US Army Corps
of Engineers
Waterways Experiment
Station

Preliminary Data Summary for August 1995 CERC Field Research Facility

by Clifford Baron, Michael Leffler, Kent Hathaway, Paul Hodges,
William Birkemeier, Brian Scarborough, Ray Townsend

Coastal Engineering Research Center

WES

Approved for Public Release; Distribution is Unlimited

Prepared for Headquarters, U.S. Army Corps of Engineers

August 1995
Preliminary Data Summary

by Field Research Facility

U.S. Army Corps of Engineers
Waterways Experiment Station
Coastal Engineering Research Center
1261 Duck Road
Duck, NC 27949-4472

Contents

Preface iv
1 — Introduction 1
2 — Meteorological Data 7
3 — Wave Data 12
4 — Current Data 17
5 — Visual Observations 20
6 — Water Levels 22
7 — Bathymetry 24
8 — Special Events 27

List of Figures

No.
1 FRF Location Map 2
2 Month at a Glance 3
3 Instrument Locations at FRF 6
4 Meteorological Monthly Summary 8
5 Wave Heights and Periods 16
6 Water Levels 22
7 CRAB Profiles 24
8 CRAB Profile Envelope 25
9 FRF Bathymetry (22 August 95) 26

List of Tables

No.
1 Instrument Status/Data Availability 4
2 Gauge Locations 5
3 Meteorological Data 9
4 Wave Data 13
5 Current Meter Data 18
6 Visually Observed Current Data 19
7 Visual Observations 21
8 Water Levels 23

Preface

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

These reports are now available via the World Wide Web at http://frf.wes.army.mil/frf.html

These web pages contain general information about the Field Research Facility and data from 1980 to the present.

Please send comments to webmaster@duck.wes.army.mil .
If the web is sufficient for your needs and you no longer require hardcopies, please let us know.

1 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 (Figure 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 research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.75 m above the National Geodetic Vertical Datum (NGVD) of the year 1929.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local bathymetric, oceanographic, and meteorological conditions. This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Clifford F. Baron at (919) 261-3511 *(baron@duck.wes.army.mil)*.

Chapter 2 presents the meteorological data; Chapters 3 through 6 present oceanographic data; Chapter 7 presents nearshore profiles and bathymetry; and Chapter 8, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used and their operational status during the month. Figure 2 shows weather and ocean conditions for the month. Table 2 and Figure 3 identifies the location of the instruments. The water depths at the wave gauges and current meters vary and may be determined from information contained in Figure 9. Other installation information is contained in Table 1.

Times given in the report are referenced to eastern standard time (EST).

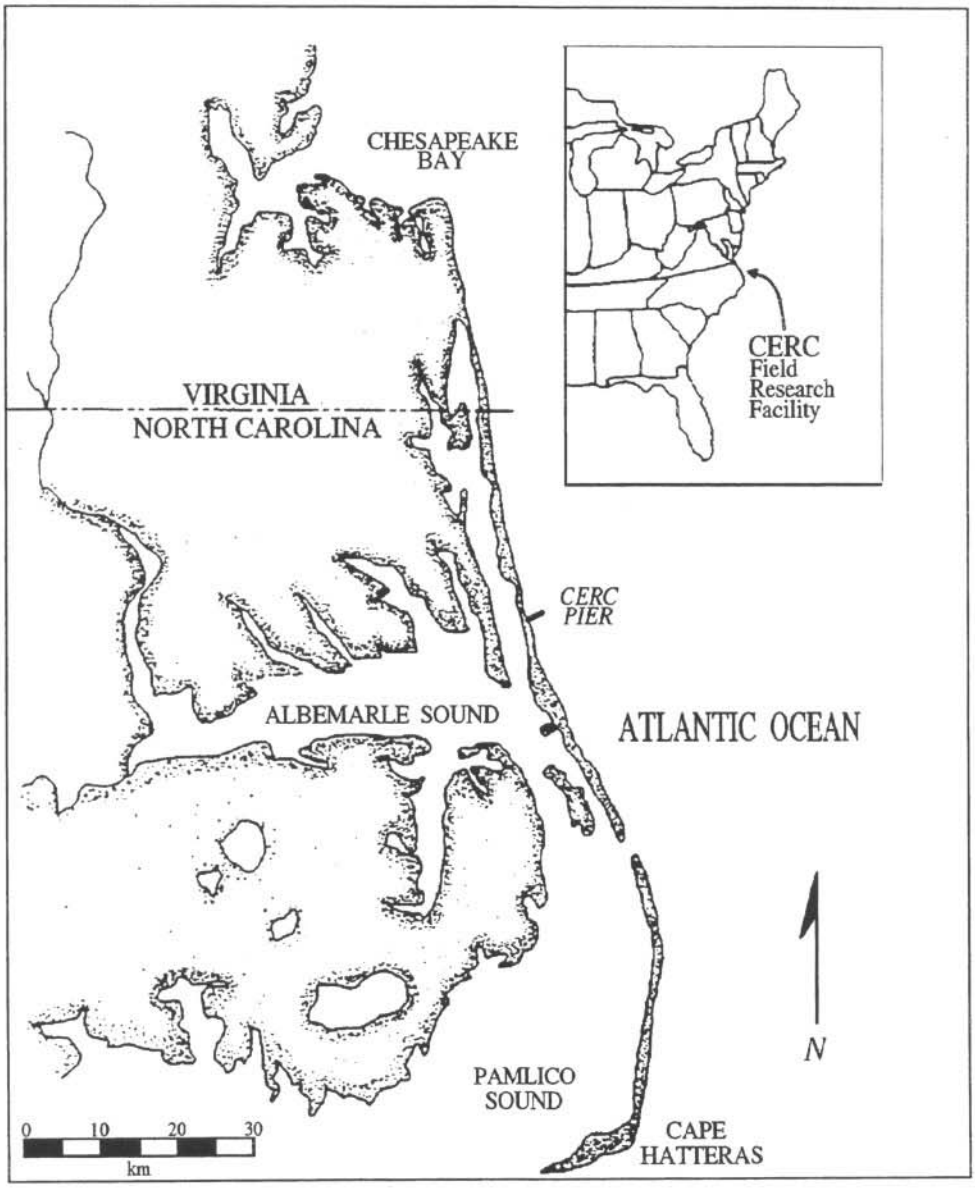

Figure 1. FRF Location Map

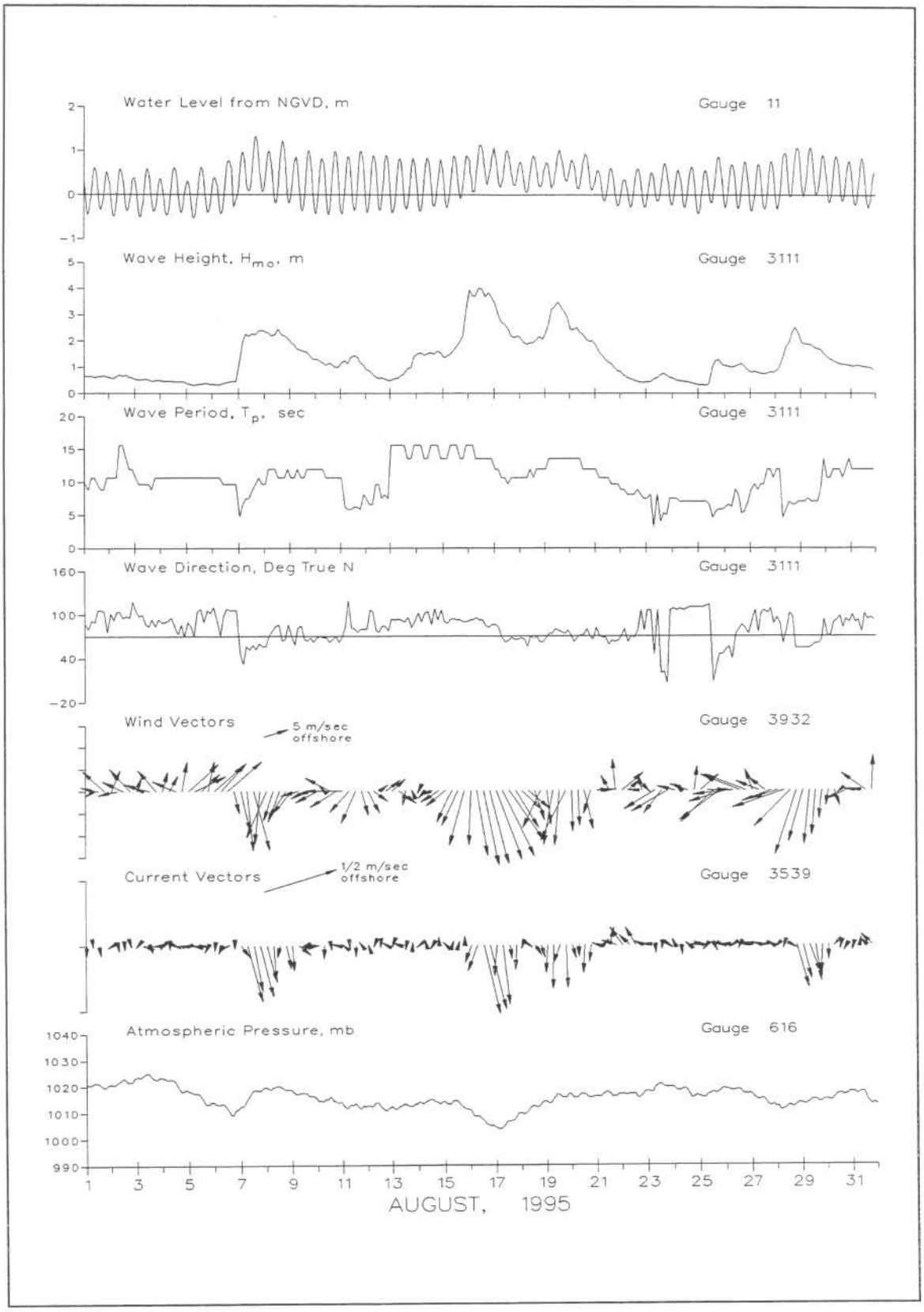

Figure 2. Month at a Glance

Table 1
Instrument Status/Data Availability

August 1995

Day of the month

Gauge ID	Description/Remarks		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
616	Atmospheric Pressure	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
604	Precipitation	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
624	Air Temperature	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3932	Anemometer	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
641	Pressure Gauge on FRF pier	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
625	Baylor staff on FRF pier	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3111	8 Meter Array 309 m north of FRF	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
111	Pressure Gauge center of 8 Meter Array	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
630	Waverider buoy 4.0 km offshore	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	/	/	/	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3539	Current meter 343 m north of FRF pier (1.6 km offshore)	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	NOAA tide gauge at end of pier	Gauge Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
		Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Visual Observations (daily oceanographic and meteorological observations)	Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Gauge Status * = Operational / = Partial - = Non-Operational
Data Collected * = All / = Partial - = None
Visual Observations * = Complete / = Partial - = None

Table 2
Gauge Locations

Gauge ID	Description	Latitude Degrees N	Longitude Degrees W	FRF Coordinates Crosshore m	FRF Coordinates Longshore m	Gauge Depth NGVD, m	Water Depth NGVD, m
616	Atmospheric Pressure	36 10′ 57.03"	75 45′ 5.50"	11.60	569.00	-----	-----
3932	Anemometer	36 11′ 1.23"	75 44′ 43.07"	585.20	517.30	19.50	-----
641	Pressure Gauge	36 10′ 57.71"	75 44′ 56.23"	239.11	516.64	-1.64	-1.96
625	Baylor Staff	36 11′ 1.04"	75 44′ 43.72"	568.00	516.64	Surface	-8.36
3111	8 Meter Array North	36 11′ 19.14"	75 44′ 36.41"	915.23	990.16	-7.50	-7.90
	8 Meter Array South	36 11′ 11.28"	75 44′ 33.28"	914.20	735.37	-7.42	-7.90
	8 Meter Array East	36 11′ 13.70"	75 44′ 32.56"	954.51	800.58	-7.62	-8.13
	8 Meter Array West	36 11′ 12.48"	75 44′ 37.11"	834.66	800.37	-6.98	-7.44
111	Pressure Gauge in center of 8 M Array	36 11′ 14.06"	75 44′ 34.39"	914.43	825.52	-7.76	-8.08
630	Waverider Buoy	36 10′ 5.10"	75 41′ 59.30"	3934.96	-2400.81	Surface	-17.00
3539	Current Meter	36 11′ 23.57"	75 44′ 9.12"	1605.80	907.60	-11.60	-11.70
11	NOAA Tide Gauge	36 11′ 1.25"	75 44′ 42.60"	596.49	514.20	Surface	-7.62

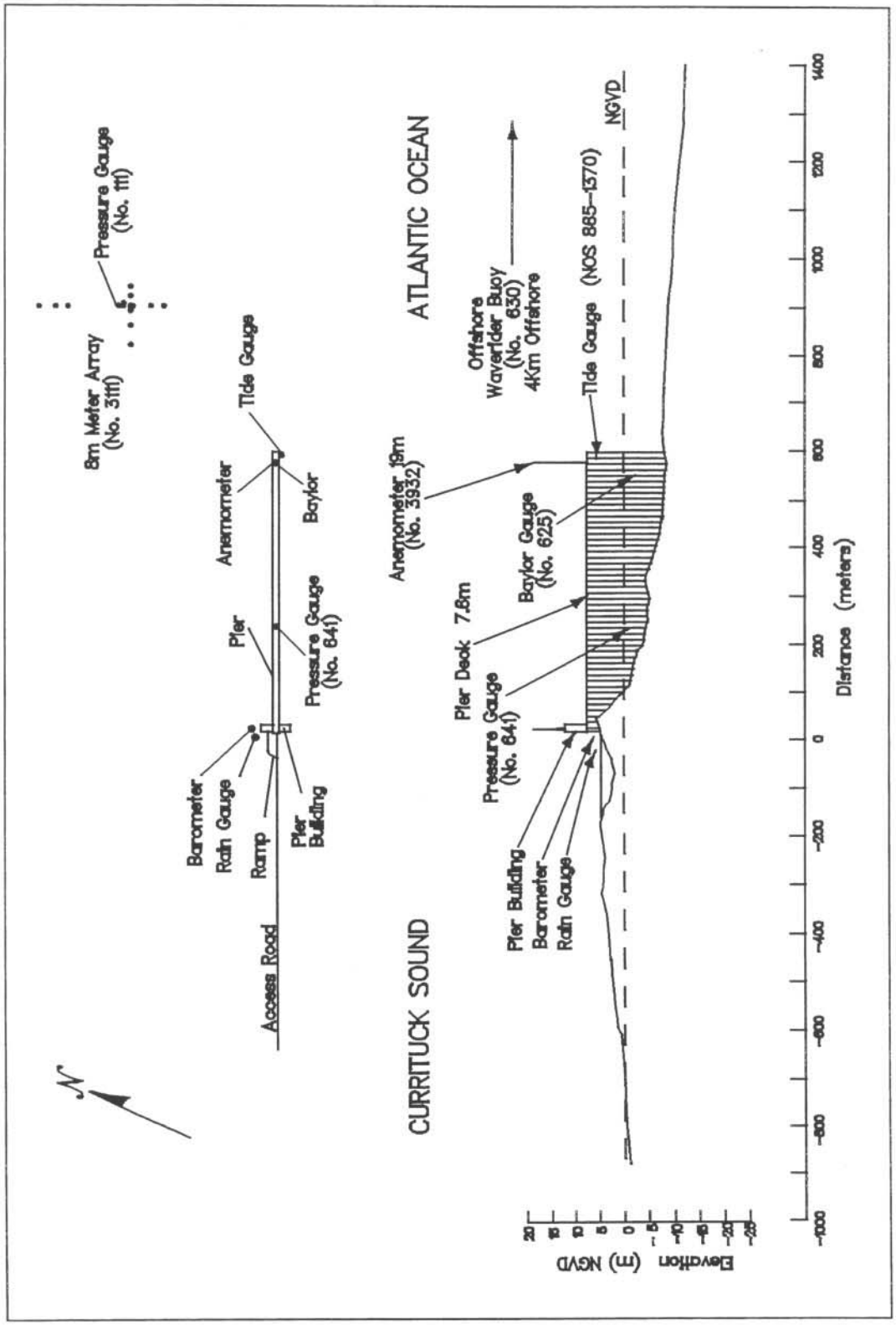

Figure 3. Instrument Locations, Elevations From NGVD

2 Meteorological Data

A variety of instruments have been installed at the FRF (Figure 3) to monitor the meteorological conditions. The data presented in Table 3 are collected and stored using a Digital Equipment Corporation VAXstation 4000. For each instrument identified in Table 1, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m using a WeatherMeasure Skyvane anemometer. Monthly resultant wind speeds and directions (Figure 4) are determined by vector averaging the data. Wind directions (Table 3) indicate where the wind is coming from. Temperature and atmospheric pressure means (Table 3) are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 3 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 Celsius (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

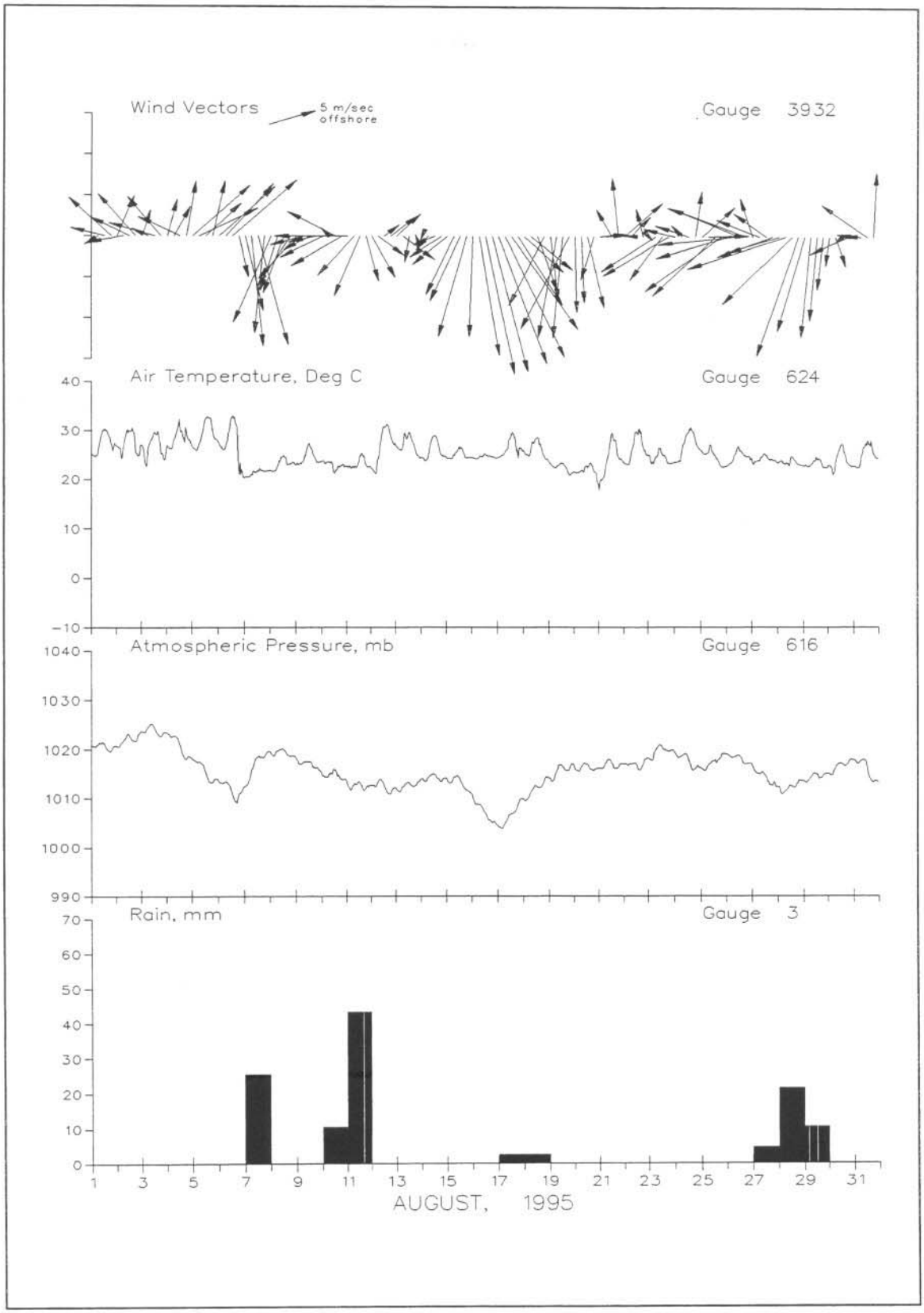

Figure 4. Meteorological Monthly Summary

Table 3
Meteorological Data

Aug 1995

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	inoperative		25.1	1020.8	0
	700	2	53	26.3	1021.2	0
	1300	4	104	30.1	1021.0	0
	1900	6	136	27.2	1019.9	0
2	100	5	200	26.8	1020.7	0
	700	4	76	26.9	1021.8	0
	1300	5	118	29.9	1022.8	0
	1900	7	141	25.6	1021.8	0
3	100	3	195	27.0	1023.7	0
	700	2	116	26.8	1024.7	0
	1300	5	107	29.7	1024.2	0
	1900	6	143	25.2	1022.8	0
4	100	5	192	26.9	1023.3	0
	700	4	205	28.2	1022.9	0
	1300	5	117	30.4	1020.9	0
	1900	7	188	29.4	1018.3	0
5	100	8	222	26.6	1018.2	0
	700	7	240	27.2	1017.5	0
	1300	5	221	32.5	1015.4	0
	1900	7	190	29.7	1013.3	0
6	100	8	223	27.4	1013.3	0
	700	8	217	27.0	1013.5	0
	1300	9	224	32.9	1010.9	0
	1900	5	348	21.1	1011.0	0
7	100	9	348	20.6	1012.5	0
	700	14	354	21.0	1015.9	25
	1300	14	346	21.7	1018.6	0
	1900	12	5	21.7	1018.7	0
8	100	11	20	21.9	1019.4	0
	700	7	15	22.8	1019.7	0
	1300	7	17	24.9	1020.1	0
	1900	7	29	23.1	1018.8	0
9	100	6	37	23.3	1017.9	0
	700	4	71	23.8	1017.6	0
	1300	3	57	26.9	1017.6	0
	1900	3	74	23.7	1016.3	0
10	100	5	58	23.8	1014.6	0
	700	1	138	23.7	1015.1	11
	1300	6	121	21.8	1016.0	0
	1900	6	55	22.8	1013.9	0

Table 3
Meteorological Data (continued)

Aug 1995

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
11	100	8	1	22.7	1012.5	0
	700	6	38	22.4	1012.8	43
	1300	8	20	24.9	1013.2	0
	1900	6	345	23.0	1012.1	0
12	100	6	333	22.2	1012.7	0
	700	4	310	24.3	1013.5	0
	1300	2	229	30.8	1012.6	0
	1900	4	228	28.9	1010.9	0
13	100	4	222	26.9	1011.8	0
	700	4	311	27.1	1012.4	0
	1300	3	8	29.7	1013.2	0
	1900	0		25.6	1012.8	0
14	100	1	21	24.5	1014.1	0
	700	2	38	25.1	1014.4	0
	1300	2	64	29.1	1014.9	0
	1900	4	52	25.1	1013.4	0
15	100	5	46	24.3	1013.5	0
	700	8	22	25.1	1014.4	0
	1300	9	21	26.2	1013.8	0
	1900	13	13	24.4	1011.6	0
16	100	12	1	24.5	1010.2	0
	700	15	352	24.7	1008.7	0
	1300	17	350	25.1	1006.8	0
	1900	17	347	24.7	1005.0	0
17	100	16	342	24.6	1004.2	0
	700	16	337	25.7	1005.0	3
	1300	13	328	29.1	1006.8	0
	1900	10	331	24.4	1009.0	0
18	100	6	317	25.6	1009.6	0
	700	6	313	26.3	1011.2	3
	1300	7	342	28.6	1012.3	0
	1900	9	22	24.9	1013.3	0
19	100	8	353	23.2	1013.9	0
	700	13	8	22.4	1015.5	0
	1300	12	4	23.4	1016.4	0
	1900	12	23	21.1	1015.8	0
20	100	9	358	21.4	1015.9	0
	700	8	357	21.8	1016.5	0
	1300	9	348	22.4	1017.0	0
	1900	5	14	21.8	1015.7	0

Table 3
Meteorological Data (concluded)

Aug 1995

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
21	100	3	264	19.8	1016.1	0
	700	2	265	23.2	1017.2	0
	1300	4	152	29.7	1017.1	0
	1900	7	174	24.7	1016.3	0
22	100	6	224	23.4	1017.0	0
	700	3	221	24.8	1017.0	0
	1300	1	94	30.0	1016.9	0
	1900	3	168	26.6	1017.0	0
23	100	1	319	25.0	1018.0	0
	700	7	53	24.6	1019.8	0
	1300	6	32	25.2	1020.4	0
	1900	8	55	23.3	1019.7	0
24	100	3	105	23.5	1019.1	0
	700	2	142	26.0	1018.8	0
	1300	4	112	29.8	1017.6	0
	1900	6	186	27.9	1016.1	0
25	100	5	223	25.7	1016.0	0
	700	4	268	25.6	1016.8	0
	1300	10	40	25.0	1017.9	0
	1900	10	48	22.7	1018.8	0
26	100	8	69	22.9	1019.0	0
	700	8	82	24.6	1018.4	0
	1300	8	115	26.0	1018.5	0
	1900	9	113	24.7	1017.0	0
27	100	5	163	23.1	1016.3	0
	700	5	114	23.8	1015.0	5
	1300	4	130	24.8	1014.3	0
	1900	6	66	24.1	1012.7	0
28	100	6	69	23.7	1012.2	0
	700	11	68	23.2	1011.5	22
	1300	11	40	24.7	1012.4	0
	1900	15	16	23.2	1013.3	0
29	100	12	13	22.8	1013.3	0
	700	12	4	23.1	1014.2	10
	1300	10	4	24.4	1014.9	0
	1900	7	5	22.6	1014.6	0
30	100	4	6	22.9	1015.0	0
	700	4	343	23.3	1016.2	0
	1300	1	45	27.4	1017.0	0
	1900	5	62	23.2	1017.1	0
31	100	2	1	22.8	1017.8	0
	700	2	1	24.3	1017.7	0
	1300	6	129	27.7	1016.2	0
	1900	8	182	25.3	1013.3	0
		Resultant		Mean	Mean	Total
		3	19	25.1	1015.7	122

3 Wave Data

Wave data are collected from three different sets of instruments, as shown in Table 1 and Figure 3. The first is an array of fifteen pressure gauges, collectively referred to as gauge 3111 (gauge 111 being one of them). Directional information is computed from these gauges using a iterative maximum liklihood estimator. The second is a Baylor staff gauge (625) and a pressure gauge (641), both attached to the pier. The third is a Waverider buoy (630). The data are collected, analyzed, and stored on optical disc using a Digital Equipment Corporation VAXstation 4000. Data is sampled at 2 hertz, with five contiguous 34 minute records, for a total collection period of nearly 2 hours and 51 minutes. This report reflects the data collection periods of 0100, 0700, 1300, and 1900 EST. The results are based only on the first 34 minute record. The exception is the 8 Meter Array (3111) which condenses the first four records into one statistical value.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gauge has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 degrees of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum.

Table 4 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 4 are average values computed from this data. Figure 5 is a time history of all H_{mo} and T_p values obtained for all gauges.

Differences in wave periods between wave gauges (Table 4 and Figure 5) may be the result of wave breaking, wave reformation, the presence of multiple wave trains containing nearly equal energy, and statistical variations in spectral estimations.

Table 4
Wave Data

Aug 1995

		641 Pressure Gauge		625 Baylor Gauge		3111 8 Meter Array			630 Waverider	
Day	Hour	Hmo,m	Tp,sec	Hmo,m	Tp,sec	Hmo,m	Tp,sec	Dir,TN	Hmo,m	Tp,sec
1	0100	0.52	11.7	0.73	11.7	0.66	9.8	86	0.89	11.7
	0700	0.58	9.9	0.65	9.9	0.66	10.8	92	0.76	10.7
	1300	0.48	10.7	0.58	9.5	0.63	9.8	106	0.69	9.2
	1900	0.63	9.2	0.63	8.9	0.67	8.9	104	0.76	9.2
2	0100	0.56	11.2	0.57	11.2	0.59	10.8	102	0.73	11.2
	0700	0.54	10.7	0.59	8.6	0.64	10.8	104	0.76	10.3
	1300	0.64	15.1	0.62	15.1	0.66	15.7	96		
	1900	0.59	13.5	0.60	13.5	0.61	12.0	96	inoperative	
3	0100	0.54	8.1	0.53	8.6	0.54	10.8	104		
	0700	0.46	8.9	0.51	9.9	0.53	9.8	100	0.62	9.5
	1300	0.48	9.9	0.46	10.3	0.51	9.8	84	0.60	7.5
	1900	0.44	7.4	0.49	8.1	0.49	10.8	84	0.62	7.0
4	0100	0.46	7.4	0.45	7.8	0.49	10.8	90	0.61	10.7
	0700	0.40	7.6	0.44	7.6	0.46	10.8	92	0.56	7.8
	1300	0.44	7.2	0.43	10.7	0.44	10.8	82	0.54	6.7
	1900	0.38	10.7	0.45	10.7	0.45	10.8	86		
5	0100	0.34	10.7	0.33	10.3	0.37	10.8	90		
	0700	0.26	10.3	0.30	10.3	0.32	10.8	70	inoperative	
	1300	0.33	10.3	0.30	10.3	0.36	10.8	108		
	1900	0.34	10.3	0.41	9.9	0.38	10.8	106	0.52	10.3
6	0100	0.33	10.7	0.31	10.3	0.35	10.8	110	0.47	10.7
	0700	0.25	10.3	0.28	10.3	0.33	10.8	72	0.42	10.7
	1300	0.38	10.3	0.35	10.3	0.41	9.8	108	0.57	9.5
	1900	0.40	11.2	0.43	10.3	0.46	9.8	106	0.63	10.7
7	0100	0.74	4.5	0.83	4.2	1.20	4.8	46	1.08	4.5
	0700	1.18	7.2	1.95	7.6	2.25	7.6	56	2.36	6.8
	1300	1.26	8.3	1.99	8.6	2.26	8.9	58	2.35	8.9
	1900	1.36	9.9	2.17	9.9	2.37	10.8	60	2.49	9.9
8	0100	1.17	9.5	2.21	10.7	2.35	9.8	56	2.43	10.3
	0700	1.20	11.2	1.95	11.2	2.19	12.0	78	2.29	11.2
	1300	1.34	11.2	2.21	11.2	2.44	10.8	86	2.47	11.2
	1900	1.42	11.7	2.03	11.2	2.20	10.8	66	2.23	11.7
9	0100	1.11	11.2	1.76	11.2	1.97	10.8	72	2.05	10.7
	0700	0.99	11.7	1.45	10.7	1.68	12.0	82	1.68	11.2
	1300	0.83	11.7	1.41	10.7	1.60	10.8	66	1.68	9.9
	1900	0.84	12.2	1.36	12.2	1.43	12.0	68	1.50	11.2
10	0100	0.68	12.9	1.11	11.7	1.29	12.0	68	1.28	11.7
	0700	0.71	11.7	1.15	11.7	1.16	12.0	68	1.18	11.7
	1300	0.62	5.5	1.00	9.9	1.16	10.8	62	1.20	10.3
	1900	0.66	11.7	0.97	11.7	0.99	10.8	70	1.00	11.2

Table 4
Wave Data (continued)

Aug 1995

Day	Hour	641 Pressure Gauge Hmo,m	Tp,sec	625 Baylor Gauge Hmo,m	Tp,sec	3111 8 Meter Array Hmo,m	Tp,sec	Dir,TN	630 Waverider Hmo,m	Tp,sec
11	0100	0.59	5.1	1.06	11.2	1.17	10.8	68	1.30	4.6
	0700	0.81	6.5	1.09	5.9	1.12	5.9	120	1.35	6.5
	1300	0.61	6.5	1.37	6.3	1.43	6.2	80	1.56	6.1
	1900	0.71	6.6	1.18	6.6	1.19	5.9	80	1.41	6.5
12	0100	0.38	3.7	0.85	9.9	0.89	7.6	80	0.96	5.9
	0700	0.46	6.8	0.72	6.8	0.75	6.6	104	0.84	7.4
	1300	0.21	9.5	0.54	9.5	0.57	9.8	76	0.62	9.2
	1900	0.36	17.1	0.53	8.1	0.56	8.2	84	0.63	8.3
13	0100	0.26	17.1	0.46	17.1	0.51	15.7	94	0.51	7.8
	0700	0.43	16.0	0.49	16.0	0.58	15.7	94	0.59	16.0
	1300	0.48	17.1	0.64	15.1	0.75	15.7	90	0.77	15.1
	1900	0.77	15.1	0.94	14.3	0.98	13.6	82	1.18	13.5
14	0100	0.99	16.0	1.41	15.1	1.50	15.7	102	1.56	13.5
	0700	1.16	14.3	1.34	14.3	1.46	13.6	102	1.68	14.3
	1300	1.08	16.0	1.44	14.3	1.54	15.7	86	1.79	15.1
	1900	1.15	14.3	1.48	15.1	1.60	15.7	92	1.75	15.1
15	0100	1.07	16.0	1.34	13.5	1.36	13.6	90	1.63	14.3
	0700	0.98	15.1	1.33	14.3	1.50	15.7	94	1.61	15.1
	1300	1.20	16.0	1.62	14.3	1.78	15.7	92	1.82	15.1
	1900	1.07	16.0	1.89	14.3	2.22	13.6	90	2.12	13.5
16	0100	1.25	16.0	3.27	16.0	3.95	15.7	92	4.22	15.1
	0700	1.13	13.5	3.11	13.5	3.72	13.6	96	3.78	13.5
	1300	1.47	14.3	3.22	13.5	3.99	13.6	92	4.01	12.9
	1900	1.27	14.3	2.98	13.5	3.84	13.6	82	3.64	13.5
17	0100	1.71	13.5	3.10	12.9	3.43	12.0	86	3.68	12.9
	0700	1.05	11.7	2.28	11.2	2.72	10.8	68	2.76	11.2
	1300	1.22	11.2	2.24	9.9	2.49	9.8	64	2.46	10.3
	1900	0.88	9.9	1.90	9.9	2.13	10.8	66	2.04	9.5
18	0100	1.09	12.2	1.99	10.3	2.10	10.8	68	2.17	10.3
	0700	0.86	12.9	1.69	10.7	1.87	10.8	56	1.92	10.3
	1300	1.11	12.9	1.78	10.7	1.93	10.8	66	2.09	11.7
	1900	0.96	12.9	1.96	11.2	2.16	12.0	62	2.31	10.3
19	0100	1.17	13.5	1.99	12.9	2.30	12.0	68	2.47	9.9
	0700	1.19	12.9	2.87	13.5	3.21	13.6	74	3.05	12.9
	1300	1.60	14.3	2.98	12.2	3.49	13.6	78	3.28	13.5
	1900	1.27	13.5	2.93	13.5	3.10	13.6	74	3.31	14.3
20	0100	1.29	13.5	2.33	13.5	2.43	13.6	72	2.88	13.5
	0700	1.10	13.5	2.28	12.2	2.53	13.6	68	2.74	12.9
	1300	1.13	12.9	1.96	12.9	2.25	12.0	72	2.33	12.9
	1900	1.03	12.2	1.82	12.2	1.98	12.0	70	1.92	12.2

Table 4
Wave Data (concluded)

Aug 1995

Day	Hour	641 Pressure Gauge Hmo,m	641 Pressure Gauge Tp,sec	625 Baylor Gauge Hmo,m	625 Baylor Gauge Tp,sec	3111 8 Meter Array Hmo,m	3111 8 Meter Array Tp,sec	3111 8 Meter Array Dir,TN	630 Waverider Hmo,m	630 Waverider Tp,sec
21	0100	1.05	11.2	1.69	11.2	1.85	12.0	82	1.81	11.2
	0700	0.86	11.7	1.32	10.7	1.46	10.8	68	1.53	10.3
	1300	0.66	11.7	1.06	10.7	1.19	10.8	58	1.16	10.3
	1900	0.46	8.9	0.87	9.2	0.98	9.8	62	1.07	10.3
22	0100	0.39	8.9	0.70	8.6	0.82	8.9	70	0.87	8.9
	0700	0.29	9.2	0.56	9.9	0.59	8.2	62	0.65	8.3
	1300	0.25	7.8	0.42	8.1	0.50	8.2	68	0.54	8.1
	1900	0.27	8.1	0.41	8.6	0.42	8.2	106	0.49	8.1
23	0100	0.20	16.0	0.39	8.1	0.43	7.6	106	0.47	7.6
	0700	0.38	8.3	0.61	2.8	0.54	3.2	46	0.66	9.2
	1300	0.47	4.0	0.72	3.9	0.72	4.1	20	0.79	8.6
	1900	0.50	7.6	0.70	5.5	0.70	5.0	6	0.89	5.2
24	0100	0.33	5.1	0.60	5.3	0.58	7.6	108	0.70	7.4
	0700	0.30	7.2	0.46	7.4	0.48	7.1	108	0.52	7.4
	1300	0.20	7.2	0.43	7.0	0.46	7.1	108	0.49	6.8
	1900	0.28	15.1	0.37	15.1	0.39	7.1	110	0.50	6.6
25	0100	0.18	15.1	0.32	7.2	0.34	7.1	110	0.41	7.0
	0700	0.23	7.2	0.29	7.4	0.32	7.1	112	0.37	7.2
	1300	0.50	4.2	0.86	4.3	1.02	4.6	8	0.74	3.4
	1900	0.79	6.0	1.18	5.9	1.27	5.9	46	1.42	5.3
26	0100	0.53	6.0	1.01	6.0	1.06	6.2	52	1.18	6.0
	0700	0.60	8.9	0.97	5.4	1.00	6.2	40	1.17	5.7
	1300	0.54	5.1	1.01	8.6	1.08	8.2	80	1.23	5.0
	1900	0.76	5.4	0.99	5.4	1.04	5.6	82	1.24	5.6
27	0100	0.46	9.9	0.76	8.3	0.81	8.9	90	0.99	9.9
	0700	0.58	9.5	0.74	9.5	0.81	8.9	76	0.88	9.2
	1300	0.44	9.5	0.65	9.5	0.75	9.8	106	0.85	9.9
	1900	0.68	11.7	0.73	11.7	0.83	12.0	108	0.97	11.7
28	0100	0.50	12.2	0.82	11.2	0.86	12.0	96	0.97	12.2
	0700	0.88	11.7	1.24	4.2	1.35	4.6	60	1.45	4.2
	1300	0.75	11.7	1.71	6.8	1.94	7.1	102	2.12	7.0
	1900	1.19	6.1	2.19	6.6	2.51	6.6	54	2.60	6.8
29	0100	0.77	7.2	1.82	7.4	1.93	7.1	54	2.18	7.4
	0700	0.99	5.7	1.69	7.2	1.86	7.6	54	2.13	7.4
	1300	0.79	6.5	1.44	7.0	1.76	7.1	60	1.85	7.6
	1900	0.89	12.2	1.57	9.2	1.69	8.9	64	1.79	9.9
30	0100	0.72	13.5	1.25	12.9	1.41	10.8	70	1.48	9.9
	0700	0.64	12.2	1.11	12.9	1.26	12.0	90	1.27	12.2
	1300	0.50	11.7	0.93	12.2	1.14	12.0	98	1.17	11.2
	1900	0.69	12.2	1.01	12.2	1.11	12.0	94	1.17	9.9
31	0100	0.59	12.9	0.93	12.2	1.03	12.0	100	1.04	12.9
	0700	0.68	12.2	1.00	11.7	1.07	12.0	92	1.13	11.7
	1300	0.63	11.7	0.90	12.2	1.02	12.0	102	1.10	11.7
	1900	0.52	12.2	0.90	10.7	0.99	12.0	96	1.12	12.2
Mean		0.73	10.8	1.20	10.3	1.33	10.4	80	1.47	10.0
Std dev		0.35	3.3	0.75	2.9	0.88	2.9	21	0.88	2.8

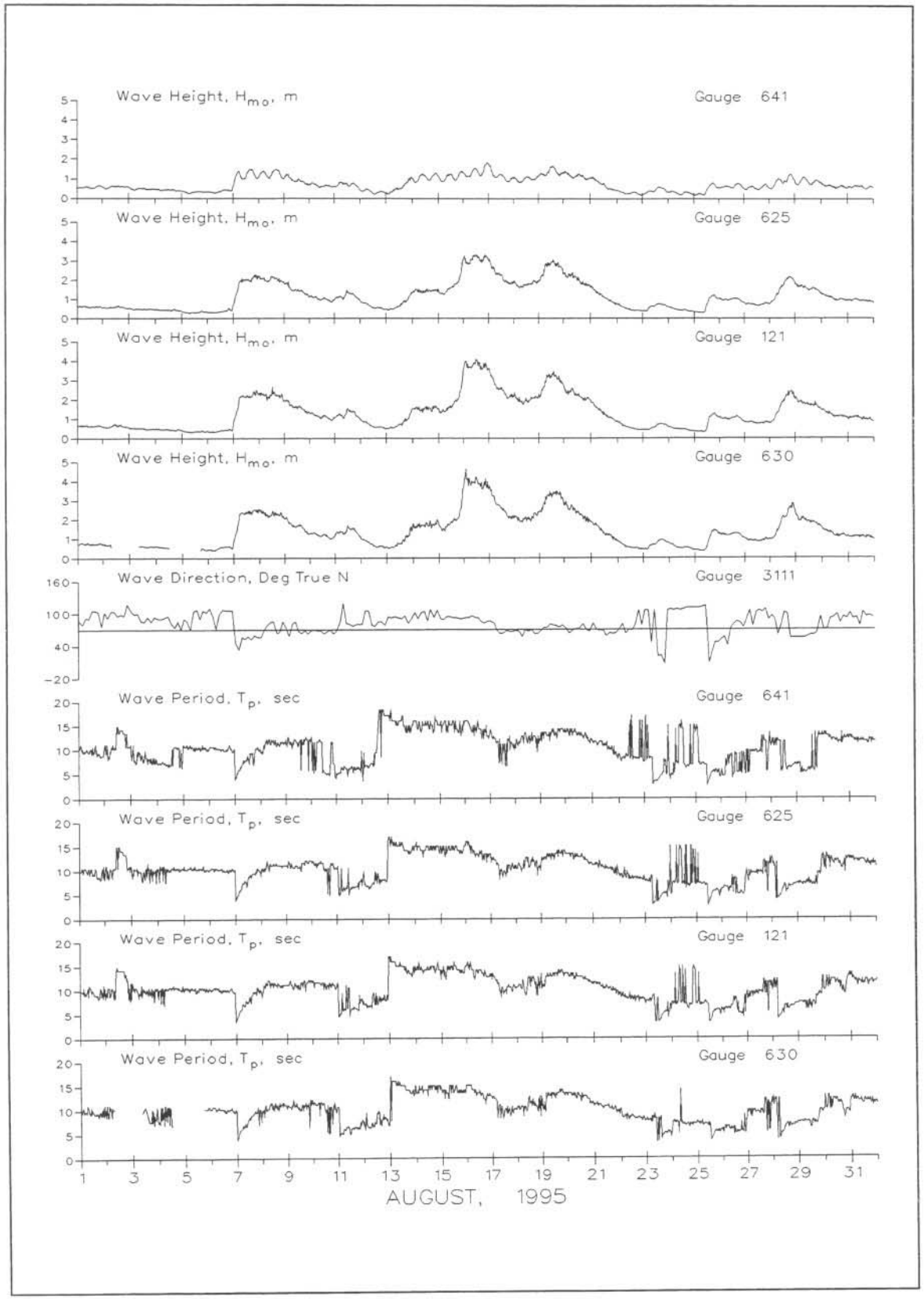

Figure 5. Wave Heights and Periods

4 Current Data

Current data (Table 5) are collected from a Marsh-McBirney electromagnetic biaxial current meter and by visually observing the movement of small drogues on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier, approximately 12 m offshore (Table 6).

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward). All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the cross-shore and longshore data. Current directions indicate the direction that the current is moving towards. Current data are plotted in Figure 2.

Table 5
Current Meter Data - Gauge 3539

AUGUST 1995

Day	Time	Cross Shore	Long Shore	Speed	Dir
1	100	4	8	9	184
	700	0	2	2	175
	1300	1	8	8	170
	1900	inoperative			
2	100	3	1	3	233
	700	1	4	4	169
	1300	1	3	3	176
	1900	0	1	1	163
3	100	2	1	2	219
	700	0	0	0	
	1300	0	6	6	162
	1900	3	0	3	263
4	100	2	2	3	217
	700	1	3	3	181
	1300	-1	3	3	119
	1900	3	0	3	274
5	100	5	0	5	251
	700	2	0	2	286
	1300	-4	2	5	91
	1900	4	4	6	205
6	100	2	4	4	187
	700	4	5	7	196
	1300	0	0	0	
	1900	1	2	2	180
7	100	-1	10	11	148
	700	6	43	44	168
	1300	7	35	35	171
	1900	6	39	40	168
8	100	4	29	29	168
	700	8	26	27	177
	1300	5	8	9	192
	1900	3	18	18	171
9	100	6	19	19	178
	700	-4	10	11	134
	1300	3	0	3	245
	1900	-1	0	2	74
10	100	0	0	0	
	700	4	9	10	183
	1300	1	4	4	171
	1900	3	-1	4	287
11	100	1	0	2	312
	700	1	2	3	175
	1300	3	9	9	179
	1900	1	-2	3	326
12	100	0	0	0	
	700	1	1	1	203
	1300	1	1	2	185
	1900	2	-2	4	302
13	100	1	1	1	197
	700	4	-2	5	293
	1300	2	3	4	190
	1900	0	-1	2	6
14	100	2	1	2	228
	700	0	-3	4	343
	1300	2	2	3	208
	1900	-1	-5	6	357
15	100	1	-1	3	317
	700	-1	-2	3	12
	1300	-1	-2	3	11
	1900	-1	-5	7	1
16	100	8	11	14	196
	700	13	16	21	198
	1300	8	53	53	169
	1900	7	50	50	168
17	100	10	22	24	184
	700	12	44	46	175
	1300	2	10	11	172
	1900	7	18	19	182
18	100	2	3	3	196
	700	0	2	3	129
	1300	-1	9	9	151
	1900	1	10	10	165
19	100	8	20	22	182
	700	12	32	34	181
	1300	9	12	15	197
	1900	10	31	33	178
20	100	1	11	11	166
	700	3	8	9	179
	1300	9	20	22	183
	1900	6	12	13	186
21	100	3	-2	4	293
	700	-3	-2	5	38
	1300	-6	-10	13	11
	1900	8	-5	10	288
22	100	3	-14	15	327
	700	4	-8	10	319
	1300	2	-14	15	332
	1900	4	-4	7	297
23	100	5	-1	5	270
	700	2	6	6	178
	1300	2	3	4	185
	1900	-1	3	3	128
24	100	0	-4	5	337
	700	2	8	8	175
	1300	1	-1	3	315
	1900	4	0	4	260
25	100	4	-3	5	294
	700	4	3	5	214
	1300	0	5	5	156
	1900	-2	3	4	116
26	100	5	-1	5	269
	700	3	1	4	231
	1300	3	3	4	203
	1900	5	-1	5	274
27	100	6	-3	7	279
	700	4	-2	5	289
	1300	4	0	4	252
	1900	2	-3	4	306
28	100	4	2	4	226
	700	2	2	3	197
	1300	-2	4	5	123
	1900	4	33	34	167
29	100	4	26	26	169
	700	1	23	23	162
	1300	6	28	28	173
	1900	8	21	22	182
30	100	4	11	12	180
	700	1	0	1	223
	1300	2	3	3	195
	1900	4	4	6	207
31	100	2	4	5	190
	700	-2	-4	6	10
	1300	2	-5	6	317
	1900	4	-9	11	316

KEY:

+cross-shore = offshore, cm/sec
-cross-shore = onshore, cm/sec
+longshore = south, cm/sec
-longshore = north, cm/sec
Speed = Resultant speed, cm/sec
Dir = Resultant direction, degrees true north

Table 6
Visually Observed Current Data

Aug 1995

	Pier End				Mid-Surf Zone				Beach		
Day	Cross Shore	Long Shore	Speed	Dir	Cross Shore	Long Shore	Speed	Dir	Location	Speed	Dir
1	0	41	41	160	0	-76	76	340	South	34	N
2	-5	-5	7	295	15	-51	53	357	South	58	N
3	1	2	2	138	10	-41	42	354	South	32	N
4	6	-8	9	17	15	-51	53	357	South	32	N
5	6	-14	15	2	25	-25	36	25	South	23	N
6	14	-21	25	13	16	-36	39	4	South	32	N
7	-308	68	316	238	13	10	16	109	North	131	S
8	-19	34	39	189	6	55	56	154	North	9	S
9	0	20	20	160	10	8	12	109	North	37	S
10	0	-2	2	346	3	-16	17	351	South	21	S
11	-9	-9	12	296	-4	-14	14	323	no observation		
12	4	25	26	151	0	0	0		North	9	S
13	2	8	8	149	12	12	17	115	South	18	N
14	0	0	0		0	-76	76	340	South	24	N
15	-10	34	35	177	0	-68	68	340	South	9	N
16	0	-68	68	340	-76	-76	108	295	no observation		
17	0	122	122	160	0	122	122	160	no observation		
18	4	38	38	154	0	87	87	160	North	8	S
19	0	41	41	160	8	38	39	149	North	9	S
20	-5	34	34	169	0	76	76	160	North	11	S
21	0	0	0		51	32	61	102	South	11	N
22	11	-11	16	26	4	-23	24	349	South	10	N
23	-12	10	16	210	-6	9	11	195	North	10	S
24	-5	23	23	171	-5	4	6	250	North	1	N
25	16	11	19	104	6	8	10	120	North	4	S
26	-13	-27	30	313	-5	-8	10	309	South	32	N
27	-3	-29	29	334	-8	-20	21	318	South	21	N
28	-17	-6	18	271	17	-29	34	11	South	24	N
29	-14	68	69	171	-11	76	77	169	South	38	S
30	-9	47	48	171	5	8	9	129	North	1	N
31	-3	-9	10	321	0	-7	7	340	South	14	N

KEY:
+cross-shore = offshore, cm/sec
-cross-shore = onshore, cm/sec
+longshore = south, cm/sec
-longshore = north, cm/sec
Speed = Resultant speed, cm/sec

5 Visual Observations

Visual wave direction measurements (Table 7) of both the primary wave train (i.e. that having the higher 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) are taken daily at the seaward end of the pier. 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 the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is oriented 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that 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 depth of visibility are also taken daily at the seaward end of the pier. A Bucket Thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The temperature is then read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the depth of visibility.

Table 7
Visual Observations

Aug 1995

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	Secchi Vis.,m
1	0615	95	75		40	26.4	1.0194	4.6
2	0555	95	115		40	22.2	1.0229	3.0
3	0625	110	130		27	20.0	1.0246	4.0
4	0610	105	140		30	19.4	1.0247	4.3
5	0905	95			15	18.9	1.0250	4.0
6	1105	115	50		9	17.8	1.0253	4.3
7	0625	20	350		183	20.6	1.0249	1.8
8	0620	55	30		329	22.5	1.0228	1.2
9	0625	60	80		120	23.1	1.0222	1.8
10	0625	65	90		56	23.6	1.0223	0.9
11	0625	95	45		49	23.1	1.0224	1.2
12	0650	90	20		24	23.3	1.0222	0.9
13	0727	100	50		12	23.9	1.0232	1.8
14	0735	100			148	25.0	1.0220	2.7
15	0702	100	55		168	25.8	1.0214	1.8
16	0847	95			232	26.1	1.0222	0.3
17	0840	65			195	26.7	1.0210	0.3
18	0630	60			163	25.6	1.0205	0.3
19	0635	70			536	25.6	1.0212	0.3
20	0727	70			317	25.0	1.0202	0.3
21	0713	35	90		145	25.0	1.0220	0.3
22	0601	100			21	24.2	1.0231	0.3
23	0725	30			23	24.2	1.0232	0.9
24	0716	95	45		5	26.1	1.0203	2.4
25	0707	115			4	24.7	1.0227	0.9
26	0835	95	50		141	25.0	1.0224	0.9
27	0837	110			100	24.2	1.0229	0.6
28	0717	100	60		173	24.4	1.0230	0.6
29	0705	25			212	24.7	1.0230	0.3
30	0705	50			147	24.7	1.0212	0.3
31	0720	80	45		141	25.6	1.0202	0.3

6 Water Levels

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A NOS acoustic tide gauge (Next Generation Water Level Measurement System, NGWLMS) is used to collect water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 6 along with a list of means and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level. Table 8 contains the range, high, low, and mean water level for each 12.42-hr tidal cycle.

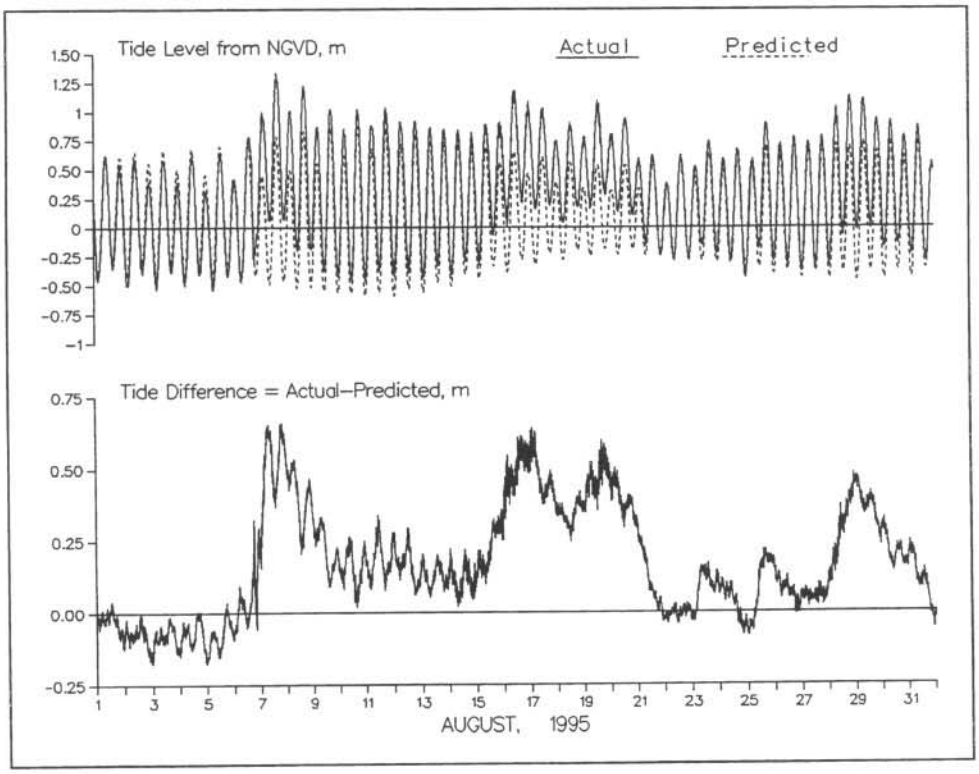

Figure 6. Water Level Variation

Table 8
Water Levels, m NGVD

AUG 1995 Tide Levels

	High			Low		Mean	Range		High			Low		Mean	Range
Day	Time	m	Day	Time	m	m	m	Day	Time	m	Day	Time	m	m	m
1	0948	0.62	1	0354	-0.46	0.09	1.08	17	0000	1.09	16	1806	0.20	0.64	0.88
1	2212	0.53	1	1630	-0.36	0.08	0.89	17	1248	1.03	17	0530	0.15	0.59	0.88
2	1100	0.59	2	0436	-0.50	0.04	1.10	18	0024	0.75	17	1842	0.18	0.47	0.57
2	2236	0.39	2	1742	-0.40	0.00	0.79	18	1300	0.90	18	0654	0.03	0.46	0.87
3	1200	0.58	3	0548	-0.54	0.04	1.12	19	0148	0.78	18	1954	0.17	0.47	0.61
4	0036	0.39	3	1848	-0.39	-0.01	0.78	19	1406	1.09	19	0700	0.15	0.62	0.94
4	1324	0.62	4	0618	-0.50	0.06	1.13	20	0236	0.80	19	2048	0.27	0.54	0.53
5	0130	0.31	4	1912	-0.41	-0.04	0.72	20	1524	0.94	20	0836	0.13	0.53	0.81
5	1418	0.64	5	0736	-0.55	0.05	1.19	21	0312	0.59	20	2148	0.10	0.33	0.49
6	0236	0.41	5	2024	-0.43	0.01	0.83	21	1524	0.62	21	0942	-0.17	0.23	0.78
6	1542	0.79	6	0848	-0.46	0.18	1.24	22	0436	0.37	21	2242	-0.25	0.07	0.62
7	0324	1.00	6	1954	-0.30	0.36	1.30	22	1654	0.62	22	1036	-0.30	0.16	0.92
7	1600	1.34	7	1030	0.06	0.68	1.28	23	0518	0.52	22	2330	-0.29	0.12	0.81
8	0448	1.01	7	2312	0.06	0.53	0.95	23	1724	0.74	23	1112	-0.17	0.28	0.90
8	1712	1.22	8	1130	-0.21	0.50	1.43	24	0530	0.59	23	2342	-0.24	0.18	0.83
9	0518	0.87	8	2330	-0.19	0.34	1.06	24	1736	0.67	24	1212	-0.29	0.17	0.97
9	1742	1.02	9	1206	-0.38	0.32	1.40	25	0654	0.59	25	0024	-0.44	0.09	1.03
10	0624	0.85	10	0018	-0.43	0.21	1.28	25	1830	0.90	25	1206	-0.19	0.35	1.09
10	1842	1.02	10	1330	-0.46	0.28	1.48	26	0718	0.72	26	0106	-0.30	0.22	1.03
11	0706	0.88	11	0130	-0.47	0.24	1.34	26	1912	0.78	26	1248	-0.32	0.22	1.10
11	1942	1.03	11	1342	-0.38	0.33	1.41	27	0730	0.73	27	0124	-0.39	0.18	1.12
12	0754	0.91	12	0206	-0.43	0.27	1.34	27	2000	0.79	27	1324	-0.35	0.24	1.14
12	2042	0.92	12	1430	-0.40	0.28	1.31	28	0842	1.03	28	0154	-0.34	0.34	1.37
13	0924	0.86	13	0236	-0.44	0.21	1.30	28	2042	1.13	28	1412	-0.08	0.54	1.21
13	2136	0.84	13	1454	-0.34	0.26	1.18	29	0918	1.10	29	0300	-0.03	0.53	1.14
14	1000	0.84	14	0406	-0.41	0.22	1.25	29	2124	0.93	29	1530	-0.02	0.46	0.96
14	2200	0.82	14	1542	-0.31	0.24	1.12	30	0942	0.92	30	0330	-0.18	0.36	1.10
15	1112	0.89	15	0424	-0.33	0.31	1.22	30	2212	0.78	30	1624	-0.16	0.31	0.94
15	2254	0.91	15	1700	-0.08	0.42	0.99	31	1054	0.87	31	0424	-0.24	0.29	1.11
16	1148	1.18	16	0530	0.00	0.62	1.18								

7 Bathymetry

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-Geodimeter surveying system; a Geodimeter 140-T self-tracking, 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 7 shows the last survey in July 1995 and the survey(s) in August 1995 on profile line 188, located 517 m south of the pier.

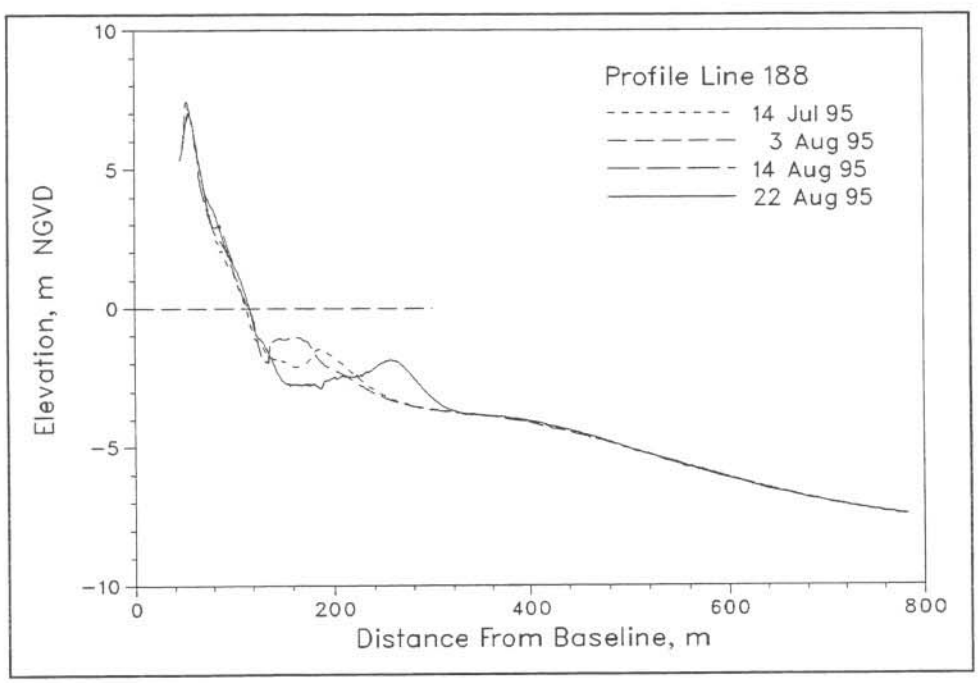

Figure 7. Monthly CRAB Profiles on Profile Line 188.

The profile envelope (Figure 8) reflects the maximum changes that occurred on the profile during 1995. Cross-hatched areas indicate changes to the annual envelope which occurred in August.

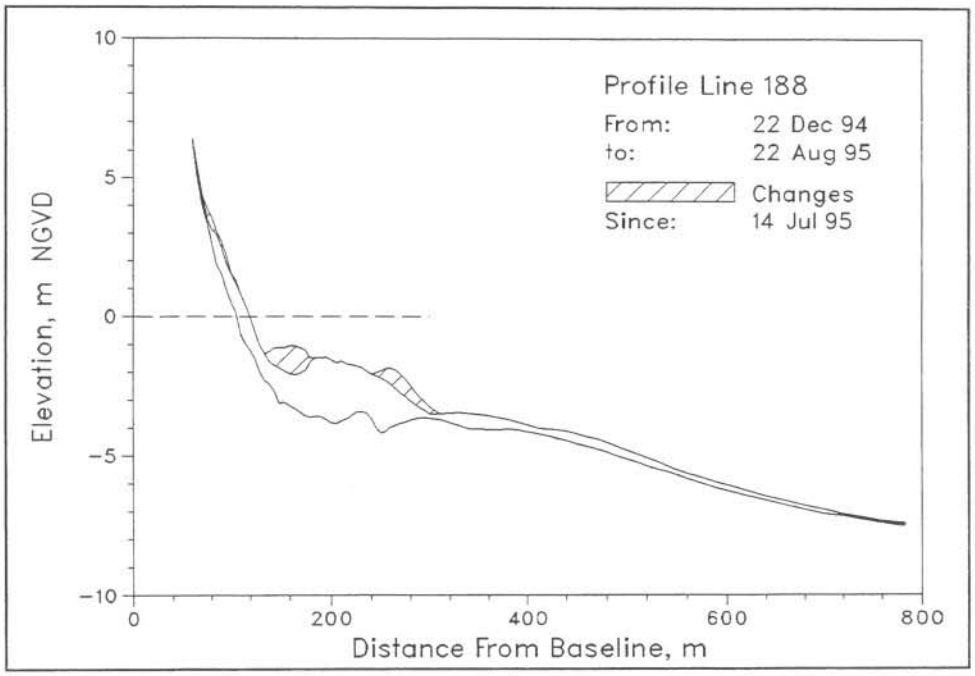

Figure 8. Profile Envelope - Profile Line 188.

B. Bathymetry. Figure 9 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 22 August. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

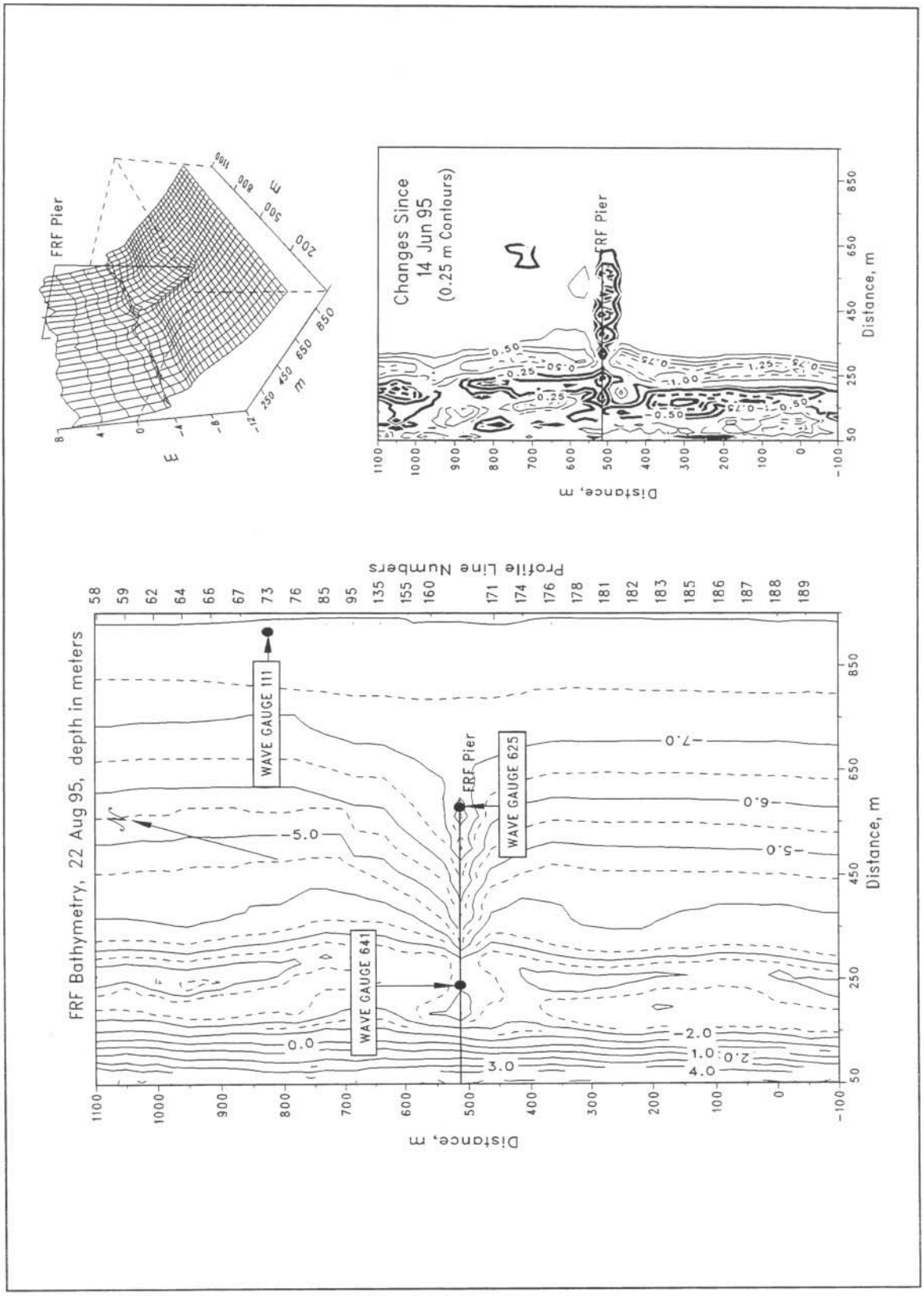

Figure 9. FRF Bathymetry, Depths Relative to NGVD

8 Special Events

A. Storm Data Collection. The following list identifies times when the wave height H_{mo} at the seaward end of the pier exceeded 2 m.

Start	End
07 Aug (0734)	08 Aug (2116)
15 Aug (2008)	18 Aug (0100)
18 Aug (1900)	20 Aug (1408)
28 Aug (1516)	28 Aug (2308)

B. Storm Synopsis.

07-08 Aug Northeasterly winds were funneled between a Canadian high pressure system and a low pressure system offshore of Cape Hatteras. Maximum onshore winds (NE) reached 10 m/s at 0400 EST on 8 August. The maximum H_{mo}, at gauge 625, reached 2.3 m (T_p=10.2 s) at 2116 EST on 07 August. There was 25 mm of precipitation.

15-18 Aug Developing in the mid-Atlantic, Hurricane Felix moved NW then turned westerly (15 Aug) putting North Carolina at risk. Downgraded from a category 3 to a category 1 (on the Saffir/Simpson Hurricane Scale) Felix stalled when interacting with a high pressure system about 300km west of Cape Hatteras, and turned NE. By the morning of 17 August, Felix had moved northward away from North Carolina and never made landfall. Maximum onshore winds (NE) reached 17 m/s at 1816 EST on 16 August. The maximum H_{mo}, at gauge 630, reached 4.6 m (T_p=15.1 s) at 0208 EST on 16 August. There was 6 mm of precipitation.

18-20 Aug Northeasterly winds were funneled between hurricane Felix and a Canadian high pressure system, as the hurricane moved to the NE away from shore. Maximum onshore winds (NE) reached 14 m/s at 1742 EST on 19 August. The maximum H_{mo}, at gauge 630, reached 3.5 m (T_p=14.2 s) at 1708 EST on 19 August. There was no precipitation.

28 Aug Northeasterly winds were funneled between a Canadian high pressure system and a low pressure system over Cape Hatteras. Maximum onshore winds (NE) reached 15 m/s at 1934 EST. The maximum H_{mo}, at gauge 625, reached 2.2 m (T_p=6.6 s) at 1900 EST. There was 22 mm of precipitation.

Distribution List

Government Agencies:

Back Bay National Wildlife Refuge
USACE-OCE
USACE-SAD
USACE-NAP
USACE-SAW
USACE-WES
NAVSAC
NOAA/NOS/OMS
National Marine Fisheries
U.S. Geological Survey
U.S. Library of Congress
U.S. National Park Service
U.S. National Weather Service
U.S. Naval Academy
U.S. Naval Civil Eng. Lab
U.S. Naval Oceanographic Off.
U.S. Naval Research Lab

Colleges/Universities:

Bucknell University
California Inst. of Tech.
Duke Marine Lab
East Carolina University
Florida Inst. of Tech.
M.I.T.
Naval Post Graduate School
NC State University
Old Dominion University
Oregon State University
Prince George's College
Scripps Institution of Oceanography
Stockton State College
University Calif-Berkeley
University of Florida
University of Maryland-College Park
University of Maryland-Baltimore
University of North Carolina
University of N C-Seagrant Program
University of Virginia
Va. Inst. of Marine Science
Rutgers University

Others:

Allied Signal Aerospace Co.
Applied Physics Lab
Cape Hatteras Nat. Seashore
Coastal and Est. Res., Inc.
Coastal Science & Eng., Inc.
Dr. Cy Galvin
GEOMET Tech., Inc.
Mr. Hodges
Dr. Hylton
Mr. Mason
Mr. Rodgers
WCTI-TV
MEC Systems Corporation
Moffatt & Nichol, Eng.
N.C. Div. Coastal Management
Oregon Inlet & Waterways Commis.
Raleigh-Durham Airport
Mr. Rowland
Mr. Savage
Science Application Int'l. Corp
Sherwood Industries
SEASUN Power Systems

Foreign:

Christchurch, Barbados
Ministry of Works, Bahamas
Dalhousie University, Halifax Nova Scotia
Queen's University, Ontario (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of Sydney (Australia)