE DATA	10
4	CURRENT DATA	15
5	SUPPLEMENTAL OBSERVATIONS	21
6	TIDAL CHARACTERISTICS	25

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.

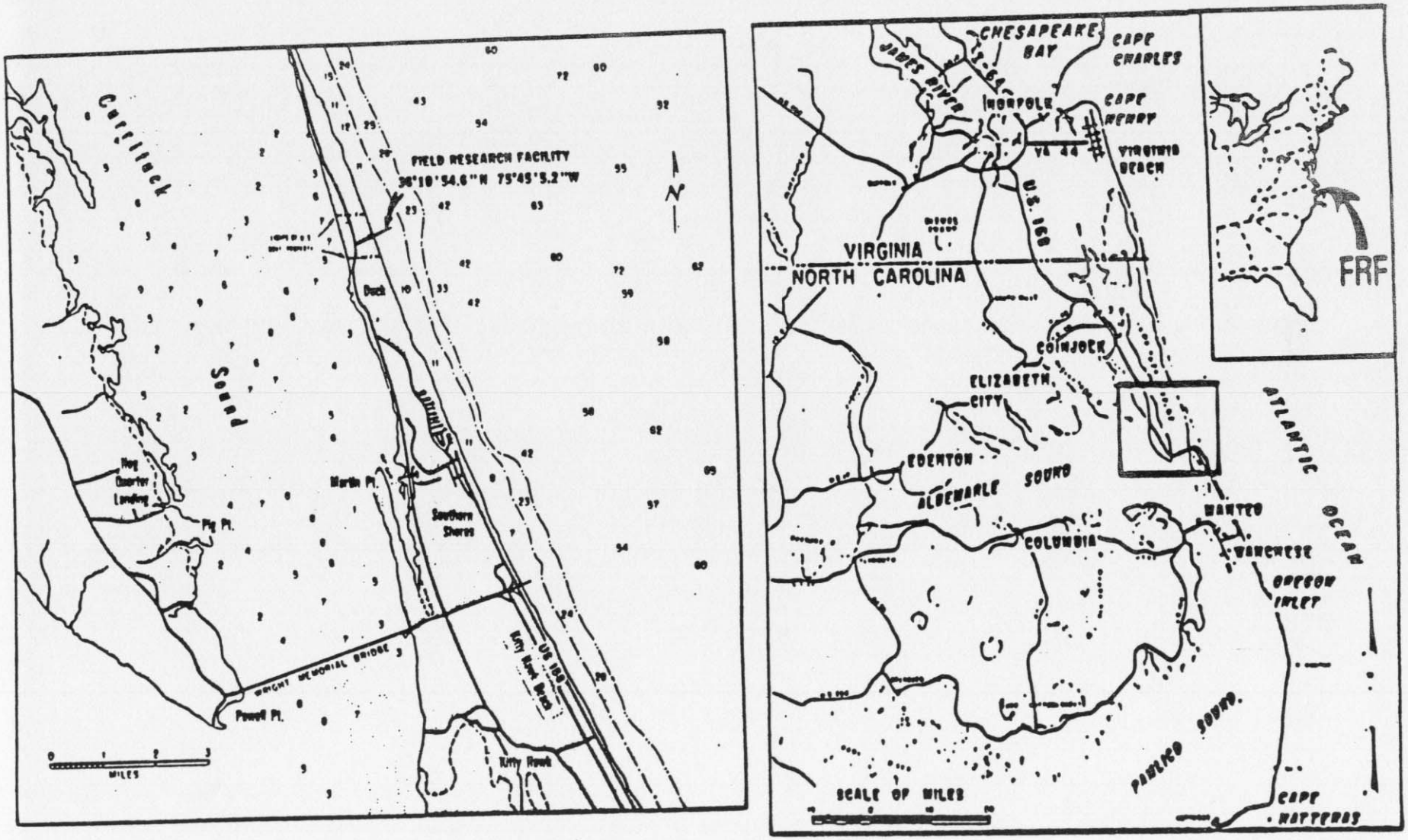


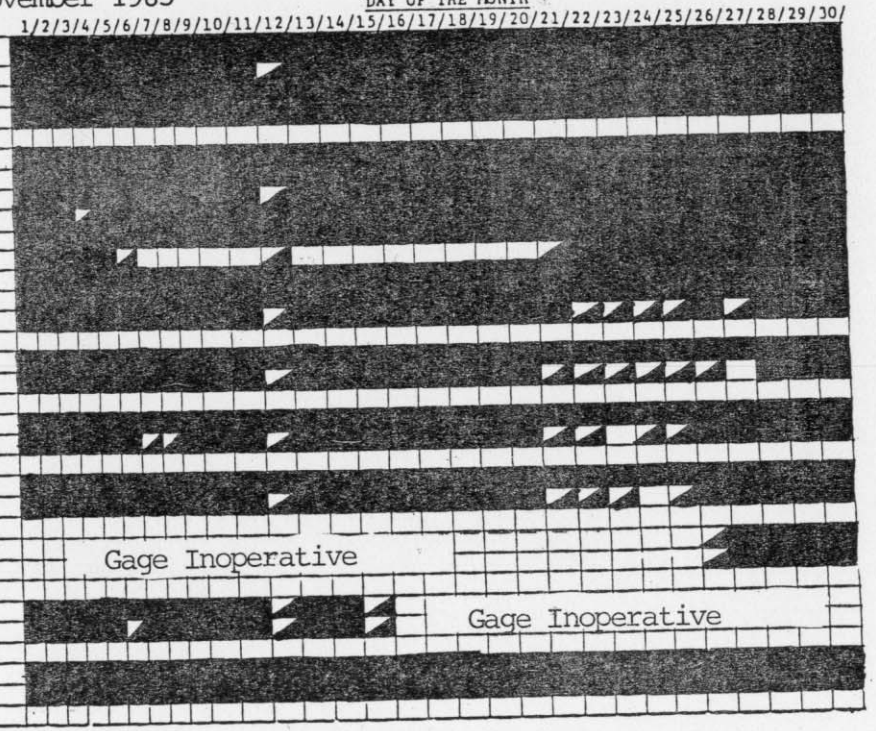
Figure 1. FRF Location Map

TABLE 1
INSTRUMENT STATUS/DATA AVAILABILITY

November 1985

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
643	Baylor staff located at station 7+80 on FRF pier	See profile data	Instrument Status
			Data Collected
623	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
639	Current meter at station 14+20 on FRF pier	See profile data	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 ◪

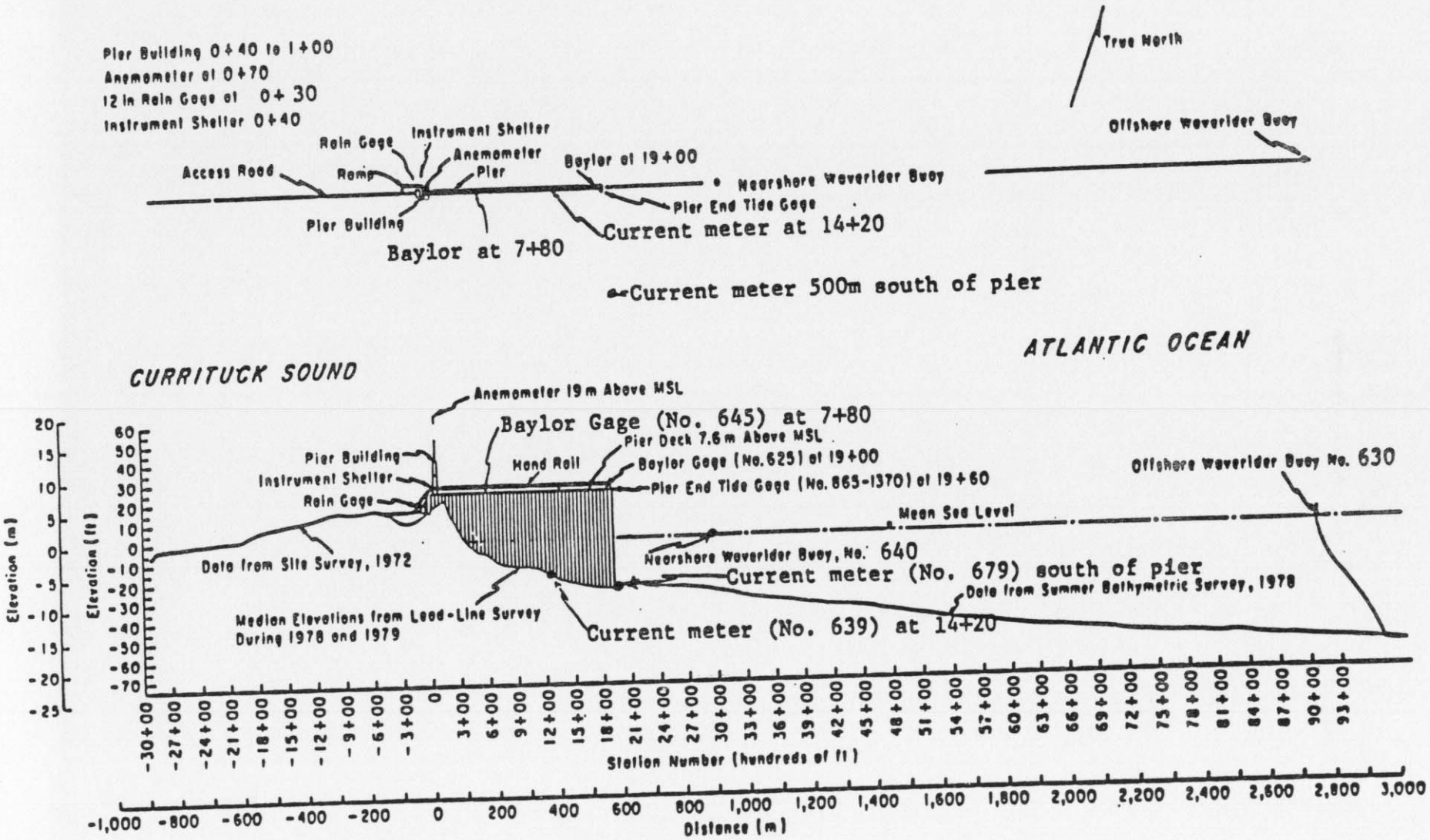


Figure 2. Instrument locations at FRF.

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 1985

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
1	100	10	39	19.1	1007.3	0
	700	9	49	19.1	1007.3	0
	1300	5	55	18.8	1004.1	6
	1900	8	62	19.0	1005.1	0
2	100	6	14	18.3	1003.5	25
	700	13	24	17.5	1002.8	0
	1300	10	346	17.0	1004.8	0
	1900	7	0	18.0	1008.4	0
3	100	5	15	17.7	1009.7	0
	700	6	27	17.8	1010.8	0
	1300	3	47	19.5	1011.2	0
	1900	6	58	18.6	1011.6	0
4	100	9	64	19.3	1010.2	0
	700	11	60	17.9	1008.3	18
	1300	14	56	17.0	1003.2	29
	1900	5	153	18.1	998.4	0
5	100	6	158	13.8	998.4	0
	700	7	181	11.2	998.9	0
	1300	4	187	13.5	999.9	0
	1900	4	175	12.4	1001.4	0
6	100	4	205	11.8	1002.7	0
	700	3	205	10.3	1005.3	0
	1300	3	206	16.0	1007.2	0
	1900	0		12.8	1010.4	0
7	100	3	176	13.2	1011.8	0
	700	4	157	13.2	1012.5	0
	1300	6	155	19.7	1010.5	0
	1900	5	170	16.4	1010.0	0
8	100	8	210	15.3	1011.0	0
	700	5	288	11.9	1017.9	0
	1300	6	302	13.4	1022.4	0
	1900	2	275	9.4	1025.8	0
9	100	2	169	8.9	1027.5	0
	700	2	180	9.7	1029.4	0
	1300	2	29	17.3	1028.8	0
	1900	2	90	15.2	1027.5	0
10	100	3	103	15.6	1026.7	0
	700	2	105	14.5	1026.2	0
	1300	3	152	23.1	1025.0	0
	1900	3	142	19.1	1025.0	0
11	100	3	143	17.1	1025.3	0
	700	1	167	16.1	1026.3	0
	1300	3	158	22.9	1025.4	0
	1900	3	121	19.4	1026.4	0
12	100	1	115	17.2	1027.0	0
	700	4	29	18.4	1028.0	0
	1300		Computer maintenance		1026.6	0
	1900	1	78	18.9	1025.6	0
13	100	0		17.8	1023.9	0
	700	2	170	17.6	1023.0	0
	1300	4	234	22.5	1020.7	0
	1900	4	189	19.5	1020.7	0
14	100	3	212	18.5	1021.0	0
	700	3	212	17.2	1022.2	0
	1300	1	37	20.5	1021.2	0
	1900	3	148	19.5	1020.7	0
15	100	8	208	18.9	1019.7	0
	700	4	240	17.5	1022.3	0
	1300	10	335	15.4	1025.2	0
	1900	9	348	13.0	1027.6	0
16	100	10	350	14.4	1027.5	0
	700	9	16	16.2	1026.1	0
	1300	2	73	18.8	1024.4	0
	1900	5	131	18.0	1023.0	0

TABLE 2: METEOROLOGICAL DATA PART 2

NOVEMBER 1985

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
17	100	4	121	19.1	1021.9	0
	700	0		16.9	1023.4	0
	1300	5	203	20.3	1023.2	0
	1900	2	29	17.0	1025.2	0
18	100	3	6	15.7	1027.0	0
	700	3	350	16.0	1028.9	0
	1300	5	37	18.2	1028.9	0
	1900	3	37	17.1	1028.7	0
19	100	2	69	16.8	1028.2	0
	700	2	25	17.3	1028.9	0
	1300	2	118	21.4	1027.4	0
	1900	2	98	18.1	1027.0	0
20	100	1	109	17.9	1025.5	0
	700	2	143	18.3	1025.0	0
	1300	4	175	24.8	1023.2	0
	1900	3	142	21.1	1022.9	0
21	100	2	156	19.3	1022.4	0
	700	3	316	18.3	1022.3	0
	1300	10	331	14.3	1022.8	0
	1900	9	335	8.4	1012.3	0
22	100	7	343	9.7	1010.3	0
	700	2	358	11.6	1007.5	0
	1300	1	302	11.3	1002.5	0
	1900	8	290	8.2	1000.6	30
23	100	13	303	7.6	1003.2	0
	700	12	312	6.1	1011.3	0
	1300	7	332	6.2	1012.5	0
	1900	3	344	6.4	1013.0	0
24	100	3	259	3.1	1011.4	0
	700	1	252	4.5	1014.8	0
	1300		Tape drive error		1021.9	0
	1900				1023.6	0
25	100				1023.9	0
	700	2	6	10.3	1017.2	0
	1300	3	342	9.2	1014.4	0
	1900	2	8	9.1	1014.8	0
26	100	0		9.7	1012.9	0
	700	0		7.7	1010.9	0
	1300	4	215	18.6	1017.7	0
	1900	5	217	18.0	1016.1	0
27	100	6	226	17.3	1014.5	0
	700	6	223	17.1	1014.1	0
	1300	6	248	21.7	1013.3	0
	1900	6	208	19.6	1013.8	0
28	100	5	226	18.4	1013.7	0
	700	5	224	17.3	1014.8	0
	1300	7	235	23.3	1013.3	0
	1900	5	186	19.3	1013.0	0
29	100	5	219	18.9	1014.1	0
	700	2	309	17.5	1016.6	0
	1300	9	24	14.1	1018.6	0
	1900	9	29	14.5	1019.3	5
30	100	7	23	15.7	1017.4	10
	700	4	318	13.8	1016.4	8
	1300	3	219	15.3	1015.2	9
	1900	4	277	12.4	1015.1	5

Note: Wind speed from 0700 6 Nov to 0700 21 Nov is derived from an anemometer located on a tower 50 m north of the pier building.

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 Waverider 6 km from shore (630) and the Baylor gage at pier station 19+00 (625).

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 1985

GAGE		645 Baylor at 7+80		625 Baylor at 19+00		640 Nearsht Wvrdr		630 Farsht Wvrdr	
DAY	TIME	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)
1	1	1.41	9.75	2.81	9.75	3.26	10.89	3.07	8.83
	7	1.66	9.75	2.53	10.89	3.06	10.89	3.19	9.75
	13	1.55	9.75	2.19	9.75	2.40	10.89	2.80	10.89
	19	1.55	9.75	1.98	8.83	2.21	9.75	2.34	8.06
2	1	1.48	8.83	1.87	8.83	2.34	8.06	2.39	8.83
	7	1.60	8.83	2.62	9.75	3.19	7.42	3.12	9.75
	13	1.55	10.89	2.69	8.83	3.26	9.75	3.27	9.75
	19	1.60	9.75	2.42	10.89	2.93	9.75	2.99	9.75
3	1	1.57	9.75	1.82	9.75	2.30	8.83	2.23	7.42
	7	1.44	9.75	1.91	8.83	2.23	8.83	2.35	8.83
	13	1.26	8.83	1.62	8.83	1.81	9.75	2.10	8.06
	19	1.33	12.34	1.84	8.83	2.05	8.83	2.08	9.75
4	1	1.33	10.89	1.82	10.89	2.27	10.89	2.28	8.06
	7	1.34	8.83	2.03	6.40	2.37	7.42	2.56	8.06
	13	1.67	9.75	2.81	9.75	3.26	9.75	3.24	9.75
	19	1.51	12.34	2.88	10.89	4.13	10.89	3.89	10.89
5	1	1.77	9.75	2.09	10.89	2.37	9.75	2.74	10.89
	7	1.36	10.89	1.36	9.75	1.63	10.89	1.76	9.75
	13	1.00	10.89	1.20	12.34	1.26	12.34	1.44	10.89
	19	.88	8.83	1.08	12.34	1.25	12.34	1.21	12.34
6	1	.63	10.89	.85	10.89	.94	12.34	1.11	12.34
	7	.53	12.34	.74	12.34	.77	12.34	.90	10.89
	13	.49	12.34	.64	12.34	.71	12.34	.72	10.89
	19	.53	10.89	.73	10.89	.78	10.89	.85	10.89
7	1	.46	10.89	.74	10.89	.77	12.34	.75	12.34
	7	.40	14.22	.76	14.22	.88	14.22	.81	12.34
	13	.44	14.22	.70	12.34	.82	12.34	.87	12.34
	19	.56	14.22	.79	14.22			.77	14.22
8	1	.50	14.22	.64	12.34	*		.79	12.34
	7	.89	5.31	1.14	5.02			1.57	5.02
	13	.97	5.02	1.38	6.87	1.41	6.40	1.71	6.87
	19	.58	6.87	.88	6.87	1.03	14.22	1.19	6.87
9	1	.48	14.22	.68	14.22	.76	14.22	.86	7.42
	7	.38	14.22	.57	14.22	.64	6.87	.68	7.42
	13	.29	12.34	.52	12.34	.57	12.34	.61	14.22
	19	.36	12.34	.49	12.34	.54	12.34	.55	10.89
10	1	.37	14.22	.50	14.22	.55	14.22	.55	10.89
	7	.43	4.53	.53	14.22	.61	12.34	.61	4.76
	13	.51	4.32	.47	10.89	.52	14.22	.56	9.75
	19	.49	5.63	.47	5.63	.50	5.63	.57	5.63
11	1	.42	5.63	.43	12.34	.45	12.34	.52	12.34
	7	.49	5.99	.47	5.99	.55	5.99	.59	6.40
	13	.39	7.42	.46	16.79	.56	7.42	.66	7.42
	19	.51	6.87	.54	14.22	.63	14.22	.68	16.79
12	1	.53	14.22	.62	14.22	.71	14.22	.75	14.22
	7	.62	6.87	.66	14.22	.73	16.79	.77	6.40
	13		Computer maintenance						
	19	.69	8.06	.95	7.42	1.09	7.42	1.28	7.42
13	1	.69	16.79	1.00	7.42	1.05	6.87	1.11	7.42
	7	.74	8.83	.91	16.79	1.05	8.83	1.24	9.75
	13	.60	20.48	.85	16.79	.93	16.79	.96	8.83
	19	.56	8.83	.78	8.83	.85	9.75	.97	8.06
14	1	.45	8.06	.65	9.75	.70	9.75	.87	8.83
	7	.46	10.89	.66	10.89	.69	8.83	.80	9.75
	13	.46	8.83	.59	9.75	.70	9.75	.70	8.83
	19	.41	9.75	.55	8.83			.76	9.75
15	1	.36	9.75	.54	10.89	*		.68	9.75
	7	.31	10.89	.47	9.75	.51	9.75	.55	10.89
	13	.71	5.02	1.39	5.31	1.57	5.02	1.53	5.31
	19	.80	7.42	1.60	6.87	1.81	6.40	1.89	5.99
16	1	.68	4.76	1.27	6.40	1.47	5.99	1.85	5.63
	7	.77	5.31	1.39	5.02	.18	8.06	1.58	8.06
	13	.67	10.89	1.22	5.31	.24	7.42	1.46	5.99
	19	.91	6.40	1.45	6.87	1.85	16.79	1.73	6.40

*=Electronic problems

TABLE 3: WAVE DATA

NOVEMBER 1985

GAGE		645 Baylor at 7+80		625 Baylor at 19+00		640 Nearsht Wvrdr		630 Farsht Wvrdr	
DAY	TIME	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)
17	1	.92	7.42	1.54	8.06	1.81	8.06	1.78	8.06
	7	.98	7.42	1.25	7.42	1.36	7.42	1.48	7.42
	13	.64	6.87	.95	6.87	.97	7.42	1.15	6.87
	19	.64	6.87	.84	10.89	.87	8.83	1.02	8.83
18	1	.52	10.89	.75	7.42	.15	5.31	.90	9.75
	7	.54	9.75	.71	8.83	.77	10.89	.89	10.89
	13	.54	8.83	.81	8.83	*		.89	8.06
	19	.54	9.75	.81	9.75	.42	9.75	.98	8.83
19	1	.53	12.34	.80	10.89	.65	16.79	.95	9.75
	7	.58	9.75	.82	9.75	.38	7.42	.98	12.34
	13	.66	10.89	.85	9.75	.94	10.89	1.06	9.75
	19	.78	12.34	.94	12.34	.96	12.34	1.06	9.75
20	1	.83	12.34	1.00	9.75	1.05	10.89	1.20	10.89
	7	.68	10.89	.89	10.89	.89	10.89	1.13	10.89
	13	.60	9.75	.75	9.75	.87	10.89	.99	10.89
	19	.54	10.89	.78	10.89	.84	10.89	.95	9.75
21	1	.57	9.75	.70	9.75	.79	10.89	.79	8.83
	7	.44	10.89	.62	8.83	.70	10.89	.89	10.89
	13	1.94	5.63	1.45	5.99				
	19	1.48	5.99					2.37	6.87
22	1	1.52	6.87						
	7	*						1.45	7.42
	13	1.12	7.42	1.56	9.75			1.90	7.42
	19	1.24	6.40			2.09	5.99	2.32	5.63
23	1					2.50	7.42	2.98	7.42
	7							2.15	8.83
	13	1.58	6.87	1.95	7.42				
	19	1.24	6.40	1.55	7.42	1.67	8.06		
24	1	.99	8.83	1.27	8.06	1.24	6.87		
	7	1.00	8.83	1.25	8.06				
	13								
	19	Tape error							
25	1			1.16	8.06	1.06	7.42	1.09	8.06
	7	.90	14.22	1.05	9.75	.97	8.83	.97	5.63
	13	.89	3.64	1.09	8.83	1.14	5.02	1.03	8.06
	19	.86	8.83	.93	8.83	.83	9.75	.88	5.99
26	1	.71	5.63	1.06	16.79	1.01	16.79	1.08	16.79
	7	.91	16.79	.38	8.83	.40	9.75	.46	6.87
	13	.25	5.02			.38	8.83	.47	9.75
	19	.24	5.63	*		.36	5.02	.58	5.31
27	1	.31	4.53			.38	5.63	.58	5.99
	7	.32	5.99			.34	5.99	.45	6.40
	13	*				.33	16.79	.52	6.40
	19	.30	16.79	.36	16.79	.34	14.22	.48	16.79
28	1	.24	16.79	.37	16.79	.53	14.22	.57	6.40
	7	.36	16.79	.46	16.79	.47	14.22	.56	14.22
	13	.31	14.22	.51	14.22	.49	14.22	.64	14.22
	19	.35	14.22	.49	14.22	.43	14.22	.52	5.31
29	1	.30	14.22	.43	14.22	.52	14.22	.65	5.99
	7	.43	4.76	.54	14.22	1.04	8.06	1.20	3.95
	13	.88	3.95	1.04	3.64	1.43	5.63	1.51	5.99
	19	1.12	5.02	1.39	5.63	1.22	4.76	1.36	5.31
30	1	.99	5.63	1.31	5.63	1.06	7.42	1.32	8.83
	7	.80	5.02	1.08	8.06	1.32	8.83	1.29	9.75
	13	.71	6.87	1.23	8.83	1.44	10.89	1.33	9.75
	19	.73	10.89	1.31	9.75				
	MEAN	.79	9.53	1.10	10.21	1.18	10.15	1.31	9.06
	STD	.42	3.44	.61	3.06	.82	3.12	.78	2.67

*=Electronic problems

Note: The data from 1900 21 Nov to 0700 26 Nov do not meet the same editing criteria imposed on the remainder of the data. However, reported values are consistent with adjacent gages.

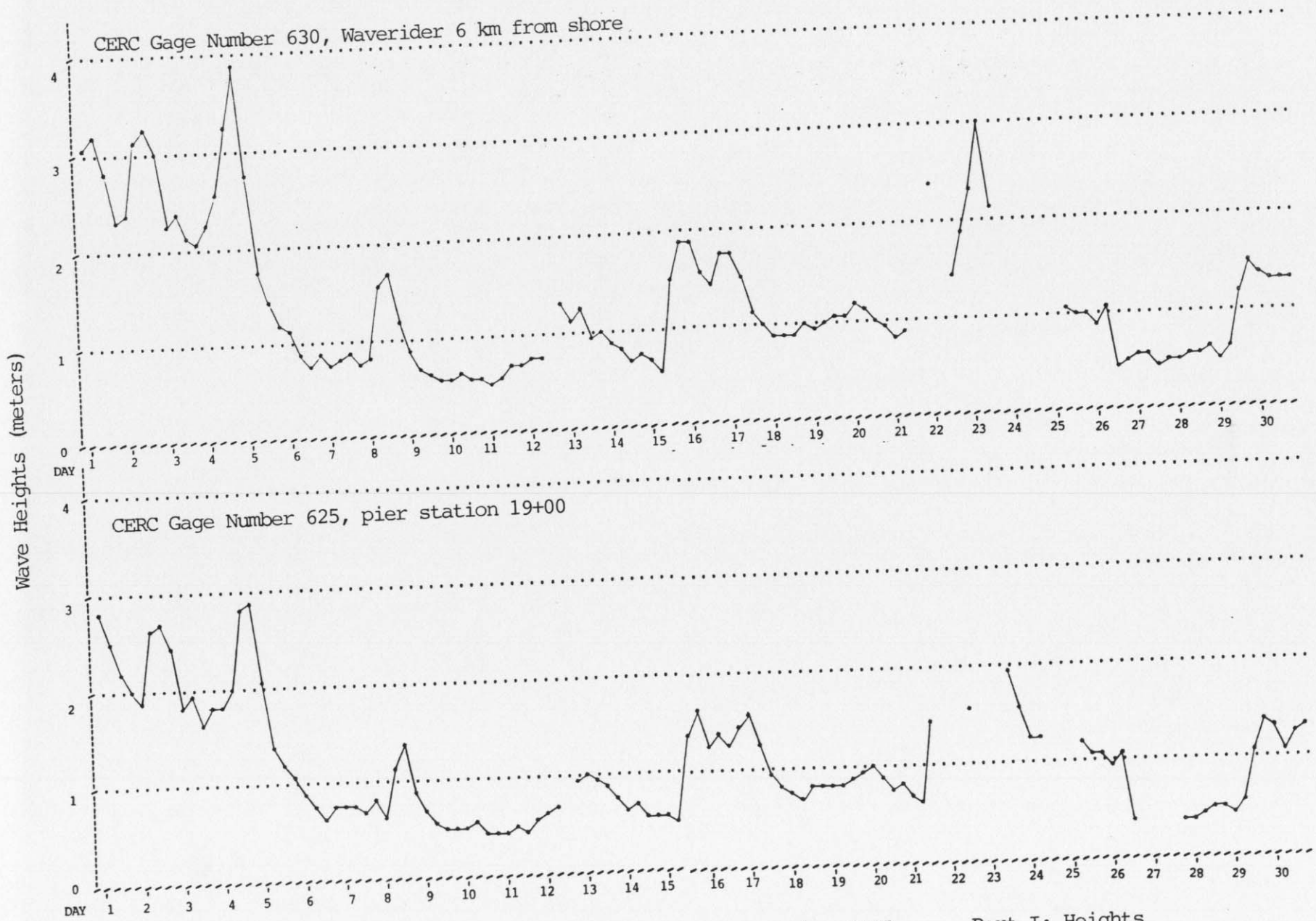


FIGURE 3. Time History of Wave Heights and Periods - November 1985 Part I: Heights

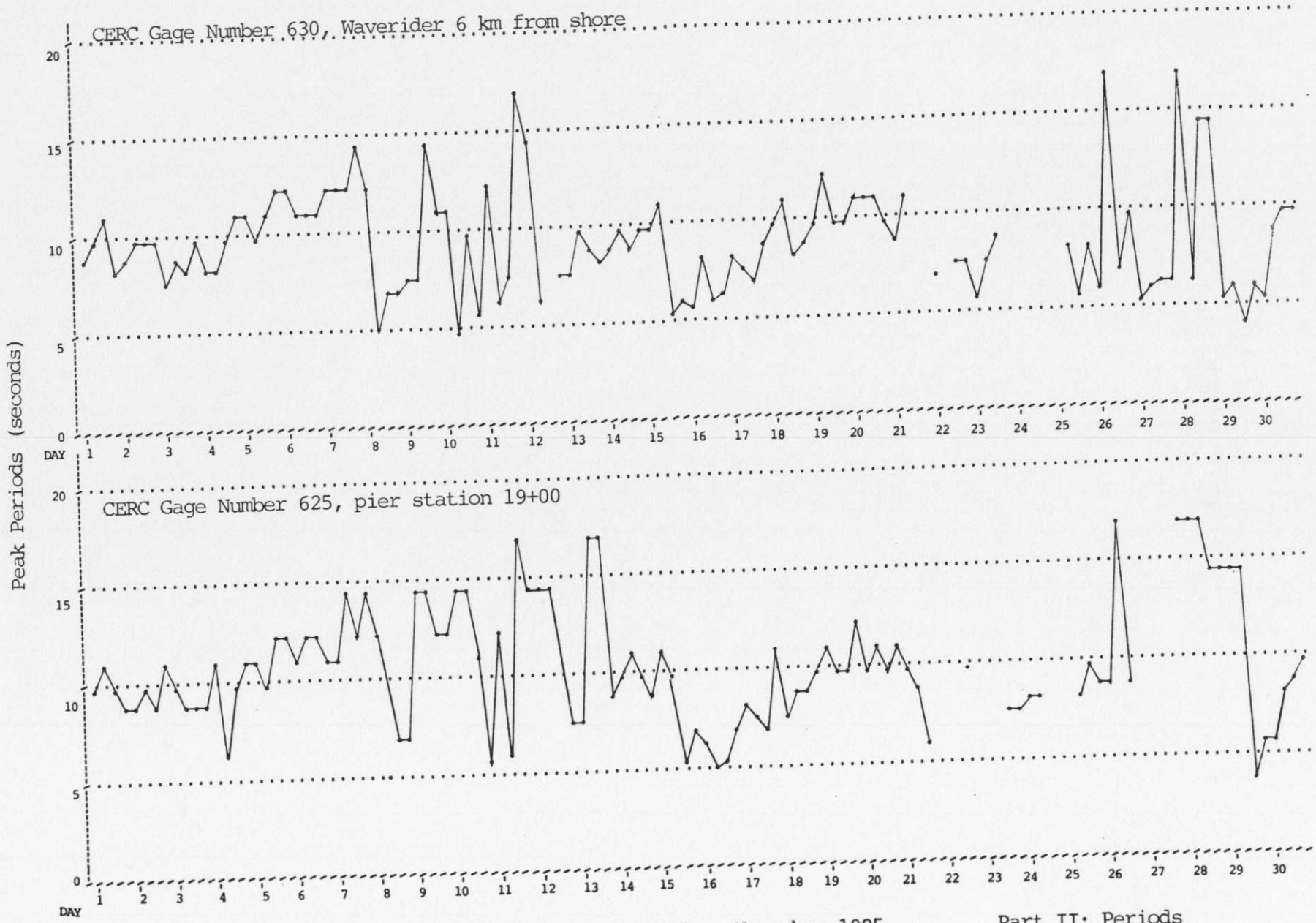


FIGURE 3. Time History of Wave Heights and Periods - November 1985

Part II: Periods

IV. CURRENT DATA

Current data (Table 4) are collected from two Marsh-McBirney electromagnetic biaxial current meters (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 1985

DAY	TIME	PIER MEASUREMENTS: DYE AT 19+00 (579m) (SURFACE) SPEED	DIR	CURRENT METER AT 14+20 (433m) I.D.#639 (DEPTH -4.2m MSL) SPEED	DIR	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
1	0100-Alongshore											41	N
	Cross-shore											7	OF
	Resultant											41	349
1	0700-Alongshore	29	N			188	152	N	South	42	N	33	N
	Cross-shore	9	On				61	On				1	OF
	Resultant	30	323				164	318				33	342
1	1300-Alongshore											12	N
	Cross-shore											0	
	Resultant											12	340
1	1900-Alongshore											10	N
	Cross-shore											1	ON
	Resultant											10	335
2	0100-Alongshore											8	N
	Cross-shore											6	OF
	Resultant											10	17
2	0700-Alongshore	17	N			164	36	N	South	13	N	11	N
	Cross-shore	26	On				9	On				5	OF
	Resultant	31	284				37	326				12	6
2	1300-Alongshore											7	N
	Cross-shore											4	OF
	Resultant											8	12
2	1900-Alongshore											29	S
	Cross-shore											6	OF
	Resultant											30	149
3	0100-Alongshore											18	S
	Cross-shore											4	ON
	Resultant											19	173
3	0700-Alongshore	4	S			164	55	S	North	3	N	20	S
	Cross-shore	2	On				0	0				6	ON
	Resultant	5	187				55	1				21	178
3	1300-Alongshore											26	S
	Cross-shore											1	ON
	Resultant											26	163
3	1900-Alongshore											2	N
	Cross-shore											1	OF
	Resultant											2	356
4	0100-Alongshore											18	N
	Cross-shore											1	ON
	Resultant											18	338
4	0700-Alongshore	87	N	GAGE INOPERATIVE		140	122	N	South	32	N	9	S
	Cross-shore	17	On				12	On				1	ON
	Resultant	88	329				123	334				9	164
4	1300-Alongshore											1	N
	Cross-shore											5	OF
	Resultant											5	56
4	1900-Alongshore											12	N
	Cross-shore											1	ON
	Resultant											12	336
5	0100-Alongshore											28	N
	Cross-shore											0	
	Resultant											28	340
5	0700-Alongshore	28	N			141	102	N	South	42	N	28	N
	Cross-shore	21	Off				25	On				0	
	Resultant	35	17				105	326				28	340
5	1300-Alongshore											26	N
	Cross-shore											1	ON
	Resultant											26	338
5	1900-Alongshore											30	N
	Cross-shore											1	ON
	Resultant											30	339
6	0100-Alongshore											30	N
	Cross-shore											0	
	Resultant											30	340
6	0700-Alongshore	20	N			143	13	S	North	36	N		
	Cross-shore	9	On				14	Off					
	Resultant	22	4				19	112					
6	1300-Alongshore											12	N
	Cross-shore											1	ON
	Resultant											12	335
6	1900-Alongshore											32	N
	Cross-shore											1	ON
	Resultant											32	339

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

		PIER MEASUREMENTS								BEACH MEASUREMENTS (500 UPDRIFT)				
		DYE AT 19+00 (579m) (SURFACE)		CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)		DYE AT MID-SURF ZONE (SURFACE) DIST. FROM				DYE 12M OFFSHORE (SURFACE)			CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679	
AY	TIME	SPEED	DIR	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR		SPEED	DIR
7	0100-Alongshore												33	N
	Cross-shore												0	
	Resultant												33	340
7	0700-Alongshore	21	N			143	16	N	South	29	S		34	N
	Cross-shore	8	Off				3	On					0	
	Resultant	23	2				16	351					34	340
7	1300-Alongshore												11	N
	Cross-shore												1	ON
	Resultant												11	336
7	1900-Alongshore												33	N
	Cross-shore												0	
	Resultant												33	340
8	0100-Alongshore												32	N
	Cross-shore												0	
	Resultant												32	340
8	0700-Alongshore	51	S			143	102	S	North	89	S		35	N
	Cross-shore	0	0				36	On					0	
	Resultant	51	160				108	179					35	340
8	1300-Alongshore												33	N
	Cross-shore												3	OF
	Resultant												33	346
8	1900-Alongshore												37	N
	Cross-shore												4	OF
	Resultant												37	347
9	0100-Alongshore												38	N
	Cross-shore												5	OF
	Resultant												38	347
9	0700-Alongshore	5	N			152	13	N	South	27	N		38	N
	Cross-shore	1	Off				2	On					5	OF
	Resultant	5	349				13	331					38	348
9	1300-Alongshore												2	N
	Cross-shore												1	OF
	Resultant												3	0
9	1900-Alongshore												38	N
	Cross-shore												3	OF
	Resultant												38	345
10	0100-Alongshore												41	N
	Cross-shore												4	OF
	Resultant												41	345
10	0700-Alongshore	9	N			140	9	N	South	4	N		38	N
	Cross-shore	2	On				1	Off					4	OF
	Resultant	9	330				9	331					38	345
10	1300-Alongshore												2	N
	Cross-shore												1	OF
	Resultant												2	6
10	1900-Alongshore												34	N
	Cross-shore												3	OF
	Resultant												34	344
11	0100-Alongshore												39	N
	Cross-shore												3	OF
	Resultant												39	344
11	0700-Alongshore	0	0	GAGE INOPERATIVE		134	15	N	South	5	N		40	N
	Cross-shore	0	0				11	Off					3	OF
	Resultant						19	17					40	345
11	1300-Alongshore												3	S
	Cross-shore												1	OF
	Resultant												3	146
11	1900-Alongshore												30	N
	Cross-shore												2	OF
	Resultant												30	345
12	0100-Alongshore												33	N
	Cross-shore												3	OF
	Resultant												33	345
12	0700-Alongshore	4	S			130	11	N	South	10	S		33	N
	Cross-shore	4	On				4	On					3	OF
	Resultant	5	202				12	321					33	344
12	1300-Alongshore													
	Cross-shore													
	Resultant													
12	1900-Alongshore												28	N
	Cross-shore												1	OF
	Resultant												28	343

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

		PIER MEASUREMENTS								BEACH MEASUREMENTS (500 UPDRIFT)				
		DYE AT 19400 (579m) (SURFACE)		CURRENT METER AT 14120(433m) I.D.#639 (DEPTH -4.2m MSL)		DYE AT MID-SURF ZONE (SURFACE) DIST. FROM BASELINE(M)				DYE 12M OFFSHORE (SURFACE)			CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679	
DAY	TIME	SPEED	DIR	SPEED	DIR		SPEED	DIR	LOCATION	SPEED	DIR		SPEED	DIR
13	0100-Alongshore												34	N
	Cross-shore												2	OF
	Resultant												34	343
13	0700-Alongshore	32	S			129	23	N	South	5	N		34	N
	Cross-shore	1	Off				6	Off					2	OF
	Resultant	32	157				23	354					34	344
13	1300-Alongshore												0	
	Cross-shore												0	
	Resultant												1	0
13	1900-Alongshore												1	N
	Cross-shore												2	OF
	Resultant												2	52
14	0100-Alongshore												1	N
	Cross-shore												2	OF
	Resultant												2	56
14	0700-Alongshore	9	N			114	16	N	South	5	N		0	
	Cross-shore	7	Off				0	0					2	OF
	Resultant	11	17				16	340					2	70
14	1300-Alongshore												3	S
	Cross-shore												1	OF
	Resultant												3	150
14	1900-Alongshore												0	
	Cross-shore												0	
	Resultant												1	0
15	0100-Alongshore												1	N
	Cross-shore												0	
	Resultant												1	340
15	0700-Alongshore	17	S			105	87	N	South	36	S		1	N
	Cross-shore	6	On				26	Off					0	
	Resultant	18	179				91	357					1	340
15	1300-Alongshore													
	Cross-shore													
	Resultant													
15	1900-Alongshore													
	Cross-shore													
	Resultant													
16	0100-Alongshore													
	Cross-shore													
	Resultant													
16	0700-Alongshore	2	S			152	47	S	North	76	S			
	Cross-shore	7	On				2	On						
	Resultant	7	232				47	163						
16	1300-Alongshore													
	Cross-shore													
	Resultant													
16	1900-Alongshore													
	Cross-shore													
	Resultant													
17	0100-Alongshore													
	Cross-shore													
	Resultant													
17	0700-Alongshore	36	N	GAGE INOPERATIVE		158	87	N	South	42	N		GAGE INOPERATIVE	
	Cross-shore	0	0				44	On						
	Resultant	36	340				97	313						
17	1300-Alongshore													
	Cross-shore													
	Resultant													
17	1900-Alongshore													
	Cross-shore													
	Resultant													
18	0100-Alongshore													
	Cross-shore													
	Resultant													
18	0700-Alongshore	13	N			140	44	N	South	15	N			
	Cross-shore	6	On				13	Off						
	Resultant	15	316				45	357						
18	1300-Alongshore													
	Cross-shore													
	Resultant													
18	1900-Alongshore													
	Cross-shore													
	Resultant													

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ON=ONSHORE
OF=OFFSHORE

		PIER MEASUREMENTS								BEACH MEASUREMENTS (500 UPDRIFT)				
		DYE AT 19+00 (579m) (SURFACE)		CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)		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	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
19	0100-Alongshore												
	Cross-shore												
	Resultant												
19	0700-Alongshore	10	N			144	68	N	South	4	S		
	Cross-shore	1	On				24	Off					
	Resultant	10	337				72	359					
19	1300-Alongshore												
	Cross-shore												
	Resultant												
19	1900-Alongshore												
	Cross-shore												
	Resultant												
20	0100-Alongshore												
	Cross-shore												
	Resultant												
20	0700-Alongshore	30	N			143	55	N	South	38	N		
	Cross-shore	6	Off				64	On					
	Resultant	31	351				84	291					
20	1300-Alongshore												
	Cross-shore												
	Resultant												
20	1900-Alongshore												
	Cross-shore												
	Resultant												
21	0100-Alongshore												
	Cross-shore												
	Resultant												
21	0700-Alongshore	9	S			140	34	N	South	8	S		
	Cross-shore	14	On				2	On					
	Resultant	16	216				34	337					
21	1300-Alongshore												
	Cross-shore												
	Resultant												
21	1900-Alongshore												
	Cross-shore												
	Resultant												
22	0100-Alongshore												
	Cross-shore												
	Resultant												
22	0700-Alongshore	38	S			141	76	S	North	37	S		
	Cross-shore	0	0				38	On					
	Resultant	38	160				85	187					
22	1300-Alongshore												
	Cross-shore												
	Resultant												
22	1900-Alongshore												
	Cross-shore												
	Resultant												
23	0100-Alongshore												
	Cross-shore												
	Resultant												
23	0700-Alongshore	38	S	GAGE INOPERATIVE		176	87	S	North	69	S	GAGE INOPERATIVE	
	Cross-shore	8	On				9	On					
	Resultant	39	171				88	166					
23	1300-Alongshore												
	Cross-shore												
	Resultant												
23	1900-Alongshore												
	Cross-shore												
	Resultant												
24	0100-Alongshore												
	Cross-shore												
	Resultant												
24	0700-Alongshore	0	0			140	0	0	South	17	N		
	Cross-shore	3	Off				0	0					
	Resultant	3	70										
24	1300-Alongshore												
	Cross-shore												
	Resultant												
24	1900-Alongshore												
	Cross-shore												
	Resultant												

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		PIER MEASUREMENTS						BEACH MEASUREMENTS (500 UPDRIFT)				
		DYE AT 19+00 (579m) (SURFACE)		CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)		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	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
25	0100-Alongshore												
	Cross-shore												
	Resultant												
25	0700-Alongshore	4	N				12	S		2	N		
	Cross-shore	3	On			135	3	Off	North				
	Resultant	6	303				12	146					
25	1300-Alongshore												
	Cross-shore												
	Resultant												
25	1900-Alongshore												
	Cross-shore												
	Resultant												
26	0100-Alongshore												
	Cross-shore												
	Resultant												
26	0700-Alongshore	5	S				3	S		0	0		
	Cross-shore	8	Off			125	6	Off	North				
	Resultant	10	102				7	98					
26	1300-Alongshore			0									
	Cross-shore			0									
	Resultant			0	0								
26	1900-Alongshore			1	S								
	Cross-shore			1	ON								
	Resultant			1	205								
27	0100-Alongshore			2	N								
	Cross-shore			1	OF								
	Resultant			2	1								
27	0700-Alongshore	0	0	3	N		7	N		8	N		
	Cross-shore	23	Off	1	OF	116	4	Off	South				
	Resultant	23	70	3	3		8	7					
27	1300-Alongshore			3	N								
	Cross-shore			2	OF								
	Resultant			4	11								
27	1900-Alongshore			1	N								
	Cross-shore			0									
	Resultant			1	340								
28	0100-Alongshore			1	N								
	Cross-shore			2	OF								
	Resultant			2	30								
28	0700-Alongshore	18	N	6	N		14	N		6	N		
	Cross-shore	14	Off	2	OF	128	7	Off	South				
	Resultant	23	17	6	2		15	7					
28	1300-Alongshore			3	N								
	Cross-shore			2	OF								
	Resultant			4	6								
28	1900-Alongshore			2	N								
	Cross-shore			1	OF								
	Resultant			2	11								
29	0100-Alongshore			3	N								
	Cross-shore			1	OF								
	Resultant			3	6								
29	0700-Alongshore	55	S	1	S		47	S		46	S		
	Cross-shore	8	On	0		140	0	0	North				
	Resultant	56	168	1	160		47	160					
29	1300-Alongshore			15	S								
	Cross-shore			5	ON								
	Resultant			16	177								
29	1900-Alongshore			14	S								
	Cross-shore			4	ON								
	Resultant			15	176								
30	0100-Alongshore			11	S								
	Cross-shore			3	ON								
	Resultant			11	175								
30	0700-Alongshore	41	S	14	S		38	S		40	S		
	Cross-shore	4	On	4	ON	140	11	On	North				
	Resultant	41	166	14	175		40	177					
30	1300-Alongshore			8	S								
	Cross-shore			1	ON								
	Resultant			9	169								
30	1900-Alongshore			11	S								
	Cross-shore			3	ON								
	Resultant			12	175								

GAGE INOPERATIVE

KEY = ALL SPEEDS IN CM/SEC
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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.

SUPPLEMENTAL OBSERVATIONS

November 1985

DAY	TIME	WAVE APPROACH ANGLE AT PIER END (° from True N) PRIMARY	SECONDARY	RADAR WAVE ANGLE (° from True N)	WIDTH OF SURF ZONE (M)	WATER CHARACTERISTICS AT PIER END TEMP (°C)	DENSITY (g/cc)	SECCI VIS (M)
1	0725	95	10	90	96	18.8	1.0210	.9
2	0805	80		80	347	18.6	1.0214	.6
3	0955	60	90	60	173	18.8	1.0213	.6
4	0810	90		90	97	18.8	1.0217	.6
5	0800	90		80	102	18.2	1.0233	.6
6	0725	70	355		70	18.1	1.0233	1.5
7	0725	65			74	18.1	1.0233	.6
8	0730	20		60	70	17.7	1.0335	.6
9	0920	70			88	17.2	1.0235	.9
10	0830	75	120		43	16.5	1.0206	1.5
11	0830	90	60		6	18.0	1.0248	1.8
12	0735				49	19.7	1.0229	2.1
13	0735	75	105		59	17.4	1.0182	1.5
14	0730	105			12	17.4	1.0207	1.5
15	0805	5			4	19.5	1.0229	1.2
16	0840	80		80	85	17.4	1.0200	1.8
17	0735	115			109	17.8	1.0215	.9
18	0815	90	30	80	71	17.4	1.0200	3.0
19	0805	100	20	80	67	17.8	1.0204	1.8
20	0800	105	120	90	78	18.5	1.0220	.9
21	0810	80	20	90	58	18.4	1.0228	1.5
22	0800	50	15	60	68	17.2	1.0208	.
23	0825	50		40	237	15.6	1.0184	.
24	0900	50	15		67	15.9	1.0203	.
25	0800	40			56	15.8	1.0201	.
26	1000	25	100		29	16.2	1.0208	1.
27	0800	120			2	17.2	1.0240	.
28	0845	140			6	17.6	1.0232	1.
29	0950	20		50	79	17.0	1.0234	2.
30	0930	60			79	17.2	1.0220	1.

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 range of each cycle while Figure 5 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.

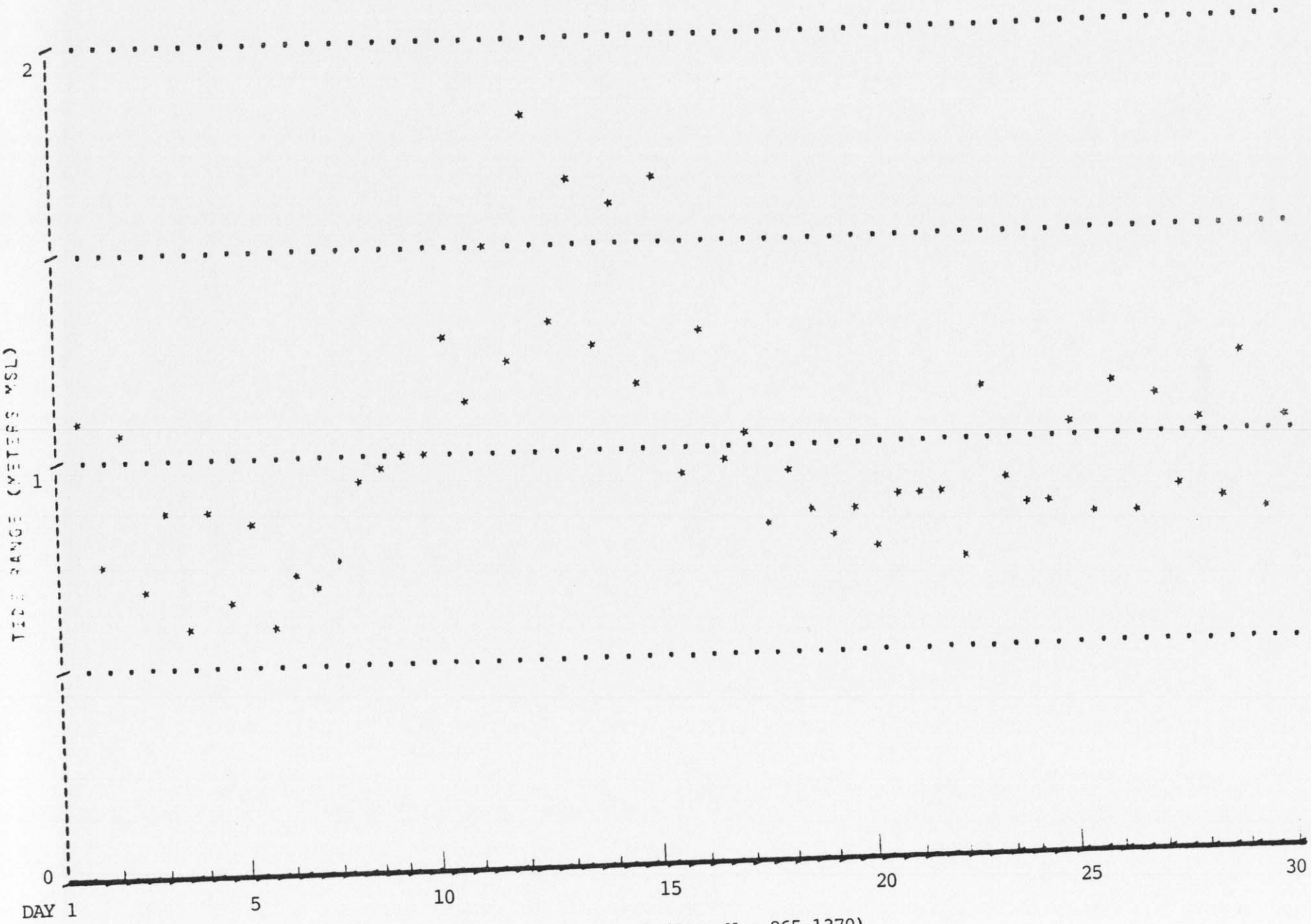

FIGURE 4. Time History of Tide Range, November 1985 (Gage No. 865-1370)

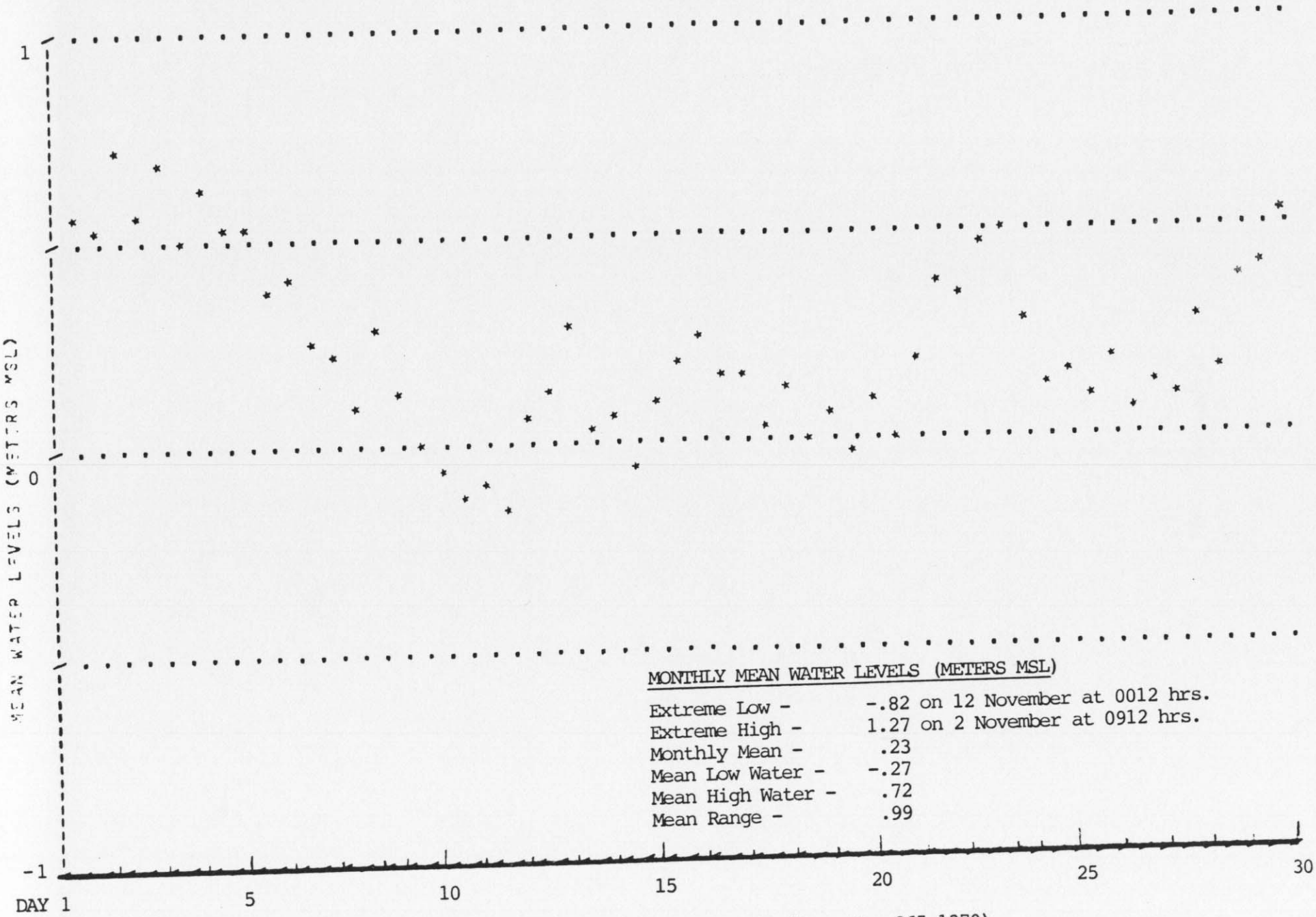

FIGURE 5. Time History of Mean Water Levels, November 1985 (Gage No. 865-1370)

TABLE 6

WATER LEVELS (METERS MSL)
Tidal Characteristics
November 1985

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-.01	1.09	.56	1.11
1	1837	.13	.90	.52	.77
2	702	.22	1.27	.73	1.06
2	1928	.21	.90	.55	.69
3	753	.27	1.16	.70	.89
3	2018	.21	.80	.51	.58
4	843	.18	1.07	.62	.89
4	2108	.13	.78	.52	.65
5	934	.11	.95	.52	.84
5	2159	.06	.67	.37	.61
6	1024	.04	.77	.41	.73
6	2249	-.10	.58	.24	.69
7	1114	-.19	.56	.21	.75
7	2340	-.37	.56	.10	.94
8	1205	-.19	.79	.28	.98
9	30	-.37	.63	.13	1.00
9	1255	-.52	.49	.00	1.01
10	120	-.71	.57	-.07	1.28
10	1346	-.70	.42	-.13	1.12
11	211	-.81	.68	-.09	1.49
11	1436	-.79	.42	-.17	1.20
12	301	-.82	.98	.08	1.80
12	1526	-.57	.76	.13	1.32
13	352	-.52	1.13	.29	1.65
13	1617	-.64	.61	.03	1.25
14	442	-.70	.89	.07	1.59
14	1707	-.68	.48	-.08	1.16
15	532	-.70	.97	.10	1.67
15	1758	-.33	.62	.18	.95
16	623	-.39	.89	.24	1.27
16	1848	-.33	.64	.15	.98
17	713	-.37	.66	.15	1.04
17	1938	-.40	.43	.03	.83
18	804	-.34	.61	.12	.94
18	2029	-.45	.38	-.01	.83
19	854	-.34	.44	.05	.78
19	2119	-.45	.40	-.03	.85
20	944	-.30	.47	.08	.77
20	2210	-.44	.42	.01	.86
21	1035	-.23	.66	.19	.88
21	2300	-.05	.81	.37	.86
22	1125	-.01	.72	.35	.73
22	2350	-.06	1.06	.48	1.12
23	1216	.10	1.01	.49	.91
24	41	-.15	.70	.28	.85
24	1306	-.29	.56	.13	.84
25	131	-.34	.69	.16	1.04
25	1356	-.35	.45	.09	.80
26	222	-.37	.75	.18	1.11
26	1447	-.36	.45	.07	.82
27	312	-.42	.69	.13	1.10
27	1537	-.36	.52	.11	.88
28	402	-.22	.82	.30	1.04
28	1628	-.27	.58	.15	.84
29	453	-.20	.98	.39	1.19
29	1718	.00	.81	.42	.81
30	543	.02	1.05	.53	1.03

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 6 shows the last survey in October and the two surveys taken during November on profile line 188, located 517 m south of the pier. As a result of the numerous periods of high waves during the month of November, surveys showed significant changes on most of the profile. Accretion of up to 0.5 m is visible on the foreshore (75 to 180 m) resulting in a pronounced berm. The well-defined nearshore bar (120 to 280 m) initially retreated 30 m seaward then migrated 50 m shoreward. The offshore bar (280 to 480 m) showed a substantial amount of accretion early in the month followed by some minor erosion at the crest. Only minor changes are visible on the remainder of the profile.

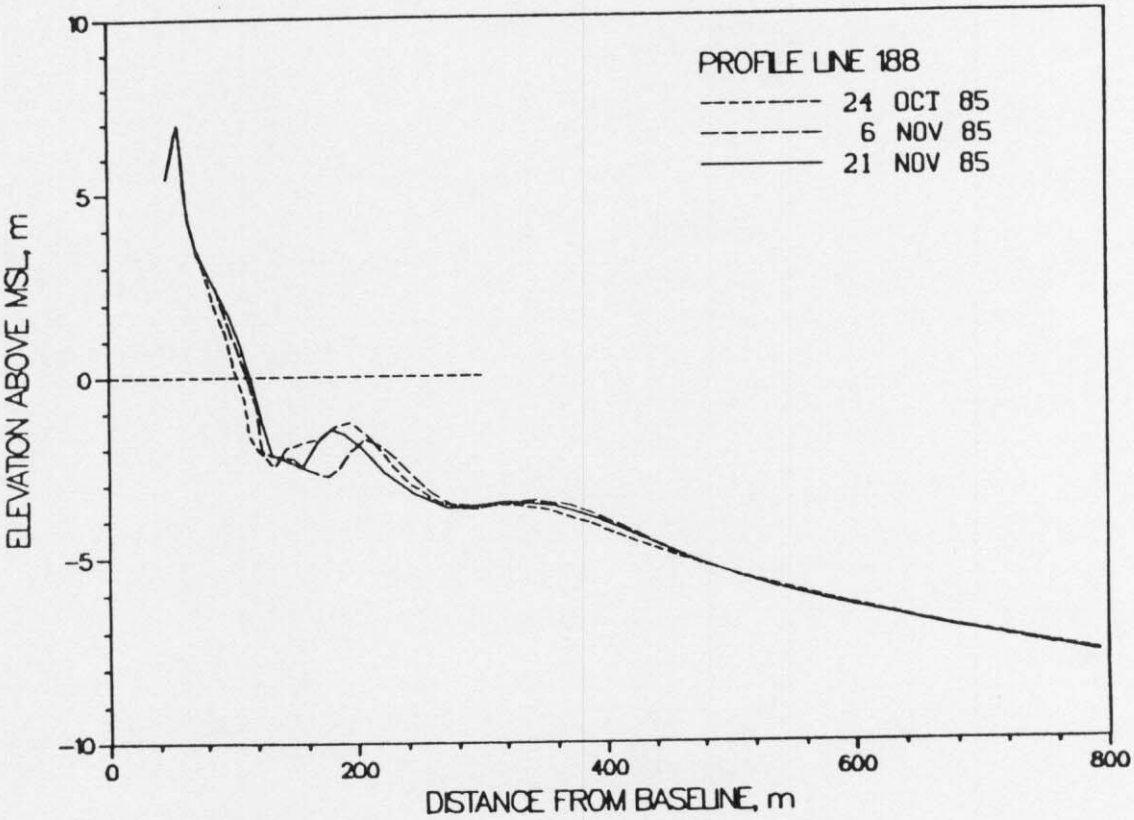

Figure 6. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 7) reflects the maximum changes which occurred on the profile between January and November. All the changes are a result of the 6 November survey.

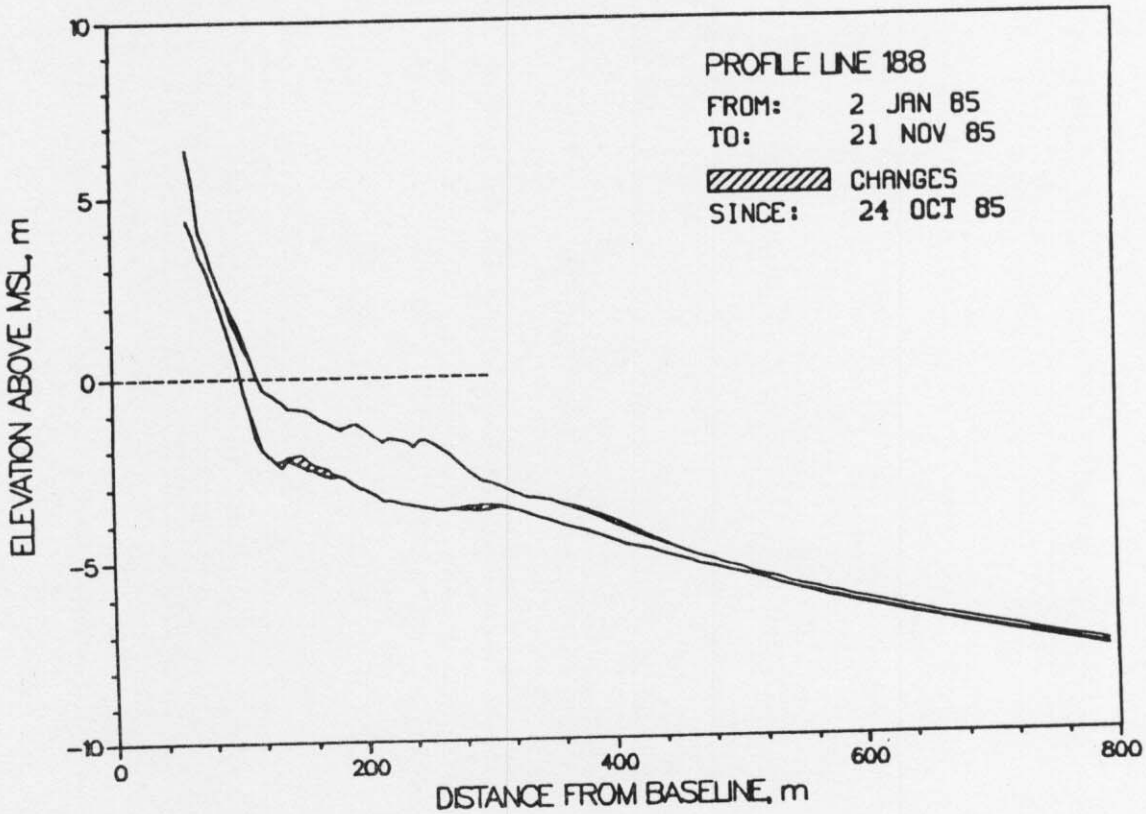

Figure 7. CRAB profile envelope - profile 188.

B. Bathymetry. No bathymetric survey was conducted this month; Figure 8 for 28 September 1985 is included for reference.

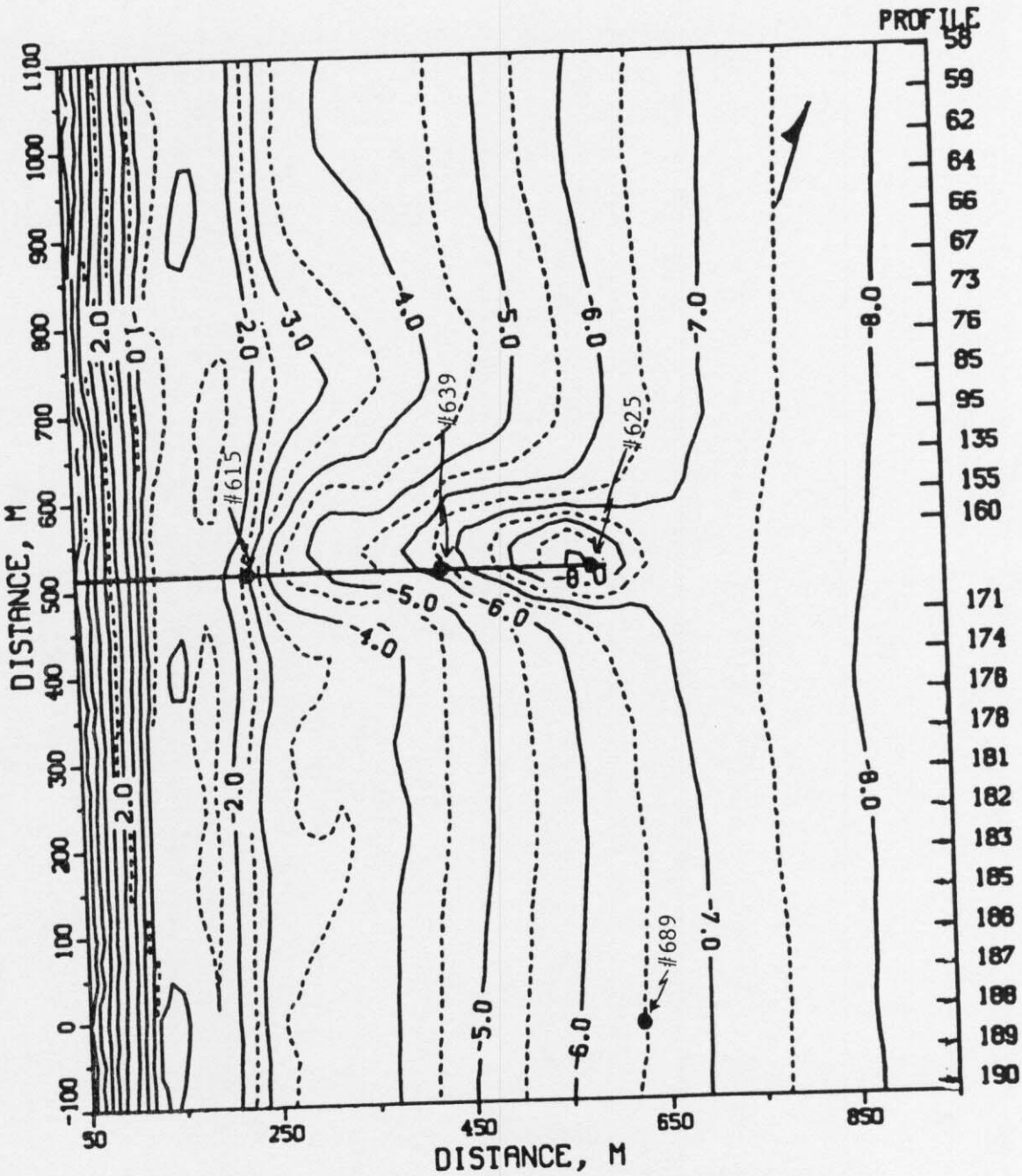

FIGURE 8. FRF BATHYMETRY 28 SEP 85
CONTOURS IN METERS

VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height at the seaward end of the pier (i.e. as measured by the Baylor gage #625 at pier station 19+00) exceeded 2 m and wave records were obtained every hour:

Start	End
1 Nov (0000)	2 Nov (0000)
2 Nov (0300)	3 Nov (0000)
4 Nov (0500)	5 Nov (0300)
21 Nov (1900)	22 Nov (0300)
22 Nov (2200)	23 Nov (1800)

B. Storm Synopsis.

1. 1-3 November: High waves were first generated by strong easterly winds associated with a large high pressure system centered over New England on 1 November. By 2 November, the remnant of Hurricane Juan, which had struck Louisiana, spawned a new storm over Cape Hatteras, NC. This storm rapidly moved offshore into the Atlantic. Maximum winds approached 14 m/s (north) with the highest Hmo (gage #625) of 3.13 m being recorded at 1000 hrs on 2 November. The lowest barometric pressure reading of 1002.3 mb occurred from 0300 to 0600, also on 2 November. Total precipitation amounted to 31 mm.

2. 4-5 November: This low pressure system developed on 3 November along a cold front in the Gulf of Mexico. The storm followed a northerly track over the Appalachian Mountains and was located over western North Carolina early on 4 November. Slowly continuing north, the storm was centered over Maryland on 5 November and off the New England coast by the 6th. Maximum winds exceeded 14.5 m/s (northeast) with the highest Hmo (gage #625) of 3.24 m recorded at 1700 hrs. on 4 November. The lowest barometric pressure of 997.5 mb occurred at 1600 hrs. also on the 4th. Total precipitation amounted to 47 mm.

3. 21-23 November: This storm was the remnant of Hurricane Kate, which made landfall on the Florida "panhandle" on 21 November and slowly moved over the southeastern states, rapidly losing strength over land. By 23 November, the now very weak low pressure system was located several hundred miles east of Cape Hatteras, NC where it continued to travel into the Atlantic. Maximum winds exceeded 14 m/s (northwest) with the highest Hmo (gage #625) of 2.82 m being recorded at 0600 hrs. on 23 November. The lowest barometric pressure of 1000.6 mb occurred at 1900 on the 22nd. Total precipitation amounted to 30 mm.

Distribution List

Government Agencies:

OCE
BERH
NAO
NASA/Wallops Flight Center
NOAA (NOS, NWS)
SAD
SAW
U.S. Geological Survey
U.S. National Park Service
U.S. Naval Academy
U.S. Naval Civil Eng. Lab
U.S. Naval Facilities Eng. Com.
U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.
Duke University
East Carolina University
Florida Inst. of Tech.
NC State University
Old Dominion University
Oregon State University
Prince George's College
Rutgers University
Scripps Inst. of Oceanography
Stockton State College
Texas A&M University
University of Akron
University of Delaware
University of Florida
University of Maryland
University of North Carolina
University of Northern Colorado
University of Rhode Island
University of Virginia
Virginia Inst. of Marine Science

Others:

City of Va. Beach, VA
Coastal Barge Corporation
Coastal and Est. Res., Inc.
Coastal Science & Eng., Inc.
Dr. Galvin
GEOMET, Inc.
Greenhorne & O'Mara, Inc.
Dr. Hylton
Ms. Johnson
Mary Marr, Inc.
Masonite Corporation
Moffatt & Nichol, Eng.
Offshore Coastal Technologies
Mr. Rowland
Mr. Savage
Sea Port Supply Corp.
Shell Development
Sohio Petroleum Co.
Mr. & Mrs. Valpey
WCTI-TV

Foreign:

W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of New South Wales (Australia)
University of Sydney (Australia)