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Waterways Experiment
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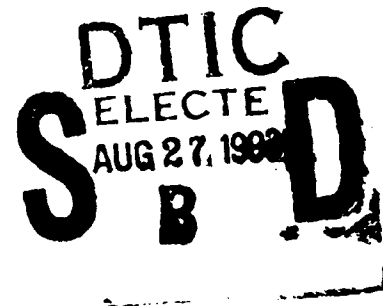


Annual Data Summary for 1991 CERC Field Research Facility

Volume II: Appendixes C Through E

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APPENDIX C: WAVE DATA FOR GAGE 111

1. Wave data summaries for Gage 111 are presented for 1991 and for 1985 through 1991 in the following forms:

Daily H_{mo} and T_p

2. Figure C1 displays the individual wave height (H_{mo}) and peak spectral wave period (T_p) values along with the monthly mean values.

Joint Distributions of H_{mo} and T_p

3. Annual and monthly joint distribution tables are presented in Tables C1 and C2, and data for 1985 through 1991 are presented in Tables C3 and C4. Each table gives the frequency (in parts per 10,000) for which the wave height and peak period were within the specified intervals; these values can be converted to percentages by dividing by 100. Marginal totals are also included. The row total gives the number of observations out of 10,000 that fell within each specified peak period interval. The column total gives the number of observations out of 10,000 that fell within each specified wave height interval.

Cumulative Distributions of Wave Height

4. Annual and monthly wave height distributions for 1991 are plotted in cumulative form in Figures C2 and C3. Data for 1985 through 1991 are presented in Figure C4.

Peak Spectral Wave Period Distributions

5. Annual and monthly peak wave period T_p distribution histograms for 1991 are presented in Figures C5 and C6. Data for 1985 through 1991 are presented in Figure C7.

Persistence of Wave Heights

6. Table C5 shows the number of times in 1991 when the specified wave height was equaled or exceeded at least once during each day for the duration (consecutive days). Data for 1985 through 1991 are averaged and given in Table C6. An example is shown below:

Height m	Consecutive Day(s) or Longer																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+	
0.5	18	15		14	13	12		11	10	9						8			7	
1.0	50	34	24	21	18	14	12	8	7	3				2						
1.5	41	19	8	6	2	1														
2.0	22	9	5	1																
2.5	10	5	2																	
3.0	6	1																		
3.5		1																		
4.0	1																			

This example indicates that wave heights equaled or exceeded 1.0 m 50 times for at least 1 day; 34 times for at least 2 days; 24 times for at least 3 days, etc. Therefore, on 16 occasions the height equaled or exceeded 1.0 m for 1 day exactly ($50 - 34 = 16$); on 10 occasions for 2 days; on 3 occasions for 3 days, etc. Note that the height exceeded 1 m 50 times for 1 day or longer, while heights exceeded 0.5 m only 18 times for this same duration. This change in durations occurred because the longer durations of lower waves may be interspersed with shorter, but more frequent, intervals of higher waves. For example, one of the times that the wave heights exceeded 0.5 m for 16 days may have represented three times the height exceeded 1 m for shorter durations.

Spectra

7. Monthly spectra for the offshore Waverider buoy (Gage 111) are presented in Figure C8. The plots show "relative" energy density as a function of wave frequency. These figures summarize the large number of spectra for each month. The figures emphasize the higher energy density associated with storms as well as the general shifts in energy density to different frequencies. As used here, "relative" indicates the spectra have been smoothed by the three-dimensional surface drawing routine. Consequently, extremely high- and low-energy density values are modified to produce a smooth surface. The figures are not intended for quantitative measurements; however,

they do provide the energy density as a function of frequency relative to the other spectra for the month.

8. Monthly and annual wave statistics for Gage 111 for 1991 and for 1985 through 1991 are presented in Table C7.

9. Figure C9 plots monthly time histories of wave height and period.

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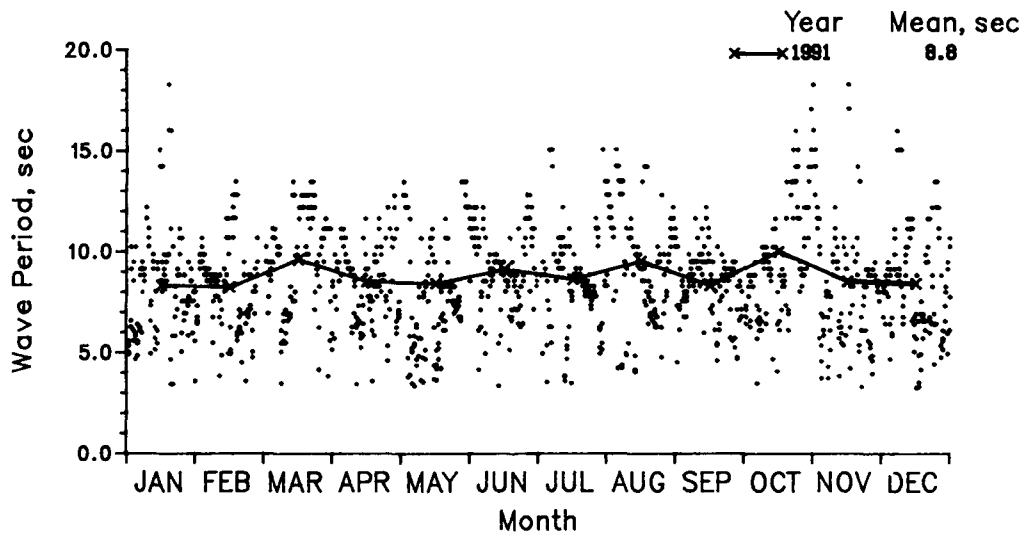
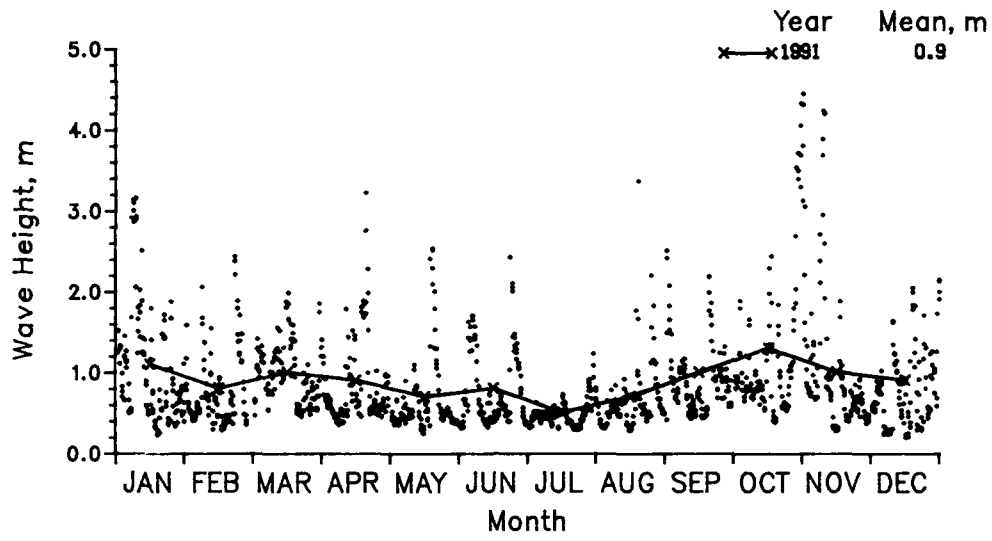


Figure C1. 1991 daily wave height and period values with monthly means for Gage 111

Table C1

Annual Joint Distribution of H_{mo} versus T_p

Height(m)	Annual 1991, Gage 111 Percent Occurrence(X100) of Height and Period												Total
	Period(sec)												
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	.	69	21	104	208	222	708	562	514	173	298	35	2914
0.50 - 0.99	.	153	243	354	437	423	985	763	756	125	208	.	4447
1.00 - 1.49	.	.	125	222	236	153	305	208	167	14	104	.	1534
1.50 - 1.99	.	.	14	62	201	83	76	42	97	14	49	.	638
2.00 - 2.49	97	42	28	.	28	.	14	.	209
2.50 - 2.99	14	14	28	7	7	.	21	.	91
3.00 - 3.49	7	7	14	7	7	14	14	.	70
3.50 - 3.99	21	7	14	7	7	56
4.00 - 4.49	7	7	.	.	28	42
4.50 - 4.99	0
5.00 - Greater	0
Total	0	222	403	742	1200	944	2144	1617	1590	354	715	70	

Table C2
Monthly Joint Distribution of H_{mo} versus T_p

January 1991, Gage 111
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	.	81	.	.	81	323	242	565	242	.	242	81	1857
0.50 - 0.99	.	161	81	403	484	323	968	806	323	161	81	.	3791
1.00 - 1.49	.	.	242	887	323	161	242	323	161	.	.	.	2339
1.50 - 1.99	.	.	81	323	161	161	81	81	242	.	.	.	1130
2.00 - 2.49	81	.	.	81	.	.	.	162
2.50 - 2.99	161	81	81	.	81	.	404
3.00 - 3.49	161	81	81	.	.	.	323
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	242	404	1613	1049	1049	1855	1937	1211	161	404	81	

February 1991, Gage 111
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	.	89	.	268	357	89	893	625	625	89	446	.	3481
0.50 - 0.99	.	89	536	179	446	268	1518	893	268	.	.	.	4197
1.00 - 1.49	.	.	89	89	268	446	446	.	.	.	.	.	1338
1.50 - 1.99	.	.	.	89	268	89	179	.	.	.	.	.	625
2.00 - 2.49	357	.	.	.	.	.	.	.	357
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	178	625	625	1696	892	3036	1518	893	89	446	0	

March 1991, Gage 111
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	85	254	.	169	.	508
0.50 - 0.99	.	169	.	85	254	254	424	847	1864	254	508	.	4659
1.00 - 1.49	.	.	85	593	593	254	508	508	424	.	847	.	3812
1.50 - 1.99	.	.	.	85	169	85	.	85	254	.	339	.	1017
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	169	85	763	1016	593	932	1525	2796	254	1863	0	

(Continued)

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Table C2 (Continued)

April 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	250	250	583	750	250	.	83	.	2166
0.50 - 0.99	.	167	.	500	583	1000	1167	667	1333	.	333	.	5750
1.00 - 1.49	.	.	83	167	250	83	83	83	83	.	.	.	832
1.50 - 1.99	.	.	.	83	250	83	167	250	167	.	.	.	1000
2.00 - 2.49	83	.	.	.	.	.	83
2.50 - 2.99	83	.	.	.	.	.	83
3.00 - 3.49	83	.	.	.	.	.	.	83
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	167	83	750	1333	1499	2166	1750	1833	0	416	0	0

May 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	242	81	565	645	403	484	323	645	645	1210	.	5243
0.50 - 0.99	.	403	645	323	81	645	726	161	242	161	.	.	3387
1.00 - 1.49	.	.	161	81	81	81	161	81	81	.	.	.	727
1.50 - 1.99	81	.	.	.	81	.	.	.	162
2.00 - 2.49	161	.	81	.	81	.	.	.	323
2.50 - 2.99	161	.	.	.	.	.	.	.	161
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	645	887	969	1210	1129	1452	565	1130	806	1210	0	0

June 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	84	.	.	84	168	1261	1345	672	.	84	.	3698
0.50 - 0.99	.	.	.	252	252	504	840	588	756	.	252	.	3444
1.00 - 1.49	.	.	84	84	168	252	336	84	672	.	336	.	2016
1.50 - 1.99	.	.	84	.	84	84	168	.	168	.	84	.	504
2.00 - 2.49	84	84	168	.	.	.	.	.	336
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	84	168	336	672	1092	2605	2017	2268	0	756	0	0

(Continued)

(Sheet 2 of 4)

Table C2 (Continued)

July 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	.	171	85	85	171	769	2735	855	684	85	342	.	5982
0.50 - 0.99	.	256	171	598	342	342	684	598	513	171	171	.	3846
1.00 - 1.49	171	.	.	.	.	.	171
1.50 - 1.99	0
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	427	256	683	513	1111	3590	1453	1197	256	513	0	0

August 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	325	244	244	1138	1382	813	407	.	4553
0.50 - 0.99	.	.	650	81	488	244	569	894	976	81	407	.	4390
1.00 - 1.49	.	.	81	.	.	163	244	81	.	.	.	.	569
1.50 - 1.99	163	81	.	.	.	81	.	.	325
2.00 - 2.49	81	.	.	.	.	.	.	.	81
2.50 - 2.99	0
3.00 - 3.49	81	.	.	.	.	.	.	.	81
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	0	731	81	1138	732	1057	2113	2358	975	814	0	0

September 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	.	.	168	336	84	756	336	420	252	.	84	.	1176
0.50 - 0.99	.	.	168	336	504	756	2185	1092	588	.	.	.	5629
1.00 - 1.49	.	.	168	336	84	84	756	672	84	.	.	.	2100
1.50 - 1.99	84	336	168	84	.	.	.	.	672
2.00 - 2.49	168	168	.	.	.	.	.	.	336
2.50 - 2.99	84	.	.	.	.	.	.	84
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	0	336	672	840	1428	3445	2268	924	0	84	0	0

(Continued)

(Sheet 3 of 4)

Table C2 (Concluded)

October 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	82	246	.	164	82	.	.	574
0.50 - 0.99	.	82	164	.	574	328	1066	1230	1066	656	410	.	5576
1.00 - 1.49	.	.	.	82	328	164	492	246	.	82	.	.	1394
1.50 - 1.99	492	.	246	.	164	.	164	.	1066
2.00 - 2.49	82	82	.	.	.	.	82	.	246
2.50 - 2.99	82	.	82
3.00 - 3.49	82	164	.	246
3.50 - 3.99	82	82	164	82	82	492
4.00 - 4.49	328	328
4.50 - 4.99	0
5.00 - Greater	0
Total	0	82	164	82	1476	656	2050	1558	1476	1066	984	410	

November 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	.	.	.	336	84	168	840	420	336	252	.	336	2772
0.50 - 0.99	.	420	252	756	672	336	924	840	504	.	84	.	4788
1.00 - 1.49	.	.	252	84	336	.	84	84	168	.	84	.	1092
1.50 - 1.99	168	.	84	.	84	84	.	.	420
2.00 - 2.49	84	84	.	.	.	.	84	.	252
2.50 - 2.99	84	84	.	.	.	84	.	252
3.00 - 3.49	84	.	.	84
3.50 - 3.99	168	.	.	.	.	168
4.00 - 4.49	84	84	.	.	.	168
4.50 - 4.99	0
5.00 - Greater	0
Total	0	420	504	1176	1344	672	2016	1596	1176	420	336	336	

December 1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	.	161	81	.	403	161	726	242	645	81	484	.	2984
0.50 - 0.99	.	81	242	726	565	81	806	565	645	.	242	.	3953
1.00 - 1.49	.	.	242	242	484	161	161	323	323	81	.	.	2017
1.50 - 1.99	.	.	.	161	484	81	.	.	.	.	.	.	726
2.00 - 2.49	161	.	.	.	161	.	.	.	322
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	242	565	1129	2097	484	1693	1130	1774	162	726	0	

Table C3
Annual Joint Distribution of H_{mo} versus T_p (All Years)

Height(m)	Annual 1985-1991, Gage 111 Percent Occurrence(X100) of Height and Period												Total
	Period(sec)												
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	6	72	32	69	129	210	660	483	416	160	274	12	2523
0.50 - 0.99	3	150	246	428	491	398	964	768	644	136	292	17	4537
1.00 - 1.49	.	13	129	347	285	150	259	206	242	29	93	.	1753
1.50 - 1.99	.	.	9	112	183	79	82	64	110	26	57	2	724
2.00 - 2.49	.	.	.	4	56	40	34	30	45	18	29	2	258
2.50 - 2.99	.	.	.	.	8	13	9	10	28	6	19	.	93
3.00 - 3.49	.	.	.	.	3	6	9	13	11	5	5	.	52
3.50 - 3.99	.	.	.	.	.	1	6	5	13	5	3	1	34
4.00 - 4.49	.	.	.	.	.	.	1	3	9	.	3	4	20
4.50 - 4.99	.	.	.	.	.	.	.	.	2	.	.	.	2
5.00 - Greater	.	.	.	.	.	.	.	1	.	.	.	.	1
Total	9	235	416	960	1155	897	2024	1583	1520	385	775	38	

Table C4

Monthly Joint Distribution of H_{no} versus T_p (All Years)

January 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	.	107	12	36	36	202	391	747	427	119	237	24	2338
0.50 - 0.99	.	154	190	474	439	297	735	783	759	83	214	.	4128
1.00 - 1.49	.	12	190	617	380	154	214	261	214	24	36	.	2102
1.50 - 1.99	.	.	12	166	285	95	95	71	83	24	12	.	843
2.00 - 2.49	95	95	59	12	47	.	24	.	332
2.50 - 2.99	12	.	47	12	107	.	12	.	190
3.00 - 3.49	24	12	24	.	.	.	60
3.50 - 3.99	12	.	.	.	12
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	273	404	1293	1247	843	1565	1898	1673	250	535	24	

February 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	.	53	40	66	119	66	277	369	383	40	198	.	1611
0.50 - 0.99	.	119	290	435	567	409	871	831	805	92	211	13	4643
1.00 - 1.49	.	.	132	528	435	224	303	264	317	13	158	.	2374
1.50 - 1.99	.	.	13	172	277	92	79	66	132	.	13	.	844
2.00 - 2.49	.	.	.	13	106	26	13	26	40	.	26	.	250
2.50 - 2.99	13	13	.	40	13	.	40	.	119
3.00 - 3.49	13	.	26	53	.	13	.	.	105
3.50 - 3.99	13	26	13	.	.	52
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	172	475	1214	1530	830	1569	1662	1716	171	646	13	

March 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	12	.	.	71	71	71	355	178	260	83	154	.	1255
0.50 - 0.99	.	118	95	414	391	473	982	876	864	107	213	.	4533
1.00 - 1.49	.	12	213	414	426	166	249	320	438	.	166	.	2404
1.50 - 1.99	.	.	12	107	201	130	83	83	201	12	130	.	959
2.00 - 2.49	71	12	83	118	83	.	71	.	438
2.50 - 2.99	12	24	.	36	59	12	36	.	179
3.00 - 3.49	12	47	.	.	.	59
3.50 - 3.99	12	.	71	12	12	.	107
4.00 - 4.49	36	.	24	.	60
4.50 - 4.99	12	.	.	.	12
5.00 - Greater	0
Total	12	130	320	1006	1172	876	1764	1623	2071	226	806	0	

(Continued)

(Sheet 1 of 4)

Table C4 (Continued)

April 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	12	12	.	74	49	86	441	392	380	196	233	.	1875
0.50 - 0.99	.	172	159	319	466	453	1042	1054	797	221	490	12	5185
1.00 - 1.49	.	25	49	184	282	135	331	331	147	25	110	.	1619
1.50 - 1.99	.	.	25	98	147	74	110	86	233	25	74	.	872
2.00 - 2.49	.	.	.	12	37	.	12	61	61	.	25	.	208
2.50 - 2.99	12	.	37	37	.	.	86
3.00 - 3.49	12	12	12	12	12	12	12	.	84
3.50 - 3.99	12	.	12	.	12	.	36
4.00 - 4.49	12	.	.	.	.	24
4.50 - 4.99	12	.	.	.	12
5.00 - Greater	0
Total	12	209	233	687	993	760	1984	1948	1691	516	956	12	

May 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	12	123	37	173	259	235	716	432	506	309	519	.	3321
0.50 - 0.99	.	160	296	321	469	556	1210	568	506	111	235	.	4432
1.00 - 1.49	.	37	62	160	148	136	395	148	185	12	74	.	1357
1.50 - 1.99	.	.	12	62	49	25	74	62	123	37	62	12	518
2.00 - 2.49	49	25	25	12	25	49	25	.	210
2.50 - 2.99	49	.	.	.	25	12	37	.	123
3.00 - 3.49	12	25	.	37
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	12	320	407	716	1023	977	2420	1222	1370	542	977	12	

June 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	25	187	37	75	336	448	1667	796	386	199	211	.	4367
0.50 - 0.99	12	112	224	348	448	299	1343	983	261	124	75	.	4229
1.00 - 1.49	.	12	62	137	211	124	124	75	149	.	62	.	956
1.50 - 1.99	.	.	25	25	62	62	37	25	50	.	50	.	336
2.00 - 2.49	.	.	.	.	12	12	50	.	12	.	25	.	111
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	37	311	348	585	1069	945	3221	1879	858	323	423	0	

(Continued)

(Sheet 2 of 4)

Table C4 (Continued)

July 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	12	86	110	37	209	613	1791	908	601	245	528	25	5165
0.50 - 0.99	.	233	380	479	380	552	1166	442	282	123	184	25	4246
1.00 - 1.49	.	.	37	110	61	49	86	12	61	.	25	.	441
1.50 - 1.99	.	.	.	12	12	12	25	49	37	.	.	.	147
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	12	319	527	638	662	1226	3068	1411	981	368	737	50	

August 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	63	38	75	188	251	842	779	729	226	214	.	3405
0.50 - 0.99	.	163	188	603	653	339	879	691	553	188	440	88	4785
1.00 - 1.49	.	.	163	264	151	101	339	113	113	25	50	.	1319
1.50 - 1.99	.	.	.	101	75	38	.	25	38	63	13	.	353
2.00 - 2.49	13	13	.	25	50	13	.	.	114
2.50 - 2.99	13	.	.	.	.	.	13
3.00 - 3.49	13	.	.	.	.	.	.	.	13
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	226	389	1043	1093	742	2073	1633	1483	515	717	88	

September 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	38	13	13	26	115	319	281	472	64	230	.	1571
0.50 - 0.99	.	128	204	319	523	421	1122	944	855	179	344	.	5039
1.00 - 1.49	.	13	89	319	191	217	446	306	281	89	115	.	2066
1.50 - 1.99	.	.	.	102	166	179	204	51	64	38	77	13	894
2.00 - 2.49	64	102	26	13	.	77	64	26	372
2.50 - 2.99	38	13	.	.	.	13	.	64
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	179	306	753	970	1072	2130	1595	1672	447	843	39	

(Continued)

(Sheet 3 of 4)

Table C4 (Concluded)

October 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	.	24	12	48	109	241	181	217	109	133	24	1098
0.50 - 0.99	.	121	290	290	543	302	929	820	869	145	434	12	4755
1.00 - 1.49	.	12	241	434	217	109	217	277	495	36	109	.	2147
1.50 - 1.99	.	.	12	205	277	36	169	133	181	60	97	.	1170
2.00 - 2.49	48	60	24	36	121	24	36	.	349
2.50 - 2.99	12	24	12	12	60	24	48	.	168
3.00 - 3.49	24	48	24	12	12	24	.	144
3.50 - 3.99	24	12	24	24	12	12	108
4.00 - 4.49	48	48
4.50 - 4.99	0
5.00 - Greater	12	.	.	.	.	12
Total	0	133	567	941	1145	664	1664	1507	1979	410	893	96	

November 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	49	37	99	49	197	493	321	321	136	222	74	1998
0.50 - 0.99	12	173	358	530	567	395	764	641	493	160	308	.	4401
1.00 - 1.49	.	12	197	518	456	222	271	123	197	62	123	.	2181
1.50 - 1.99	.	.	.	136	259	99	62	86	99	12	37	.	790
2.00 - 2.49	.	.	.	25	37	111	111	37	62	.	25	.	408
2.50 - 2.99	37	12	12	12	.	12	.	73
3.00 - 3.49	12	.	37	25	12	.	.	86
3.50 - 3.99	25	.	.	.	.	25
4.00 - 4.49	12	25	.	.	.	37
4.50 - 4.99	0
5.00 - Greater	0
Total	12	234	592	1308	1368	1073	1713	1294	1222	382	727	74	

December 1985-1991, Gage 111
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	156	39	104	169	117	377	416	325	195	416	.	2314
0.50 - 0.99	13	143	286	611	455	273	507	572	676	104	364	52	4056
1.00 - 1.49	.	26	104	481	468	169	143	234	299	65	91	.	2080
1.50 - 1.99	.	.	.	156	390	104	39	26	65	39	117	.	936
2.00 - 2.49	143	26	.	13	39	52	26	.	299
2.50 - 2.99	26	.	13	26	13	26	.	104
3.00 - 3.49	26	.	13	13	.	.	.	52
3.50 - 3.99	13	26	13	13	13	.	.	78
4.00 - 4.49	13	52	.	13	.	78
4.50 - 4.99	0
5.00 - Greater	0
Total	13	325	429	1352	1625	754	1092	1313	1508	481	1053	52	

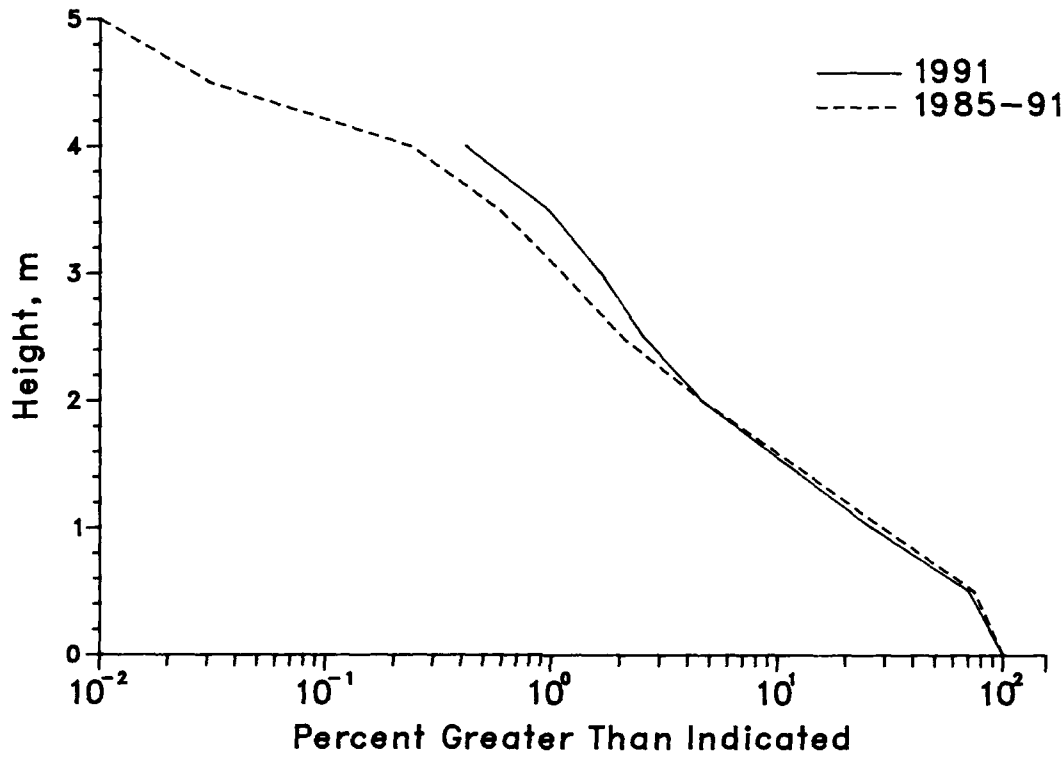


Figure C2. Annual cumulative wave height distributions for Gage 111

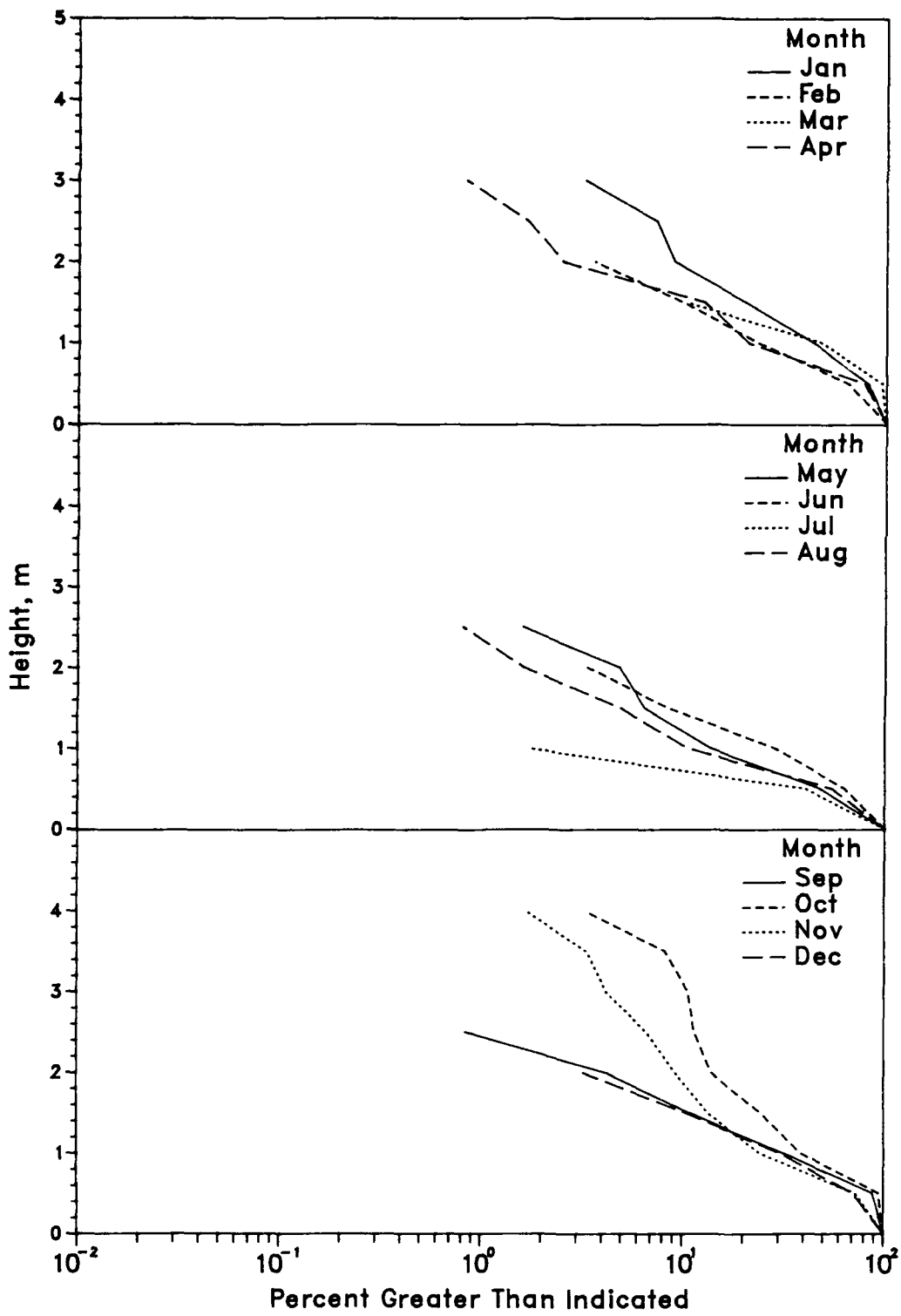


Figure C3. 1991 monthly wave height distributions for Gage 111

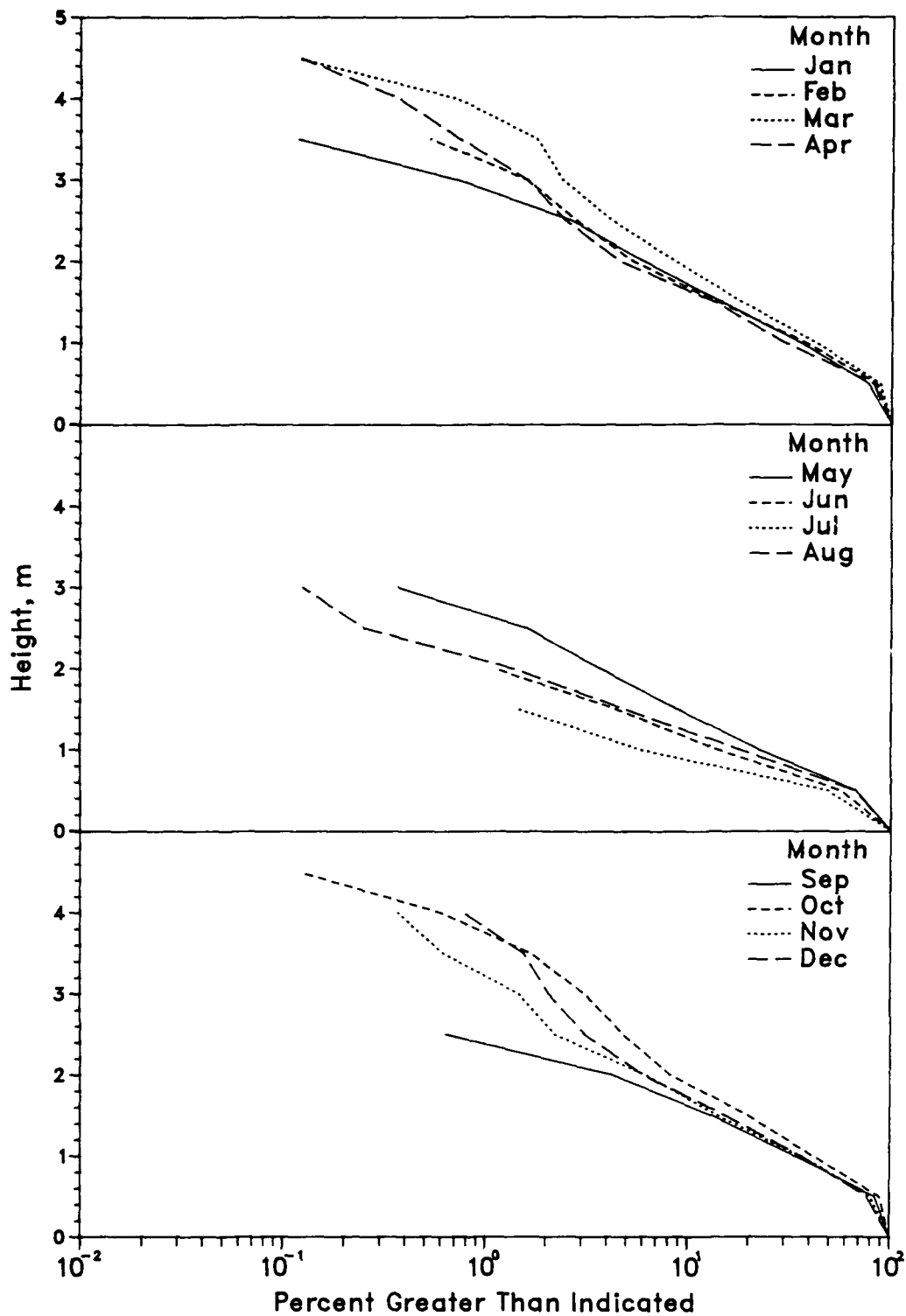


Figure C4. 1985-1991 monthly wave height distributions for Gage 111

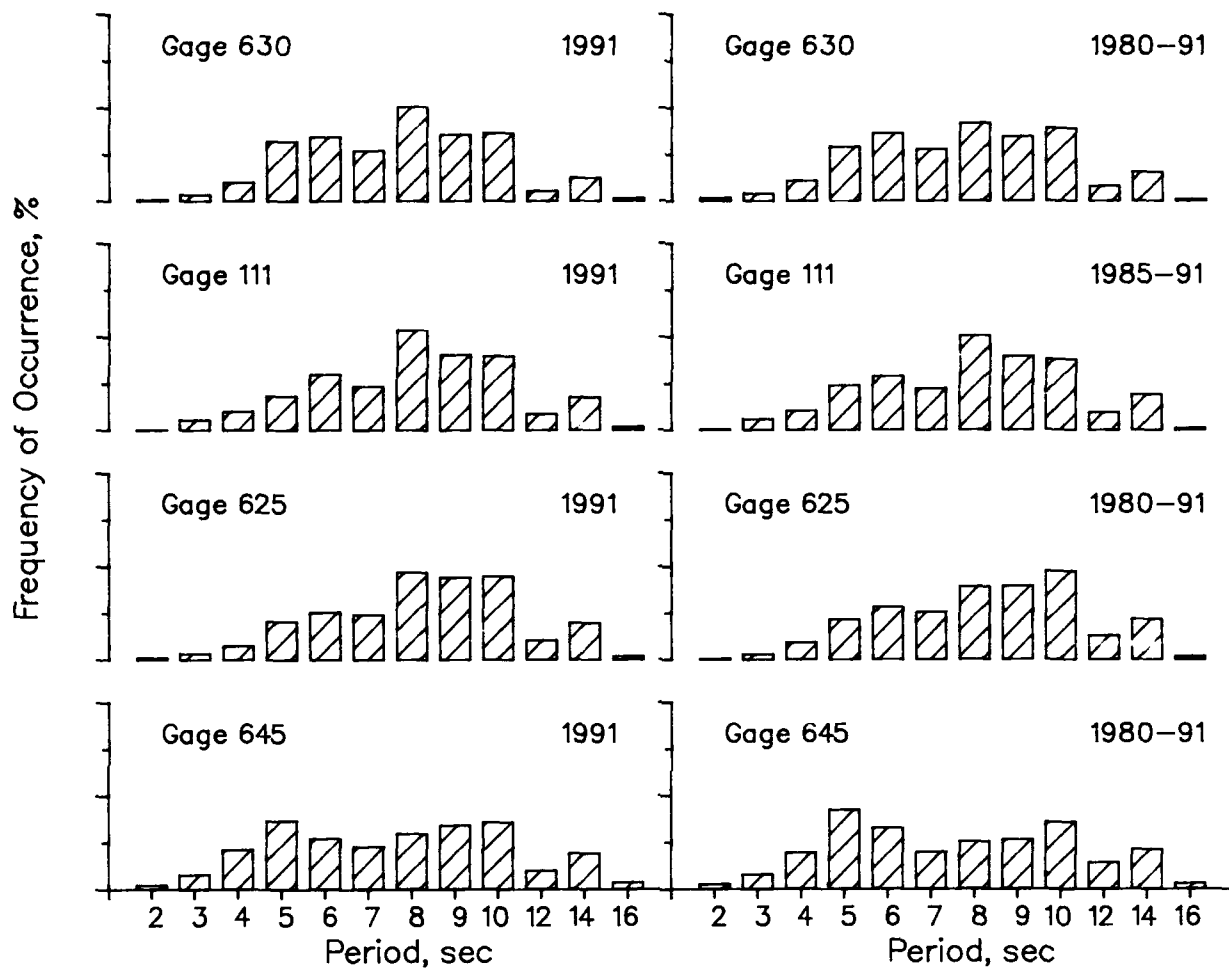


Figure C5. Annual wave period distributions for all gages

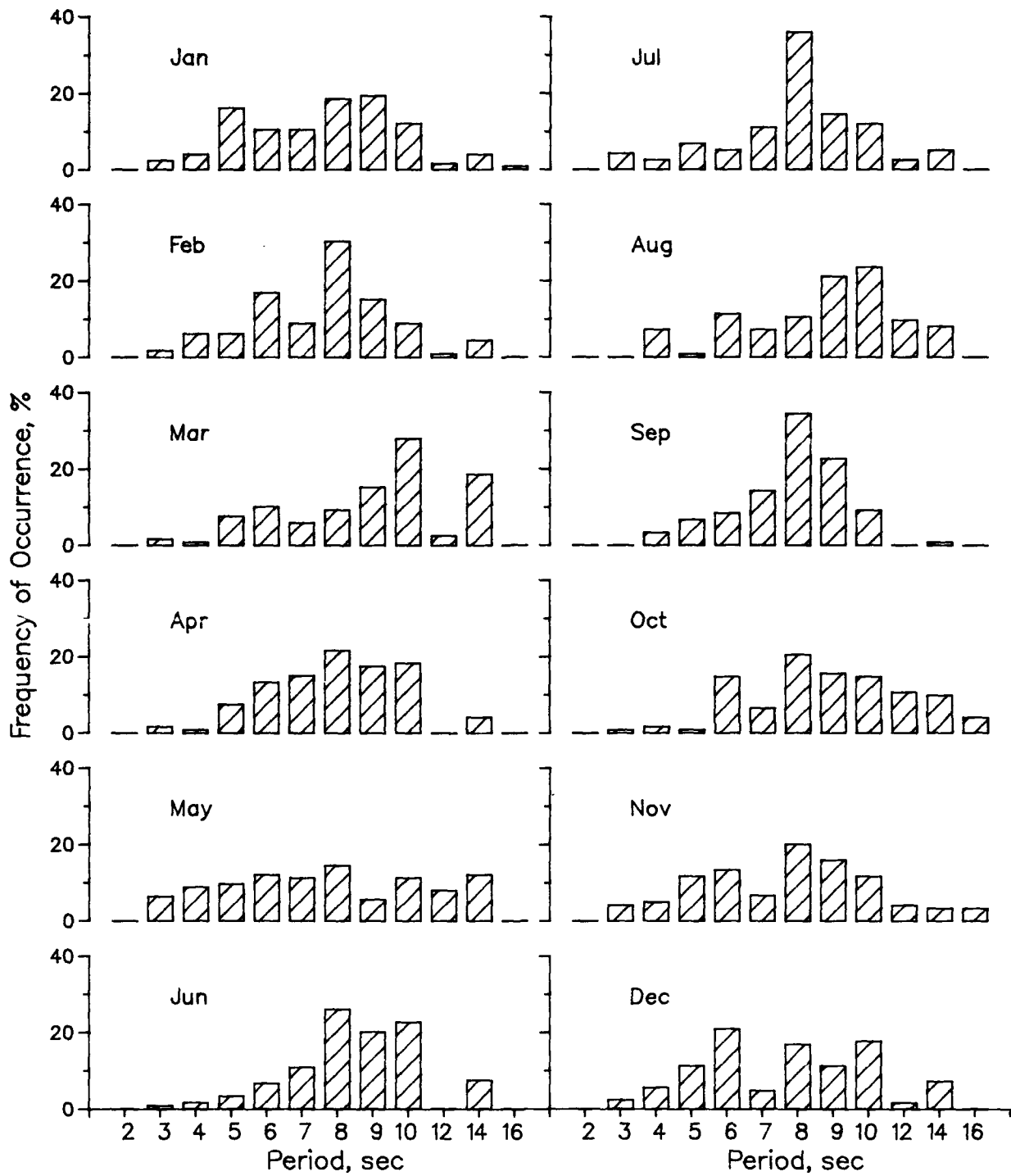


Figure C6. 1991 monthly wave period distributions for Gage 111

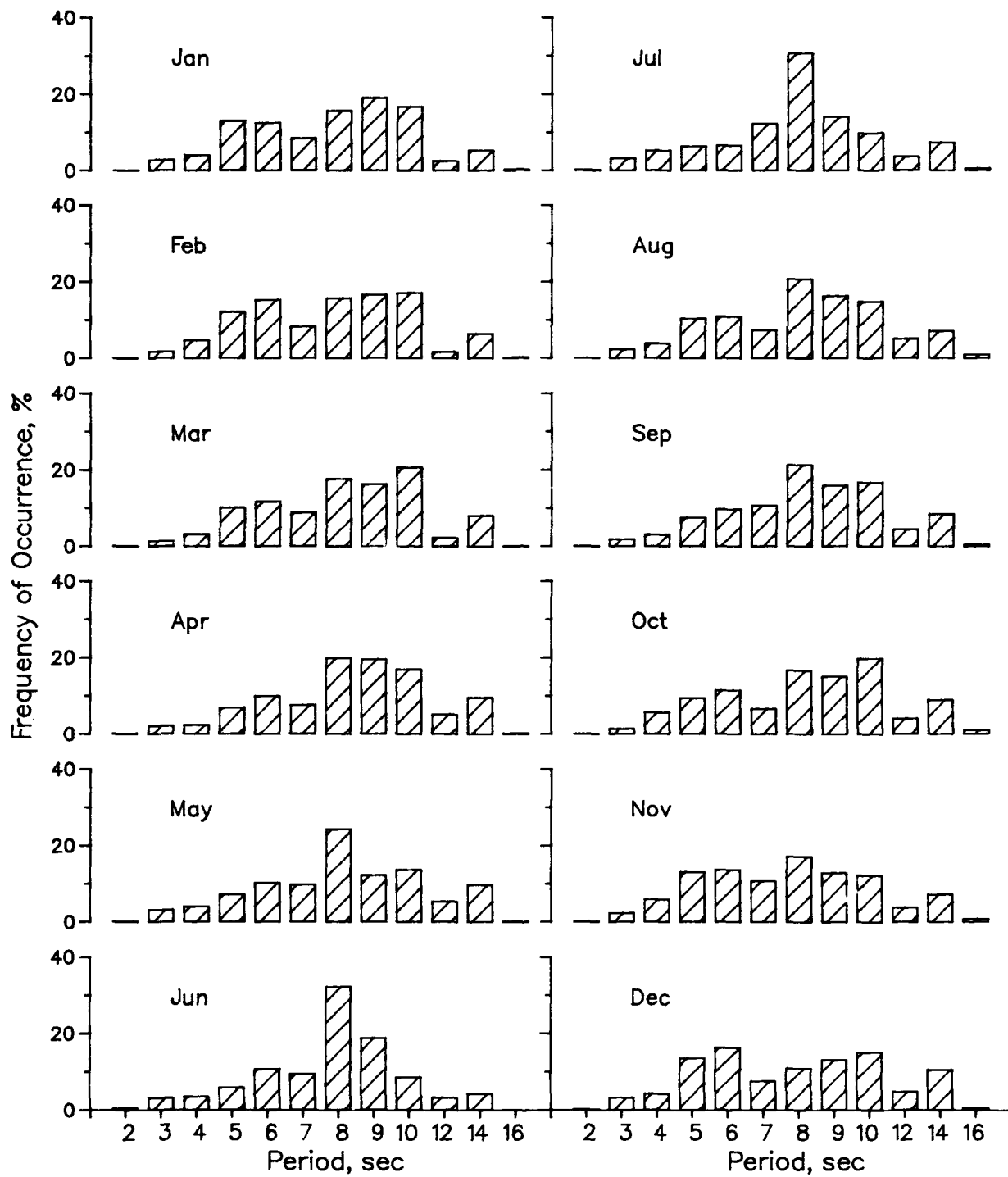


Figure C7. 1985-1991 monthly wave period distributions for Gage 111

Table C5
1991 Persistence of H_{mo} for Gage 111

Height (m)	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	33	29	25	23	21	20	19	15	13	12		10	7				6	5	4
1.0	45	33	23	13	8		3		2										
1.5	35	19	8	5		2													
2.0	16	9	4		1														
2.5	8		3		1														
3.0	5	3			1														
3.5		2		1															
4.0		2																	

Table C6
1985 Through 1991 Average Persistence of H_{mo} for Gage 111

Height (m)	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	29	26	23	22	19	18	16	14	13	12	10	9	8		7		6		5
1.0	49	34	22	14	10	7	5	4	3	2		1							
1.5	35	19	8	4	2		1												
2.0	16	8	3		1														
2.5	8	3	2		1														
3.0	4	2	1																
3.5	2		1																
4.0	2	1																	

* Data from Gage 640 from 1985 and 1986 as well as data from Gage 141 for 1987 were used for comparison with Gage 111.

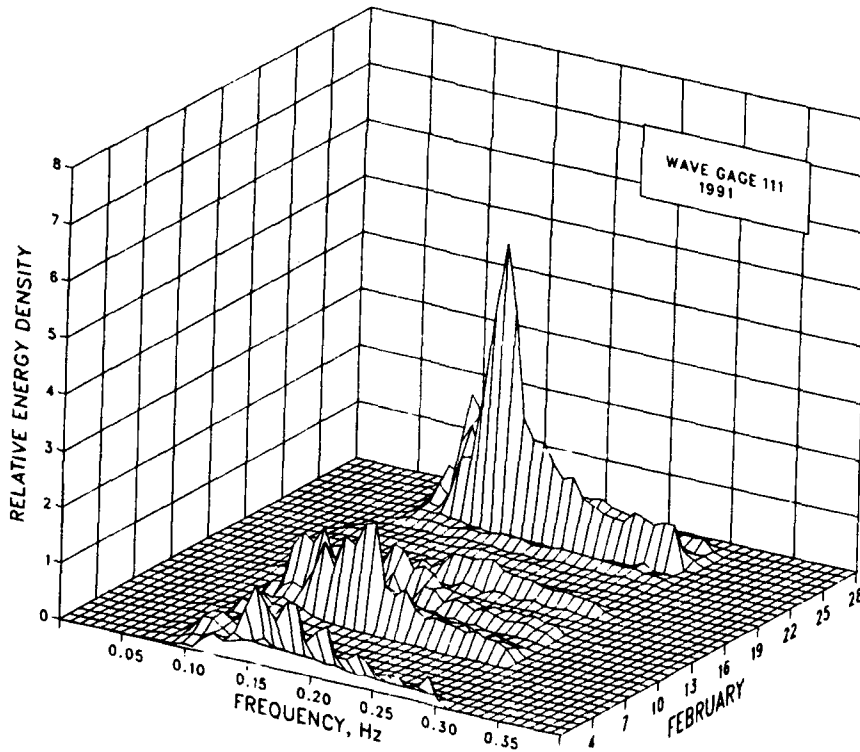
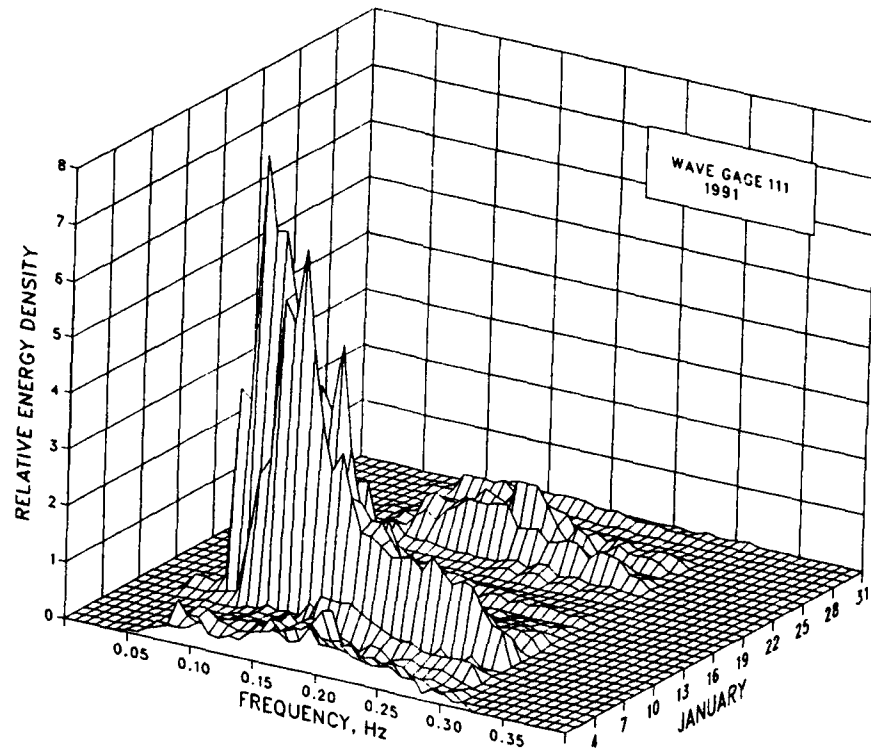


Figure C8. 1991 monthly spectra for Gage 111
(Sheet 1 of 6)

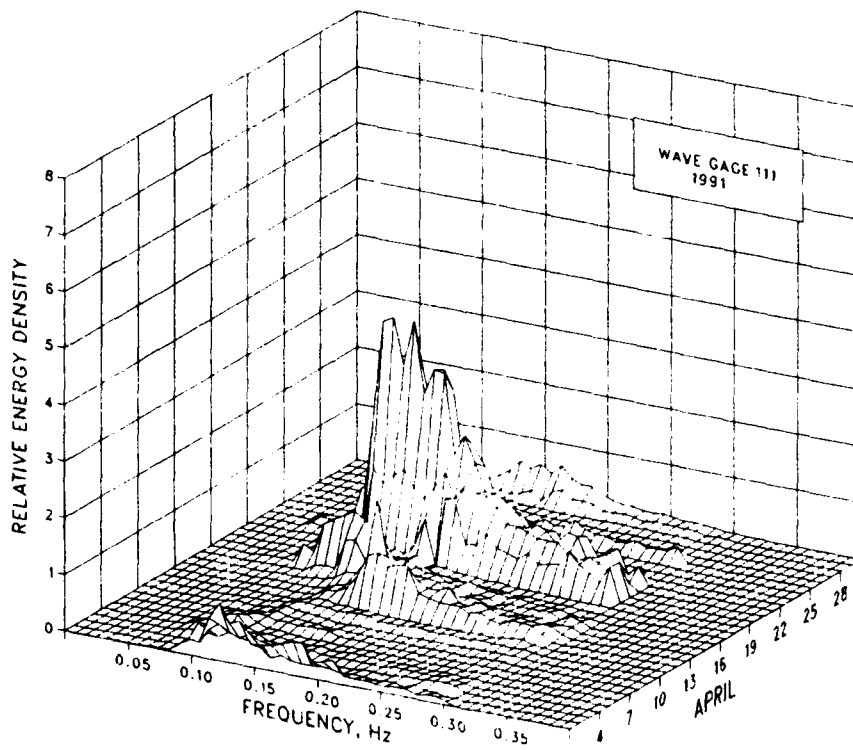
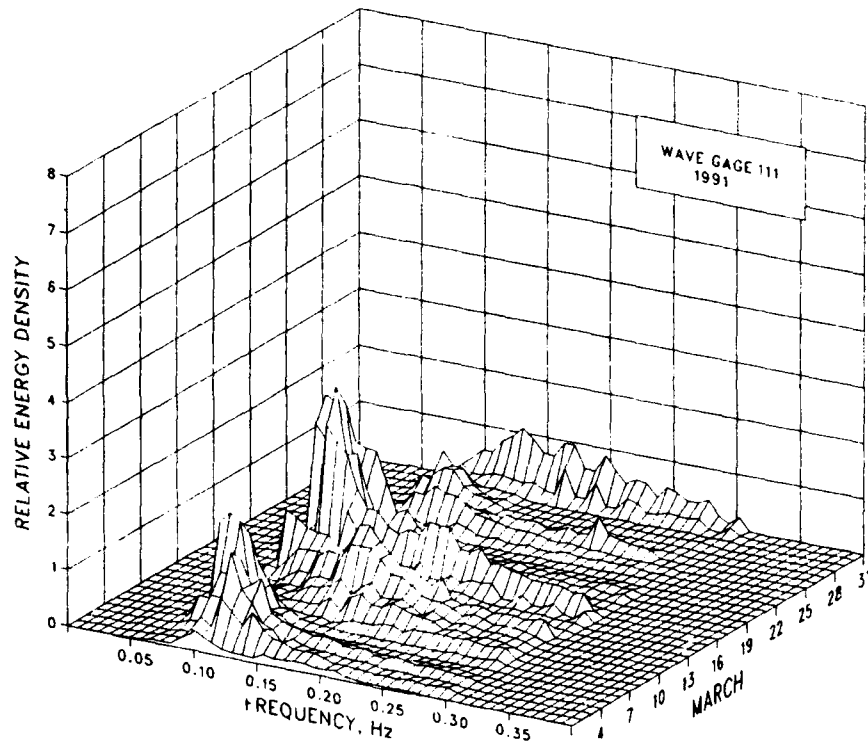


Figure C8. (Sheet 2 of 6)

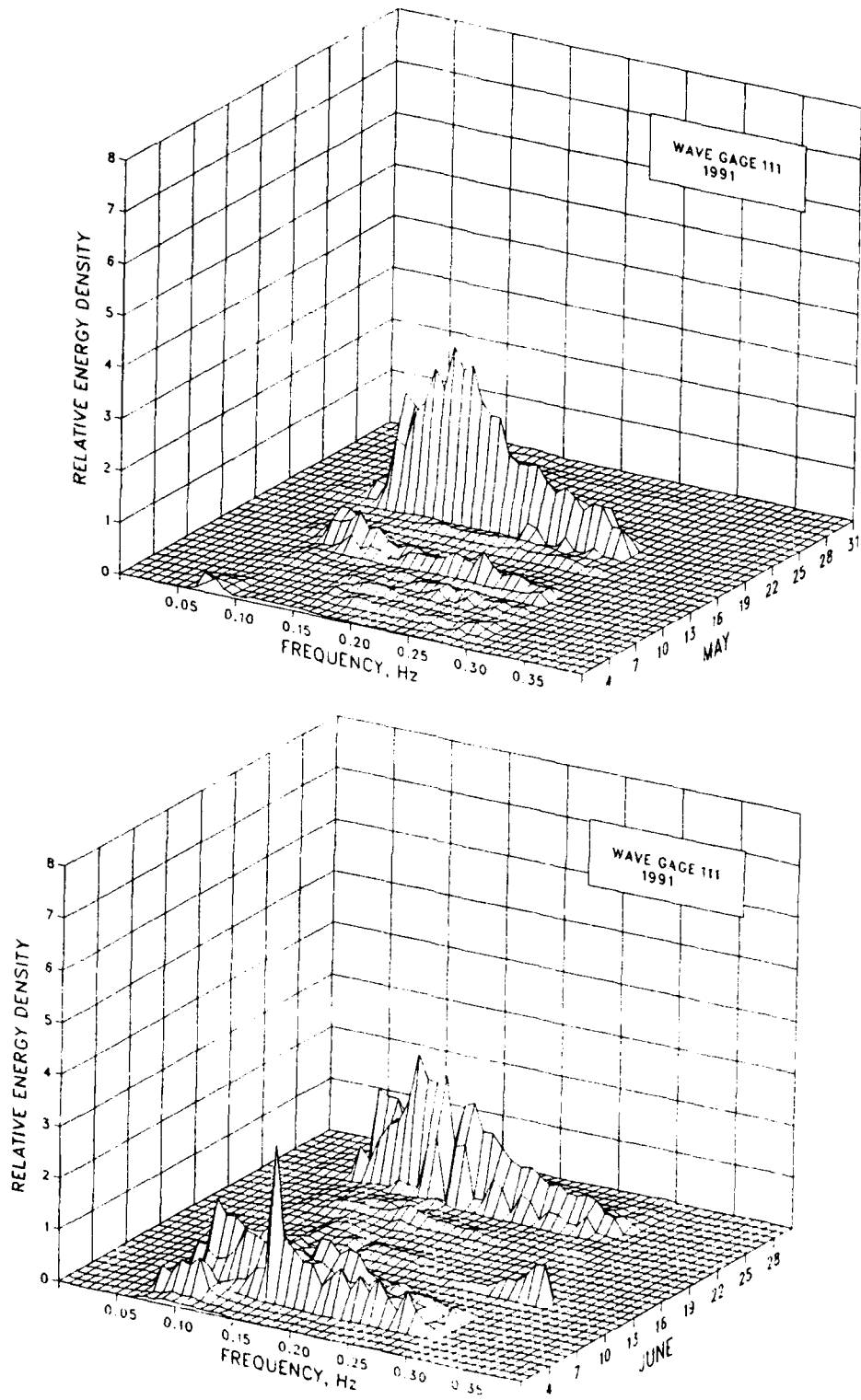


Figure C8. (Sheet 3 of 6)

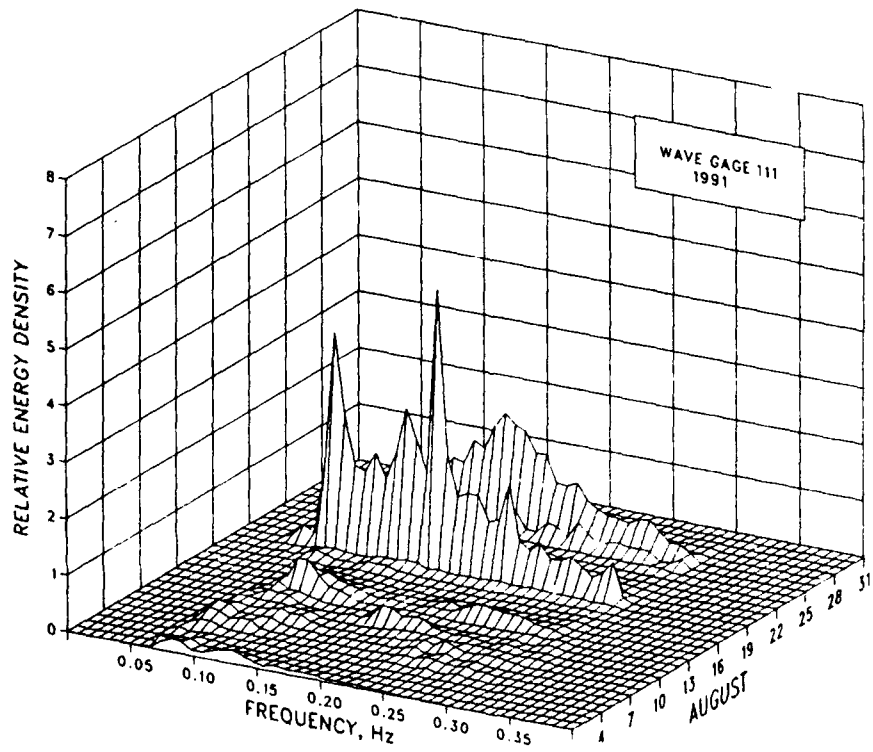
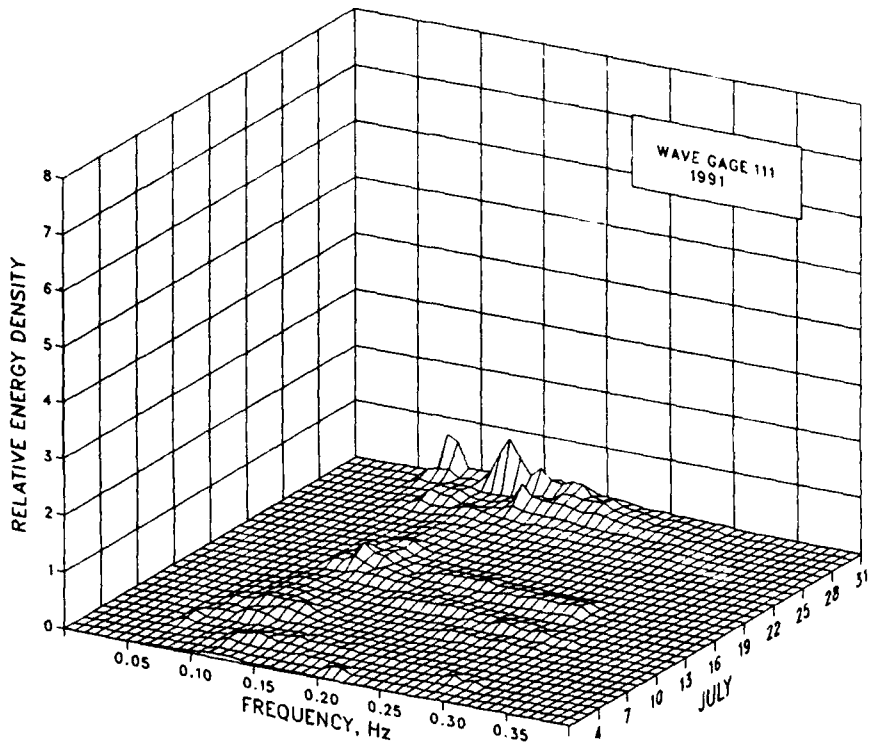


Figure C8. (Sheet 4 of 6)

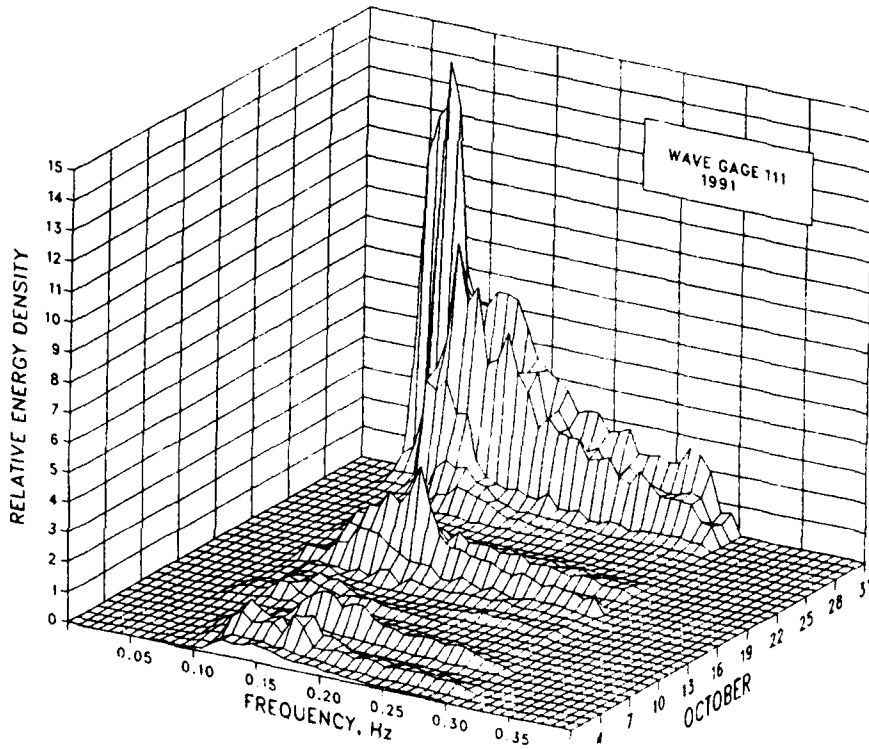
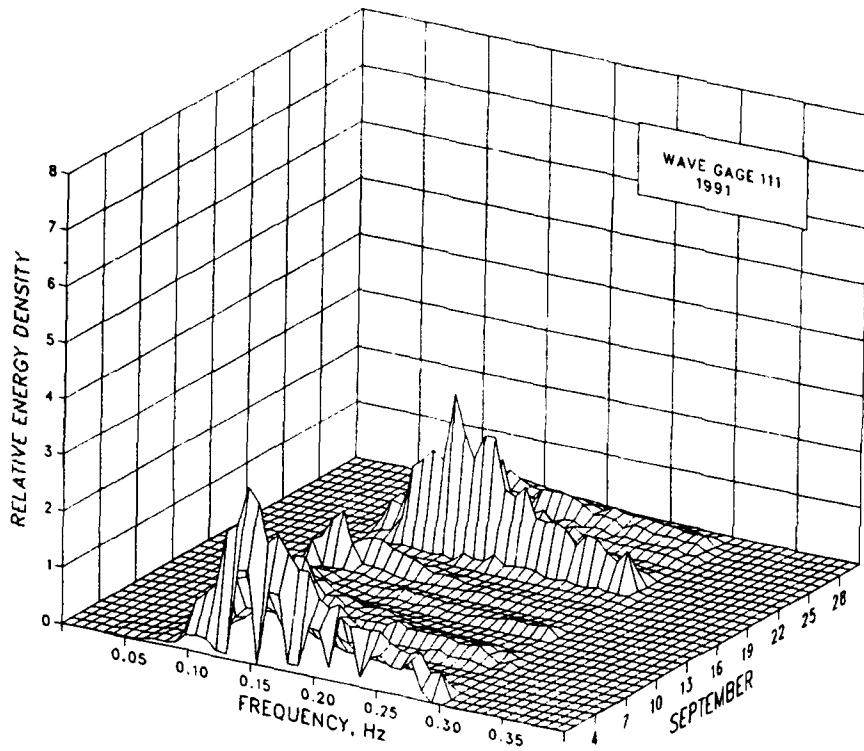


Figure C8. (Sheet 5 of 6)

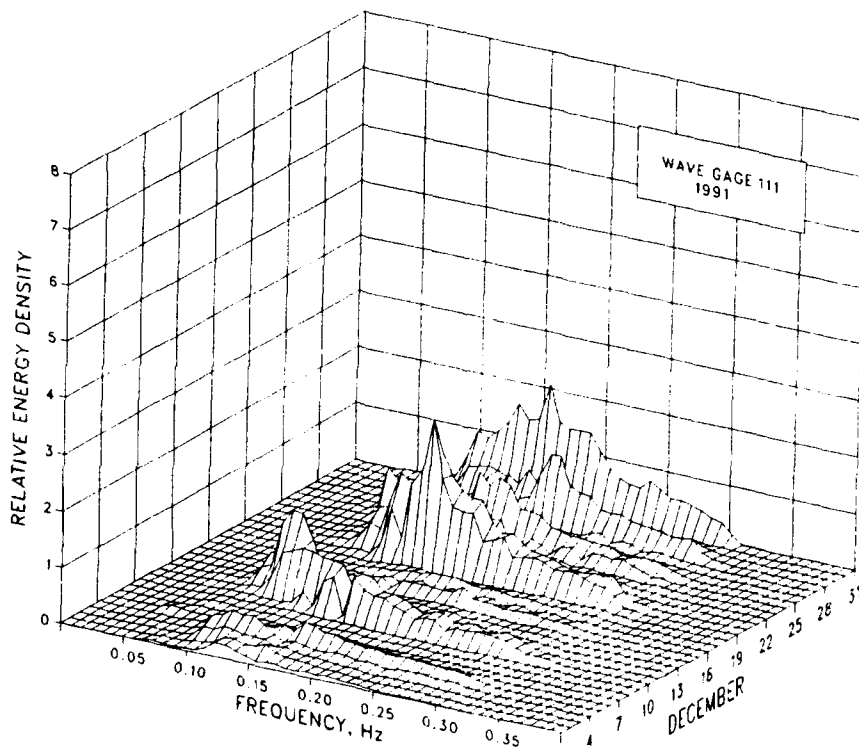
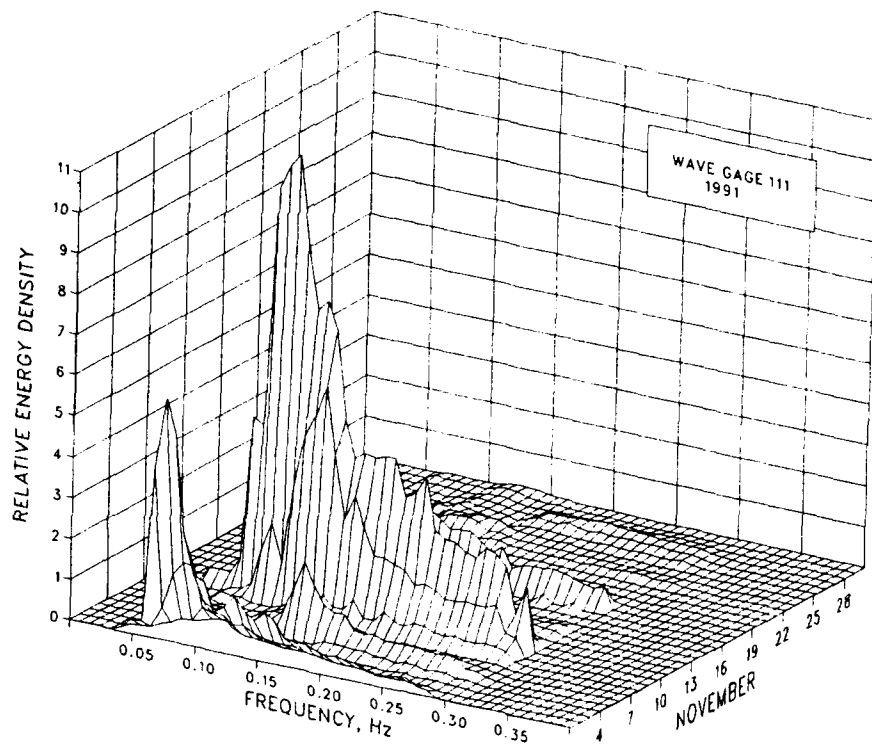


Figure C8. (Sheet 6 of 6)

Table C7
Wave Statistics for Gage 111

Month	1991							1985-1991						
	Height			Date	Period			Height			Date	Period		
	Mean	Std. Dev.	Extreme		Mean	Std. Dev.	Number	Mean	Std. Dev.	Extreme		Mean	Std. Dev.	Number
m	m	m	sec	sec	Obs.	m	m	m	sec	sec	Obs.			
Jan	1.1	0.8	3.2	9	8.3	2.7	124	1.0	0.6	3.8	1987	8.5	2.6	843
Feb	0.8	0.5	2.4	23	8.2	2.1	112	1.0	0.6	4.0	1989	8.5	2.5	758
Mar	1.0	0.4	2.0	16	9.6	2.5	118	1.1	0.7	4.5	1987	8.8	2.4	845
Apr	0.9	0.6	3.2	20	8.5	2.0	120	1.0	0.6	4.8	1988	9.2	2.7	816
May	0.7	0.5	2.5	19	8.4	3.1	124	0.8	0.5	3.3	1986	8.9	2.8	810
Jun	0.8	0.5	2.4	23	9.1	2.0	119	0.7	0.4	2.4	1986	8.5	2.3	804
Jul	0.5	0.2	1.2	30	8.6	2.4	117	0.6	0.3	1.9	1986	8.7	2.6	815
Aug	0.7	0.5	3.4	19	9.5	2.6	123	0.8	0.4	3.4	1991	8.8	2.8	796
Sep	1.0	0.5	2.5	1	8.3	1.6	119	1.0	0.5	2.8	1989	9.0	2.6	784
Oct	1.3	1.0	4.4	31	10.0	3.2	122	1.1	0.7	5.0	1991	9.0	2.8	829
Nov	1.0	0.8	4.2	9	8.5	3.0	119	1.0	0.6	4.2	1991	8.4	2.9	811
Dec	0.9	0.5	2.2	31	8.4	2.8	124	1.0	0.7	4.5	1989	8.8	3.1	769
Annual	0.9	0.6	4.4	Oct	8.8	2.6	1441	0.9	0.6	5.0	Oct 1991	8.8	2.7	9680

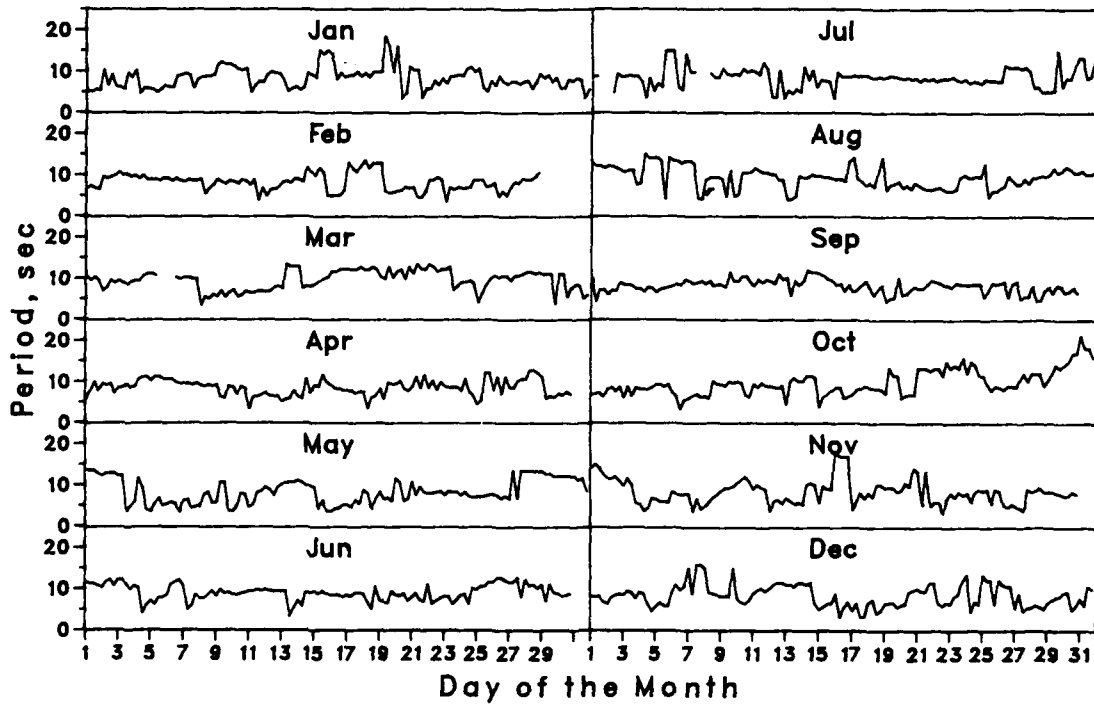
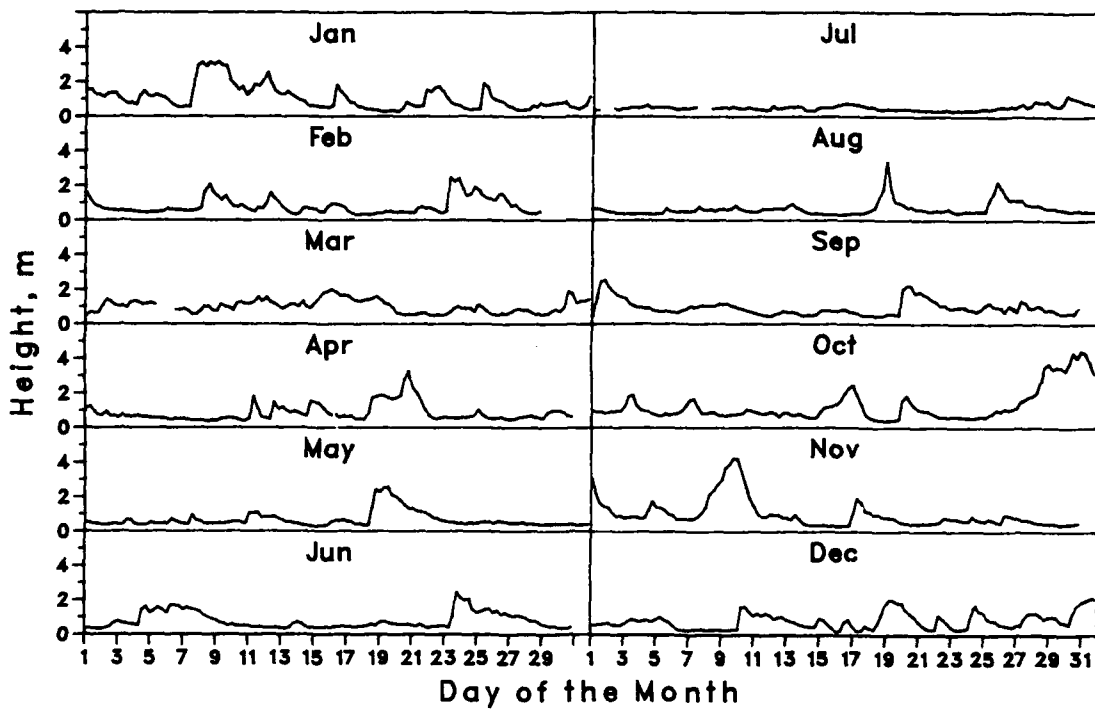


Figure C9. Time histories of wave height and period for Gage 111

APPENDIX D: WAVE DATA FOR GAGE 625

1. Wave data summaries for Gage 625 are presented for 1991 and for 1980 through 1991 in the following forms:

Daily H_{m0} and T_p

2. Figure D1 displays the individual wave height (H_{m0}) and peak spectral wave period (T_p) values along with the monthly mean values.

Joint Distributions of H_{m0} and T_p

3. Annual and monthly joint distribution tables are presented in Tables D1 and D2, and data for 1980 through 1991 are presented in Tables D3 and D4. Each table gives the frequency (in parts per 10,000) for which the wave height and peak period were within the specified intervals; these values can be converted to percentages by dividing by 100. Marginal totals are also included. The row total gives the number of observations out of 10,000 that fell within each specified peak period interval. The column total gives the number of observations out of 10,000 that fell within each specified wave height interval.

Cumulative Distributions of Wave Height

4. Annual and monthly wave height distributions for 1991 are plotted in cumulative form in Figures D2 and D3. Data for 1980 through 1991 are presented in Figure D4.

Peak Spectral Wave Period Distributions

5. Annual and monthly peak wave period T_p distribution histograms for 1991 are presented in Figures D5 and D6. Data for 1980 through 1991 are presented in Figure D7.

Persistence of Wave Heights

6. Table D5 shows the number of times in 1991 when the specified wave height was equaled or exceeded at least once during each day for the duration (consecutive days). Data for 1980 through 1991 are averaged and given in Table D6. An example is shown below:

Height m	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	18	15		14	13	12		11	10	9				8		7			
1.0	50	34	24	21	18	14	12	8	7	3				2					
1.5	41	19	8	6	2	1													
2.0	22	9	5	1															
2.5	10	5	2																
3.0	6	1																	
3.5		1																	
4.0	1																		

This example indicates that wave heights equaled or exceeded 1.0 m 50 times for at least 1 day; 34 times for at least 2 days; 24 times for at least 3 days, etc. Therefore, on 16 occasions the height equaled or exceeded 1.0 m for 1 day exactly ($50 - 34 = 16$); on 10 occasions for 2 days; on 3 occasions for 3 days, etc. Note that the height exceeded 1 m 50 times for 1 day or longer, while heights exceeded 0.5 m only 18 times for this same duration. This change in durations occurred because the longer durations of lower waves may be interspersed with shorter, but more frequent, intervals of higher waves. For example, one of the times that the wave heights exceeded 0.5 m for 16 days may have represented 3 times the height exceeded 1 m for shorter durations.

Spectra

7. Monthly spectra for the offshore Waverider buoy (Gage 625) are presented in Figure D8. The plots show "relative" energy density as a function of wave frequency. These figures summarize the large number of spectra for each month. The figures emphasize the higher energy density associated with storms as well as the general shifts in energy density to different frequencies. As used here, "relative" indicates the spectra have been smoothed by the three-dimensional surface drawing routine. Consequently, extremely high- and low-energy density values are modified to produce a smooth surface. The figures are not intended for quantitative measurements; however,

they do provide the energy density as a function of frequency relative to the other spectra for the month.

8. Monthly and annual wave statistics for Gage 625 for 1991 and for 1980 through 1991 are presented in Table D7.

9. Figure D9 plots monthly time histories of wave height and period.

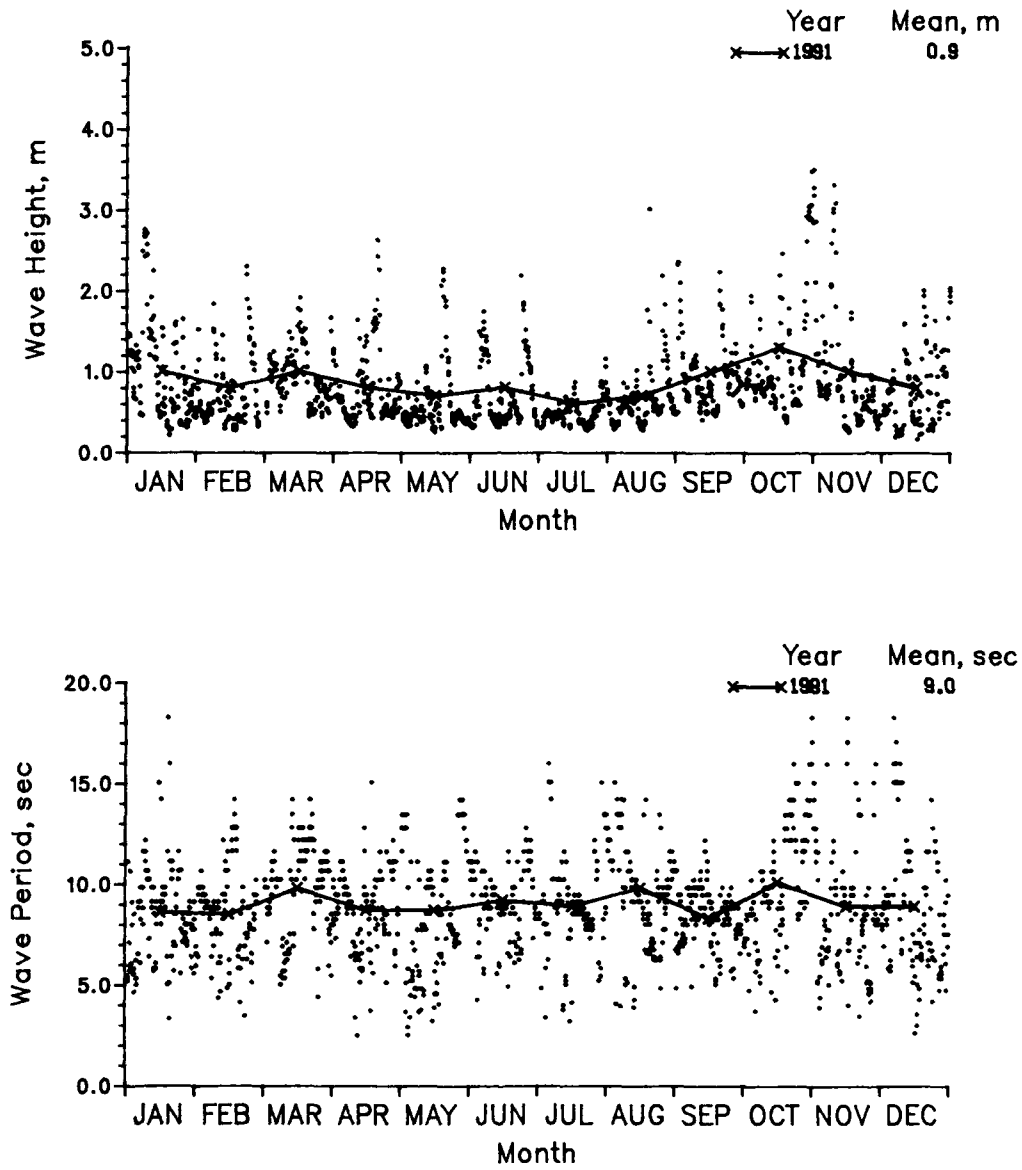


Figure D1. 1991 daily wave height and period values with monthly means for Gage 625

Table D1

Annual Joint Distribution of H_{mo} versus T_p

Height(m)	Annual 1991, Gage 625 Percent Occurrence(X100) of Height and Period												Total
	Period(sec)												
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	28	.	14	76	132	257	652	673	569	229	382	35	3047
0.50 - 0.99	7	132	180	479	375	451	798	791	847	125	215	7	4407
1.00 - 1.49	.	.	97	222	208	167	291	236	194	14	118	.	1547
1.50 - 1.99	.	.	7	49	215	42	69	35	139	21	28	.	605
2.00 - 2.49	.	.	.	.	83	35	42	14	14	7	7	.	202
2.50 - 2.99	.	.	.	.	.	14	21	14	21	14	28	7	119
3.00 - 3.49	.	.	.	.	7	.	7	7	7	14	14	14	70
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	7	7
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	35	132	298	826	1020	966	1880	1770	1791	424	792	70	

Table D2
 Monthly Joint Distribution of H_{mo} versus T_p

January 1991, Gage 625
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	.	.	81	81	484	323	565	565	.	403	81	2583
0.50 - 0.99	.	81	.	403	565	161	1048	645	242	81	.	.	3226
1.00 - 1.49	.	.	81	1129	242	323	242	242	403	.	.	.	2662
1.50 - 1.99	.	.	.	81	161	81	161	81	242	.	.	.	807
2.00 - 2.49	242	81	81	.	.	.	323
2.50 - 2.99	81	81	161	.	81	.	404
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	81	81	1694	1049	1049	2097	1614	1694	81	484	81	

February 1991, Gage 625
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	.	.	179	268	.	357	1429	536	179	804	.	3752
0.50 - 0.99	.	89	357	446	536	357	1429	625	179	.	.	.	4018
1.00 - 1.49	.	.	.	179	446	357	357	89	.	.	.	.	1428
1.50 - 1.99	357	89	179	.	.	.	.	.	625
2.00 - 2.49	89	89	.	.	.	.	.	.	178
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	89	357	804	1696	892	2322	2143	715	179	804	0	

March 1991, Gage 625
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	.	.	85	424	169	424	339	85	424	85	254	848
0.50 - 0.99	.	.	.	339	593	254	424	169	847	169	85	508	5084
1.00 - 1.49	.	.	.	85	.	85	.	.	339	.	254	.	3304
1.50 - 1.99	763
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	0	85	848	762	763	763	1101	3729	339	1609	0	

(Continued)

(Sheet 1 of 4)

Table D2 (Continued)

April 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	83	250	1083	500	750	.	83	.	2749
0.50 - 0.99	83	167	.	500	583	667	917	750	1583	.	83	.	5333
1.00 - 1.49	.	.	.	83	167	83	250	83	83	.	83	.	832
1.50 - 1.99	.	.	.	83	250	.	83	250	167	.	.	.	833
2.00 - 2.49	83	.	83	.	.	.	.	.	166
2.50 - 2.99	83	.	.	.	.	.	.	83
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	83	167	0	666	1166	1083	2416	1583	2583	0	249	0	

May 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	161	.	81	484	323	1048	484	484	1129	968	887	.	6049
0.50 - 0.99	.	484	645	403	.	484	323	242	81	.	81	.	2743
1.00 - 1.49	.	.	161	.	81	.	161	.	242	.	.	.	645
1.50 - 1.99	81	.	.	.	161	.	.	.	242
2.00 - 2.49	161	.	81	81	.	.	.	.	323
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	161	484	887	887	646	1532	1049	807	1613	968	968	0	

June 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	336	168	1513	1681	924	.	.	.	4622
0.50 - 0.99	.	.	84	168	252	252	420	504	924	.	84	.	2688
1.00 - 1.49	.	.	84	168	168	168	252	336	420	.	336	.	1932
1.50 - 1.99	168	.	.	.	504	.	.	.	672
2.00 - 2.49	84	.	.	.	.	.	.	84
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	0	168	336	924	672	2185	2521	2772	0	420	0	

(Continued)

(Sheet 2 of 4)

Table D2 (Continued)

July 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	.	85	.	85	684	2222	1368	598	256	256	.	5554
0.50 - 0.99	.	256	171	769	171	598	598	427	855	171	256	.	4272
1.00 - 1.49	85	85	.	.	.	.	.	170
1.50 - 1.99	0
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	256	256	769	256	1367	2905	1795	1453	427	512	0	0

August 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	244	1057	1057	325	569	.	3252
0.50 - 0.99	.	163	163	244	650	325	325	1220	1463	488	488	.	5529
1.00 - 1.49	.	.	163	.	.	163	244	163	.	.	.	.	733
1.50 - 1.99	81	81	81	.	.	81	.	.	324
2.00 - 2.49	81	.	.	.	.	.	.	.	81
2.50 - 2.99	0
3.00 - 3.49	81	.	.	.	.	.	.	.	81
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	163	326	244	893	569	894	2440	2520	894	1057	0	0

September 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	84	84	84	252	.	.	84	.	588
0.50 - 0.99	.	.	.	504	252	1176	2017	1261	588	.	84	.	5882
1.00 - 1.49	.	.	168	168	.	168	924	924	84	.	.	.	2436
1.50 - 1.99	.	.	.	168	336	.	84	84	.	.	.	.	672
2.00 - 2.49	168	168	84	.	.	.	.	.	420
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	0	168	840	840	1596	3193	2521	672	0	168	0	0

(Continued)

(Sheet 3 of 4)

Table D2 (Concluded)

October 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	82	164	164	328	328	246	1393	902	164	164	.	574
0.50 - 0.99	656	574	656	.	.	.	5247
1.00 - 1.49	.	.	.	82	246	164	492	492	.	82	164	.	1722
1.50 - 1.99	.	.	82	164	328	.	164	.	164	82	82	.	1066
2.00 - 2.49	82	82	.	.	.	.	82	.	246
2.50 - 2.99	82	.	82	164	164	82	574
3.00 - 3.49	82	.	164	82	164	492
3.50 - 3.99	82	82
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	82	246	410	984	574	1640	1967	1148	1230	1394	328	

November 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	.	.	84	84	.	840	504	252	420	336	252	2772
0.50 - 0.99	.	168	420	924	588	336	1008	840	336	.	168	.	4788
1.00 - 1.49	.	.	168	84	420	84	.	84	84	.	168	.	1092
1.50 - 1.99	168	84	.	.	84	84	.	.	420
2.00 - 2.49	168	.	.	.	84	84	.	.	336
2.50 - 2.99	84	84	84	.	.	84	.	336
3.00 - 3.49	84	.	84	.	84	.	252
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	168	588	1092	1428	588	2016	1512	924	588	840	252	

December 1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	161	.	.	81	242	323	484	242	565	323	726	81	3228
0.50 - 0.99	.	81	81	806	403	323	585	726	887	.	161	81	4114
1.00 - 1.49	.	.	323	403	161	161	81	242	161	.	81	.	1613
1.50 - 1.99	645	81	81	.	.	.	.	.	807
2.00 - 2.49	161	.	.	81	.	.	.	.	242
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	161	81	404	1290	1612	888	1211	1291	1613	323	968	162	

Table D3
Annual Joint Distribution of H_{mo} versus T_p (All Years)

Height(m)	Annual 1980-1991, Gage 625 Percent Occurrence(X100) of Height and Period												Total
	Period(sec)												
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	10	17	35	63	114	222	531	490	422	199	270	24	2397
0.50 - 0.99	5	90	236	434	461	430	719	759	866	170	306	31	4507
1.00 - 1.49	.	5	92	300	323	216	202	200	343	47	137	2	1867
1.50 - 1.99	.	.	3	63	183	97	65	65	139	41	73	5	734
2.00 - 2.49	.	.	.	1	42	41	24	33	66	38	43	2	290
2.50 - 2.99	.	.	.	.	3	13	20	22	39	16	31	2	146
3.00 - 3.49	.	.	.	.	1	.	5	7	16	7	11	1	48
3.50 - 3.99	.	.	.	.	.	.	.	.	3	1	3	1	8
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	15	112	366	861	1127	1019	1566	1576	1894	519	874	68	

Table D4
 Monthly Joint Distribution of H_{mo} versus T_p (All Years)

January 1980-1991, Gage 625
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	8	25	50	75	109	192	318	543	401	134	184	17	2056
0.50 - 0.99	.	151	234	401	468	268	527	527	895	134	242	8	3855
1.00 - 1.49	.	.	84	577	543	226	201	192	435	.	75	.	2333
1.50 - 1.99	.	.	.	92	234	209	84	109	176	33	33	.	970
2.00 - 2.49	67	142	33	33	151	42	75	.	543
2.50 - 2.99	8	17	33	33	67	25	33	.	216
3.00 - 3.49	8	8	.	.	.	16
3.50 - 3.99	8	.	.	.	8
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	8	176	368	1145	1429	1054	1196	1445	2141	368	642	25	

February 1980-1991, Gage 625
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	8	25	42	67	58	209	267	334	92	209	.	1311
0.50 - 0.99	17	58	167	409	384	401	710	701	1068	75	301	8	4299
1.00 - 1.49	.	.	100	409	426	284	209	234	584	58	175	.	2479
1.50 - 1.99	.	.	.	134	292	117	83	117	225	75	92	.	1135
2.00 - 2.49	33	58	42	58	67	58	100	.	416
2.50 - 2.99	17	17	33	67	17	92	.	243
3.00 - 3.49	25	8	33	8	8	.	82
3.50 - 3.99	8	8	17	.	33
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	17	66	292	994	1202	935	1295	1418	2386	391	994	8	

March 1980-1991, Gage 625
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	7	.	.	73	44	81	286	198	264	125	169	.	1247
0.50 - 0.99	7	37	191	506	418	477	741	653	983	117	360	.	4490
1.00 - 1.49	.	7	139	308	330	293	213	227	616	37	337	.	2507
1.50 - 1.99	.	.	.	66	183	88	95	73	235	59	161	7	967
2.00 - 2.49	.	.	.	7	59	37	37	37	125	66	59	.	427
2.50 - 2.99	.	.	.	.	.	7	29	15	88	37	51	.	227
3.00 - 3.49	.	.	.	.	.	.	15	15	51	15	37	.	133
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	14	44	330	960	1034	983	1416	1218	2362	456	1174	7	

(Continued)

(Sheet 1 of 4)

Table D4 (Continued)

April 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	16	8	8	62	54	85	435	396	427	148	311	.	1950
0.50 - 0.99	8	62	171	248	357	411	839	963	1312	210	497	16	5094
1.00 - 1.49	.	8	78	186	264	217	217	303	357	47	179	.	1856
1.50 - 1.99	.	.	8	31	132	54	70	124	202	16	78	.	715
2.00 - 2.49	.	.	.	8	23	.	31	23	70	16	8	.	179
2.50 - 2.99	.	.	.	.	8	23	23	16	47	31	8	.	156
3.00 - 3.49	.	.	.	.	.	.	.	8	31	.	16	.	55
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	24	78	265	535	838	790	1615	1833	2446	468	1097	16	

May 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	22	29	43	94	202	331	634	540	554	245	382	7	3083
0.50 - 0.99	7	158	288	410	533	526	1037	958	691	108	223	7	4946
1.00 - 1.49	.	.	58	122	137	180	302	173	281	14	86	.	1353
1.50 - 1.99	.	.	.	43	72	14	50	50	79	14	65	.	387
2.00 - 2.49	.	.	.	.	50	29	7	14	.	36	22	7	165
2.50 - 2.99	.	.	.	.	.	.	.	.	22	22	14	.	58
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	7	.	7
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	29	187	389	669	994	1080	2030	1735	1627	439	799	21	

June 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	34	59	84	92	335	486	1382	821	477	168	142	17	4097
0.50 - 0.99	8	142	243	410	318	444	1131	1064	603	101	67	17	4548
1.00 - 1.49	.	.	50	134	168	126	134	134	201	.	42	8	997
1.50 - 1.99	.	.	.	34	59	25	17	8	126	.	50	.	319
2.00 - 2.49	.	.	.	.	8	17	8	8	8	.	.	.	49
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	42	201	377	670	888	1098	2672	2035	1415	269	301	42	

(Continued)

(Sheet 2 of 4)

Table D4 (Continued)

July 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	44	106	70	176	581	1348	1093	705	361	370	70	4924
0.50 - 0.99	.	132	326	449	599	617	714	661	432	256	167	70	4423
1.00 - 1.49	.	.	44	150	123	88	62	35	44	.	18	.	564
1.50 - 1.99	.	.	.	9	18	18	18	9	9	.	.	.	81
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	176	476	678	916	1304	2142	1798	1190	617	555	140	

August 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	17	17	41	158	407	822	954	705	290	266	8	3685
0.50 - 0.99	17	91	207	523	598	606	797	788	689	224	332	75	4947
1.00 - 1.49	.	.	66	183	183	124	199	91	58	17	8	.	929
1.50 - 1.99	.	.	.	41	100	41	17	8	41	17	33	.	298
2.00 - 2.49	17	8	.	.	25	.	41	.	91
2.50 - 2.99	8	8	8	.	.	.	24
3.00 - 3.49	8	.	.	8	8	.	.	.	24
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	17	108	290	788	1064	1186	1843	1857	1534	548	680	83	

September 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-	16.0-	
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9	Longer	
0.00 - 0.49	.	.	9	18	70	123	176	361	361	202	229	53	1602
0.50 - 0.99	.	70	220	317	458	467	643	801	1021	167	458	.	4622
1.00 - 1.49	.	.	53	326	326	308	317	352	423	123	202	.	2430
1.50 - 1.99	.	.	.	97	238	150	106	97	79	53	88	9	917
2.00 - 2.49	18	79	44	18	9	79	62	9	318
2.50 - 2.99	9	9	26	35	.	26	.	105
3.00 - 3.49	9	.	.	.	9
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	70	282	758	1110	1136	1295	1655	1937	624	1065	71	

(Continued)

(Sheet 3 of 4)

Table D4 (Concluded)

October 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	7	.	21	50	14	114	263	227	277	107	234	36	1350
0.50 - 0.99	.	78	206	341	384	298	547	724	1058	199	320	36	4191
1.00 - 1.49	.	7	128	405	348	192	149	313	440	99	213	14	2308
1.50 - 1.99	.	.	28	99	249	71	78	71	234	114	128	21	1093
2.00 - 2.49	85	64	50	107	142	71	64	7	590
2.50 - 2.99	14	43	57	43	28	28	78	21	312
3.00 - 3.49	14	14	7	43	36	14	128
3.50 - 3.99	14	7	.	7	28
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	7	85	383	895	1094	782	1158	1499	2200	668	1073	156	

November 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	8	8	46	69	46	137	366	289	274	236	327	61	1867
0.50 - 0.99	.	53	358	518	586	396	571	609	647	244	327	30	4339
1.00 - 1.49	.	30	145	358	548	297	244	160	267	114	122	8	2293
1.50 - 1.99	.	.	.	53	244	198	107	61	114	84	61	15	937
2.00 - 2.49	76	23	23	8	69	53	53	.	305
2.50 - 2.99	15	30	46	15	23	38	.	167
3.00 - 3.49	8	8	30	8	23	.	77
3.50 - 3.99	15	.	15
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	8	91	549	998	1500	1066	1349	1181	1416	762	966	114	

December 1980-1991, Gage 625
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	17	17	25	67	118	126	252	319	336	311	411	25	2024
0.50 - 0.99	.	50	227	680	437	260	353	638	949	218	361	118	4291
1.00 - 1.49	.	.	143	453	479	243	168	160	361	42	151	.	2200
1.50 - 1.99	.	.	.	50	378	193	42	42	109	17	67	.	898
2.00 - 2.49	50	42	8	84	109	25	34	.	352
2.50 - 2.99	8	25	25	42	84	.	25	.	209
3.00 - 3.49	17	8	.	.	.	25
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	17	67	395	1250	1470	889	848	1302	1956	613	1049	143	

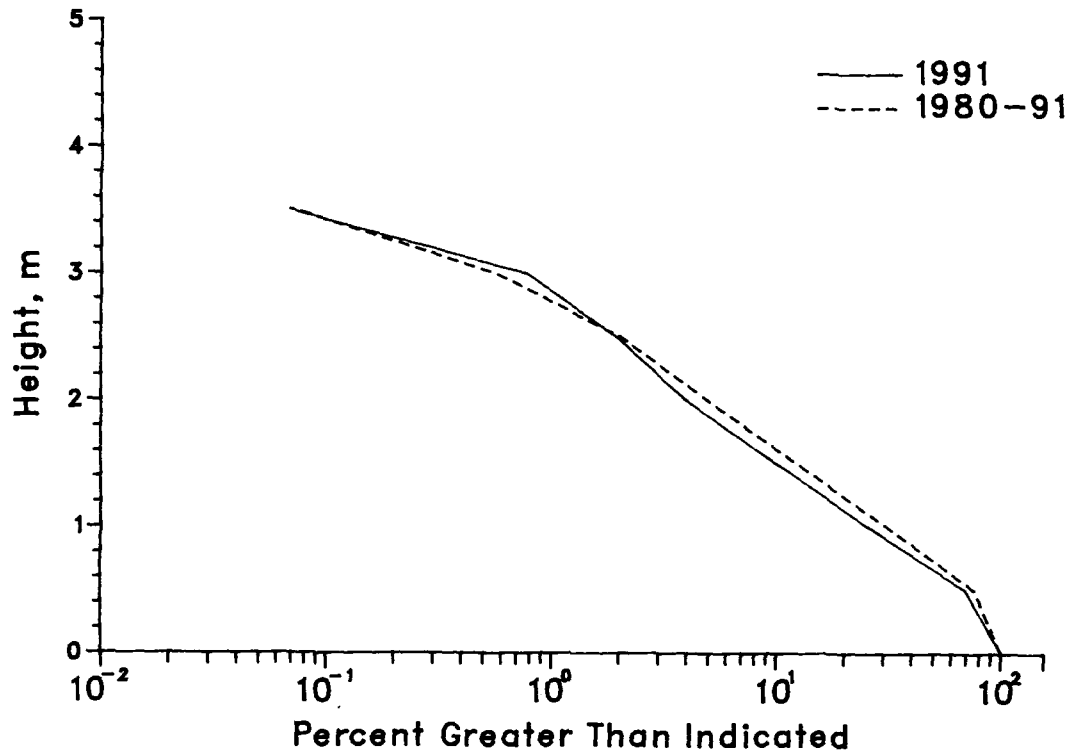


Figure D2. Annual cumulative wave height distributions for Gage 625

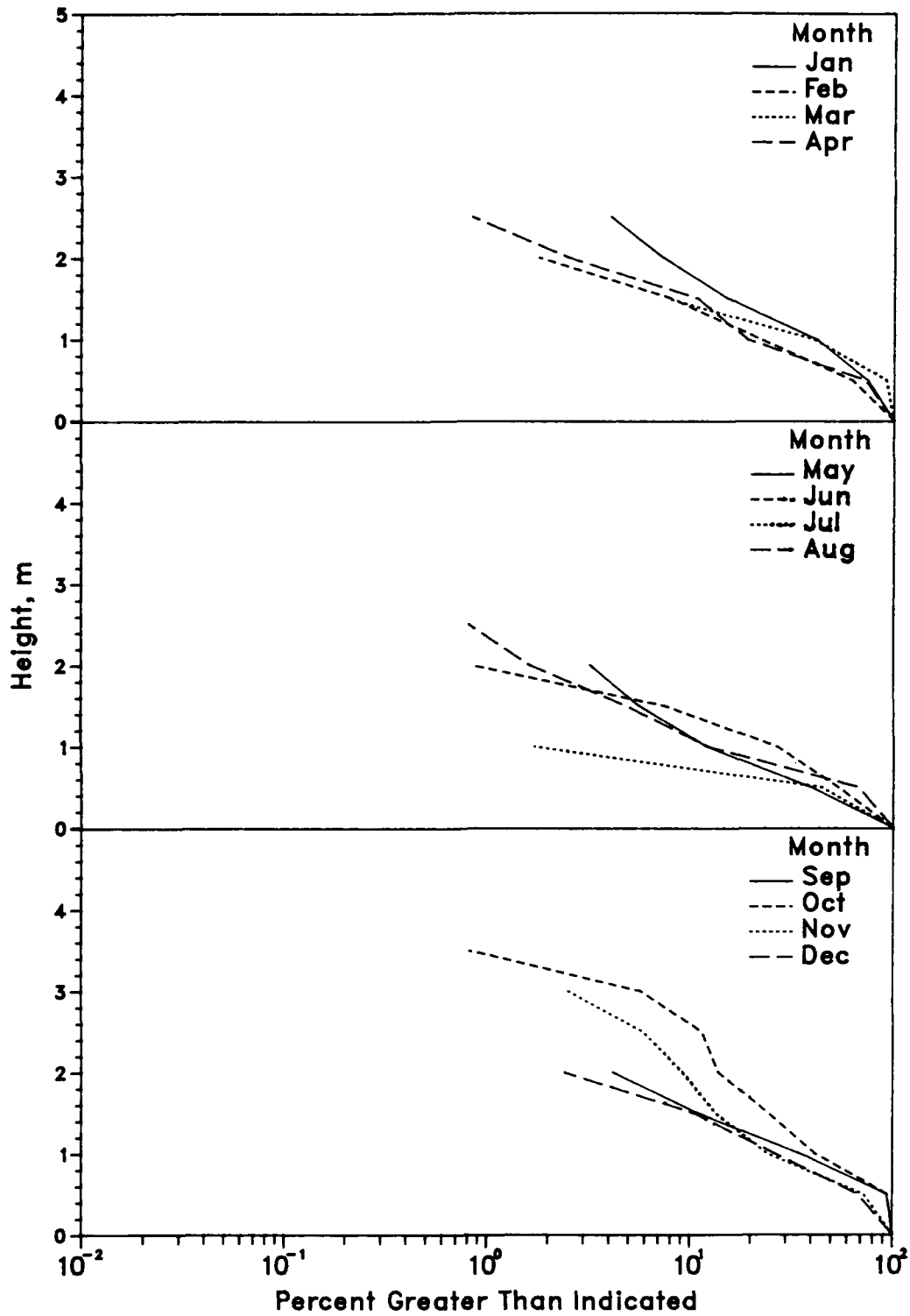


Figure D3. 1991 monthly wave height distributions for Gage 625

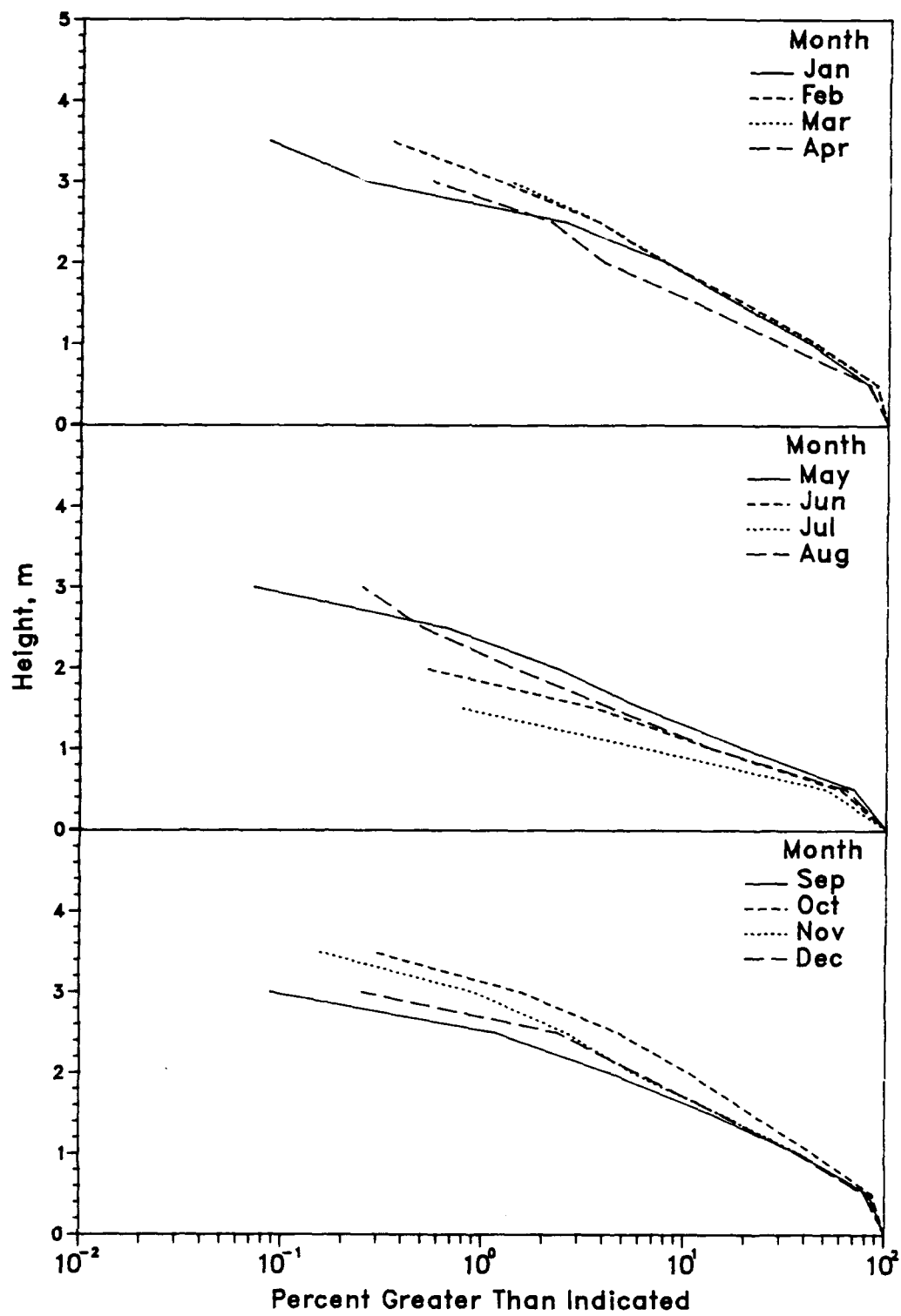


Figure D4. 1980-1991 monthly wave height distributions for Gage 625

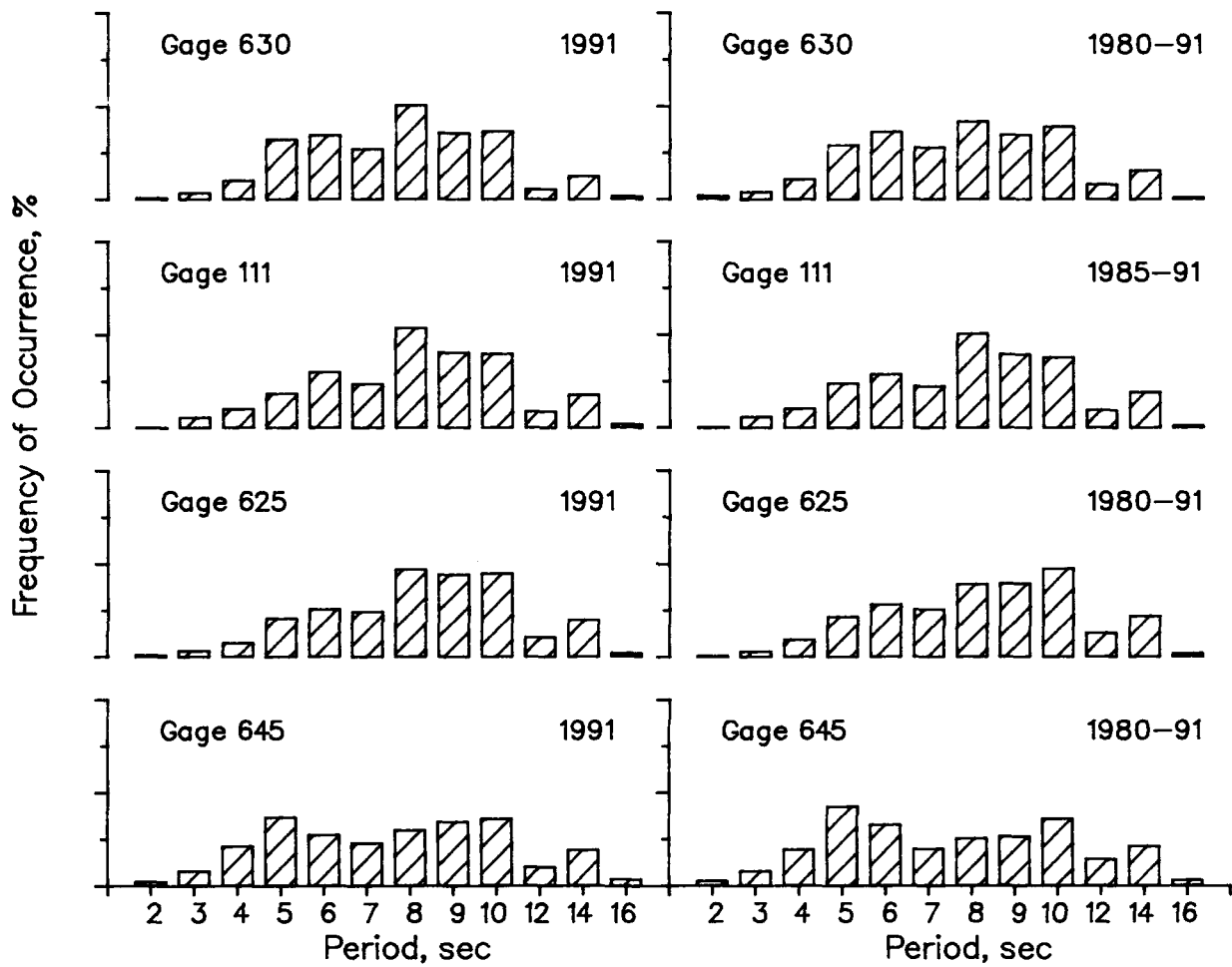


Figure D5. Annual wave period distributions for all gages

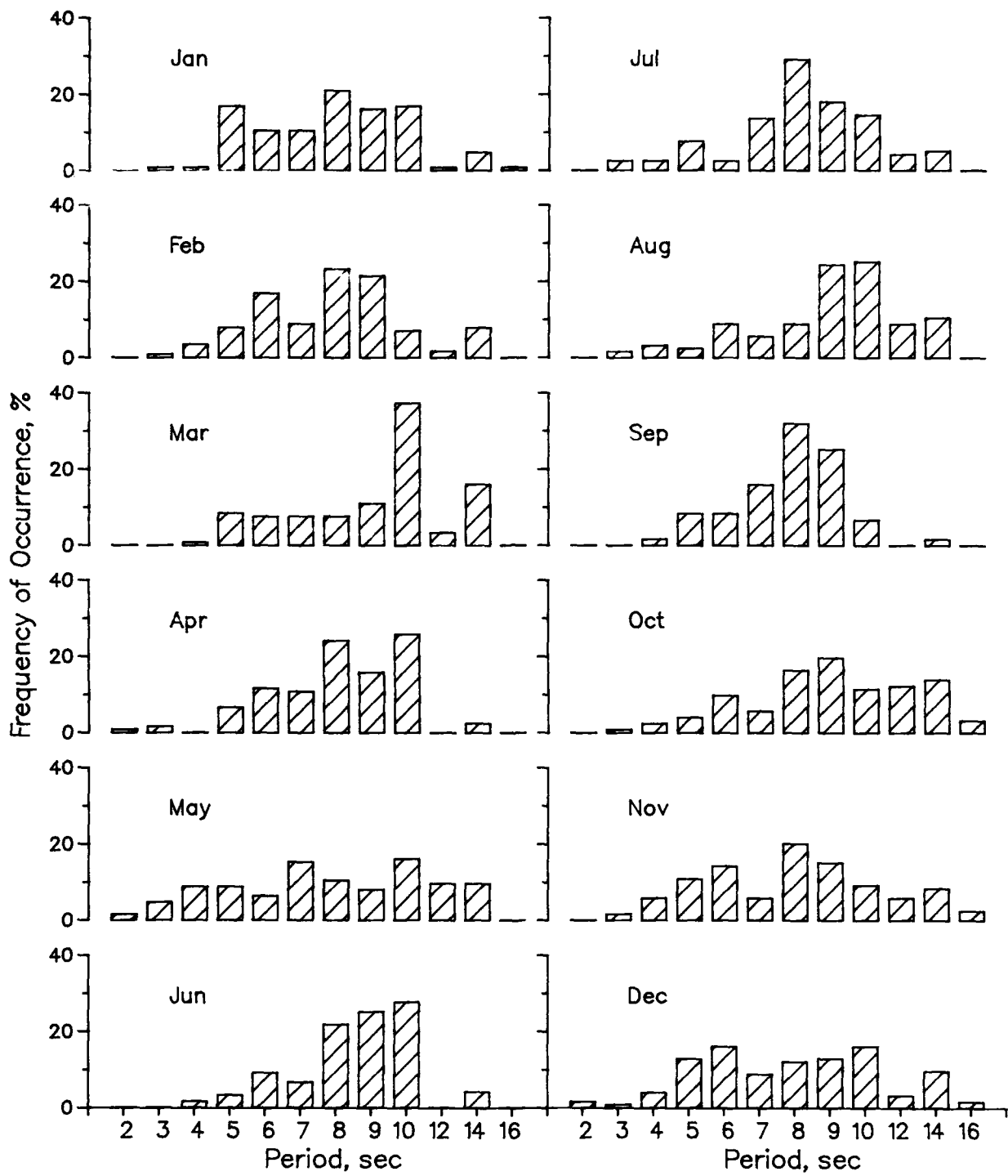


Figure D6. 1991 monthly wave period distributions for Gage 625

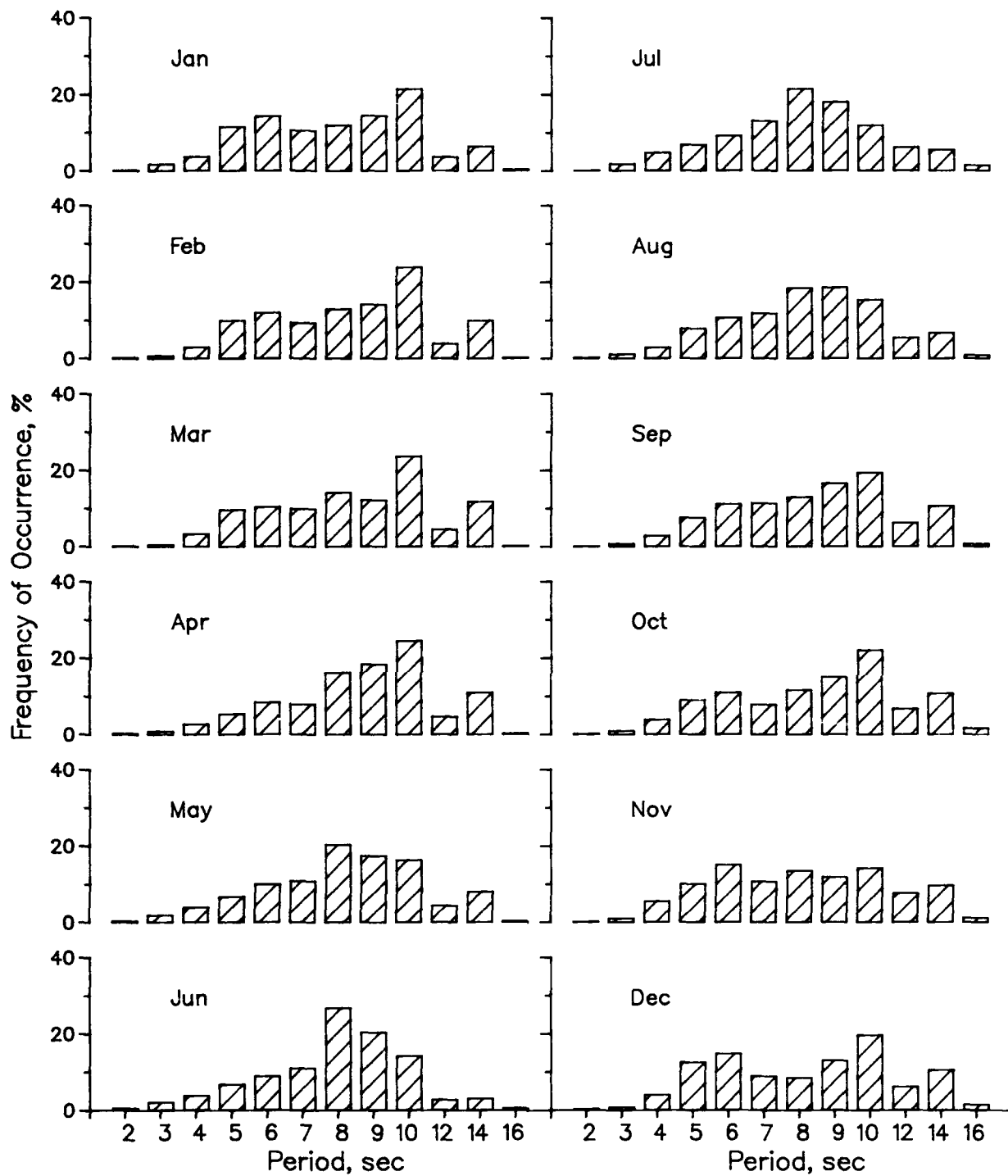


Figure D7. 1980-1991 monthly wave period distributions for Gage 625

Table D5
 1991 Persistence of H_{mo} for Gage 625

Height (m)	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	32	30	23	22		20	17	14	10	9	8		7		6				5
1.0	45	34	21	12	7		3		2				1						
1.5	32	15	7	3		2													
2.0	15	7	3		1														
2.5	5	3	2		1														
3.0	3	2	1																
3.5	1																		

Table D6
 1980 Through 1991 Average Persistence of H_{mo} for Gage 625

Height (m)	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	29	26	22	20	17	15	13	11	10		9	8	7		6	5		4	3
1.0	45	31	21	14	9	6	5	4	3				1						
1.5	29	16	8	5	3	2	1												
2.0	14	7	4	2	1														
2.5	7	3	2	1															
3.0	2	1																	
3.5	1																		
4.0																			

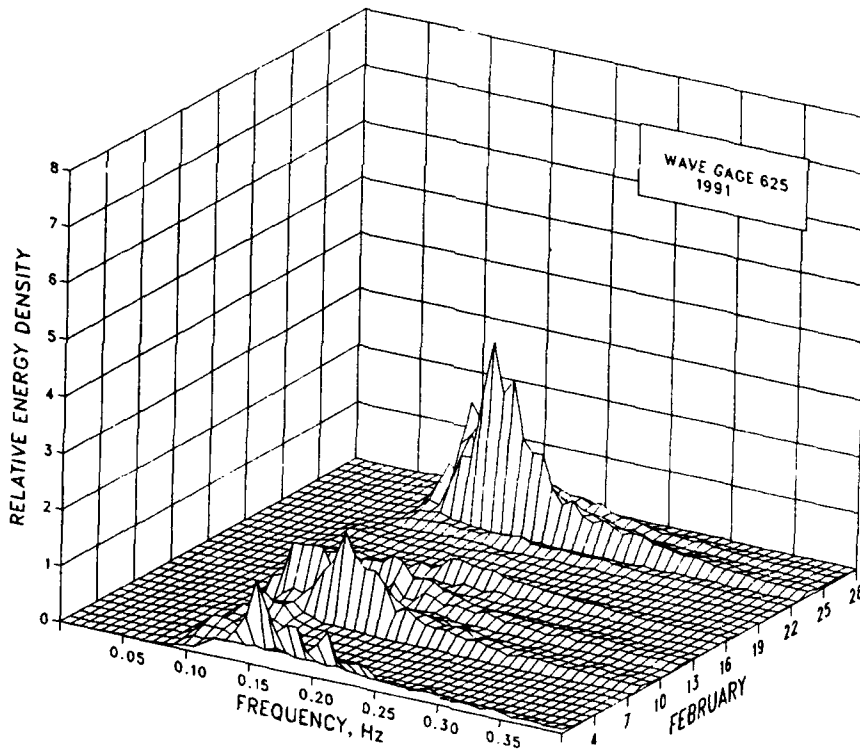
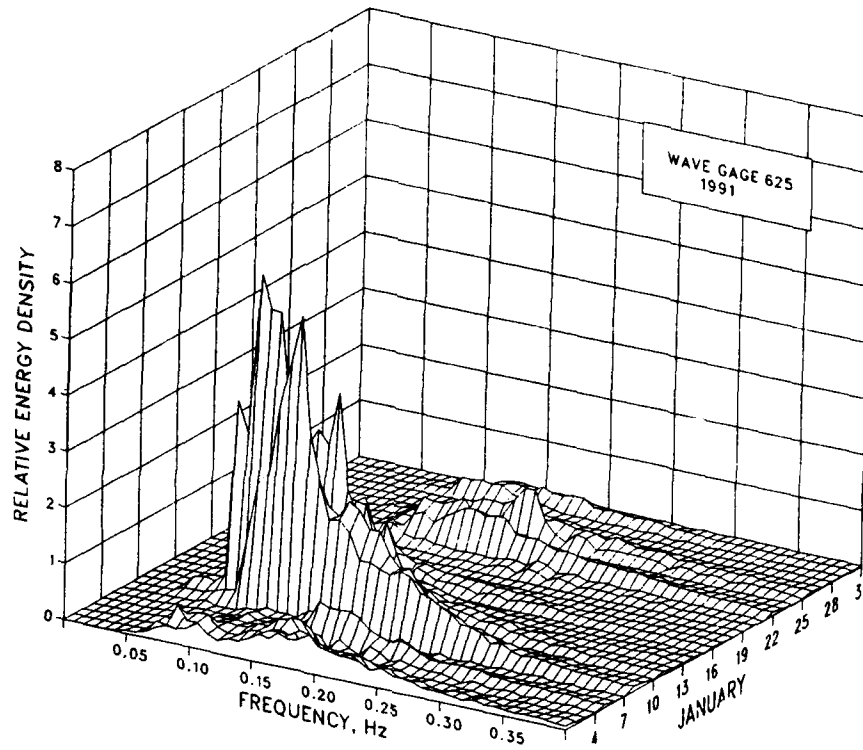


Figure D8. 1991 monthly spectra for Gage 625
(Sheet 1 of 6)

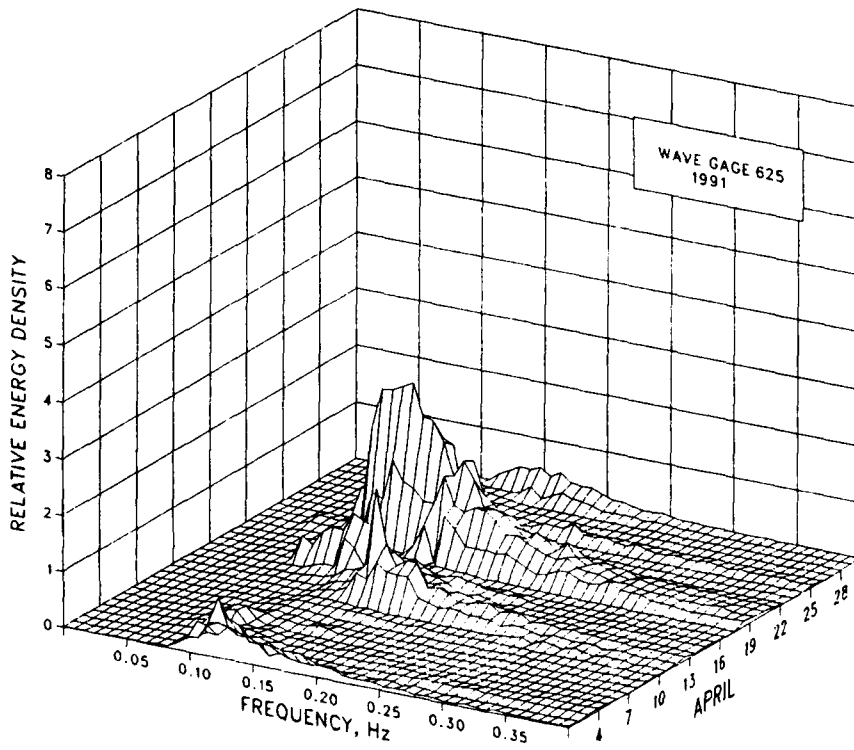
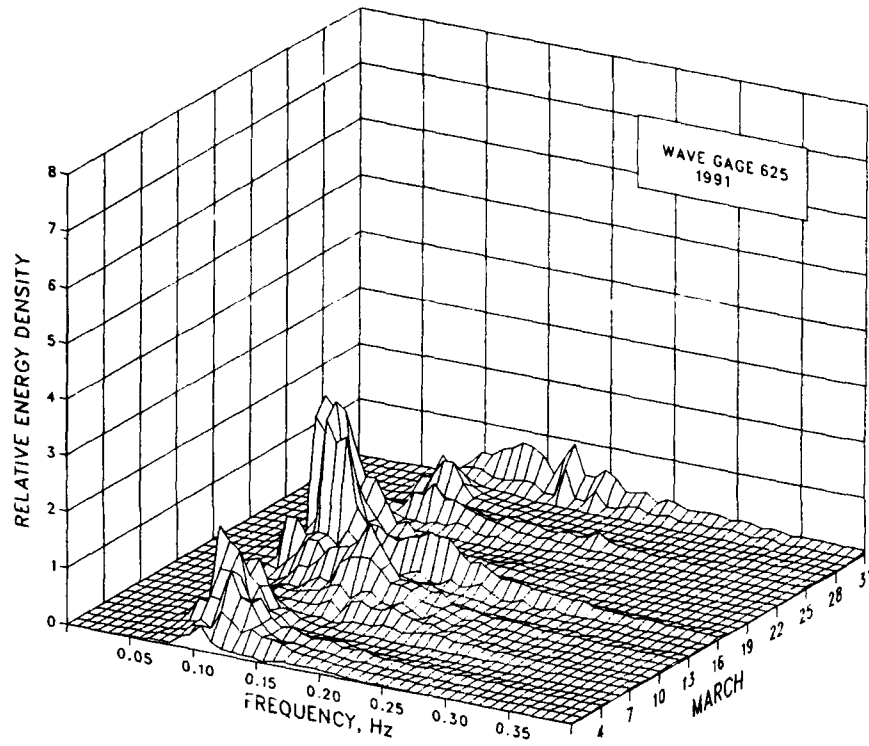


Figure D8. (Sheet 2 of 6)

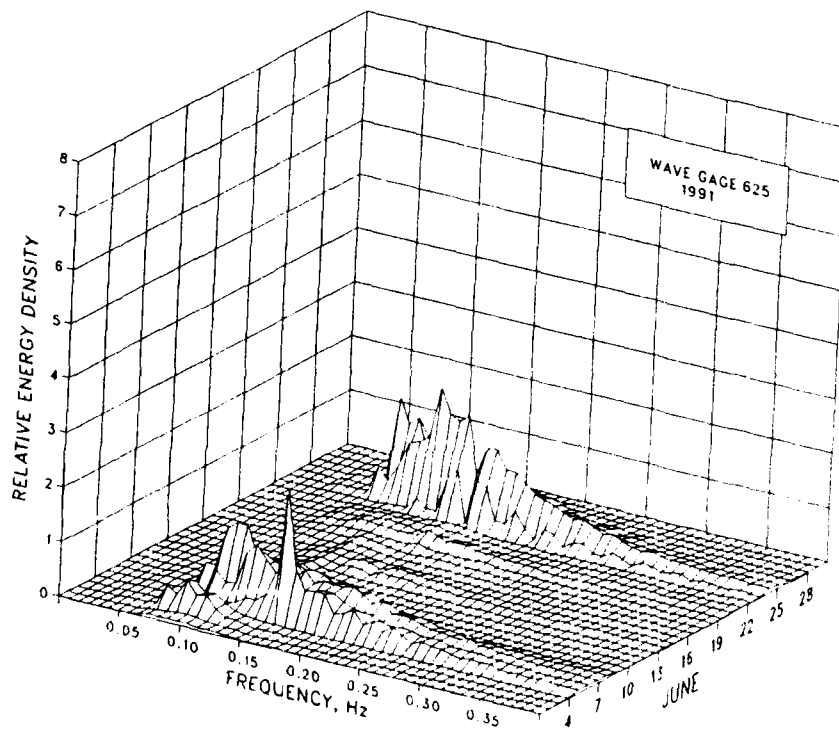
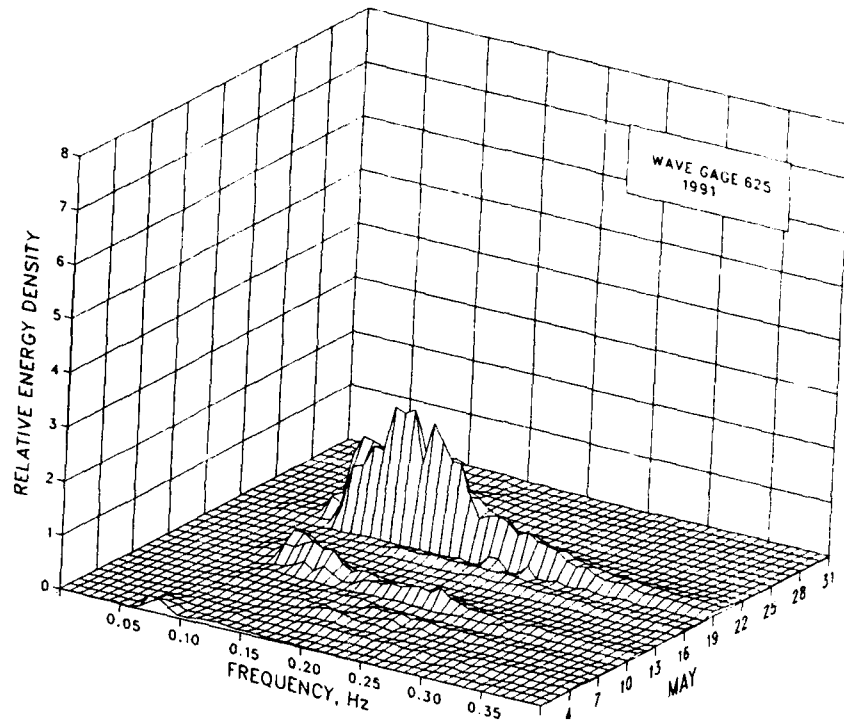


Figure D8. (Sheet 3 of 6)

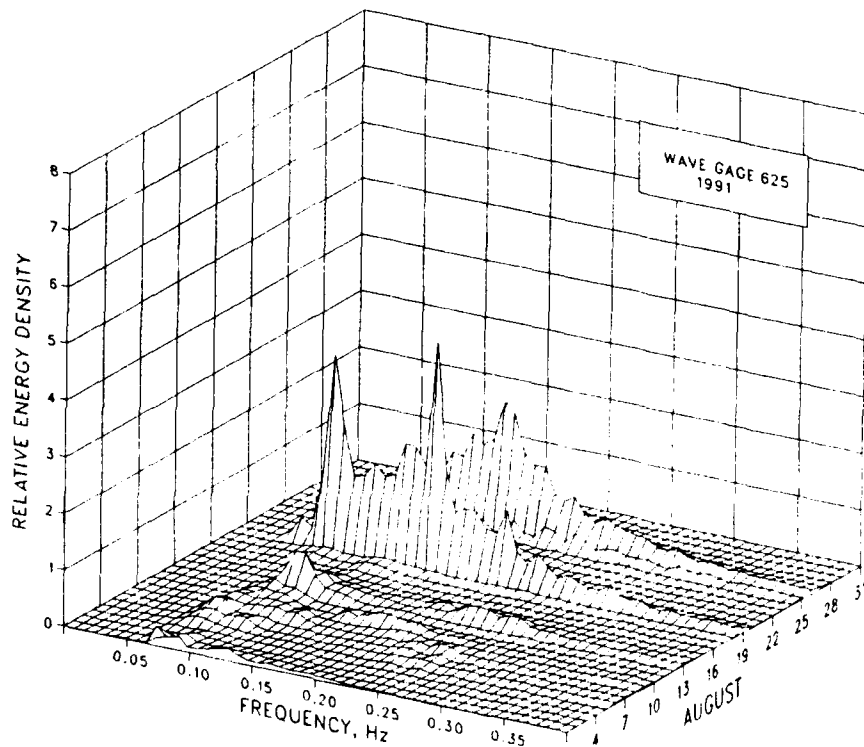
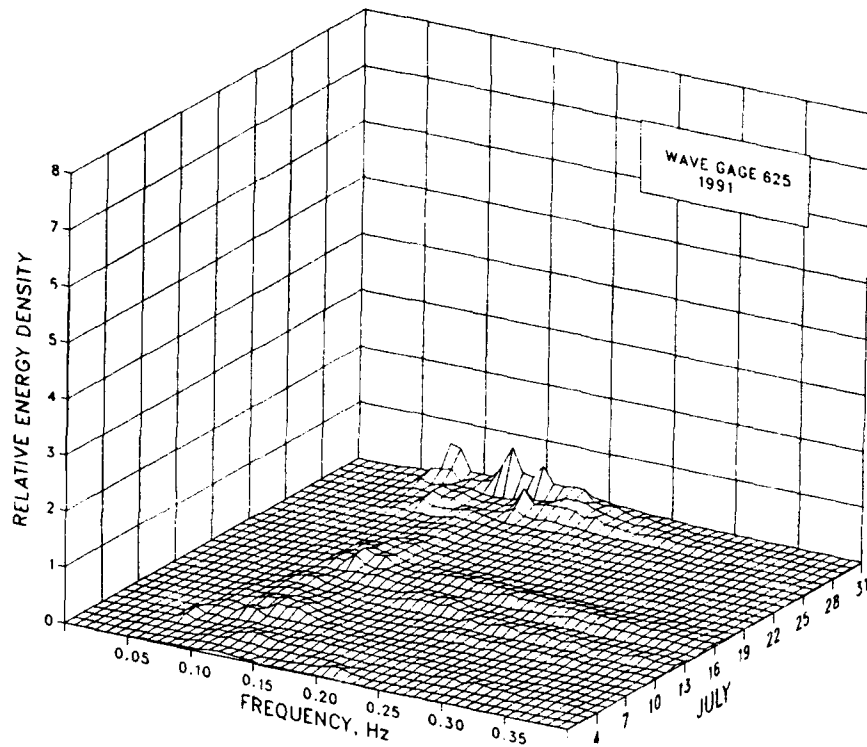


Figure D8. (Sheet 4 of 6)

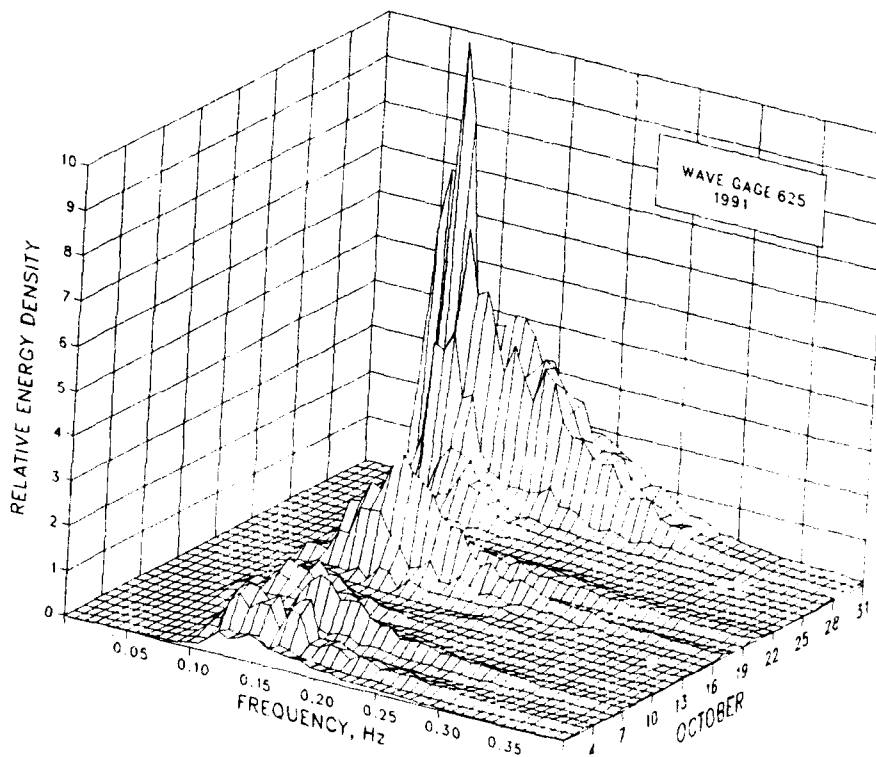
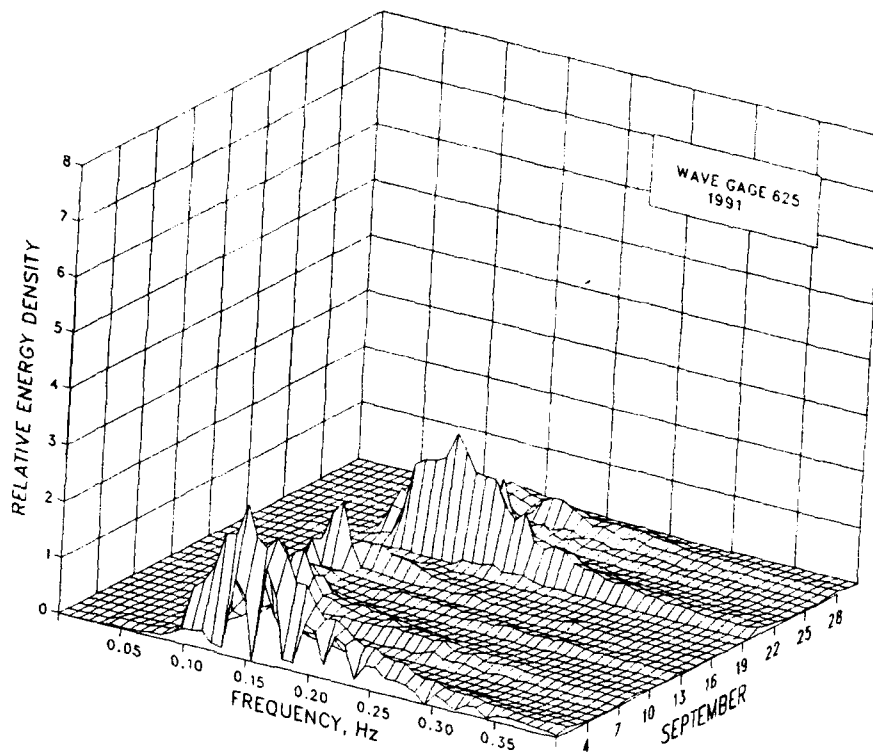


Figure D8. (Sheet 5 of 6)

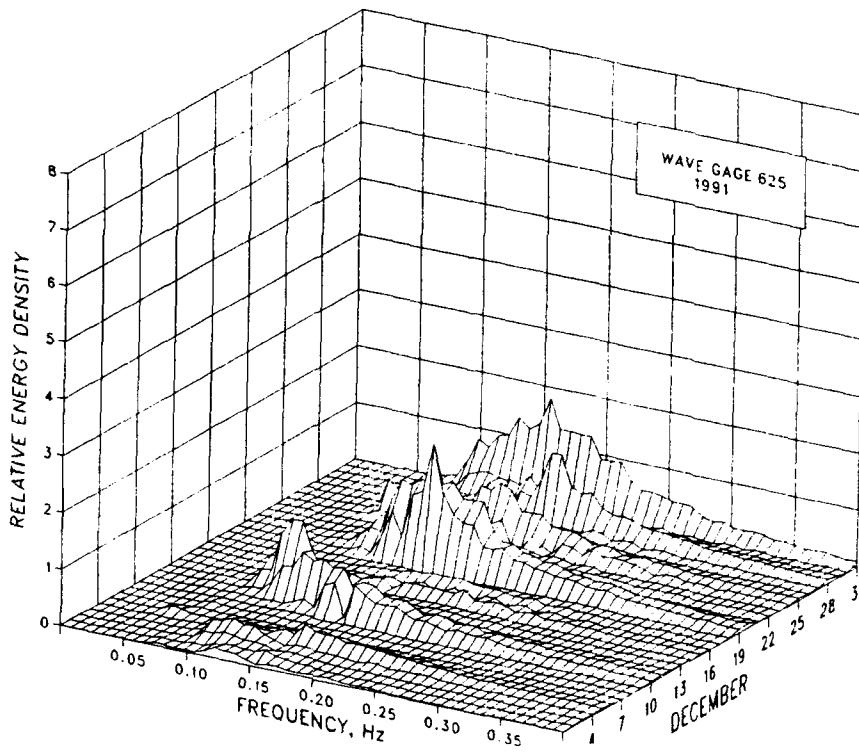
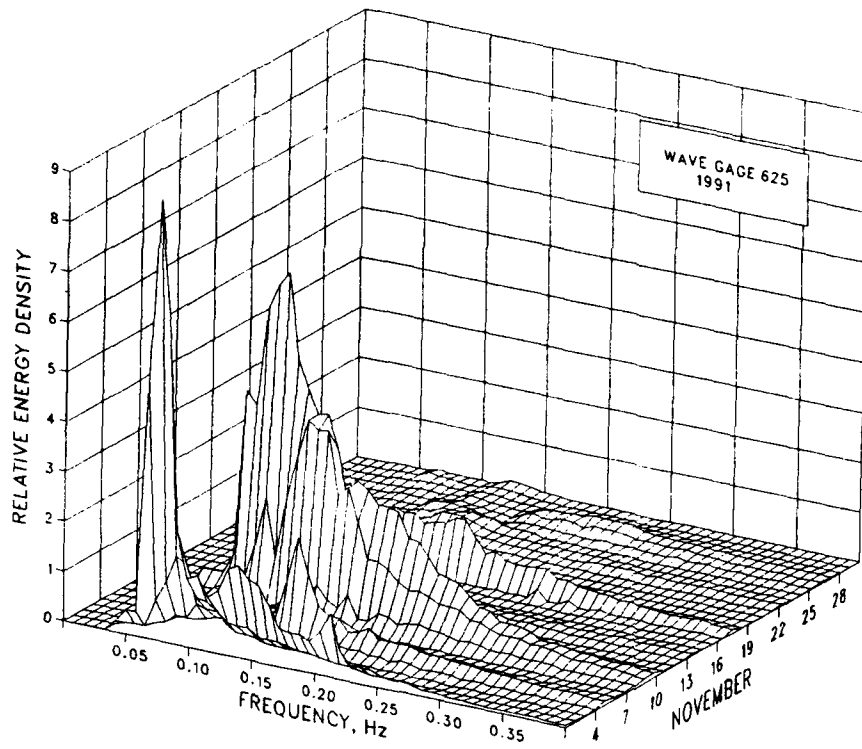


Figure D8. (Sheet 6 of 6)

Table D7
Wave Statistics for Gage 625

Month	1991							1980-1991						
	Height			Date	Period			Height			Date	Period		
	Mean	Std. Dev.	Extreme		Mean	Std. Dev.	Number	Mean	Std. Dev.	Extreme		Mean	Std. Dev.	Number
m	m	m	sec	sec	Obs.	m	m	m	sec	sec	Obs.			
Jan	1.0	0.7	2.8	8	8.6	2.6	124	1.0	0.6	3.5	1988	8.5	2.7	1196
Feb	0.8	0.5	2.3	23	8.5	2.2	112	1.1	0.6	3.8	1989	8.9	2.6	1198
Mar	1.0	0.4	1.9	16	9.8	2.4	118	1.1	0.6	3.4	1983	9.0	2.6	1363
Apr	0.8	0.5	2.6	20	8.7	2.1	120	0.9	0.6	3.4	1988	9.3	2.6	1288
May	0.7	0.5	2.3	19	8.7	3.2	124	0.8	0.5	3.0	1986	8.7	2.6	1389
Jun	0.8	0.5	2.2	23	9.2	1.8	119	0.7	0.4	2.3	1983	8.4	2.3	1194
Jul	0.6	0.2	1.2	30	8.9	2.5	117	0.6	0.3	1.8	1985	8.7	2.8	1135
Aug	0.7	0.4	3.0	19	9.8	2.6	123	0.7	0.4	3.1	1981	8.8	2.7	1205
Sep	1.0	0.5	2.4	1	8.3	1.6	119	1.0	0.5	3.0	1983	9.1	2.7	1135
Oct	1.3	0.8	3.5	31	10.1	3.3	122	1.1	0.7	3.5	1991	9.2	2.9	1408
Nov	1.0	0.7	3.3	9	8.9	3.3	119	1.0	0.6	3.5	1981	8.8	3.0	1313
Dec	0.8	0.5	2.0	31	8.9	3.3	124	1.0	0.6	3.1	1986	9.0	3.1	1191
Annual	0.9	0.5	3.5	Oct	9.0	2.7	1441	0.9	0.5	3.8	Feb 1989	8.9	2.8	15016

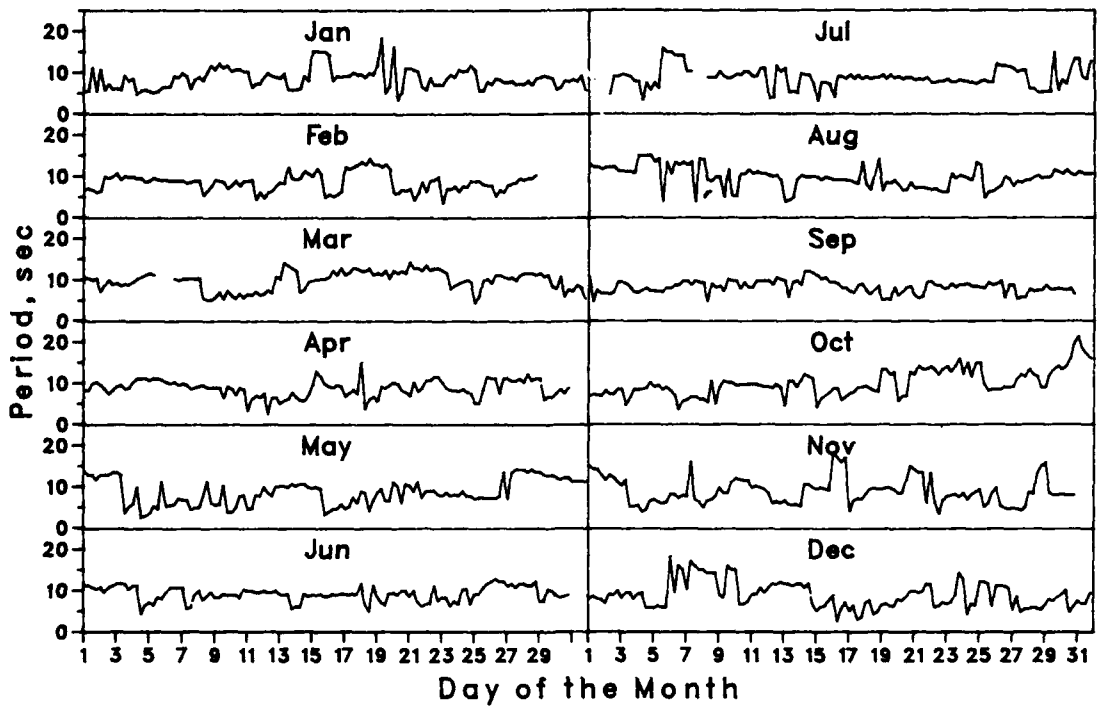
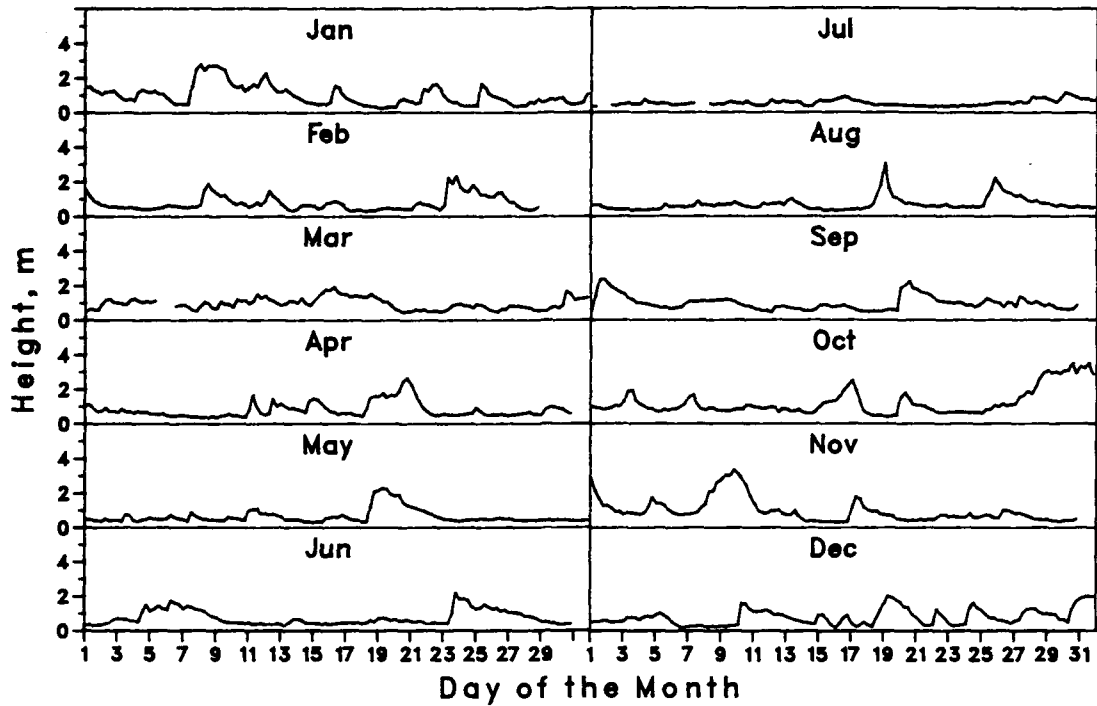


Figure D9. Time histories of wave height and period for Gage 625

APPENDIX E: WAVE DATA FOR GAGE 645

1. Wave data summaries for Gage 645 are presented for 1991 and for 1980 through 1991 in the following forms:

Daily H_{m0} and T_p

2. Figure E1 displays the individual wave height (H_{m0}) and peak spectral wave period (T_p) values along with the monthly mean values.

Joint Distributions of H_{m0} and T_p

3. Annual and monthly joint distribution tables are presented in Tables E1 and E2, and data for 1980 through 1991 are presented in Tables E3 and E4. Each table gives the frequency (in parts per 10,000) for which the wave height and peak period were within the specified intervals; these values can be converted to percentages by dividing by 100. Marginal totals are also included. The row total gives the number of observations out of 10,000 that fell within each specified peak period interval. The column total gives the number of observations out of 10,000 that fell within each specified wave height interval.

Cumulative Distributions of Wave Height

4. Annual and monthly wave height distributions for 1991 are plotted in cumulative form in Figures E2 and E3. Data for 1980 through 1991 are presented in Figure E4.

Peak Spectral Wave Period Distributions

5. Annual and monthly peak wave period T_p distribution histograms for 1991 are presented in Figures E5 and E6. Data for 1980 through 1991 are presented in Figure E7.

Persistence of Wave Heights

6. Table E5 shows the number of times in 1991 when the specified wave height was equaled or exceeded at least once during each day for the duration (consecutive days). Data for 1980 through 1991 are averaged and given in Table E6. An example is shown below:

Height m	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	18	15		14	13	12		11	10	9				8		7			
1.0	50	34	24	21	18	14	12	8	7	3			2						
1.5	41	19	8	6	2	1													
2.0	22	9	5	1															
2.5	10	5	2																
3.0	6	1																	
3.5		1																	
4.0	1																		

This example indicates that wave heights equaled or exceeded 1.0 m 50 times for at least 1 day; 34 times for at least 2 days; 24 times for at least 3 days, etc. Therefore, on 16 occasions the height equaled or exceeded 1.0 m for 1 day exactly ($50 - 34 = 16$); on 10 occasions for 2 days; on 3 occasions for 3 days, etc. Note that the height exceeded 1 m 50 times for 1 day or longer, while heights exceeded 0.5 m only 18 times for this same duration. This change in durations occurred because the longer durations of lower waves may be interspersed with shorter, but more frequent, intervals of higher waves. For example, one of the times that the wave heights exceeded 0.5 m for 16 days may have represented three times the height exceeded 1 m for shorter durations.

Spectra

7. Monthly spectra for the offshore Waverider buoy (Gage 645) are presented in Figure E8. The plots show "relative" energy density as a function of wave frequency. These figures summarize the large number of spectra for each month. The figures emphasize the higher energy density associated with storms as well as the general shifts in energy density to different frequencies. As used here, "relative" indicates the spectra have been smoothed by the three-dimensional surface drawing routine. Consequently, extremely high- and low-energy density values are modified to produce a smooth surface. The figures are not intended for quantitative measurements; however,

they do provide the energy density as a function of frequency relative to the other spectra for the month.

8. Monthly and annual wave statistics for Gage 645 for 1991 and for 1980 through 1991 are presented in Table E7.

9. Figure E9 plots monthly time histories of wave height and period.

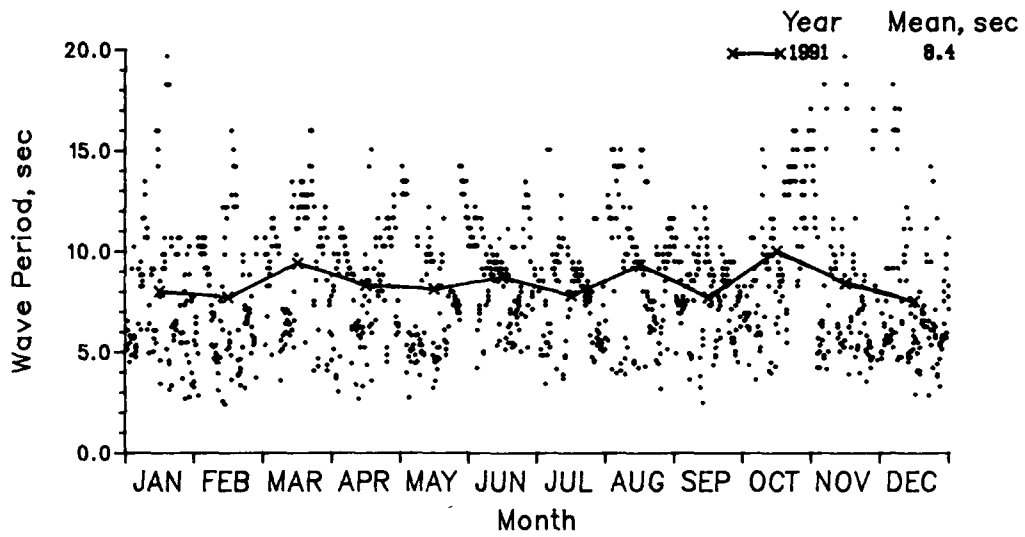
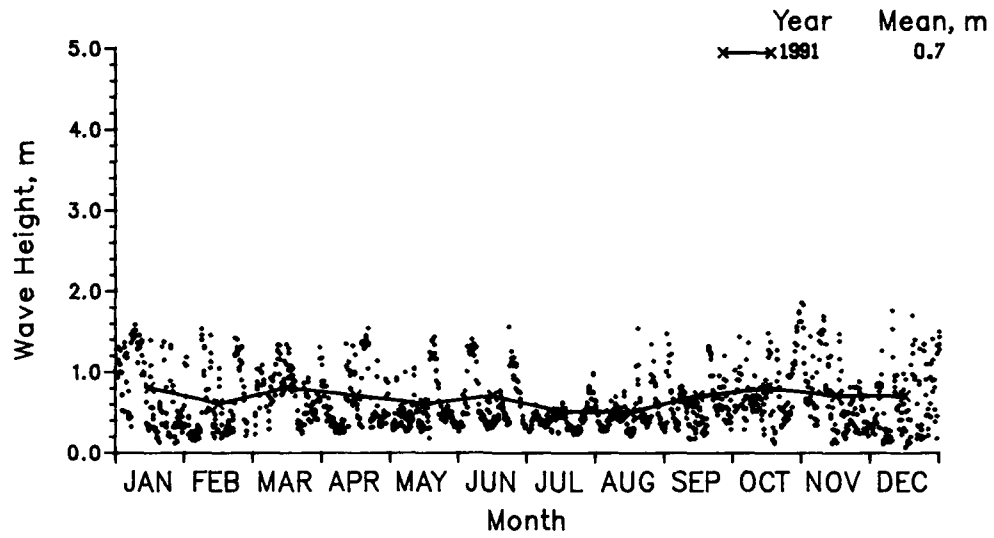


Figure E1. 1991 daily wave height and period values with monthly means for Gage 645

Table E1

Annual Joint Distribution of H_{m0} versus T_p

Height(m)	Annual 1991, Gage 645 Percent Occurrence(X100) of Height and Period												Total
	Period(sec)												
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- longer	
0.00 - 0.49	56	97	341	396	229	403	723	821	855	250	494	118	4783
0.50 - 0.99	21	209	389	751	431	250	292	445	389	83	160	7	3427
1.00 - 1.49	.	7	118	313	410	243	153	90	167	42	56	.	1599
1.50 - 1.99	.	.	.	7	21	14	21	14	21	21	56	14	189
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	77	313	848	1467	1091	910	1189	1370	1432	396	766	139	

Table E2
Monthly Joint Distribution of H_{mo} versus T_p

January 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	81	161	161	242	161	403	323	968	645	81	403	323	3952
0.50 - 0.99	81	484	242	645	484	81	81	403	81	.	.	.	2582
1.00 - 1.49	.	.	403	1129	484	242	403	81	403	.	.	.	3145
1.50 - 1.99	.	.	.	.	.	.	81	.	81	81	81	.	324
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	162	645	806	2016	1129	726	888	1452	1210	162	484	323	

February 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	268	357	357	179	179	89	714	982	1161	179	1071	.	5536
0.50 - 0.99	.	357	625	804	89	89	.	.	.	.	.	.	1964
1.00 - 1.49	.	.	179	357	1161	536	179	.	.	.	.	.	2412
1.50 - 1.99	.	.	.	89	.	.	.	.	.	.	.	.	89
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	268	714	1161	1429	1429	714	893	982	1161	179	1071	0	

March 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	.	85	85	.	.	169	339	763	339	678	.	2458
0.50 - 0.99	.	85	424	847	424	339	254	593	1356	339	678	.	5339
1.00 - 1.49	.	.	85	424	508	254	169	85	169	85	424	.	2203
1.50 - 1.99	0
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	85	594	1356	932	593	592	1017	2288	763	1780	0	

(Continued)

(Sheet 1 of 4)

Table E2 (Continued)

April 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	.	167	167	417	333	750	1083	2083	83	250	.	5333
0.50 - 0.99	83	500	167	500	583	167	417	333	.	.	83	.	2833
1.00 - 1.49	.	.	83	167	500	250	250	250	250	.	.	.	1750
1.50 - 1.99	83	.	.	.	.	.	83
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	83	500	417	834	1500	750	1500	1666	2333	83	333	0	

May 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	81	81	645	1048	242	565	484	484	726	887	887	.	6130
0.50 - 0.99	81	242	565	565	161	484	161	242	81	81	.	.	2663
1.00 - 1.49	.	.	242	323	161	.	81	242	161	.	.	.	1210
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	162	323	1452	1936	564	1049	726	968	968	968	887	0	

June 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	.	.	252	336	672	1176	1345	1008	.	.	.	4789
0.50 - 0.99	.	.	.	588	252	336	168	336	924	168	252	.	3024
1.00 - 1.49	.	.	168	168	504	252	252	168	420	.	168	.	2100
1.50 - 1.99	84	.	.	.	.	.	.	84
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	0	168	1008	1092	1344	1596	1849	2352	168	420	0	

(Continued)

(Sheet 2 of 4)

Table E2 (Continued)

July 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	.	.	769	769	342	684	2564	1197	598	.	342	.	7265
0.50 - 0.99	.	256	85	1111	256	256	256	256	256	.	.	.	2732
1.00 - 1.49	0
1.50 - 1.99	0
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	256	854	1880	598	940	2820	1453	854	0	342	0	

August 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	.	81	488	163	407	407	244	1626	2114	650	1057	.	7237
0.50 - 0.99	.	163	488	407	163	244	244	407	244	.	.	.	2360
1.00 - 1.49	163	81	.	.	.	81	.	.	325
1.50 - 1.99	81	.	.	81
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	244	976	570	733	732	488	2033	2358	812	1057	0	

September 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0-	3.0-	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	12.0-	14.0-		16.0-
	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	11.9	13.9	15.9		Longer
0.00 - 0.49	84	.	252	168	84	1092	840	672	420	.	168	.	3780
0.50 - 0.99	.	252	672	672	504	504	1008	924	336	.	84	.	4956
1.00 - 1.49	.	.	84	168	168	588	84	84	84	.	.	.	1260
1.50 - 1.99	0
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	84	252	1008	1008	756	2184	1932	1680	840	0	252	0	

(Continued)

(Sheet 3 of 4)

Table E2 (Concluded)

October 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	84	.	.	.	84	420	168	336	588	420	.	2100
0.50 - 0.99	.	84	336	420	1008	84	588	1176	756	420	588	.	5460
1.00 - 1.49	.	.	.	252	420	252	252	.	336	168	84	.	1764
1.50 - 1.99	84	420	168	672
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	168	336	672	1428	420	1260	1344	1428	1260	1512	168	

November 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	.	84	336	756	168	336	840	336	252	.	336	672	4116
0.50 - 0.99	.	84	756	1176	504	252	168	336	336	.	84	84	3780
1.00 - 1.49	.	84	.	336	420	168	84	168	84	168	.	.	1512
1.50 - 1.99	84	168	168	.	168	.	588
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	0	252	1092	2268	1092	756	1176	1008	840	168	588	756	

December 1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	161	323	806	887	403	161	242	645	161	161	323	403	4676
0.50 - 0.99	.	.	323	1290	726	161	161	323	323	.	161	.	3468
1.00 - 1.49	.	.	161	403	484	323	81	.	81	.	.	.	1533
1.50 - 1.99	242	81	.	.	.	.	.	.	323
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	161	323	1290	2580	1855	726	484	968	565	161	484	403	

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Table E3
Annual Joint Distribution of H_{mo} versus T_p (All Years)

Height(m)	Annual 1980-1991, Gage 645 Percent Occurrence(X100) of Height and Period												Total
	Period(sec)												
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	74	130	256	425	286	295	564	627	704	323	416	80	4180
0.50 - 0.99	22	182	464	925	619	297	315	309	494	130	243	24	4024
1.00 - 1.49	.	1	56	333	353	166	112	87	174	82	132	6	1502
1.50 - 1.99	.	.	.	10	45	30	21	31	55	28	51	5	276
2.00 - 2.49	.	.	.	.	1	3	1	1	4	4	4	.	18
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	96	313	776	1693	1304	791	1013	1055	1431	567	846	115	

Table E4
 Monthly Joint Distribution of H_{mo} versus T_p (All Years)

January 1980-1991, Gage 645
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	86	109	281	375	219	180	289	679	710	242	273	86	3529
0.50 - 0.99	31	203	414	1015	710	219	234	312	554	86	219	16	4013
1.00 - 1.49	.	.	101	625	585	273	203	70	234	31	141	.	2263
1.50 - 1.99	.	.	.	8	8	16	16	16	78	16	31	.	189
2.00 - 2.49	.	.	.	.	.	.	.	.	.	8	.	.	8
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	117	312	796	2023	1522	688	742	1077	1576	383	664	102	

February 1980-1991, Gage 645
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	122	106	245	375	139	163	294	334	710	139	400	8	3035
0.50 - 0.99	49	179	449	995	555	220	228	318	685	131	261	.	4070
1.00 - 1.49	.	.	57	579	636	261	122	122	294	179	188	.	2438
1.50 - 1.99	.	.	.	16	82	65	41	33	24	49	131	.	441
2.00 - 2.49	.	.	.	.	8	.	.	.	.	8	.	.	16
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	171	285	751	1965	1420	709	685	807	1713	506	980	8	

March 1980-1991, Gage 645
 Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	125	96	214	339	184	103	339	353	493	184	398	.	2828
0.50 - 0.99	44	206	464	1001	552	287	302	346	685	199	390	7	4483
1.00 - 1.49	.	7	110	398	405	177	140	96	250	162	265	.	2010
1.50 - 1.99	.	.	.	15	59	44	44	88	162	96	118	.	626
2.00 - 2.49	.	.	.	.	7	7	7	.	.	15	15	.	51
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	169	309	788	1753	1207	618	832	883	1590	656	1186	7	

(Continued)

(Sheet 1 of 4)

Table E4 (Continued)

April 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	55	150	253	340	293	293	475	625	839	380	427	24	4154
0.50 - 0.99	24	269	443	759	498	293	396	324	672	111	356	8	4153
1.00 - 1.49	.	.	40	253	285	111	127	134	214	63	142	.	1369
1.50 - 1.99	.	.	.	8	47	24	55	32	79	24	24	.	293
2.00 - 2.49	.	.	.	.	.	.	.	16	16	.	.	.	32
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	79	419	736	1360	1123	721	1053	1131	1820	578	949	32	

May 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	90	179	284	508	291	411	695	628	867	336	538	52	4879
0.50 - 0.99	15	187	590	912	717	374	359	277	419	90	149	22	4111
1.00 - 1.49	.	.	45	172	127	45	82	97	149	45	97	.	859
1.50 - 1.99	.	.	.	22	60	7	.	7	15	15	15	.	141
2.00 - 2.49	.	.	.	.	.	.	7	.	.	.	.	.	7
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	105	366	919	1614	1195	837	1143	1009	1450	486	799	74	

June 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	109	233	365	807	543	567	1110	1056	606	380	217	124	6117
0.50 - 0.99	23	163	365	784	411	256	349	326	342	54	47	23	3143
1.00 - 1.49	.	.	39	155	163	54	62	39	132	.	54	.	698
1.50 - 1.99	.	.	.	.	23	8	8	.	.	.	.	.	39
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	132	396	769	1746	1140	885	1529	1421	1080	434	318	147	

(Continued)

(Sheet 2 of 4)

Table E4 (Continued)

July 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	53	197	439	659	522	568	1408	1143	810	416	522	159	6896
0.50 - 0.99	.	151	401	704	500	257	295	189	159	76	53	45	2830
1.00 - 1.49	.	.	8	136	38	15	23	.	38	.	8	.	266
1.50 - 1.99	8	.	.	.	.	.	.	.	8
2.00 - 2.49	0
2.50 - 2.99	0
3.00 - 3.49	0
3.50 - 3.99	0
4.00 - 4.49	0
4.50 - 4.99	0
5.00 - Greater	0
Total	53	348	848	1499	1068	840	1726	1332	1007	492	583	204	0

August 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	52	155	237	533	570	473	814	1065	1043	370	518	59	5889
0.50 - 0.99	7	192	518	858	518	318	333	237	259	30	111	.	3381
1.00 - 1.49	.	.	30	163	170	74	59	15	37	37	67	.	652
1.50 - 1.99	.	.	.	.	15	22	7	.	22	15	.	.	81
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	59	347	785	1554	1273	887	1213	1317	1361	452	696	59	0

September 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)												Total
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- Longer	
0.00 - 0.49	62	46	147	279	147	325	433	511	642	325	426	54	3397
0.50 - 0.99	39	193	449	759	557	433	441	433	534	255	488	15	4596
1.00 - 1.49	.	.	46	457	348	217	155	124	147	85	139	15	1733
1.50 - 1.99	.	.	.	15	46	62	15	8	15	23	54	8	246
2.00 - 2.49	.	.	.	.	.	.	.	.	.	8	15	.	23
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	101	239	642	1510	1098	1037	1044	1076	1338	696	1122	92	0

(Continued)

(Sheet 3 of 4)

Table E4 (Concluded)

October 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	30	75	113	174	158	121	302	325	574	279	377	60	2588
0.50 - 0.99	8	91	423	853	664	226	385	453	853	204	302	38	4500
1.00 - 1.49	.	.	45	408	430	279	181	166	347	196	196	23	2271
1.50 - 1.99	.	.	.	15	68	60	30	68	136	60	91	53	581
2.00 - 2.49	.	.	.	.	.	8	.	.	23	15	15	.	61
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	38	166	581	1450	1320	694	898	1012	1933	754	981	174	

November 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	24	56	225	353	168	184	385	289	473	353	393	160	3063
0.50 - 0.99	16	152	569	1131	802	425	257	273	409	233	233	56	4556
1.00 - 1.49	.	8	48	313	561	297	112	80	128	168	168	32	1915
1.50 - 1.99	.	.	.	16	72	40	16	96	96	32	88	.	456
2.00 - 2.49	.	.	.	.	.	.	.	.	8	.	.	.	8
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	40	216	842	1813	1603	946	770	738	1114	786	882	248	

December 1980-1991, Gage 645
Percent Occurrence(X100) of Height and Period

Height(m)	Period(sec)											Total	
	2.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 11.9	12.0- 13.9	14.0- 15.9		16.0- Longer
0.00 - 0.49	78	148	265	350	179	132	179	475	669	467	490	171	3603
0.50 - 0.99	16	202	482	1346	949	257	187	218	366	93	311	54	4481
1.00 - 1.49	.	.	109	358	529	202	78	109	125	23	125	.	1658
1.50 - 1.99	.	.	.	8	54	16	23	31	31	8	70	.	241
2.00 - 2.49	.	.	.	.	.	16	.	.	.	.	.	.	16
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - Greater	.	.	.	.	.	.	.	.	.	.	.	.	0
Total	94	350	856	2062	1711	623	467	833	1191	591	996	225	

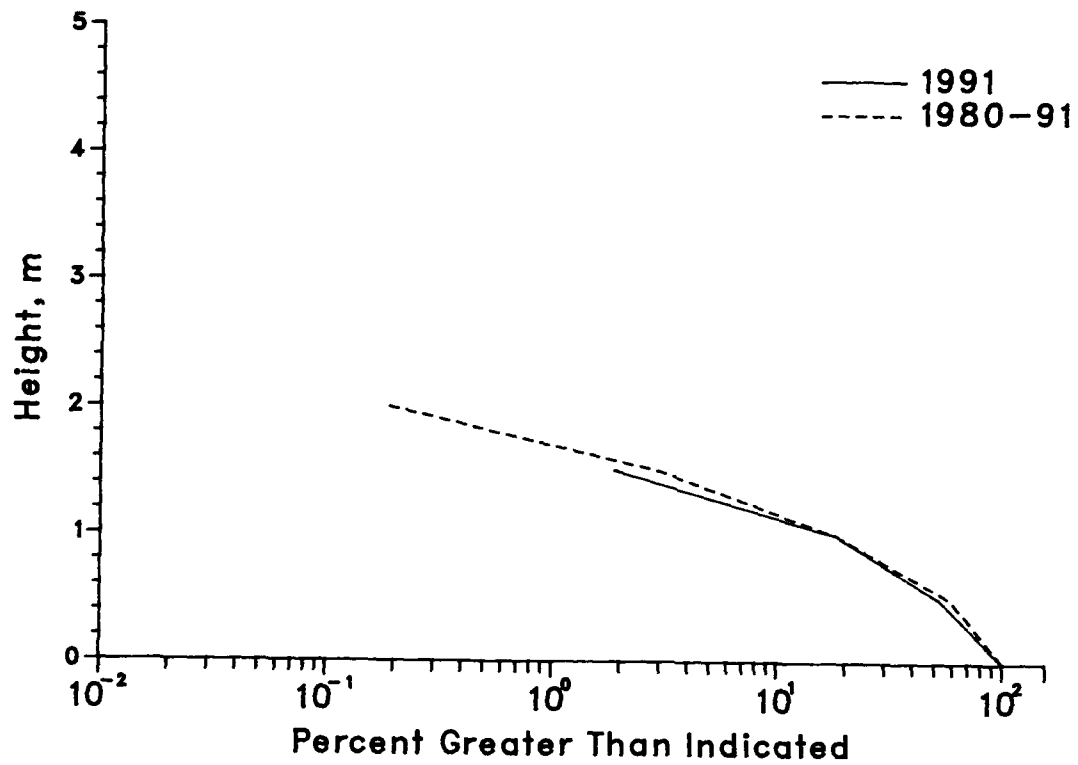


Figure E2. Annual cumulative wave height distributions for Gage 645

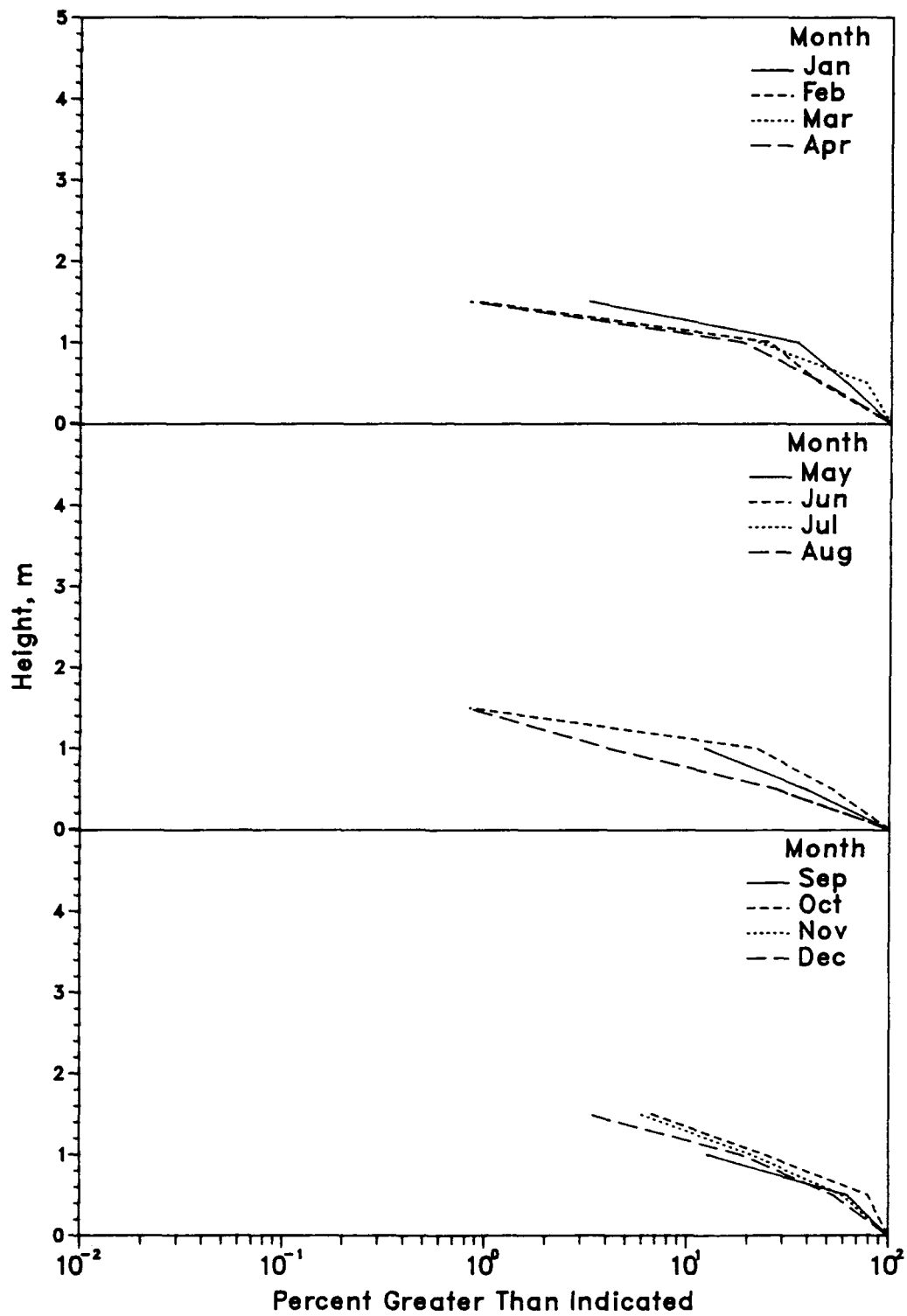


Figure E3. 1991 monthly wave height distributions for Gage 645

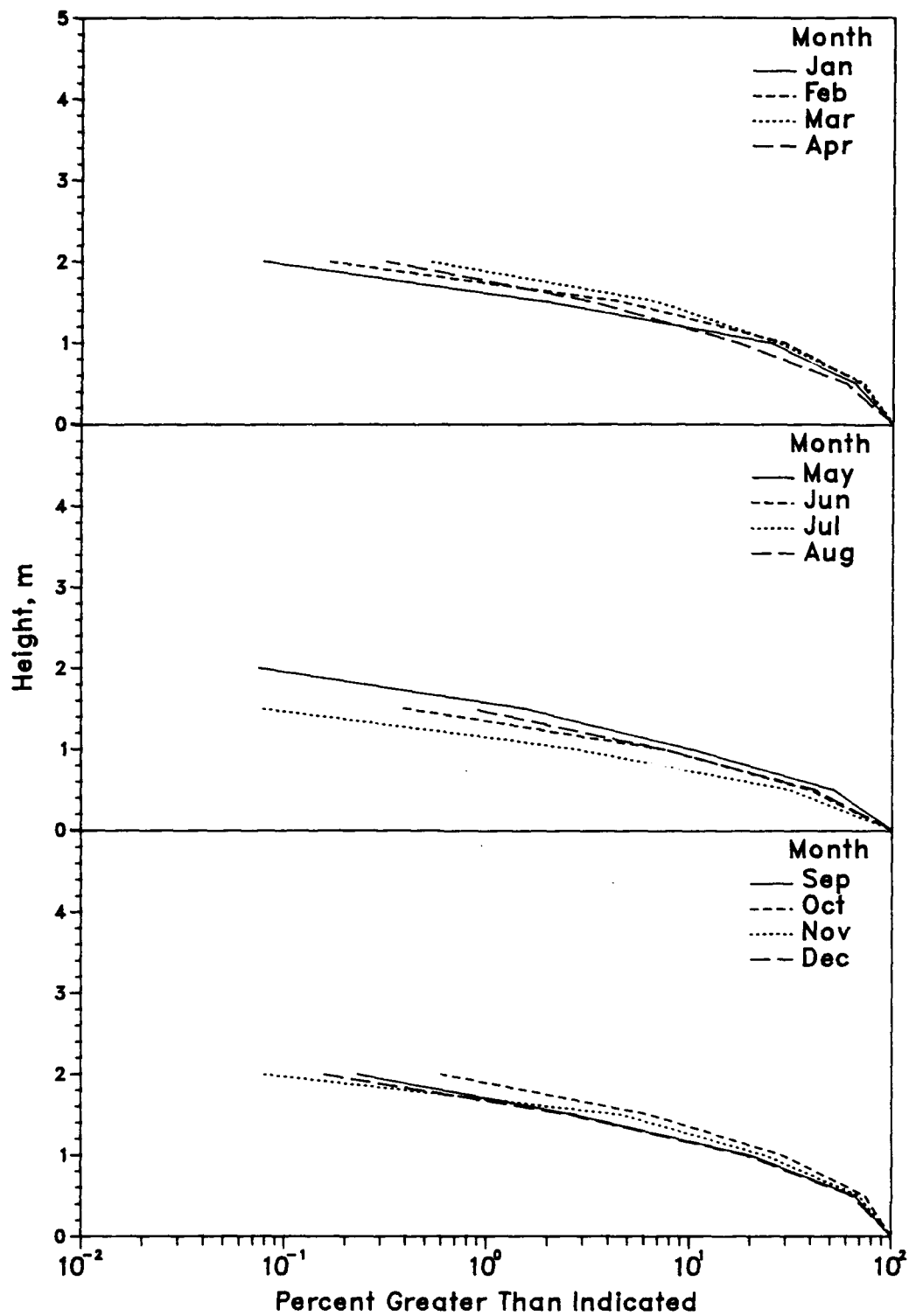


Figure E4. 1980-1991 monthly wave height distributions for Gage 645

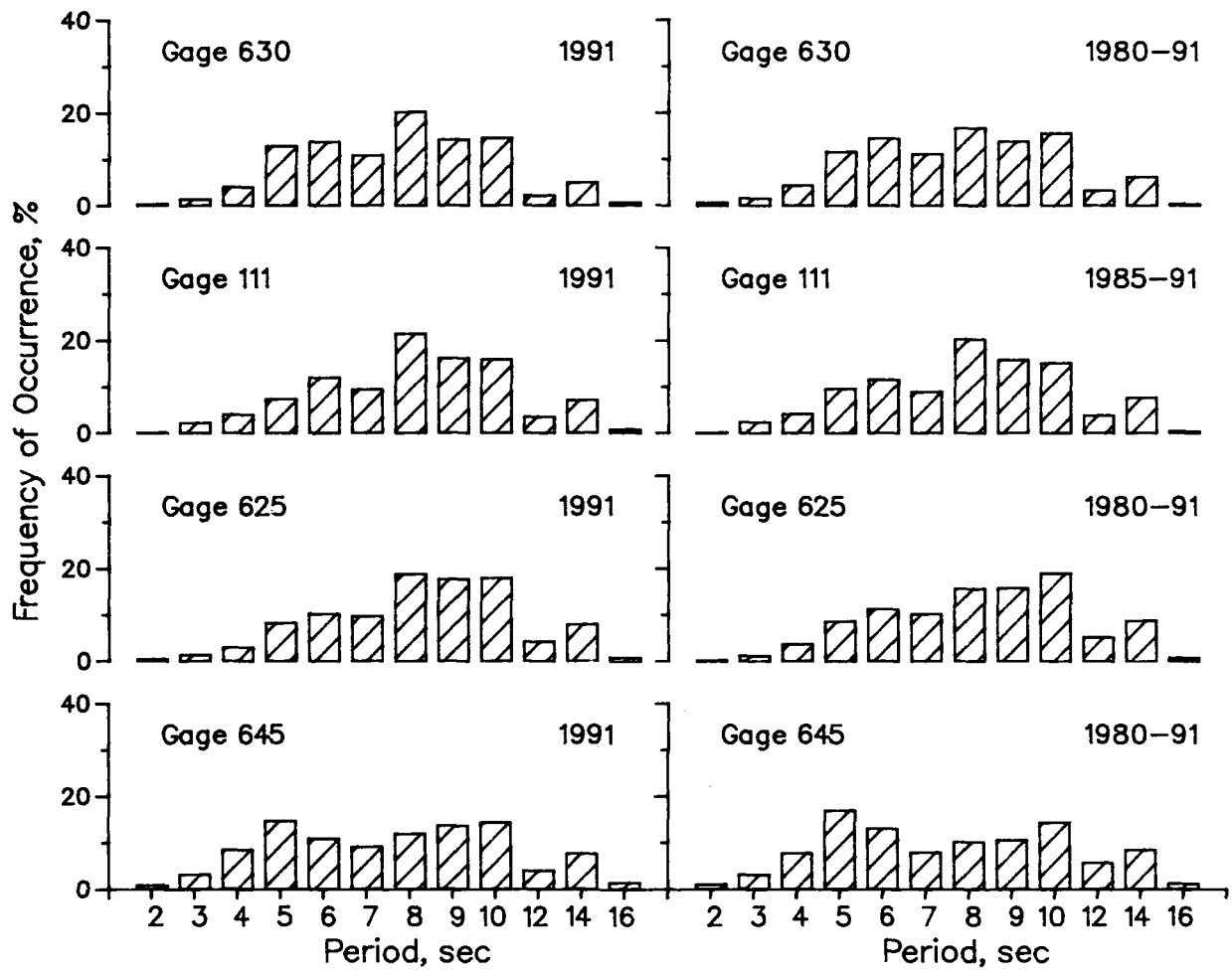


Figure E5. Annual wave period distributions for all gages

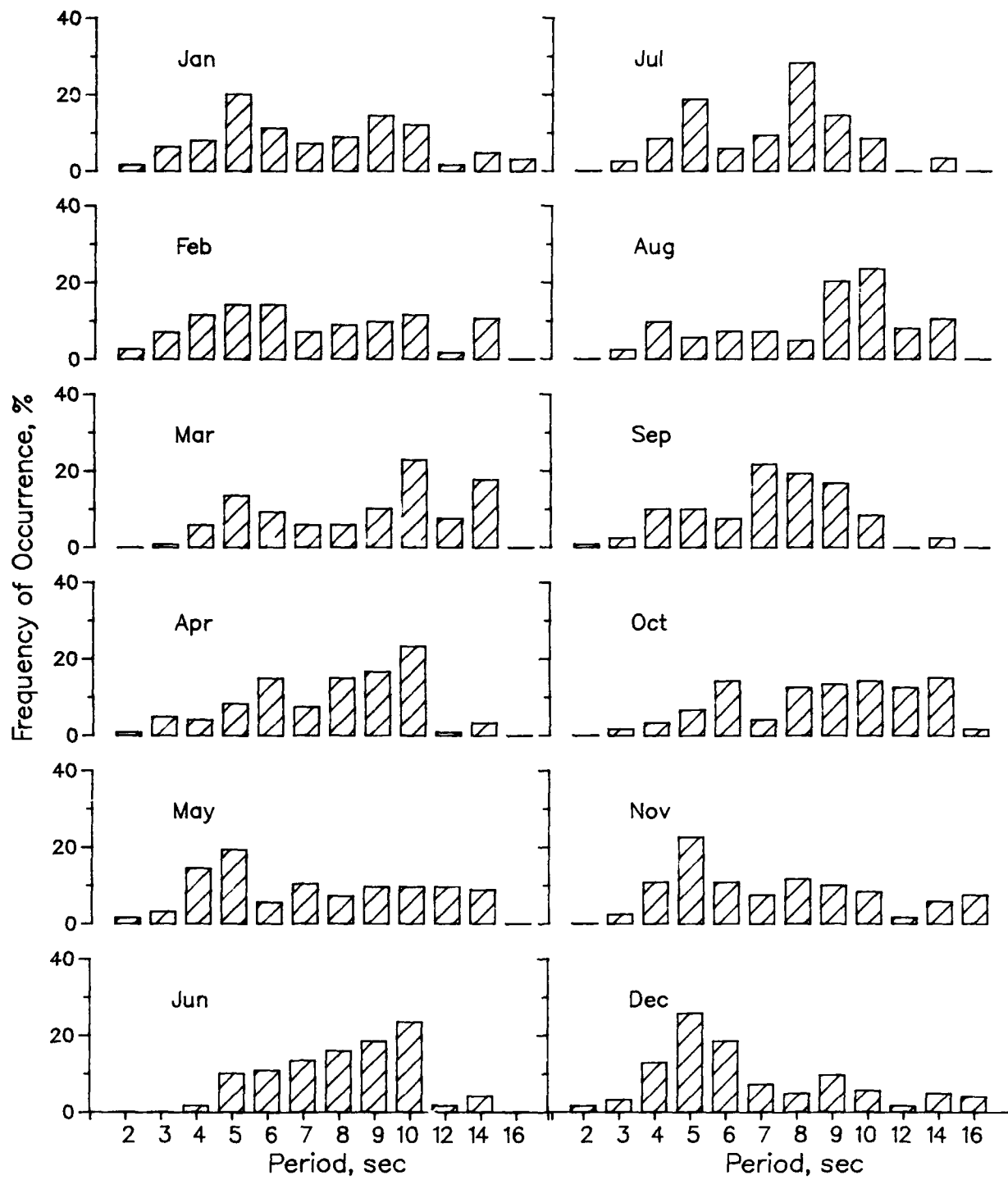


Figure E6. 1991 monthly wave period distributions for Gage 645

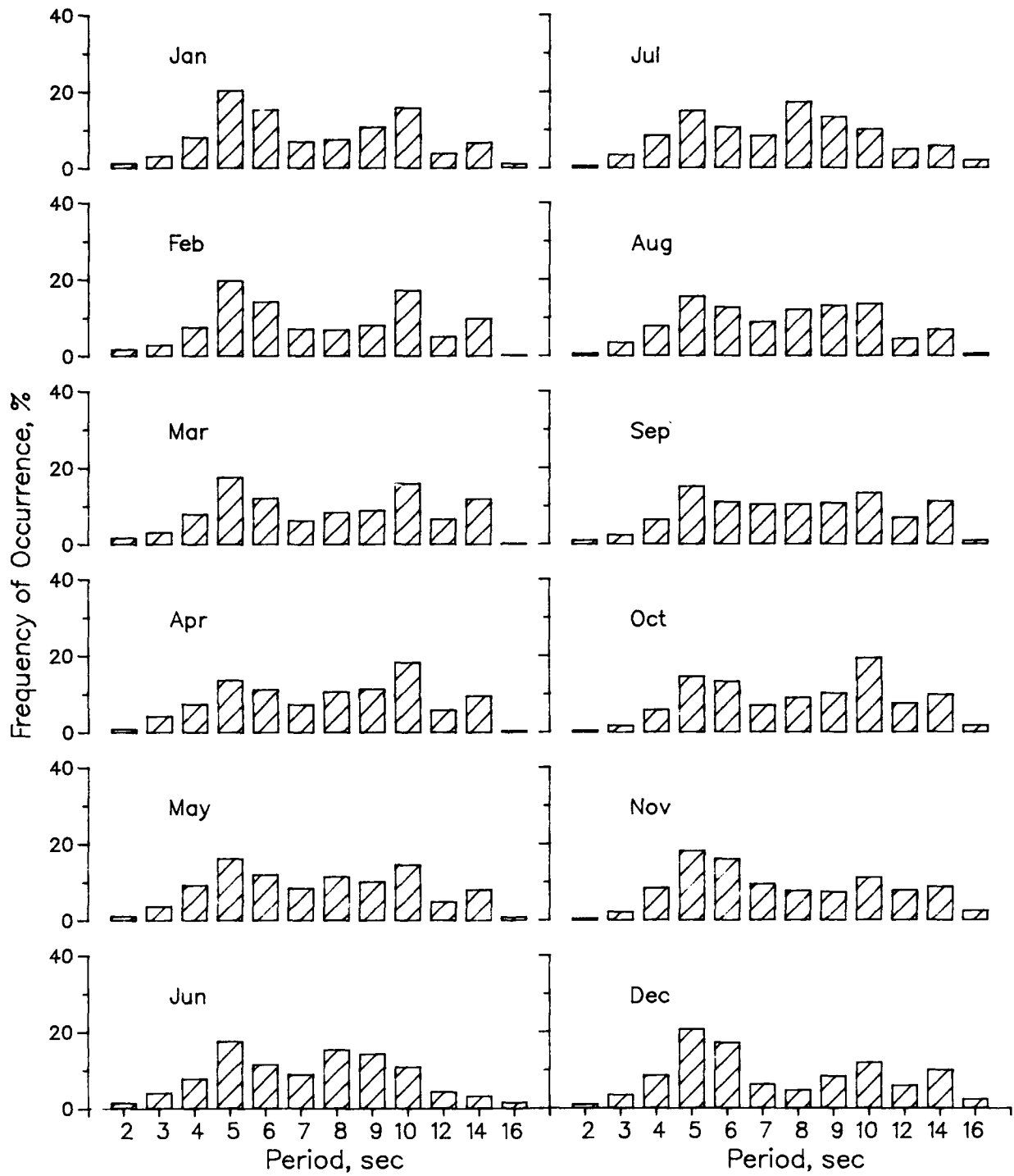


Figure E7. 1980-1991 monthly wave period distributions for Gage 645

Table E5
 1991 Persistence of H_{mo} for Gage 645

Height (m)	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	47	38	29	24	21	14		10	8				6		4				3
1.0	44	31	15	10	6	3	1												
1.5	10	3		1															
2.0		1																	
2.5		1																	
3.0		1																	
3.5		1																	
4.0		1																	

Table E6
 1980 Through 1991 Average Persistence of H_{mo} for Gage 645

Height (m)	Consecutive Day(s) or Longer																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19+
0.5	44	36	29	24	19	15	12	11	9	8	7	6		5			4		3
1.0	43	26	15	9	5	3	2	1											
1.5	14	6	2		1														
2.0	2	1																	
2.5																			
3.0																			
3.5																			
4.0																			

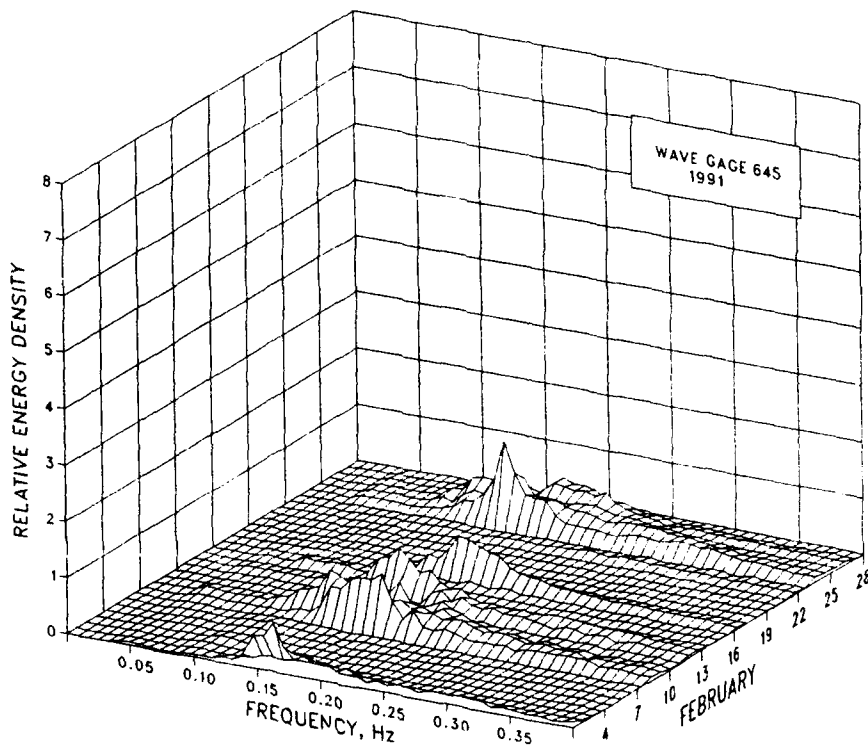
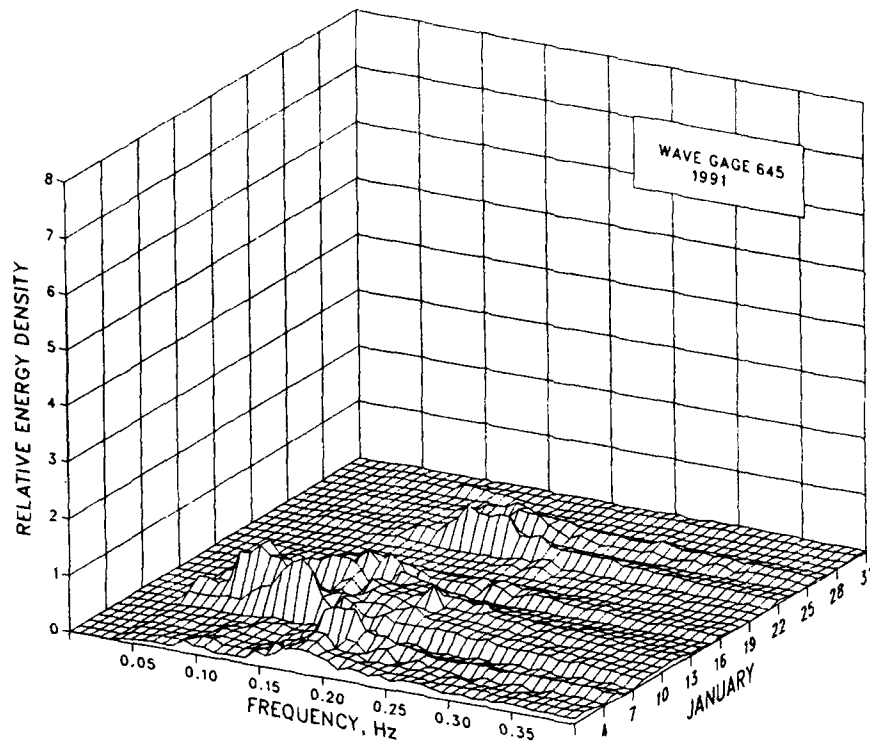


Figure E8. 1991 monthly spectra for Gage 645
(Sheet 1 of 6)

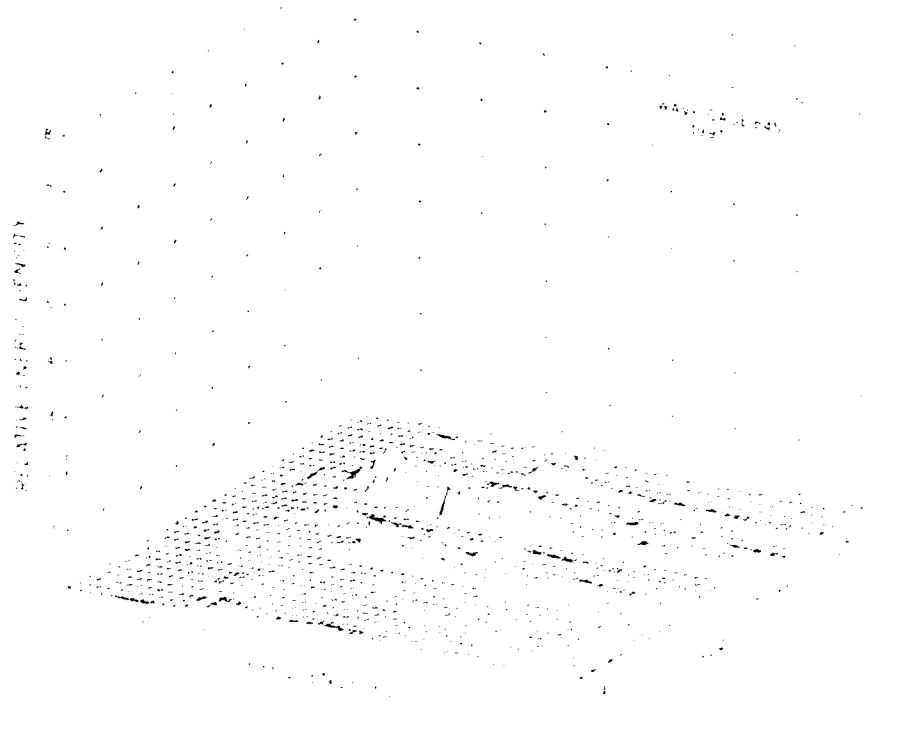
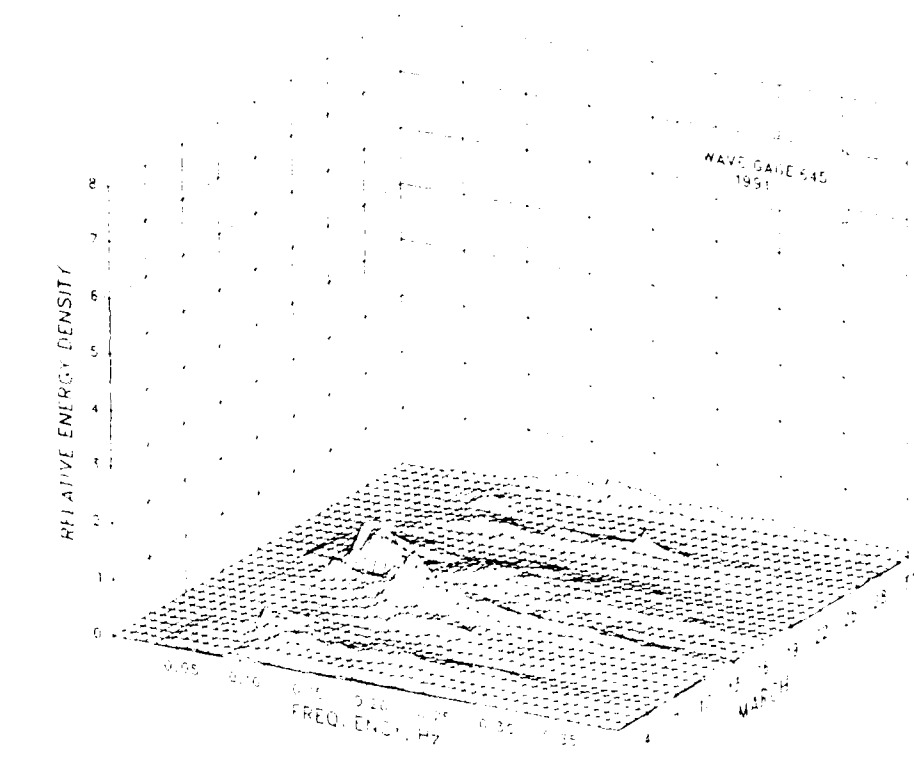


Figure E8. (Sheet 2 of 6)

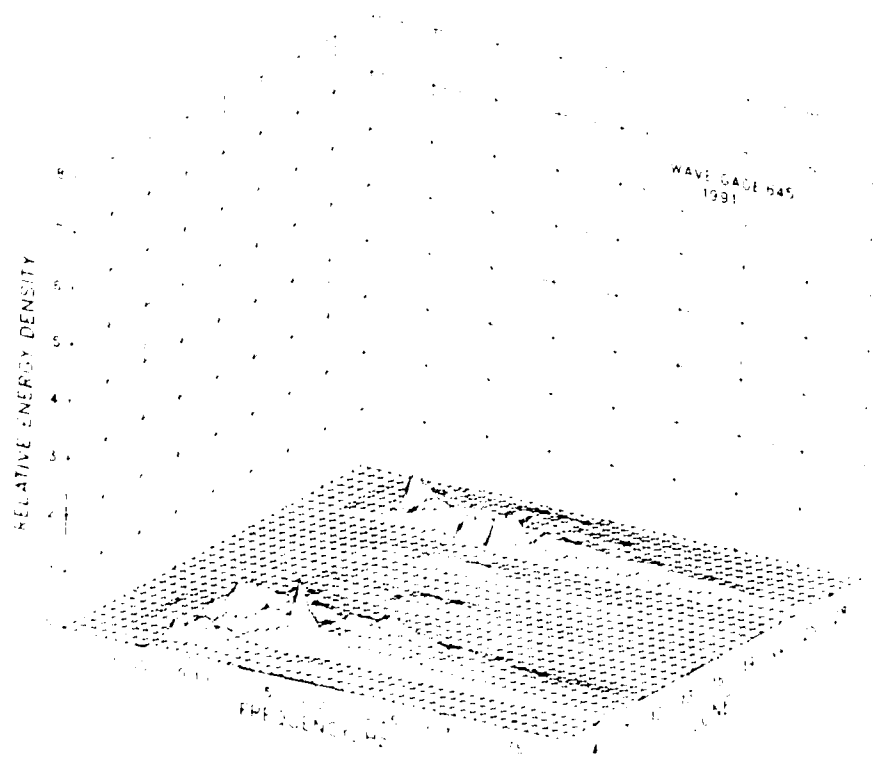
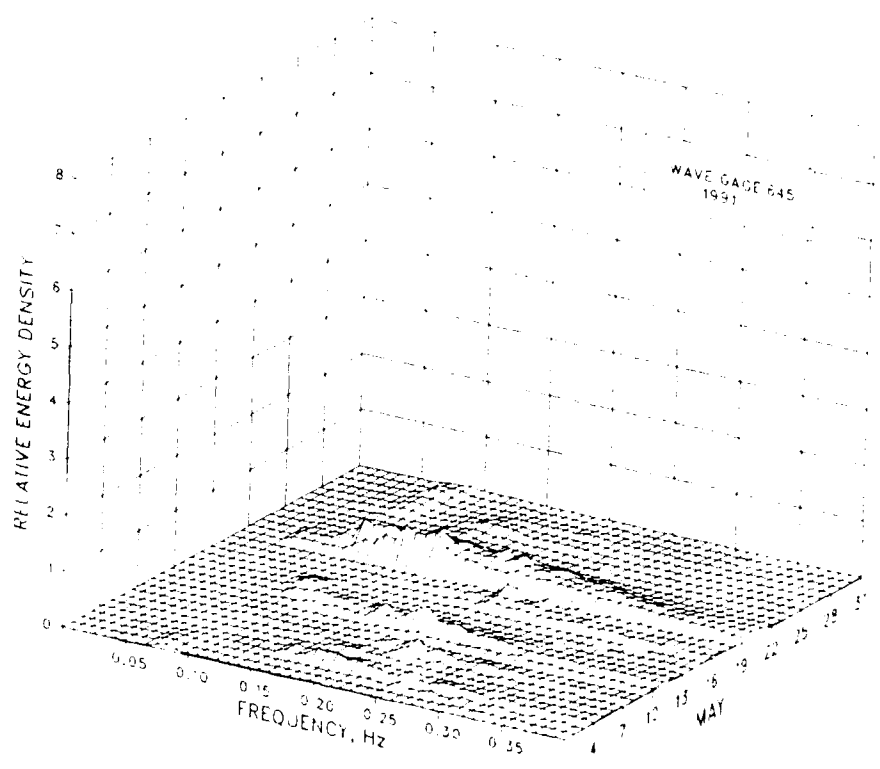


Figure E8. (Sheet 3 of 6)

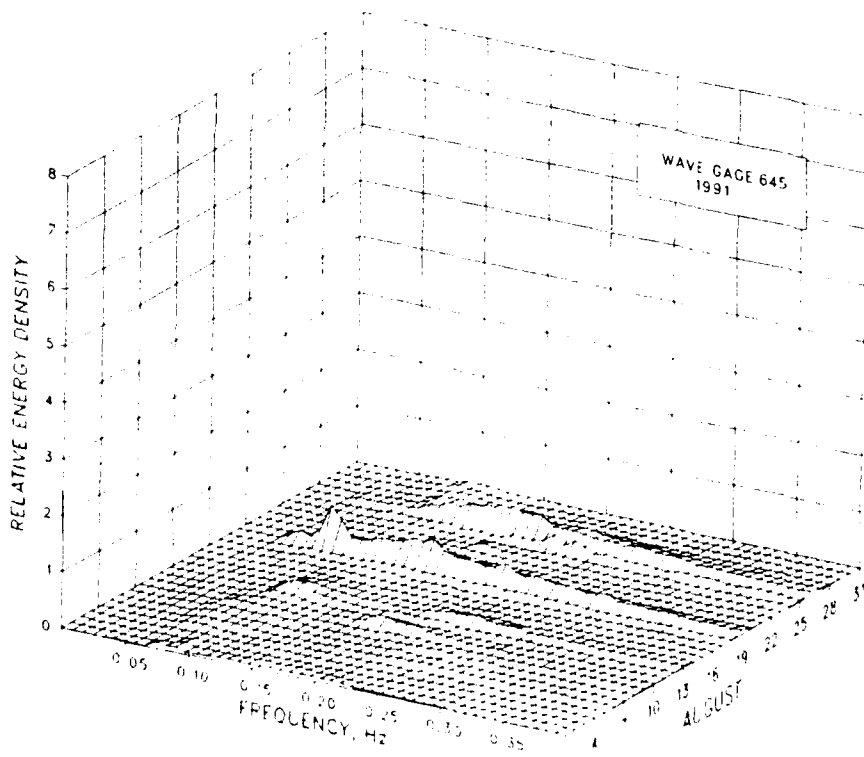
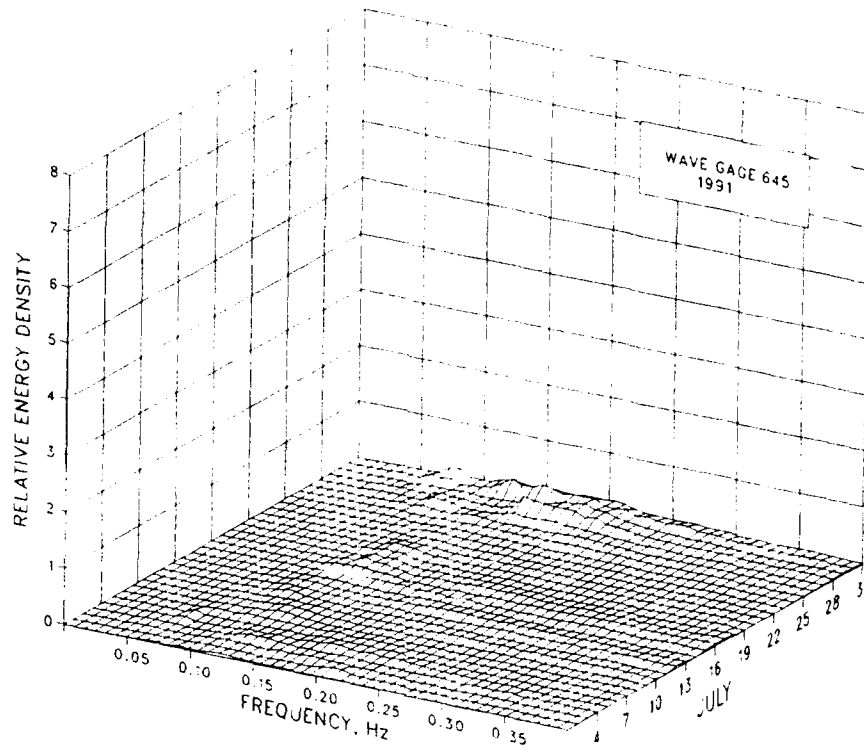


Figure E8. (Sheet 4 of 6)

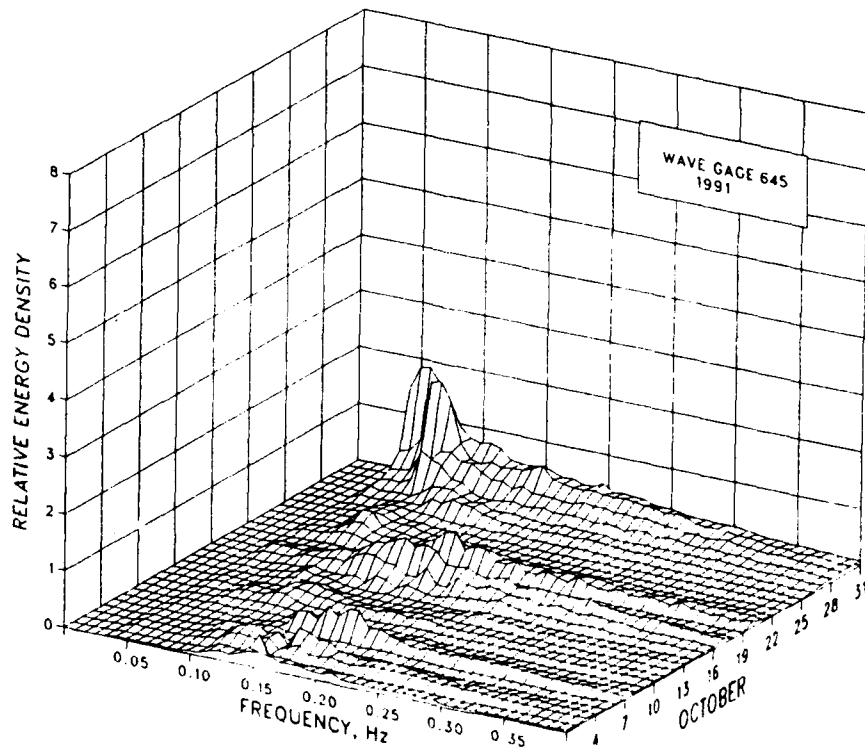
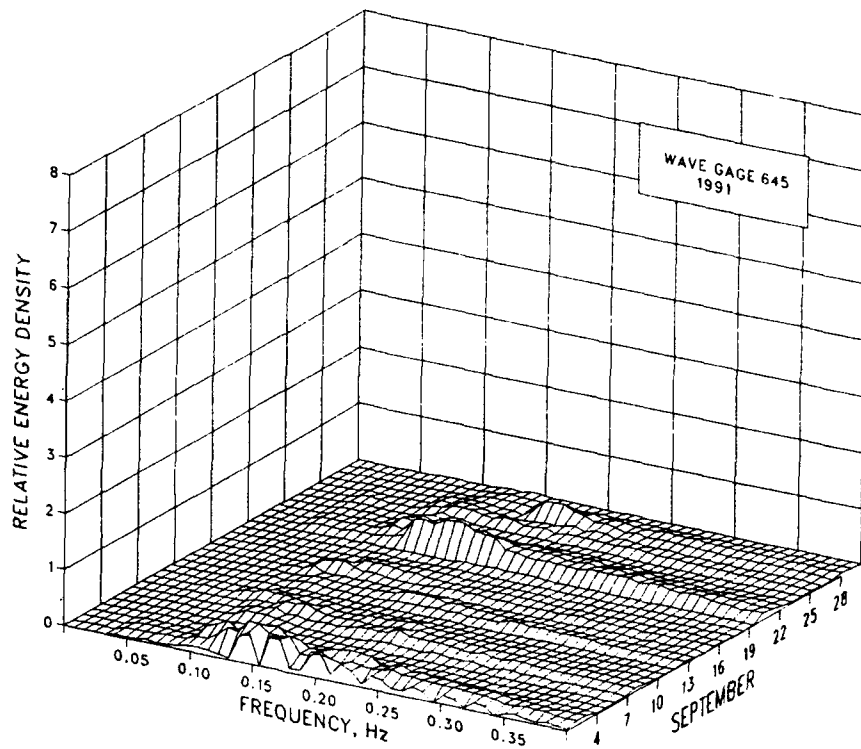


Figure E8. (Sheet 5 of 6)

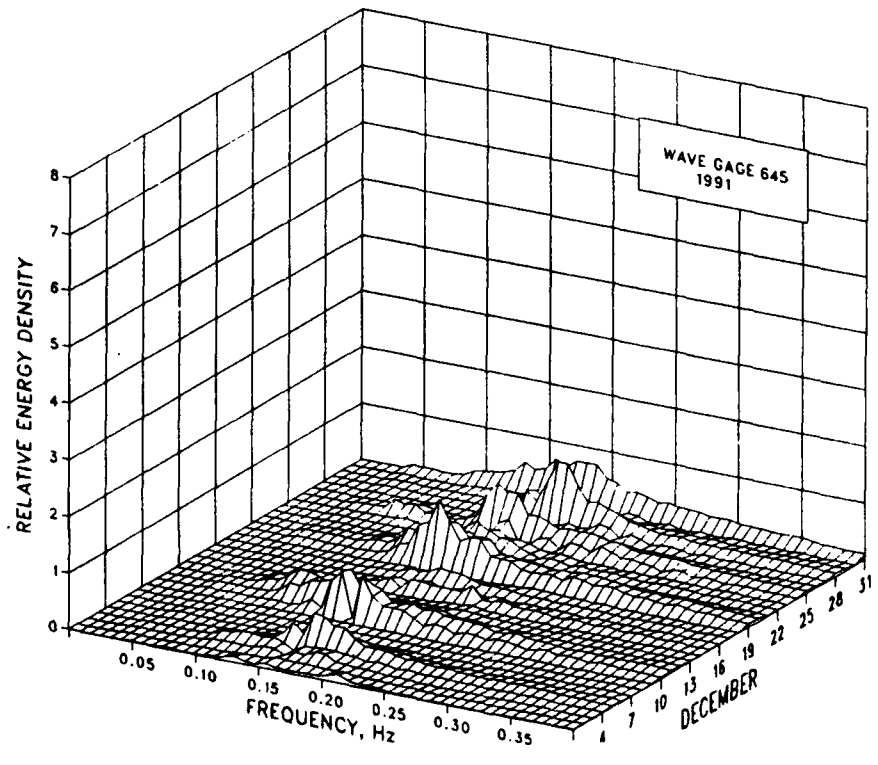
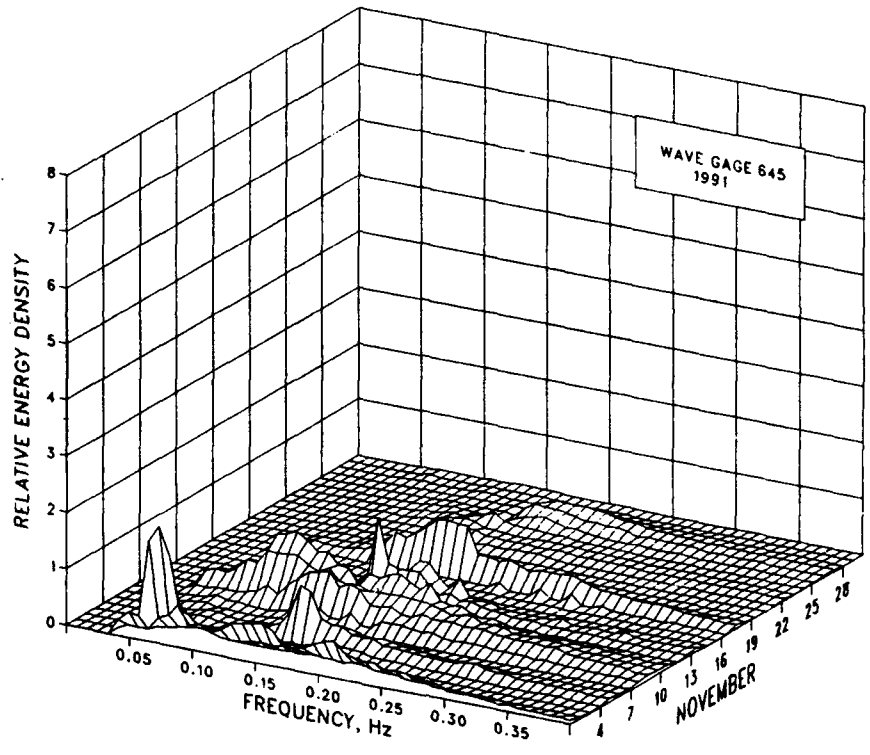


Figure E8. (Sheet 6 of 6)

Table E7
Wave Statistics for Gage 645

Month	1991							1980-1991							
	Height			Date	Period			Number	Height			Date	Period		
	Mean	Std. Dev.	Extreme		Mean	Std. Dev.	Number		Mean	Std. Dev.	Extreme		Mean	Std. Dev.	Number
	m	m	m	sec	sec	Obs.	m	m	m	sec	sec	Obs.			
Jan	0.8	0.5	1.6	9	8.0	3.6	124	0.7	0.4	2.0	1980	8.0	3.2	1281	
Feb	0.6	0.5	1.5	8	7.7	3.1	112	0.8	0.4	2.0	1983	8.1	3.1	1226	
Mar	0.8	0.3	1.3	15	9.4	3.1	118	0.8	0.5	2.3	1980	8.4	3.3	1358	
Apr	0.7	0.4	1.5	21	8.3	2.5	120	0.7	0.4	2.3	1987	8.5	3.2	1264	
May	0.6	0.3	1.4	20	8.1	3.3	124	0.6	0.4	2.0	1987	8.1	3.2	1338	
Jun	0.7	0.4	1.6	23	8.7	2.1	119	0.5	0.3	1.7	1990	7.8	3.0	1288	
Jul	0.5	0.2	1.0	30	7.8	2.3	117	0.5	0.3	1.6	1990	8.2	3.2	1321	
Aug	0.5	0.3	1.5	19	9.3	3.1	123	0.6	0.3	1.7	1982	8.1	3.1	1352	
Sep	0.7	0.3	1.5	1	7.7	2.1	119	0.7	0.4	2.1	1985	8.6	3.2	1292	
Oct	0.8	0.4	1.9	31	10.0	3.4	119	0.8	0.5	2.2	1982	8.8	3.3	1325	
Nov	0.7	0.5	1.8	1	8.4	4.0	119	0.8	0.4	2.0	1981	8.4	3.6	1247	
Dec	0.7	0.5	1.8	10	7.5	3.4	124	0.7	0.4	2.2	1989	8.1	3.6	1285	
Annual	0.7	0.4	1.9	Oct	8.4	3.2	1438	0.7	0.4	2.3	Apr 1987	8.2	3.3	15577	

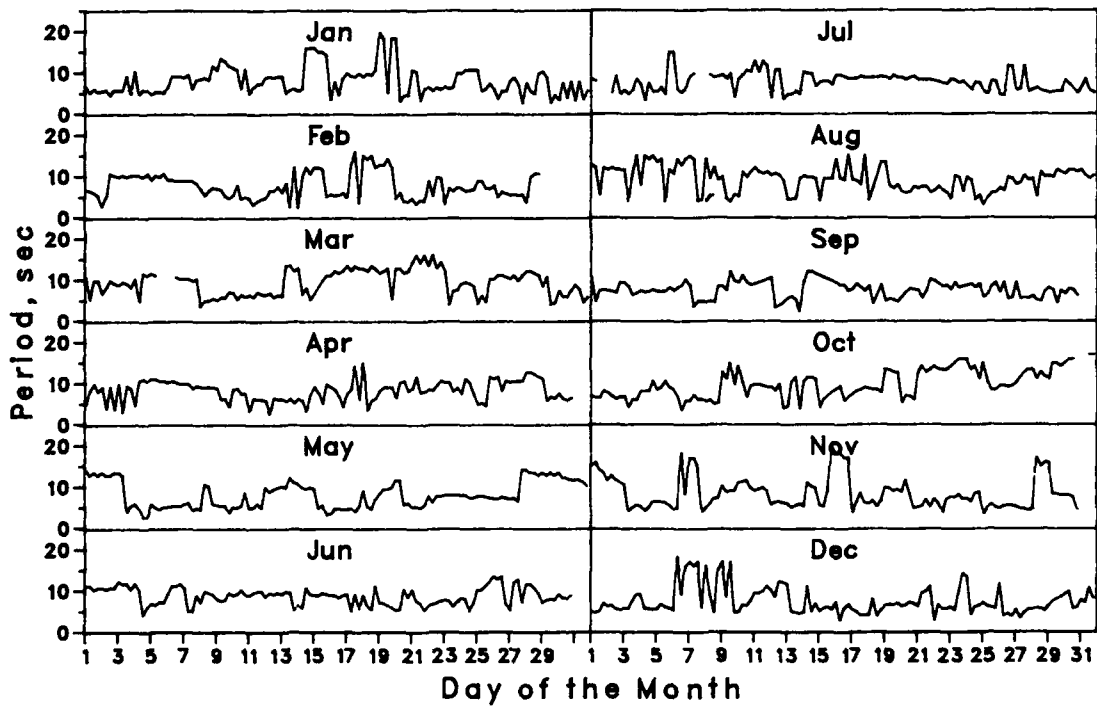
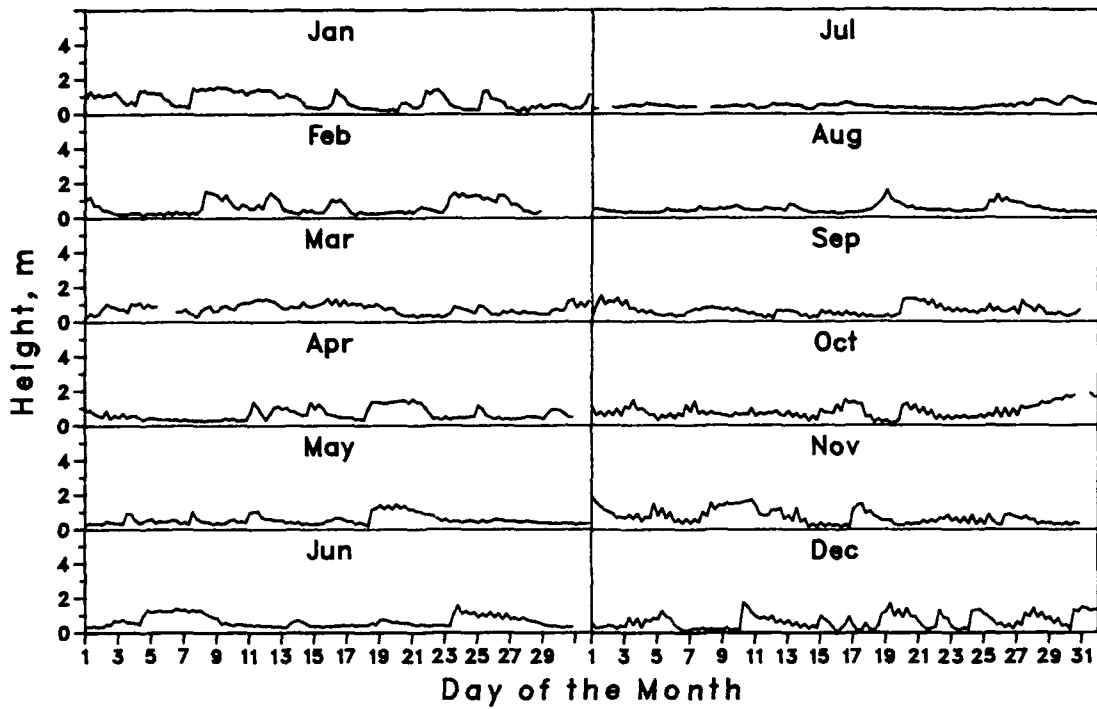


Figure E9. Time histories of wave height and period for Gage 645

REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words) This report provides basic data and summaries for the measurements made during 1991 at the US Army Engineer Waterways Experiment Station (WES) Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) in Duck, NC. The report includes comparisons of the present year's data with cumulative statistics from 1980 to the present. Meteorological and oceanographic data, monthly bathymetric survey results, samples of biannual aerial photography, and descriptions of 18 storms that occurred during the year are summarized in this report. The year was highlighted by a major storm (the "Halloween Storm") in late October. Waves with 6-m significant height and periods exceeding 21 sec were measured 6 km from shore. This report is the 13th in a series of annual summaries of data collected at the FRF that began with Miscellaneous Report CERC-82-16, which summarized data collected during 1977-1979. These reports are available from the WES Technical Report Distribution Section of the Information Technology Laboratory, Vicksburg, MS.			
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14. (Continued).

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Oceanographic research--statistics (LC)

Oceanographic research stations--North Carolina--Duck (LC)

Water waves--statistics (LC)