CHAPTER 7

REVISIONS TO HURRICANE DESIGN WAVE PRACTICES

BY

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1. ABSTRACT

The 1959 paper "Hurricane Design Wave Practices" (ref. 1) has been widely used in the past for obtaining design wave criteria. Additional wave data and revisions in wave forecasting procedures, including computing techniques, ideas and experience, make it possible to bring these techniques up to date.

This paper should be considered also as an extension of the paper "A Non-Dimensional Hurricane Wave Model" (ref. 2) as well as revisions to the 1959 paper (ref. 1).

Graphs, formulae and procedures are presented making it possible to calculate the entire deep water wave fields from model hurricane wind fields.

The revisions have been applied to the U.S. East and Gulf coasts past historical hurricanes and also to the U.S. Weather Service standard project and probable maximum hurricanes for deep water conditions. The results of these calculations are presented in figures and tables and can serve as inputs for particular locations to calculate design storm surge and design wave criteria over the continental shelf to the coast line, making use of the material in the references listed at the end of this paper.

2. SUMMARY BASIC RELATIONSHIPS FOR STATIONARY MODEL HURRICANE WIND FIELDS

Detailed equations are given in reference 2. Specifically,

$$1) \quad \frac{U_r}{U_R} = -\tfrac{1}{2}\,\frac{fR}{U_R}\,\frac{r}{R} + \sqrt{\left(1+\frac{fR}{U_R}\right)\frac{R}{r}\,e^{(1-R/r)} + \left(\tfrac{1}{2}\,\frac{fR}{U_R}\right)^2}$$

where U_r and U_R are the wind speeds at radial distance r and R (radius of maximum wind) from the hurricane center, ϕ is latitude, ω is angular velocity of the earth, and $f = 2\,\omega \sin \phi$. (See list of symbols)

For wave generation we consider only U_r for $r \geq R$, and avoid entering into the eye of the hurricane. Fig. 1 shows relationships for eq. 1 for $r/R \geq 1.0$. The wind speed U_R is given (ref. 5) by

$$2) \quad U_R = K \sqrt{\Delta P} - 0.5\, fR$$

where ΔP is the central pressure reduction in inches of mercury from normal pressure, and the constant K varies from 67 at 20 to 25 degrees latitude to about 63 at 45 degrees latitude for U.S. coasts.

The sustained wind speed at the 10-meter reference plane above mean sea level is given (ref. 5) by

$$3) \quad U_{Rs} = K^* U_R \text{, where } K^* = 0.865 \text{ for all U.S. East Coast and Gulf Coast zones, except } K^* = 0.886 \text{ for Gulf Coast Zone B.}$$

The components U_x/U_R and U_y/U_R of the wind speeds depend upon the angular position of r/R and the incurvature angle β that the wind makes with the tangent to the isobars.

3. SUMMARY BASIC RELATIONSHIPS FOR STATIONARY MODEL HURRICANE DEEP WATER WAVE FIELDS

Detailed expressions are given in reference 2. Specifically, the component wind fields are used together with wave forecasting relationships to calculate component wave fields H_x/H_R and H_y/H_R, and the final resultant wave field becomes

$$4) \quad H_r = \sqrt{H_x^2 + H_y^2} \quad \text{and} \quad 5) \quad H_R = K' \sqrt{R\Delta P}$$

Fig. 2 in analogy to Fig. 1 gives relationships for H_r/H_R, based on calculations for 51 model stationary hurricanes. Fig. 3 can be used to determine K' for use in eq. 5. K' in Fig. 3 must be increased by $0.886/0.865 = 1.024$ for Zone B of the Gulf of Mexico.

4. MOVING HURRICANE

The stationary model hurricane wave field is directly coupled with the corresponding model hurricane wave field. Any change in the wind field will result in a directly related change in the wave field. For a moving hurricane the changes in wind speed components are

6) $\Delta U_y = \frac{1}{2} V \cos \Theta$ and 7) $\Delta U_x = 0$, where V is the forward speed of the hurricane, whose path is parallel to the y- axis and Θ is the angle of radius r measured counterclockwise from the x- axis. There will also be a change in effective fetch length as a result in movement of the hurricane.

There is a critical forward speed of the hurricane, when the hurricane moves in phase with the group velocity of the waves, afterwhich a faster forward speed will result in the hurricane moving ahead of the maximum waves.

Eqs. for critical forward speed are as follows:

8) $V_c = 1.515\ T_c$ knots

9) $$T_c = T_R \left[1 - \frac{.7575\ T_R}{U_{Rs}} \right]^{-1} = T_R \left[1 + \frac{1}{2} \frac{V_c}{U_{Rs}} \right]$$

10) $$H_c = H_R \left[1 + \frac{1}{2} \frac{V_c}{U_{Rs}} \right]^2$$

and the wave period can be obtained from

11) $$\frac{T}{U} = 0.4 \tanh \left\{ 1.07 \left[\operatorname{arc\,tanh} \frac{40H}{U^2} \right]^{0.6} \right\}$$

In eq. 11 $T = T_c$ and T_R in sec, $H = H_c$ and H_R in feet and $U = U_{Rs} + \frac{1}{2} V_c$ in knots. Eqs. 10 and 11 can be used also for actual forward speed of the hurricane when $V_a \leq V_c$, by replacing V_c with V_a, H and H_c with H_a, and $U = U_{Rs} + \frac{1}{2} V_a$.

For complete development of the above equation, see reference 2. Figs. 1, 2, 3 and 4 are selected from reference 2.

5. APPLICATION TO HISTORICAL, STANDARD PROJECT AND PROBABLE MAXIMUM HURRICANES

The parameters of the hurricanes for various zones and latitudes are R, ΔP , and V_a (see refs. 5 and 6). The summary of relationships given in this paper were used to calculate the deep water wave characteristics. The range in critical forward speed seems to be between about 18 and 28 knots. Only a few of the Gulf of Mexico hurricanes exceed the critical forward speed. However, there are quite a few Atlantic hurricanes, particularly for higher latitudes that exceed the critical forward speed. Calculations are made for H_R , H_c and H_a and T_R , T_c and T_a . However, when $V_a > V_c$ we use the values of H_c and T_c in place of H_a and T_a respectively.

The results of these calculations are given in appendix A for the historical hurricanes and in appendix B for the standard project and probable maximum hurricanes, all for the U.S. Gulf of Mexico Coast and the U.S. East Coast. Fig. 5 shows the various zones for the Gulf of Mexico and the U.S. Eastern seaboard.

6. PRESENTATION OF RESULTS

6.1 Historical Hurricanes (See Figs. 6, 7, 8 and 9 and appendix A)

The above are for the historical hurricanes. Generally, the maximum significant wave heights occur for the East Coast. Most of the hurricanes for about latitude 30°N enter the U.S. mainland from the Gulf of Mexico. The extreme range in critical forward speed of the hurricanes for maximum significant wave heights fall between 18 and 28 knots. For latitudes lower than about 30°N latitude, the actual forward speeds are less than the critical forward speed. For latitudes greater than about 30°N latitude, many of the hurricanes exceed the critical forward speed. The maximum intensity of the hurricanes seem to be reached at about 30°N latitude. At higher latitudes the actual forward speeds of many of the hurricanes greatly exceed the critical forward speed.

Generally speaking R increases and ΔP decreases with increase in latitude, and $R\Delta P$ increases with latitude to about 30 or 35°N latitude. According to Fig. 3 K' decreases with increase in latitude. Thus the product $K' \sqrt{R\Delta P}$ increases to a maximum at about 30°N latitude and then decreases northward. This, of course, is for deep water conditions. The effect of the depth and width of the continental shelf will result in other possible modifications. The total water depth, including storm surge will have an effect on the maximum waves over the continental shelf.

6.2 Standard Project and Probable Maximum Hurricanes (See Figs. 10 through 14 and appendix B)

The above are for the standard project and probable maximum hurricanes for the East Coast U.S.A. These figures show that the worst hurricane deep

water wave conditions occur around 30°N latitude. Fig. 10 adds emphasis to the fact that there is a sudden increase in actual forward speed between 30°N and 35°N latitude, and these speeds exceed the critical forward speed. Figs. 13 and 14 show the limiting wave height conditions as governed by the critical forward speed.

The standard project hurricane is estimated as that extreme hurricane that can be reasonably expected to occur within a particular zone on the average of once every 100 years. Similarly the probable maximum hurricane has the 1000-year recurrence interval.

It is interesting to compare the historical with the standard and probable maximum hurricane. The maximum significant wave height calculated for the historical hurricane moving at actual speed and that for the maximum standard project hurricane are about H_R = 60 feet. The maximum significant wave height calculated for the historical hurricane assuming critical forward speed and that for the maximum probable maximum hurricane are about H_R = 70 feet. Thus the wave energy spectrum of the 1000-year hurricane as compared to the 100-year hurricane will be in the ratio of $(70/60)^2$ = 1.36.

7. WAVES OVER THE CONTINENTAL SHELF

The standard project and probable maximum hurricanes given in appendix B can be moved over the continental shelf. The data in the tables can be used as input data, together with previous expressions for calculating the storm surge (see ref. 1, 2, & 4). Each location will have to be treated as a separate problem. The two-dimensional hydrodynamical equations for storm surge should be used to determine the total water depths. The generation of waves over the continental shelf will have to take into account the modifications of wave height due to bottom friction, percolation, refraction and diffraction, and a regeneration due to the wind, and finally the breaking wave criteria.

8. REFERENCES

1. Bretschneider, C.L. (1959) "Hurricane Design Wave Practices", Trans. ASCE, Vol. 124, pp. 39-62.

2. Bretschneider, C.L. (1972) "A Non-Dimensional Stationary Hurricane Wave Model", Proc. 1972 Offshore Tech. Conf., Houston, Texas, May 1972, Paper No. 1517.

3. Bretschneider, C.L. (1970) "Revisions in Wave Forecasting", Look Lab/Hawaii (a quarterly of the U. of Hawaii) Vol. 1, No. 3, pp. 31-34.

4. Bretschneider, C.L. (1967) "Storm Surge" Advances in Hydroscience, pp. 341-418, ed. Ven Te Chow, Academic Press, N.Y. & London.

5. Graham, H.E. and D.E. Nunn (1959) "Meteorological Considerations Pertinent to Standard Project Hurricane, Atlantic and East Coasts of the U.S.", National Hurricane Research Proj. Report No. 33, U.S. Weather Service.

6. U.S. Dept. of Commerce (May 7, 1968) "Meteorological Characteristics of the Probable Maximum Hurricane, Atlantic and Gulf Coasts of the U.S.", Int. Rept., Memo to Corps of Engrs., HUR 7-97.

9. LIST OF SYMBOLS

e	base of natural logarithms
f	Coriolis parameter
H	significant wave height (in general)
H_a	significant wave height due to actual increase in forward speed of hurricane
H_c	maximum significant wave height for hurricane moving at critical forward speed
H_R	significant wave height at R, stationary hurricane
H_x	component of H along x-axis
H_y	component of H along y-axis
K	constant varying from 67 at 20 to 25 degrees latitude to about 63 at 45 degrees latitude for U.S. coasts
K^*	0.865 for all U.S. East Coast and Gulf Coast Zones and 0.886 for Gulf Coast Zone B
K'	coefficient (see Figure 3)
ΔP	central pressure reduction from normal in inches of mercury
R	radius of maximum wind, nautical miles
r	radial distance
T	significant wave period
T_a	significant wave period at R for actual forward speed of hurricane
T_c	significant wave period at R for critical forward speed
T_R	significant wave period at R for stationary hurricane
U	wind speed (general)
U_R	geostrophic wind speed at distance R from hurricane center
U_r	geostrophic wind speed at distance r from hurricane center
U_{Rs}	surface wind speed at distance R from hurricane center

U_x	component of wind speed along x-axis
U_y	component of wind speed along y-axis
ΔU_x	change in x component of wind speed for a moving hurricane
ΔU_y	change in y component of wind speed for a moving hurricane
V	forward speed of the hurricane
V_a	actual forward speed of a hurricane
V_c	critical forward speed of a hurricane
β	incurvature angle of the wind vector
θ	angle position of the radius measured counterclockwise from the x-y axis
ϕ	latitude
ω	angular velocity of the earth

FIGURES

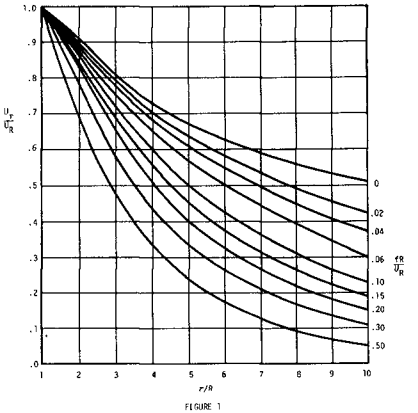

FIGURE 1

U_r/U_R VS r/R FOR VALUES OF fR/U_R (SEE EQ. 1)

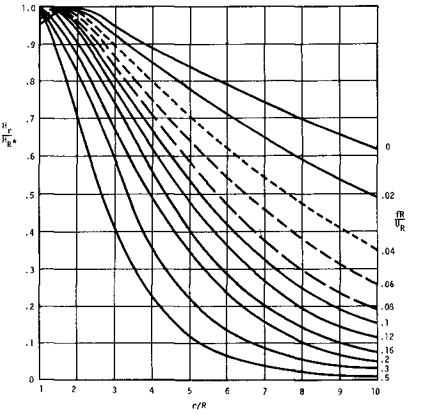

FIGURE 2

H_r/H_R* VS r/R FOR VALUES OF fR/U_R

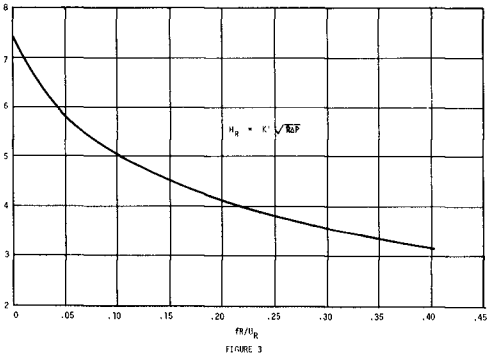

FIGURE 3

K' VS fR/U_R FOR $\beta = 25^\circ$

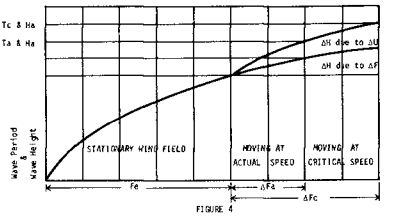

FIGURE 4

SCHEMATIC DIAGRAM FOR MOVING HURRICANE WHEN $V_a < V_c$

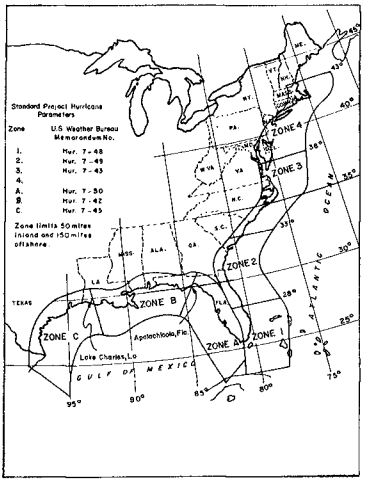

FIGURE 5
HURRICANE ZONES, ATLANTIC AND GULF COAST, U.S.A., FOR U.S. WEATHER SERVICE

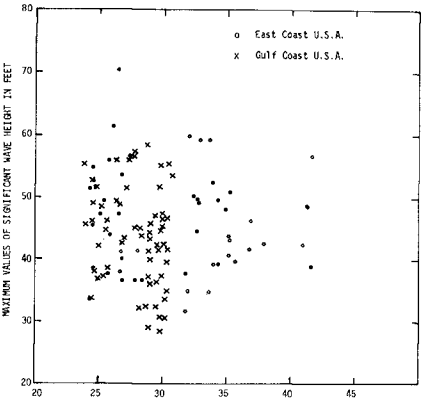

FIGURE 6
HISTORICAL HURRICANE HINDCAST SIGNIFICANT WAVE HEIGHTS (ACCORDING TO CRITICAL FORWARD SPEED) VS LATITUDE

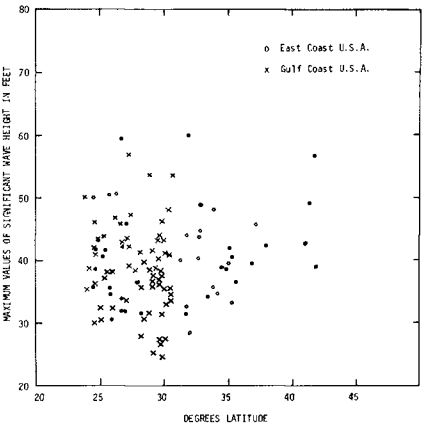

FIGURE 7
HISTORICAL HURRICANE HINDCAST SIGNIFICANT WAVE HEIGHTS (ACCORDING TO ACTUAL FORWARD SPEED) VS LATITUDE

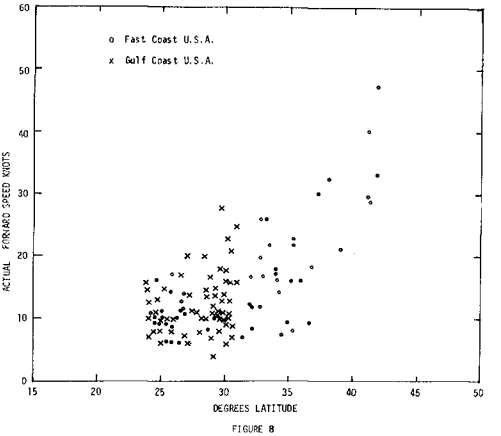

FIGURE 8
ACTUAL FORWARD SPEED IN KNOTS VS LATITUDE

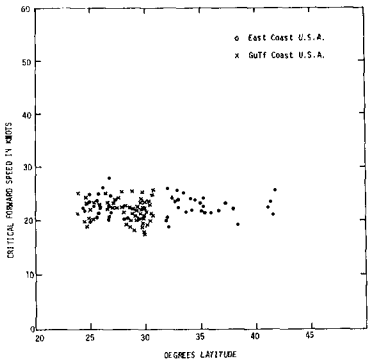

FIGURE 9

CRITICAL FORWARD SPEED IN KNOTS VS LATITUDE

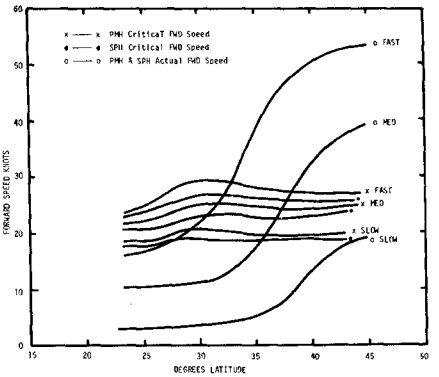

FIGURE 10

STANDARD PROJECT AND MAXIMUM PROBABLE HURRICANE FORWARD SPEED AND CRITICAL FORWARD SPEEDS, VS LATITUDE, EAST COAST U.S.A.

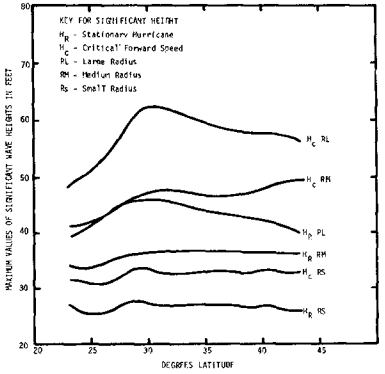

FIGURE 11

STANDARD PROJECT HURRICANE MAXIMUM VALUES OF SIGNIFICANT WAVE HEIGHT FOR STATIONARY HURRICANE AND CRITICAL FORWARD SPEED, EAST COAST, U.S.A.

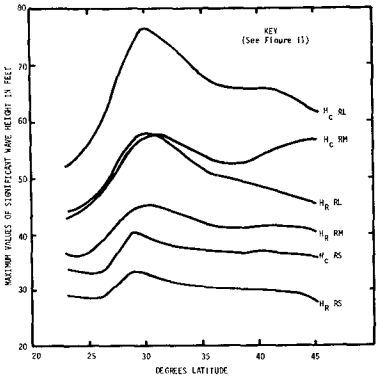

FIGURE 12

PROBABLE MAXIMUM HURRICANE MAXIMUM VALUES OF SIGNIFICANT WAVE HEIGHT FOR STATIONARY HURRICANE AND CRITICAL FORWARD SPEED, EAST COAST U.S.A.

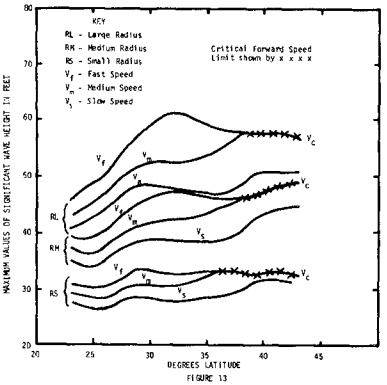

FIGURE 13

STANDARD PROJECT HURRICANE MAXIMUM VALUES OF SIGNIFICANT WAVE HEIGHT FOR SLOW, MEDIUM AND FAST SPEEDS OF FORWARD MOTION, EAST COAST U.S.A.

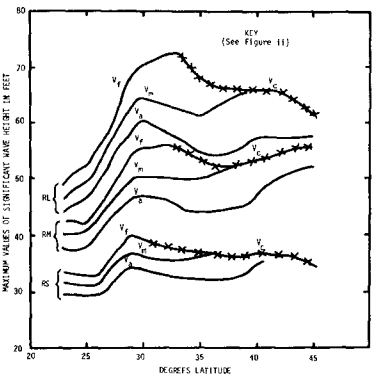

FIGURE 14

PROBABLE MAXIMUM HURRICANE MAXIMUM VALUES OF SIGNIFICANT WAVE HEIGHT FOR SLOW, MEDIUM AND FAST SPEEDS

APPENDIX A

TABLES I AND II

Deep Water Hurricane Wind and Wave Calculations for Historical Hurricanes, Hindcasts for U.S. Gulf Coast and U.S. East Coast.

TABLE I

Atlantic Ocean U.S. East Coast Historical Hurricanes Zones One to Four

TABLE II

Gulf of Mexico U.S. Coast Historical Hurricanes Zones A, B, and C.

Notations in the Above Tables:

ϕ	latitude degrees
R	radius of maximum wind nautical miles
ΔP	central pressure reduction from normal in inches of H_g
U_R	maximum sustained 10-minute average wind velocity above friction layer for stationary hurricane in knots
U_{Rs}	0.865 U_R - 10-minute average at the 10-meter level for stationary hurricane (except Zone B)
U_{Rs}	0.886 U_R for Zone B only
V_c	critical forward speed in knots
U_{Rc}	$U_{Rs} + \frac{1}{2} V_c$
V_a	actual forward speed in knots
U_{Ra}	$U_{Rs} + \frac{1}{2} V_a$
H	(1) H_R, (2) H_c, (3) H_a significant wave height feet at R for (1) stationary, (2) critical speed and, (3) actual speed respectively T_R, T_c, T_a significant wave period seconds at R for (1) stationary, (2) critical speed and (3) actual speed respectively.

TABLE I - 1

ATLANTIC OCEAN U.S. EAST COAST HISTORICAL HURRICANE ZONE ONE

No	Date	Lat ϕ	R	ΔP	STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
					U_R	U_{RS}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
		Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 2, 1935	24.8	6	3.57	125	108	32.5	12.1	20.0	118	38.8	13.2	9	113	35.3	12.6
2	Sept. 9, 1919	24.8	15	2.48	103	89	38.4	13.6	23.3	101	49.0	15.4	8	93	41.9	14.2
3	Oct. 20, 1926	24.6	21	2.40	101	87	41.9	14.3	24.8	99	54.6	16.3	16	95	50.0	15.6
4	Sept. 10, 1960	24.5	(25.8)**	2.37									9			
5	Sept. 18, 1926	25.8	24	2.33	99	86	42.5	14.5	25.1	99	55.9	16.6	17	94	51.4	15.9
6	Sept. 16, 1928	26.7	53	2.30	95	82	51.2	16.0	28.5	96	70.6	18.8	13	89	59.6	17.3
7	Sept. 17, 1947	26.2	34	2.16	94	81	44.8	15.0	26.3	94	60.5	17.4	10	86	50.5	15.9
8	Sept. 4, 1933	26.9	29	1.94	89	77	39.9	14.1	24.8	89	53.7	16.3	11	83	45.8	15.1
9	Sept. 15, 1945	25.5	24	1.83	88	76	36.9	13.5	23.7	88	49.3	15.6	10	81	41.9	14.4
10	Sept. 8, 1965	25.2	22	1.78	87	75	35.4	13.2	23.2	87	47.2	15.3	11	80	40.8	14.2
11	Sept. 28, 1929	24.9	28	1.77	86	74	38.0	13.7	24.3	86	51.4	16.0	10	79	43.3	14.7
12	Aug. 26, 1949	26.7	23	1.76	85	74	35.2	13.2	23.1	86	47.1	15.3	14	81	42.2	14.5
13	Oct. 17, 1950	25.8	(25.8)**	1.72									6			
14	Oct. 11, 1909	24.5	22	1.62	83	72	33.6	13.0	22.7	83	45.2	15.0	10	77	38.5	13.8
15	July 28, 1926	28.0	14	1.58	82	71	28.2	11.7	20.4	81	36.8	13.4	(11)***	76		
16	Sept. 22, 1948	26.8	16	1.51	80	69	29.0	12.0	21.0	80	38.1	14.0	11	75	34.0	13.0
17	Sept. 27, 1964	25.5	(25.8)**	1.35									9			
18	Nov. 4, 1935	(25.8)*	(25.8)**	1.19									(11)***			
19	Oct. 20, 1924	25.8	25	1.09	67	58	27.2	11.7	21.0	69	37.9	13.8	6	61	30.1	12.3
20	Sept. 11, 1903	25.8	43	1.08	64	55	30.3	12.4	22.7	67	43.9	14.9	8	59	34.8	13.3
21	Oct. 18, 1906	26.9	35	1.08	65	56	28.8	12.1	21.9	67	41.0	14.4	6	59	31.9	12.7
22	Oct. 5, 1948	25.8	31	1.07	65	56	28.2	11.9	21.5	67	39.9	14.2	13	63	35.0	13.3
23	June 17, 1906	26.9	26	1.01	64	55	25.8	11.4	20.5	65	36.3	13.5	12	61	31.7	12.7

* Average of all latitudes Zone One
** Average of all R Zone One
*** Average of all V_a Zone One

TABLE I - 2

ATLANTIC OCEAN U.S. EAST COAST HISTORICAL HURRICANES ZONE TWO

No	Date				STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
					U_R	U_{RS}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
		Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 26, 1958	32.7	19	2.40	100	87	38.6	13.7	23.6	99	49.8	15.6	12	93	44.1	14.6
2	Oct. 15, 1954	32.0	36	2.26	95	82	44.4	14.9	26.1	95	59.7	17.2	(26)	95	59.7	17.2
3	Sept. 29, 1959	32.0	(29.3)**	1.87									12			
4	July 28, 1926	28.4	14	1.58	82	71	28.1	11.7	20.3	82	36.7	13.4	8	75	31.3	12.4
5	Aug. 30, 1954	(31.4)*	(29.3)**	1.57									(12.6)***			
6	Aug. 12, 1955	32.5	45	1.52	75	65	35.7	13.4	24.1	77	50.2	15.9	7	69	39.7	14.2
7	Sept. 10, 1960	32.9	33	1.45	75	65	32.5	12.8	22.8	76	44.9	15.0	(26)[1]	78	44.9	15.0
8	Sept. 19, 1955	32.8	50	1.41	71	61	34.5	13.2	23.9	73	49.1	15.8	10	66	40.3	14.3
9	Sept. 9, 1964	33.1	(29.3)**	1.39									17			
10	Oct. 15, 1947	32.1	13	1.33	75	65	24.2	10.9	19.0	74	31.9	12.5	17	73	31.0	12.4
11	Sept. 16, 1928	29.5	(29.3)**	1.77									(12.6)***			
12	Aug. 11, 1940	32.0	27	1.14	67	58	26.9	11.6	20.8	68	37.4	13.7	12	64	32.7	12.8
13	Oct. 25, 1921	29.0	(29.3)**	1.01									10			
14	Sept. 15, 1945	29.0	(29.3)**	1.01									(12.6)***			
15	Aug. 28, 1911	32.1	27	1.00	62	54	24.7	11.2	20.1	64	34.7	13.2	8	58	28.5	12.0

* Average all latitude Zone Two
** Average all R Zone Two
*** Average all V_a Zone Two
( )[1] $V_a > V_c$

TABLE I - 3

ATLANTIC OCEAN U.S. EAST COAST HISTORICAL HURRICANES ZONE THREE

					STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
		Lat ϕ	R	ΔP	U_R	U_{Rs}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
No	Date	Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 27, 1958	34.0	25	2.26	96	83	40.0	14.0	24.4	95	52.7	16.1	18	92	49.2	15.6
2	Oct. 15, 1954	33.0	36	2.26	94	81	44.0	14.8	26.0	94	59.2	17.2	26	94	59.2	17.2
3	Sept. 21, 1938	33.7	50	2.06	88	76	44.0	14.9	26.5	89	59.2	17.2	(17)*	85	54.4	16.6
4	Sept. 14, 1944	35.2	(39)*	2.04	90	78	33.4	12.8	22.0	89	43.3	14.5	(23)[1]	90	43.3	14.5
5	Sept. 10, 1954	(34.8)*	17	1.95												
6	Sept. 16, 1933	35.2	42	1.67	78	68	36.6	13.6	24.3	80	50.9	16.0	9	72	41.6	14.5
7	Aug. 28, 1958	34.0	(39)*	1.66									17			
8	Aug. 30, 1954	33.4	(39)*	1.57									(17)			
9	Sept. 11, 1960	37.4	36	1.57	76	66	33.5	13.0	23.2	78	46.4	15.3	(30)[1]	81	46.4	15.3
10	Aug. 12, 1955	34.5	45	1.52	75	66	35.1	13.3	24.0	77	49.3	15.8	7	68	39.0	14.0
11	Sept. 19, 1955	35.0	50	1.41	71	61	33.7	13.1	23.7	73	48.1	15.6	9	65	38.9	14.0
12	Sept. 18, 1936	35.2	34	1.39	72	62	31.2	12.5	22.4	74	43.4	14.8	16	71	39.7	14.1
13	Aug. 23, 1933	36.9	36	1.29	68	59	29.6	12.2	22.0	70	41.6	14.5	18	68	39.3	14.1
14	Aug. 25, 1924	35.2	34	1.22	67	58	28.6	12.0	21.6	69	40.3	14.3	(22)[1]	69	40.3	14.3
15	Sept. 3, 1913	35.8	41	1.11	63	55	27.6	11.8	21.5	66	39.7	14.2	16	63	36.4	13.6
16	Aug. 24, 1949	33.5	24	1.06	65	56	24.7	11.2	19.9	66	34.3	13.1	22	67	34.3	13.1
17	Dec. 2, 1925	34.2	54	.97	47	41	26.4	11.6	21.4	51	39.2	14.2	14	56	34.5	13.3
18	Sept. 16, 1967	36.6	(39)*	.95									9			
19	Sept. 17, 1906	34.0	61	.94	55	48	26.1	11.6	21.5	59	39.2	14.2	16	56	35.6	13.5

* Average for Zone 3 ( )[1] $V_a > V_c$

TABLE I - 4

ATLANTIC OCEAN U.S. COAST HISTORICAL HURRICANES ZONE FOUR

					STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
		Lat ϕ	R	ΔP	U_R	U_{Rs}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
No	Date	Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 21, 1938	41.8	50	2.06	82	71	40.8	14.3	25.7	84	56.8	16.9	(47)[1]	95	56.8	16.9
2	Sept. 11, 1954	41.3	(44)	1.95									(40)[1]			
3	Sept. 16, 1933	(40.3)*	(44)	1.67									(33)[1]			
4	Sept. 14, 1944	41.4	48	1.61	72	62	34.4	13.2	23.8	74	48.8	15.7	(30)[1]	77	48.8	15.7
5	Sept. 11, 1960	38.0	(44)	1.57									(32)[1]			
6	Aug. 31, 1954	41.8	22	1.54	75	65	28.8	12.0	21.2	76	39.1	14.0	(33)[1]	82	39.1	14.0
7	Sept. 18, 1936	38.0	34	1.39	71	61	30.4	12.4	22.2	73	42.4	14.6	(33)[1]	78	42.4	14.6
8	Aug. 26, 1924	41.3	66	1.22	59	51	28.7	12.1	22.4	62	42.7	14.8	(29)[1]	66	42.7	14.8
9	Aug. 29, 1958	39.0	(44)	1.19									21			

*Average Zone 4 ( )[1] $V_a > V_c$

TABLE II - A

GULF OF MEXICO U.S. COAST HISTORICAL HURRICANES ZONE A

No	Date	Lat φ	R	ΔP	STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
					U_R	U_{Rs}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
		Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 2, 1935	24.8	6	4.00	125	108	32.5	12.1	20.0	118	39.0	13.2	9	113	35.3	12.6
2	Sept. 9, 1919	24.6	15	2.50	103	89	38.4	13.6	23.3	101	49.1	15.4	8	93	42.0	14.2
3	Oct. 20, 1926	23.8	21	2.40	101	88	42.2	14.4	24.9	100	55.0	16.4	16	95	50.2	15.7
4	Sept. 10, 1960	26.0	(18.6)*	2.37	-	-	-	-	-	-	-	-	9	-	-	-
5	Sept. 21, 1948	24.5	7	2.30	100	87	27.4	11.3	19.0	106	33.7	12.5	8	91	30.0	11.8
6	Oct. 17, 1910	24.5	16	2.12	95	83	35.8	13.2	22.8	94	46.3	15.0	11	88	40.7	14.1
7	Sept. 8, 1965	25.2	21	2.00	90	78	36.6	13.4	23.4	90	48.4	15.5	15	86	44.0	14.7
8	Oct. 18, 1944	24.6	27	1.90	89	77	39.3	14.0	24.6	90	52.8	16.2	13	83	46.2	15.2
9	Sept. 17, 1947	26.4	34	1.90	88	76	41.1	14.3	25.3	87	55.9	16.7	(10.7)**	75	47.1	15.3
10	Sept. 18, 1926	26.5	24	1.90	88	76	37.1	13.5	23.7	88	49.4	15.7	17	85	45.8	15.1
11	Sept. 28, 1929	24.8	28	2.00	86	74	38.0	13.8	24.3	86	51.4	16.0	10	79	43.3	14.7
12	Oct. 25, 1921	28.1	18	2.00	83	72	31.0	12.4	22.0	83	41.0	14.2	10	77	35.4	13.2
13	Oct. 11, 1909	24.3	22	2.00	83	71	33.7	13.0	22.7	83	45.3	15.0	10	76	38.6	13.8
14	Sept. 16, 1928	27.7	53	2.00	78	68	40.3	14.3	25.8	81	57.0	17.0	(10.7)**	67	57.0	17.0
15	Sept. 4, 1950	29.1	(18.6)*	2.00	-	-	-	-	-	-	-	-	(10.7)**	-	-	-
16	Aug. 26, 1949	27.2	23	2.00	80	69	32.5	12.7	22.4	80	43.8	14.8	14	76	39.4	14.0
17	Sept. 15, 1945	25.5	24	2.00	80	69	33.1	12.8	22.7	81	44.8	15.0	10	74	38.0	13.8
18	Oct. 6, 1964	24.0	(18.6)*	1.45	-	-	-	-	-	-	-	-	15	-	-	-
19	Sept. 4, 1933	27.8	29	1.44	76	66	32.9	12.8	22.8	78	46.2	15.1	11	72	38.6	14.0
20	June 9, 1966	30.0	(18.6)*	1.28	-	-	-	-	-	-	-	-	9	-	-	-
21	Oct. 19, 1924	25.0	19	1.22	72	62	27.0	11.6	20.5	72	36.8	13.5	8	66	30.6	12.4
22	Nov. 4, 1935	25.0	(18.6)*	1.20	-	-	-	-	-	-	-	-	(10.7)**	-	-	-
23	Sept. 11, 1903	27.0	43	1.10	64	56	30.0	12.3	22.5	66	43.3	14.8	7	59	33.8	13.1
24	Oct. 18, 1906	25.0	35	1.10	65	57	29.3	12.2	22.1	68	42.0	14.6	6	60	32.5	12.9
25	Oct. 5, 1948	24.0	31	1.10	66	57	28.7	12.1	21.8	68	40.8	14.4	13	63	35.6	13.4
26	Oct. 18, 1950	28.0	(18.6)*	1.04	-	-	-	-	-	-	-	-	(10.7)**	-	-	-
27	June 17, 1906	25.1	26	1.01	64	56	26.3	11.5	20.7	66	37.0	13.7	(10.7)**	55	37.0	13.7
28	Oct. 4, 1966	24.2	(18.6)*	1.00	-	-	-	-	-	-	-	-	7	-	-	-
29	Oct. 7, 1941	29.8	18	1.00	62	54	22.0	10.5	18.7	63	30.3	12.3	11	59	26.7	11.6

NOTE:
*Average all R Zone A **Average all V_a Zone A

TABLE II - B

GULF OF MEXICO U.S. COAST HISTORICAL HURRICANES ZONE B

No	Date	Lat φ	R	ΔP	STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
					U_R	U_{Rs}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
		Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 8, 1900	27.0	(14)[2]	2.28	98	87	37.3	14.0	23.2	98	49.0	15.3	(13.8)**	94	43.5	15.0
2	Sept. 10, 1965	28.9	32	2.13	93	83	43.8	14.7	25.8	95	58.6	17.0	17	91	53.3	16.3
3	Sept. 29, 1915	29.9	29	2.05	91	81	41.3	14.3	25.0	94	55.1	16.5	10	86	46.6	15.2
4	Sept. 14, 1919	27.0	(31)*	2.00	-	-	-	-	-	-	-	-	20	-	-	-
5	Sept. 20, 1926	30.5	17	1.72	85	75	31.7	12.5	21.6	86	41.4	14.2	7	79	34.7	13.0
6	July 21, 1909	25.8	19	1.61	82	73	32.3	12.6	22.0	84	42.7	14.5	(13.8)**	72	42.7	14.5
7	Aug. 25, 1926	29.6	27	1.61	81	72	35.0	13.2	23.3	83	47.3	15.4	10	77	40.1	14.1
8	Oct. 3, 1964	29.0	21	1.59	81	72	32.5	12.7	22.2	83	43.3	14.0	7	75	35.7	13.3
9	July 5, 1916	30.7	50	1.54	76	67	38.2	14.0	25.0	80	53.8	16.5	25	80	53.8	16.5
10	July 31, 1936	30.5	19	1.46	78	69	29.7	12.1	21.2	79	39.5	14.0	9	73	33.7	13.0
11	Sept. 28, 1917	30.4	33	1.44	75	67	33.8	13.0	23.2	78	46.6	15.3	13	73	40.8	14.3
12	Sept. 27, 1906	30.6	73	1.42	69	62	38.0	14.0	25.4	74	55.3	16.8	16	69	48.5	15.7
13	June 16, 1934	30.0	37	1.40	74	66	34.2	13.1	23.5	77	47.6	15.5	16	73	43.1	14.7
14	Sept. 19, 1947	30.0	33	1.35	73	65	32.6	12.8	22.8	76	45.2	15.1	16	73	41.2	14.4
15	Aug. 14, 1901	30.0	33	1.20	69	61	30.2	12.4	22.1	72	42.3	14.6	14	68	37.6	13.8
16	Oct. 18, 1916	30.4	19	1.16	69	61	25.8	11.4	20.0	71	35.0	13.2	21	72	35.0	13.2
17	Aug. 7, 1940	29.0	11	1.16	70	62	22.1	10.4	18.1	71	29.0	12.0	8	66	25.0	11.1
18	Sept. 23, 1956	30.0	22	1.16	69	61	27.0	11.6	20.6	71	37.0	13.6	10	66	31.6	12.6
19	July 27, 1943	28.2	16	1.14	69	61	24.7	11.1	19.4	71	32.1	12.8	8	65	28.0	11.8
20	Sept. 30, 1929	30.1	65	1.12	62	55	32.0	13.8	23.5	66	47.2	15.5	6	58	35.6	13.5
21	Aug. 30, 1950	30.2	21	1.00	64	57	24.3	11.1	19.7	66	33.5	13.0	23	68	33.0	13.0
22	Sept. 21, 1920	29.6	28	.99	63	55	25.8	11.4	20.5	65	36.3	13.6	(28)[1]	69	36.3	13.6
23	Sept. 20, 1909	29.9	88	.98	54	48	29.3	12.3	23.0	60	45.0	15.2	11	54	36.4	13.7
24	Oct. 7, 1941	29.9	18	.94	62	55	22.5	10.6	18.8	65	30.8	12.4	11	62	27.2	11.7
25	Sept. 15, 1960	28.1	19	1.04	91	81	35.0	13.0	23.0	92	45.0	15.0	10	87	41.2	14.2

NOTE: ( )[1] $V_a > V_c$ ( )[2] Estimated *Average of all R **Average of all V

TABLE II - C

GULF OF MEXICO U.S. COAST HISTORICAL HURRICANES ZONE C

No	Date	Lat φ	R	ΔP	STATIONARY				CRITICAL SPEED				ACTUAL SPEED			
					U_R	U_{Rs}	H_R	T_R	V_c	U_{Rc}	H_c	T_c	V_a	U_{Ra}	H_a	T_a
		Degrees	N.M.	In Hg	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec	Knots	Knots	Feet	Sec
1	Sept. 20, 1967	26.0	(19.9)*	2.66	-	-	-	-	-	-	-	-	(11.2)**	-	-	-
2	Sept. 11, 1961	27.2	20	2.28	98	85	39.3	13.9	24.0	97	51.2	15.8	6	88	42.1	14.3
3	Sept. 8, 1900	29.2	14	2.28	99	85	34.7	12.9	22.2	96	44.3	14.6	10	90	38.9	13.7
4	Aug. 13, 1932	29.1	12	2.09	95	82	31.4	12.3	21.0	92	40.0	13.9	15	89	37.4	13.4
5	June 27, 1957	29.2	19	1.97	91	79	35.0	13.1	22.7	90	45.8	15.0	14	86	41.5	14.3
6	Aug. 18, 1916	27.5	35	1.92	88	76	41.3	14.4	25.4	89	56.3	16.8	11	82	47.5	15.4
7	Sept. 14, 1919	27.7	(19.9)*	1.92	-	-	-	-	-	-	-	-	20	-	-	-
8	Sept. 5, 1933	25.9	20	1.90	90	78	35.6	13.2	23.0	89	46.9	15.2	8	82	39.3	13.9
9	Aug. 30, 1942	28.5	18	1.85	88	76	33.3	12.8	22.2	88	43.7	14.6	14	83	39.7	14.0
10	Aug. 16, 1915	29.8	32	1.78	85	73	37.8	13.7	24.3	86	51.4	16.0	11	79	43.7	14.8
11	June 22, 1921	29.7	17	1.75	86	74	31.4	12.4	21.6	85	41.2	14.2	11	80	36.3	13.3
12	July 21, 1909	29.0	19	1.61	82	71	31.1	12.4	21.6	82	41.2	14.3	12	77	36.5	13.4
13	Sept. 23, 1941	29.7	21	1.61	82	71	31.8	12.6	22.0	82	42.5	14.5	13	77	38.0	13.7
14	Aug. 27, 1945	29.0	18	1.35	75	65	27.5	11.7	20.5	75	36.8	13.5	4	67	29.2	12.0
15	June 28, 1929	28.5	13	1.30	74	64	24.4	11.0	19.1	74	32.2	12.6	15	72	30.5	12.2
16	Aug. 7, 1940	29.9	11	1.16	70	61	21.5	10.3	17.9	70	28.3	11.8	8	65	24.4	11.0
17	July 27, 1943	29.5	16	1.14	69	60	23.9	10.9	19.2	68	32.2	12.6	8	64	27.2	11.6
18	Aug. 4, 1933	25.9	25	1.12	68	59	27.6	11.8	21.1	69	38.4	13.9	10	64	32.5	12.8
19	Oct. 4, 1949	28.9	28	1.04	64	56	26.3	11.5	20.7	66	37.0	13.7	11	61	31.7	12.7

*Average of all R Zone C **Average of all V_a Zone C

APPENDIX B

TABLES III TO VI

Deep Water Hurricane Wind and Wave Calculations for Standard Project Hurricanes, Probable Maximum Hurricanes. Predictions for U.S. Gulf of Mexico: Zones A, B, and C; U.S. East Coast: Zones 1, 2, 3 and 4.

TABLE III

Standard Project Hurricanes for Gulf Coast U.S. Zones A, B and C.

TABLE IV

Probable Maximum Hurricanes for Gulf Coast U.S. Zones A, B and C.

TABLE V

Standard Project Hurricanes for East Coast Zones 1, 2, 3 and 4.

TABLE VI

Probable Maximum Hurricanes for East Coast Zones 1, 2, 3 and 4.

Notations in the Above Tables:

ϕ	latitude degrees
ΔP	central pressure reduction from normal inches of H_g
R	radius of maximum wind nautical miles
U_R	maximum sustained 10-minute average wind velocity above friction layer for stationary hurricane, knots
V	forward speed of hurricane in knots (V = 0 stationary, V = V_c critical speed, V = slow, medium or fast speed of translation as indicated)
U_{Rs}	maximum 10-minute average sustained wind speed at 10 meter water level, knots
U_{Rs}	$0.865\ U_R + \frac{1}{2}\ V$, knots (except Zone B)
U_{Rs}	$0.886\ U_R + \frac{1}{2}\ V$, knots for Zone B only
H_R	significant wave height in feet at R
T_R	significant wave periods in seconds at R

TABLE III- A
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR GULF COAST U.S. ZONE A

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1				Small R = 4					Medium R = 7					Large R = 11		
Lat ϕ = 24°	U_R	121.5					121.1					120.7				
Δ P = 3.34 in Hg	V	0	17.7	3.0	10.0	17.0	0	20.6	3.0	10.0	17.0	0	23.2	3.0	10.0	17.0
	U_{RS}	105.1	114.0	106.6	115.1	113.6	104.8	115.1	106.3	114.8	113.3	104.4	116.0	105.9	105.4	112.9
	H_R	26.5	31.1	27.2	29.0	30.9	33.5	40.5	34.5	36.8	39.2	40.6	50.1	41.7	44.6	47.4
	T_R	10.8	11.7	10.9	11.3	11.7	12.4	13.6	12.5	13.0	13.4	13.8	15.3	14.0	14.4	14.9
2				Small R = 4					Medium R = 7					Large R = 12		
Lat ϕ = 25°	U_R	119.6					119.3					118.7				
Δ P = 3.24 in Hg	V	0	17.6	3.0	10.0	17.0	0	20.4	3.0	10.0	17.0	0	23.5	3.0	10.0	17.0
	U_{RS}	103.5	112.3	105.0	108.5	112.0	103.2	113.4	104.7	108.2	111.7	102.7	114.5	104.2	107.7	111.2
	H_R	26.0	30.6	26.7	28.5	30.4	32.9	39.7	33.9	36.2	38.5	41.3	51.3	42.5	45.4	48.4
	T_R	10.7	11.6	10.8	11.2	11.6	12.3	13.5	12.4	12.9	13.3	13.9	15.5	14.1	14.6	15.1
3				Small R = 4					Medium R = 8					Large R = 14		
Lat ϕ = 26°	U_R	116.8					116.3					115.6				
Δ P = 3.09 in Hg	V	0	17.4	4.0	11.0	17.0	0	20.9	4.0	11.0	17.0	0	24.1	4.0	11.0	17.0
	U_{RS}	101.0	109.7	103.0	106.5	109.5	100.6	111.1	102.6	106.1	109.1	100.0	112.1	102.0	105.5	108.5
Marco, Florida	H_R	25.2	29.8	26.2	28.1	29.7	33.8	41.2	35.2	37.6	39.8	42.4	53.2	44.1	47.1	49.9
	T_R	10.6	11.5	10.8	11.1	11.4	12.5	13.8	12.7	13.2	13.6	14.2	15.9	14.5	15.0	15.4
4				Small R = 5					Medium R = 10					Large R = 18		
Lat ϕ = 27°	U_R	112.1					111.5					110.6				
Δ P = 2.86 in Hg	V	0	18.1	4.0	11.0	18.0	0	21.8	4.0	11.0	18.0	0	24.8	4.0	11.0	18.0
	U_{RS}	97.0	106.1	99.0	102.5	106.0	96.5	107.4	98.5	102.0	105.5	95.6	108.0	97.6	101.1	104.6
Lemon Bay, Florida	H_R	26.5	31.7	27.6	29.6	31.7	35.5	44.0	37.0	39.7	42.5	43.6	55.6	45.4	48.8	52.2
	T_R	10.9	12.0	11.2	11.6	12.0	12.9	14.4	13.2	13.7	14.1	14.5	16.4	14.8	15.3	15.9
5				Small R = 6					Medium R = 12					Large R = 21		
Lat ϕ = 28°	U_R	106.7					105.9					104.8				
Δ P = 2.60 in Hg	V	0	18.6	4.0	11.0	19.0	0	22.2	4.0	11.0	19.0	0	24.9	4.0	11.0	19.0
	U_{RS}	92.3	101.6	94.3	97.8	101.8	91.6	102.7	93.6	97.1	101.1	90.7	103.2	92.7	96.2	100.2
Ounedin, Florida	H_R	27.2	32.9	28.3	30.5	* *	36.0	45.2	37.5	40.4	43.8	42.9	55.5	44.9	48.3	52.4
	T_R	11.2	12.3	11.4	11.8	* *	13.1	14.7	13.4	13.9	14.4	14.5	16.4	14.8	15.3	16.0
6				Small R = 6					Medium R = 13					Large R = 24		
Lat ϕ = 29°	U_R	104.1					103.2					101.8				
Δ P = 2.48 in Hg	V	0	18.4	4.0	11.0	20.0	0	22.3	4.0	11.0	20.0	0	25.2	4.0	11.0	20.0
	U_{RS}	90.0	99.2	92.0	95.5	100.0	89.2	100.4	91.2	94.7	99.2	88.0	100.6	92.0	93.5	98.0
	H_R	26.4	32.1	27.6	29.7	* *	35.7	45.2	37.3	40.2	44.1	43.2	56.4	45.2	48.7	53.5
	T_R	11.0	12.1	11.3	11.7	* *	13.1	14.7	13.4	13.9	14.5	14.5	16.6	14.9	15.4	16.2
7				Small R = 7					Medium R = 14					Large R = 26		
Lat ϕ = 30°	U_R	102.4					101.4					99.9				
Δ P = 2.41 in Hg	V	0	19.0	4.0	11.0	21.0	0	22.4	4.0	11.0	21.0	0	25.3	4.0	11.0	21.0
	U_{RS}	88.5	98.0	90.5	104.0	99.0	87.7	98.9	89.7	93.2	98.2	86.4	99.1	88.4	91.9	96.9
Carbur, Florida	H_R	27.7	33.9	28.9	31.2	* *	35.7	45.4	37.4	40.4	44.8	43.2	56.7	45.2	48.8	54.3
	T_R	11.3	12.6	11.6	12.0	* *	13.1	14.8	13.4	13.9	14.7	14.6	16.7	14.9	15.5	16.3

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE III- 8
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR GULF COAST U.S. ZONE 8

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 7					Medium R = 14					Large R = 27				
Lat ϕ = 30°	U_R	101.5					100.6					98.9				
ΔP = 2.37 in Hg	V	0	19.1	4.0	11.0	28.0	0	22.5	4.0	11.0	28.0	0	25.6	4.0	11.0	28.0
	U_{RS}	89.8	99.4	91.8	95.3	103.8	89.0	100.3	91.0	94.5	103.0	87.5	100.3	89.5	93.0	101.5
Apalachicola, Florida	H_R	28.1	34.3	29.3	31.6	* *	36.2	45.9	37.8	40.8	* *	44.2	58.1	46.2	49.9	* *
	T_R	11.4	12.6	11.7	12.1	* *	13.2	14.8	13.5	14.0	* *	14.7	16.9	15.1	15.7	* *
2		Small R = 7					Medium R = 14					Large R = 28				
Lat ϕ = 30°	U_R	100.8					99.9					98.1				
ΔP = 2.34 in Hg	V	0	19.1	4.0	11.0	28.0	0	22.4	4.0	11.0	28.0	0	25.7	4.0	11.0	28.0
	U_{RS}	89.2	98.8	91.2	94.7	103.2	88.4	99.6	92.4	93.9	102.4	86.8	99.6	88.8	92.3	100.8
Grayton Beach, Florida	H_R	27.9	34.1	29.1	31.4	* *	35.9	45.6	37.6	40.5	* *	44.3	58.4	46.4	50.1	* *
	T_R	11.4	12.6	11.6	12.1	* *	13.1	14.8	13.4	13.9	* *	14.8	17.0	15.1	15.7	* *
3		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 30.5°	U_R	100.5					99.6					97.6				
ΔP = 2.33 in Hg	V	0	19.0	4.0	11.0	28.0	0	22.4	4.0	11.0	28.0	0	25.8	4.0	11.0	28.0
	U_{RS}	88.9	98.4	90.9	94.4	102.9	88.1	99.3	90.1	103.6	102.1	86.4	99.3	88.4	91.9	100.4
Pensacola, Florida	H_R	27.8	34.0	29.0	31.3	* *	35.7	45.4	37.4	40.3	* *	44.5	58.8	46.6	50.3	* *
	T_R	11.4	12.6	11.6	12.1	* *	13.1	14.8	13.4	13.9	* *	14.8	17.0	15.2	15.8	* *
4		Small R = 7					Medium R = 14					Large R = 30				
Lat ϕ = 30.5°	U_R	100.3					99.4					97.2				
ΔP = 2.32 in Hg	V	0	19.0	4.0	11.0	28.0	0	22.3	4.0	11.0	28.0	0	25.9	4.0	11.0	28.0
	U_{RS}	88.8	98.3	90.8	94.3	102.8	87.9	99.1	89.9	93.4	101.9	86.0	99.0	88.0	91.5	100.0
	H_R	27.7	34.0	29.0	31.2	* *	35.6	45.3	37.3	40.2	* *	44.8	59.3	46.9	50.7	* *
	T_R	11.3	12.6	11.6	12.0	* *	13.1	14.7	13.4	13.9	* *	14.9	17.1	15.2	15.8	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE III- 8
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR GULF COAST U.S. ZONE 8
(CONTINUED)

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
5		Small R = 7					Medium R = 14					Large R = 30				
Lat ϕ = 30°	U_R	100.4					99.5					97.4				
ΔP = 2.32	V	0	19.0	4.0	11.0	28.0	0	22.4	4.0	11.0	28.0	0	26.0	4.0	11.0	28.0
	U_{RS}	88.9	98.4	90.9	94.4	102.9	88.0	99.2	92.0	93.5	102.0	86.2	99.2	88.2	91.7	100.2
New Orleans, Louisiana	H_R	27.7	34.0	29.0	31.3	* *	35.7	45.4	37.4	40.3	* *	45.0	59.5	47.1	50.9	* *
	T_R	11.4	12.6	11.6	12.1	* *	13.1	14.8	13.4	13.9	* *	14.9	17.1	15.2	15.8	* *
6		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 29.5°	U_R	100.7					99.8					97.8				
ΔP = 2.33 in Hg	V	0	19.1	4.0	11.0	28.0	0	22.4	4.0	11.0	28.0	0	25.9	4.0	11.0	28.0
	U_{RS}	89.1	98.7	91.1	94.6	103.1	88.3	99.0	90.3	93.8	102.3	86.6	99.6	88.6	92.1	100.6
Lake Barre, Louisiana	H_R	27.8	34.1	29.1	31.4	* *	35.9	45.6	37.6	40.6	* *	44.8	59.2	46.9	50.7	* *
	T_R	11.4	12.6	11.6	12.1	* *	13.1	14.8	13.4	14.0	* *	14.9	17.1	15.2	15.8	* *
7		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 29.5°	U_R	100.9					100.0					98.0				
ΔP = 2.34 in Hg	V	0	19.1	4.0	11.0	28.0	0	22.5	4.0	11.0	28.0	0	25.9	4.0	11.0	28.0
	U_{RS}	89.3	98.9	91.3	94.8	103.3	88.5	99.8	90.5	94.0	102.5	86.8	99.8	88.6	92.3	100.8
March Island, Louiana	H_R	27.9	34.2	29.2	31.4	* *	36.0	45.8	37.7	40.6	* *	44.9	59.3	47.0	50.8	* *
	T_R	11.4	12.6	11.6	12.1	* *	13.2	14.8	13.4	14.0	* *	14.9	17.1	15.2	15.8	* *
8		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 30°	U_R	101.3					100.4					98.5				
ΔP = 2.36 in Hg	V	0	19.1	4.0	11.0	28.0	0	22.5	4.0	11.0	28.0	0	25.7	4.0	11.0	28.0
	U_{RS}	89.6	99.2	91.6	95.1	103.6	88.8	100.1	90.8	94.3	102.8	87.2	100.2	89.2	92.7	101.2
Grand Chenier, Louisiana	H_R	28.0	34.3	29.3	31.5	* *	36.1	45.8	37.8	40.7	* *	44.5	58.7	46.6	50.3	* *
	T_R	11.4	12.6	11.7	12.1	* *	13.2	14.8	13.5	14.0	* *	14.8	17.0	15.1	15.7	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE III- C
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR GULF COAST U.S. ZONE C

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1				Slow R = 7					Medium R = 14					Large R = 27		
Lat ϕ = 30°	U_R	101.7					100.8					99.1				
	V	0	19.0	4.0	11.0	28.0	0	22.3	4.0	11.0	28.0	0	25.4	4.0	11.0	28.0
Δ P = 2.38 in Hg	U_{Rs}	88.0	97.5	90.0	93.5	102.0	87.2	98.4	89.2	92.7	101.2	85.7	98.4	87.7	91.2	99.7
Port Arthur, Texas	H_R	27.5	33.7	28.7	31.0	* *	35.5	45.1	37.1	40.1	* *	43.3	57.1	45.4	49.0	* *
	T_R	11.3	12.5	11.6	12.0	* *	13.1	14.7	13.4	13.9	* *	14.6	16.8	14.9	15.5	* *
2				Slow R = 7					Medium R = 14					Large R = 26		
Lat ϕ = 29°	U_R	102.2					101.3					99.8				
	V	0	19.0	4.0	11.0	28.0	0	22.4	4.0	11.0	28.0	0	25.4	4.0	11.0	28.0
Δ P = 2.4 in Hg	U_{Rs}	88.4	97.9	90.4	93.9	102.4	87.7	98.9	89.7	93.2	101.7	86.3	99.0	88.3	91.8	100.3
Galveston, Texas	H_R	27.7	34.0	28.9	31.2	* *	35.8	45.6	37.5	40.5	* *	43.3	57.0	45.4	49.0	* *
	T_R	11.3	13.0	11.6	12.1	* *	13.1	14.8	13.4	14.0	* *	14.6	16.7	14.9	15.5	* *
3				Slow R = 6					Medium R = 13					Large R = 25		
Lat ϕ = 29°	U_R	103.0					102.1					100.6				
	V	0	18.3	4.0	11.0	28.0	0	22.2	4.0	11.0	28.0	0	25.3	4.0	11.0	28.0
Δ P = 2.43 in Hg	U_{Rs}	89.1	98.3	91.1	94.6	103.1	88.3	99.4	90.3	93.8	102.3	87.0	99.7	89.0	92.5	101.0
Bay City, Texas	H_R	26.1	31.8	27.3	29.4	* *	35.3	44.7	36.9	39.8	* *	43.2	56.6	45.2	48.8	* *
	T_R	11.0	12.1	11.2	11.6	* *	13.0	14.6	13.3	13.8	* *	14.6	16.7	14.9	15.5	* *
4				Slow R = 6					Medium R = 13					Large R = 24		
Lat ϕ = 28°	U_R	103.9					103.1					101.7				
	V	0	18.4	4.0	11.0	28.0	0	22.3	4.0	11.0	28.0	0	25.2	4.0	11.0	28.0
Δ P = 2.47 in Hg	U_{Rs}	89.9	99.1	91.9	95.4	103.9	89.2	100.4	91.2	94.7	103.2	88.0	100.6	90.0	93.5	102.0
San Antonio Bay, Texas	H_R	26.4	32.1	27.6	29.7	* *	35.8	45.3	37.4	40.4	* *	43.4	56.7	45.3	48.9	* *
	T_R	11.0	12.2	11.3	11.7	* *	13.1	14.7	13.4	13.9	* *	14.6	16.7	14.9	15.5	* *
5				Slow R = 6					Medium R = 12					Large R = 23		
Lat ϕ = 27°	U_R	105.5					104.8					103.5				
	V	0	18.5	4.0	11.0	28.0	0	22.2	4.0	11.0	28.0	0	25.3	4.0	11.0	28.0
Δ P = 2.54 in Hg	U_{Rs}	91.3	99.1	91.9	95.4	103.9	90.6	100.4	91.2	94.7	103.2	89.5	100.6	90.0	93.5	102.0
Sarita, Texas	H_R	26.9	32.6	28.1	30.2	* *	35.7	45.0	37.3	40.1	* *	43.8	57.1	45.8	49.4	* *
	T_R	11.1	12.2	11.4	11.8	* *	13.0	14.6	13.3	13.8	* *	14.6	16.7	15.0	15.5	* *
6				Slow R = 6					Medium R = 11					Large R = 20		
Lat ϕ = 26°	U_R	107.7					107.1					106.1				
	V	0	18.7	4.0	11.0	28.0	0	22.0	4.0	11.0	28.0	0	24.9	4.0	11.0	28.0
Δ P = 2.64 in Hg	U_{Rs}	93.1	102.5	95.1	98.6	107.1	92.6	103.6	94.6	98.1	106.6	91.7	104.2	93.7	97.2	105.7
Brownsville, Texas	H_R	27.5	33.3	28.7	30.9	* *	35.5	44.4	37.1	39.9	* *	43.3	55.8	45.2	48.6	* *
	T_R	11.2	12.4	11.5	11.9	* *	13.0	14.5	13.3	13.7	* *	14.5	16.5	14.8	15.4	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE IV - A
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR GULF COAST U.S. ZONE A

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1				Small R = 4					Medium R = 7					Large R = 11		
Lat ϕ = 24°	U_R	132.5					132.1					131.7				
	V	0	18.4	3.0	10.0	17.0	0	21.3	3.0	10.0	17.0	0	24.1	3.0	10.0	17.0
Δ P = 3.97 in Hg	U_{Rs}	114.6	123.8	116.1	119.6	123.1	114.3	125.0	115.8	119.3	122.8	113.9	126.0	115.4	118.9	122.4
	H_R	29.0	33.9	29.8	31.6	33.5	36.8	44.0	37.8	40.1	42.5	44.5	54.5	45.7	48.5	51.4
	T_R	11.2	12.1	11.4	11.7	12.1	12.9	14.1	13.0	13.4	13.8	14.4	15.9	14.6	15.0	15.4
2				Small R = 4					Medium R = 7					Large R = 12		
Lat ϕ = 25°	U_R	130.4					130.1					129.5				
	V	0	18.2	3.0	10.0	17.0	0	21.2	3.0	10.0	17.0	0	24.4	3.0	10.0	17.0
Δ P = 3.85 in Hg	U_{Rs}	112.8	121.9	114.3	117.8	121.3	112.5	123.1	114.0	117.5	121.0	112.0	124.2	113.5	117.0	120.5
	H_R	28.5	33.3	29.2	31.1	32.9	36.1	43.2	37.1	39.4	41.8	45.3	55.7	46.5	49.4	52.4
	T_R	11.1	12.0	11.3	11.6	12.0	12.8	14.0	12.9	13.3	13.7	14.5	16.1	14.7	15.2	15.6
3				Small R = 4					Medium R = 8					Large R = 14		
Lat ϕ = 26°	U_R	127.5					127.0					126.3				
	V	0	18.0	4.0	11.0	17.0	0	21.7	4.0	11.0	17.0	0	25.1	4.0	11.0	17.0
Δ P = 3.68 in Hg	U_{Rs}	110.3	119.3	112.3	115.8	118.8	109.9	120.8	111.9	115.4	118.4	109.3	121.9	111.3	114.8	117.8
	H_R	27.7	32.4	28.7	30.6	32.2	37.2	44.9	38.5	41.0	43.1	46.9	58.3	48.7	51.2	54.5
Marco, Florida	T_R	11.0	11.9	11.2	11.5	11.8	13.0	14.3	13.3	13.7	14.0	14.9	16.6	15.1	15.6	16.0
4				Small R = 5					Medium R = 10					Large R = 18		
Lat ϕ = 27°	U_R	124.1					123.5					122.5				
	V	0	18.9	4.0	11.0	18.0	0	22.7	4.0	11.0	18.0	0	26.1	4.0	11.0	18.0
Δ P = 3.50 in Hg	U_{Rs}	107.3	116.8	109.3	112.8	116.3	106.8	118.2	108.8	112.3	115.8	106.0	119.1	108.0	111.5	115.0
	H_R	29.6	35.0	30.7	32.7	34.8	39.6	48.5	41.1	43.8	46.6	49.1	61.9	51.0	54.4	57.8
Lemon Bay, Florida	T_R	11.5	12.5	11.7	12.1	12.4	13.6	15.0	13.8	14.3	14.7	15.3	17.2	15.6	16.1	16.6
5				Small R = 6					Medium R = 12					Large R = 21		
Lat ϕ = 28°	U_R	121.0					120.3					119.1				
	V	0	19.6	4.0	11.0	19.0	0	23.6	4.0	11.0	19.0	0	26.5	4.0	11.0	19.0
Δ P = 3.34 in Hg	U_{Rs}	104.7	114.5	108.7	110.2	114.2	104.0	115.8	106.0	109.5	113.5	103.1	116.4	105.1	108.6	112.6
	H_R	31.1	37.2	32.3	34.4	37.0	41.6	51.5	43.2	46.1	49.5	49.8	63.5	51.8	55.3	59.5
Ounedin, Florida	T_R	11.8	12.9	12.1	12.5	12.9	14.0	16.6	14.2	14.7	15.3	15.5	17.5	15.8	16.3	16.9
6				Small R = 6					Medium R = 13					Large R = 24		
Lat ϕ = 29°	U_R	118.7					117.8					116.4				
	V	0	19.4	4.0	11.0	20.0	0	23.7	4.0	11.0	20.0	0	26.8	4.0	11.0	20.0
Δ P = 3.22 in Hg	U_{Rs}	102.7	112.4	104.7	108.2	112.7	101.9	113.8	103.9	107.4	111.9	100.7	114.1	102.7	106.2	110.7
	H_R	30.4	36.4	31.6	33.7	* *	41.6	51.9	43.3	46.2	50.2	50.5	64.9	52.5	56.2	61.0
Yankeetown, Florida	T_R	11.7	12.8	12.0	12.4	* *	14.0	15.7	14.3	14.8	15.4	15.6	17.7	15.9	16.5	17.2
7				Small R = 7					Medium R = 14					Large R = 26		
Lat ϕ = 30°	U_R	116.8					115.9					114.3				
	V	0	20.1	4.0	11.0	21.0	0	23.8	4.0	11.0	21.0	0	27.0	4.0	11.0	21.0
Δ P = 3.13 in Hg	U_{Rs}	101.0	111.1	103.0	105.5	111.5	100.2	112.1	102.2	105.7	110.7	98.8	113.3	100.8	104.3	109.3
	H_R	31.9	38.5	33.1	35.4		41.7	52.2	43.4	46.4	50.9	50.5	65.3	52.6	56.3	62.0
	T_R	12.1	13.3	12.3	12.7		14.1	15.7	14.3	14.8	15.5	15.7	17.8	16.0	16.5	17.3
Carbur, Florida																

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE IV - B
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR GULF COAST U.S. ZONE B

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 7					Medium R = 14					Large R = 27				
Lat ϕ = 30°	U_R	115.8					114.9					113.2				
	V	0	20.2	4.0	11.0	28.0	0	24.0	4.0	11.0	28.0	0	27.3	4.0	11.0	28.0
Δ P = 3.08 in Hg	U_{Rs}	102.5	112.6	104.5	108.0	116.5	101.7	113.7	103.7	107.2	115.7	100.2	113.9	102.2	105.7	114.2
Apalachicola, Florida	H_R	32.3	39.0	33.6	35.9	* *	42.3	52.8	43.9	46.9	* *	51.8	66.9	53.9	57.6	* *
	T_R	12.1	13.3	12.4	12.8	* *	14.1	15.8	14.4	14.9	* *	15.9	18.0	16.2	16.7	* *
2		Small R = 7					Medium R = 14					Large R = 28				
Lat ϕ = 30°	U_R	115.3					114.3					112.5				
	V	0	20.2	4.0	11.0	28.0	0	23.9	4.0	11.0	28.0	0	27.4	4.0	11.0	28.0
Δ P = 3.05 in Hg	U_{Rs}	102.0	112.1	104.0	107.5	116.0	101.2	113.2	103.2	106.7	115.2	99.6	113.3	101.6	105.1	113.6
Grayton Beach, Florida	H_R	32.1	38.8	33.4	35.7	* *	42.0	52.5	43.7	46.7	* *	52.0	67.3	54.1	57.9	* *
	T_R	12.1	13.3	12.4	12.8	* *	14.1	15.8	14.4	14.9	* *	15.9	18.1	16.2	16.8	* *
3		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 30°	U_R	114.7					113.8					111.8				
	V	0	20.1	4.0	11.0	28.0	0	23.8	4.0	11.0	28.0	0	27.6	4.0	11.0	28.0
Δ P = 3.02 in Hg	U_{Rs}	101.5	111.6	103.5	107.0	115.5	100.7	112.6	102.7	106.2	114.7	98.9	113.7	100.9	104.4	112.9
Pensacola, Florida	H_R	32.0	38.6	33.3	35.5	* *	41.8	52.2	43.4	46.5	* *	52.2	67.8	54.4	58.2	* *
	T_R	12.1	13.3	12.3	12.7	* *	14.1	15.7	14.3	14.8	* *	15.9	18.2	16.3	16.8	* *
4		Small R = 7					Medium R = 14					Large R = 30				
Lat ϕ = 30°	U_R	114.7					113.8					111.7				
	V	0	20.1	4.0	11.0	28.0	0	23.8	4.0	11.0	28.0	0	27.7	4.0	11.0	28.0
Δ P = 3.02 in Hg	U_{Rs}	101.5	111.6	103.5	107.0	115.5	100.7	112.6	102.7	106.2	114.7	98.8	113.7	100.8	103.3	112.8
Mobile, Alabama	H_R	32.0	38.6	32.3	35.5	* *	41.8	52.2	43.4	46.5	* *	52.8	68.6	54.9	58.8	* *
	T_R	12.1	13.3	12.3	12.7	* *	14.1	15.7	14.3	14.8	* *	16.1	18.3	16.4	16.9	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE IV - B
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR GULF COAST U.S. ZONE B

(CONTINUED)

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
5		Small R = 7					Medium R = 14					Large R = 30				
Lat ϕ = 30°	U_R	114.7					113.8					111.7				
	V	0	20.1	4.0	11.0	28.0	0	23.8	4.0	11.0	28.0	0	27.7	4.0	11.0	28.0
Δ P = 3.02 in Hg	U_{Rs}	101.5	112.6	103.5	107.0	115.5	100.7	112.6	102.7	106.2	114.7	98.8	112.7	100.8	104.3	112.8
New Orleans, Florida	H_R	32.0	38.6	33.3	35.5	* *	41.8	52.2	43.4	46.5	* *	52.8	68.6	54.9	58.8	* *
	T_R	12.1	13.3	12.3	12.7	* *	14.1	15.7	14.3	14.8	* *	16.1	18.3	16.4	16.9	* *
6		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 30°	U_R	115.1					114.1	23.9	4.0	11.0		112.2				
	V	0	20.2	4.0	11.0	28.0	0				28.0		27.6	4.0	11.0	28.0
Δ P = 3.04 in Hg	U_{Rs}	101.8	111.9	103.8	107.3	115.8	101.0	113.0	103.0	106.5	115.0	99.3	113.2	101.4	104.9	113.4
Lake Barre, Louisiana	H_R	32.1	38.8	33.4	35.7	* *	41.9	52.4	43.6	46.6	* *	52.5	68.1	54.6	58.4	* *
	T_R	12.1	13.3	12.3	12.8	* *	14.1	15.8	14.4	14.9	* *	16.0	18.2	16.3	16.9	* *
7		Small R = 7					Medium R = 14					Large R = 29				
Lat ϕ = 30°	U_R	115.4					114.5					112.6				
	V	0	20.2	4.0	11.0	28.0	0	23.9	4.0	11.0	28.0	0	27.6	4.0	11.0	28.0
Δ P = 3.06 in Hg	U_{Rs}	102.2	112.3	104.2	107.7	116.2	101.4	113.4	103.4	106.9	115.4	99.6	113.4	101.6	105.1	113.6
March Island, Louisiana	H_R	32.2	38.9	33.5	35.8	* *	42.1	52.6	43.8	46.8	* *	52.7	68.3	54.8	58.6	* *
	T_R	12.1	13.3	12.4	12.8	* *	14.1	15.8	14.4	14.9	* *	16.0	18.2	16.3	16.9	* *
8		Small R = 7					Medium R = 14					Large R = 28				
Lat ϕ = 30°	U_R	116.2					115.3					113.4				
	V	0	20.2	4.0	11.0	28.0	0	24.0	4.0	11.0	28.0	0	27.5	4.0	11.0	28.0
Δ P = 3.10 in Hg	U_{Rs}	102.8	112.3	104.2	107.7	116.2	102.0	113.4	103.4	106.9	115.4	100.4	113.4	101.6	105.1	113.6
Grand Chenier, Louisiana	H_R	32.4	39.1	33.7	36.0	* *	42.4	53.0	44.1	47.1	* *	52.5	67.9	54.7	58.5	* *
	T_R	12.2	13.4	12.4	12.8	* *	14.2	15.8	14.4	14.9	* *	16.0	18.2	16.3	16.9	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE IV - C
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR GULF COAST U.S. ZONE C

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1				Small R = 7					Medium R = 14					Large R = 27		
Lat ϕ = 30°	U_R	117.0					116.0					114.3				
Δ P = 3.14 in Hg	V	0	20.1	4.0	11.0	28.0	0	23.9	4.0	11.0	28.0	0	27.2	4.0	11.0	28.0
	U_{RS}	101.2	111.3	103.2	106.7	115.2	100.4	112.4	102.4	105.9	114.4	98.9	112.5	100.9	104.4	112.9
Port Arthur, Texas	H_R	31.9	38.6	33.2	35.5	* *	42.0	52.3	43.4	46.5	* *	51.2	66.2	53.3	57.0	* *
	T_R	12.1	13.3	12.3	12.7	* *	14.1	15.7	14.4	14.8	* *	15.8	18.0	16.1	16.7	* *
2				Small R = 7					Medium R = 14					Large R = 26		
Lat ϕ = 29°	U_R	118.2					117.3					115.8				
Δ P = 3.20 in Hg	V	0	20.2	4.0	11.0	28.0	0	24.0	4.0	11.0	28.0	0	27.2	4.0	11.0	28.0
	U_{RS}	102.2	112.3	104.2	107.7	116.2	101.5	113.5	103.5	107.0	115.5	100.1	113.7	102.1	105.6	114.1
Galveston, Texas	H_R	32.3	39.0	33.6	35.9	* *	42.5	53.1	44.2	47.2	* *	51.5	66.5	53.6	57.3	* *
	T_R	12.1	13.4	12.4	12.8	* *	14.2	15.9	14.5	15.0	* *	15.8	18.0	16.1	16.7	* *
3				Small R = 6					Medium R = 14					Large R = 25		
Lat ϕ = 29°	U_R	119.4					118.4					117.0				
Δ P = 3.26 in Hg	V	0	19.5	4.0	11.0	28.0	0	24.2	4.0	11.0	28.0	0	27.1	4.0	11.0	28.0
	U_{RS}	103.3	113.1	105.1	108.8	117.3	102.4	114.5	104.4	107.9	116.4	101.2	114.8	103.2	106.7	115.2
Bay City, Texas	H_R	30.6	36.6	31.8	33.9	* *	42.9	53.7	44.6	47.7	* *	51.5	66.2	53.6	57.2	* *
	T_R	11.8	12.9	12.0	12.4	* *	14.3	15.9	14.5	15.0	* *	15.8	17.9	16.1	16.7	* *
4				Small R = 6					Medium R = 14					Large R = 24		
Lat ϕ = 28°	U_R	120.8					119.8					118.6				
Δ P = 3.33 in Hg	V	0	19.6	4.0	11.0	28.0	0	24.4	4.0	11.0	28.0	0	27.2	4.0	11.0	28.0
	U_{RS}	104.5	114.3	106.5	110.0	118.5	103.6	115.8	105.6	109.1	117.6	102.6	116.2	104.6	108.1	116.6
San Antonio Bay, Texas	H_R	31.0	37.1	32.2	34.4	* *	43.7	54.6	45.4	48.5	* *	51.8	66.5	53.9	57.6	* *
	T_R	11.8	12.9	12.1	12.5	* *	14.4	16.1	14.7	15.1	* *	15.8	17.9	16.1	16.7	* *
5				Small R = 6					Medium R = 14					Large R = 23		
Lat ϕ = 27°	U_R	122.4					121.4					120.3				
Δ P = 3.41 in Hg	V	0	19.7	4.0	11.0	28.0	0	24.6	4.0	11.0	28.0	0	27.2	4.0	11.0	28.0
	U_{RS}	105.8	114.3	106.5	110.0	118.5	105.0	115.8	105.6	109.1	117.6	104.1	116.2	104.6	108.1	116.6
Sarita, Texas	H_R	31.5	37.7	32.7	34.9	* *	44.6	55.7	46.3	49.4	* *	52.2	66.8	54.3	57.9	* *
	T_R	11.9	13.0	12.1	12.5	* *	14.5	16.2	14.8	15.3	* *	18.9	18.0	16.2	16.7	* *
6				Small R = 6					Medium R = 14					Large R = 20		
Lat ϕ = 26°	U_R	124.1					123.2					122.5				
Δ P = 3.50 in Hg	V	0	19.9	4.0	11.0	28.0	0	24.8	4.0	11.0	28.0	0	26.7	4.0	11.0	28.0
	U_{RS}	107.3	117.3	109.3	112.8	121.3	106.5	119.3	108.5	112.0	120.5	105.9	119.3	107.9	111.4	119.9
Brownsville, Texas	H_R	32.0	38.3	33.3	35.4	* *	45.6	56.8	47.3	50.4	* *	51.1	64.8	53.1	56.6	* *
	T_R	12.0	13.1	12.2	12.6	* *	14.7	16.4	14.9	15.4	* *	15.7	17.6	15.9	16.5	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE V - 1
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR EAST COAST U.S. ZONE 1

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 4					Medium R = 7					Large R = 10				
Lat ϕ = 23°	U_R	122.9					122.6					122.3				
	V	0	17.8	3.0	10.0	16.0	0	20.7	3.0	10.0	16.0	0	22.8	3.0	10.0	16.0
Δ P = 3.42 in Hg	U_{Rs}	106.3	115.2	107.8	111.3	114.3	106.1	116.5	107.6	111.1	114.1	105.8	117.2	107.3	110.8	113.8
	H_R	26.9	31.6	27.6	29.5	31.1	34.1	41.1	35.1	37.4	39.4	39.6	48.6	40.7	43.4	45.8
	T_R	10.9	11.8	11.0	11.4	11.7	12.5	13.7	12.6	13.0	13.4	13.6	15.0	13.8	14.2	14.6
2		Small R = 4					Medium R = 7					Large R = 11				
Lat ϕ = 24°	U_R	121.5					121.1					120.7				
	V	0	17.7	3.0	10.0	17.0	0	20.6	3.0	10.0	17.0	0	23.2	3.0	10.0	17.0
Δ P = 3.34 in Hg	U_{Rs}	105.1	113.9	106.6	110.1	113.6	104.8	115.1	106.3	109.8	113.3	104.4	116.0	105.9	109.4	112.9
	H_R	26.5	31.1	27.2	29.0	30.9	33.5	40.5	34.5	36.8	39.2	40.6	50.1	41.7	44.6	47.4
	T_R	10.8	11.7	10.9	11.3	11.7	12.4	13.6	12.5	13.0	13.4	13.8	15.3	14.0	14.4	14.9
3		Small R = 4					Medium R = 7					Large R = 12				
Lat ϕ = 25°	U_R	119.6					119.3					118.7				
	V	0	17.6	3.0	10.0	17.0	0	20.4	3.0	10.0	17.0	0	23.5	3.0	10.0	17.0
Δ P = 3.24 in Hg	U_{Rs}	103.5	112.3	105.0	108.5	112.0	103.2	113.6	104.7	108.2	111.7	102.7	114.5	104.5	107.7	110.2
	H_R	26.0	30.6	26.7	28.5	30.4	32.9	39.7	33.9	36.2	38.5	41.3	51.3	42.5	45.4	48.4
	T_R	10.7	11.6	10.8	11.2	11.6	12.3	13.5	12.4	12.9	13.3	13.9	15.5	14.1	14.6	15.1
4		Small R = 4					Medium R = 8					Large R = 13				
Lat ϕ = 25.5°	U_R	118.5					118.0					117.5				
	V	0	17.5	3.0	10.0	17.0	0	21.0	3.0	10.0	17.0	0	23.9	3.0	10.0	17.0
Δ P = 3.18 in Hg	U_{Rs}	102.5	111.3	104.0	107.5	111.0	102.1	112.6	103.6	107.1	110.6	101.6	113.6	102.1	106.6	110.1
	H_R	25.7	30.2	26.4	28.2	30.1	34.4	41.9	35.4	37.9	40.4	42.2	52.7	43.4	46.4	49.5
	T_R	10.6	11.5	10.8	11.2	11.5	12.6	13.9	12.8	13.2	13.6	14.1	15.8	14.3	14.8	15.3
5		Small R = 4					Medium R = 8					Large R = 14				
Lat ϕ = 26°	U_R	116.8					116.3					115.6				
	V	0	17.4	4.0	11.0	17.0	0	20.9	4.0	11.0	17.0	0	24.1	4.0	11.0	17.0
Δ P = 3.09 in Hg	U_{Rs}	101.0	109.7	103.0	106.5	109.5	100.6	111.1	102.6	106.1	109.5	100.0	112.1	102.0	105.5	108.5
	H_R	25.2	29.8	26.2	28.1	30.7	33.8	41.2	35.2	37.6	39.8	42.4	53.2	44.1	47.1	49.9
	T_R	10.6	11.5	10.8	11.1	11.5	12.5	13.8	12.7	13.2	13.6	14.2	15.9	14.5	15.0	15.4
6		Small R = 5					Medium R = 10					Large R = 18				
Lat ϕ = 27°	U_R	112.1					111.5					110.6				
	V	0	18.1	4.0	11.0	18.0	0	21.8	4.0	11.0	18.0	0	24.8	4.0	11.0	18.0
Δ P = 2.86 in Hg	U_{Rs}	97.0	106.1	99.0	102.5	106.0	96.5	107.5	98.5	102.0	107.5	95.6	108.0	97.6	101.1	104.6
	H_R	26.5	31.7	27.6	29.6	31.7	35.5	44.0	37.0	39.7	42.5	43.6	55.6	45.4	48.4	52.2
	T_R	10.9	12.0	11.2	11.6	12.0	12.9	14.4	13.2	13.7	14.1	14.5	16.4	14.8	15.3	15.9

TABLE V - 2
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR EAST COAST U.S. ZONE 2

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 6					Medium R = 12					Large R = 25				
Lat ϕ = 28°	U_R	106.5					105.7					104.1				
	V		18.6	4.0	11.0	19.0	0	22.2	4.0	11.0	19.0	0	25.7	4.0	11.0	19.0
Δ P = 2.59 in Hg	U_{Rs}	92.1	101.4	94.1	77.6	101.6	91.4	102.5	93.4	96.9	90.9	90.1	103.0	92.1	95.6	99.0
	H_R	27.1	32.8	28.3	30.4	* *	35.9	45.1	37.5	40.3	43.7	45.2	59.0	47.2	50.8	55.2
	T_R	11.1	12.3	11.4	11.8	* *	13.1	14.7	13.4	13.9	14.4	14.9	17.0	15.2	15.8	16.4
2		Small R = 7					Medium R = 15					Large R = 32				
Lat ϕ = 29°	U_R	102.7					101.6					99.5				
	V	0	19.1	4.0	11.0	20.0	0	22.8	4.0	11.0	20.0	0	26.0	4.0	11.0	20.0
Δ P = 2.42 in Hg	U_{Rs}	88.8	98.4	90.8	95.5	98.8	87.9	99.2	89.9	92.4	97.9	86.0	99.0	88.0	91.5	96.0
	H_R	27.8	34.1	29.1	31.4	* *	36.8	47.0	38.5	41.6	45.7	46.2	61.5	48.4	52.3	57.6
	T_R	11.4	12.6	11.6	12.1	* *	13.3	15.0	13.6	14.2	14.8	15.1	17.4	15.5	16.1	16.9
3		Small R = 7					Medium R = 17					Large R = 38				
Lat ϕ = 30.5°	U_R	100.0					98.7					95.9				
	V	0	18.8	4.0	11.0	21.0	0	23.0	4.0	11.0	21.0	0	26.7	4.0	11.0	21.0
Δ P = 2.42 in Hg	U_{Rs}	86.5	95.9	88.5	92.0	97.0	85.3	96.8	87.3	90.8	95.8	83.0	96.4	85.0	88.5	93.5
	H_R	27.0	33.2	28.2	30.5	* *	36.9	47.6	38.7	41.9	46.6	46.2	62.3	48.5	52.5	58.7
	T_R	11.2	12.4	11.5	11.9	* *	13.4	15.2	13.7	14.2	15.0	15.2	17.6	15.5	16.2	17.1
4		Small R = 7					Medium R = 17					Large R = 38				
Lat ϕ = 30°	U_R	99.2					97.9					95.1				
	V	0	18.8	4.0	11.0	22.0	0	22.9	4.0	11.0	22.0	0	26.5	4.0	11.0	22.0
Δ P = 2.3 in Hg	U_{Rs}	85.8	95.2	87.8	90.3	96.9	84.7	96.2	86.7	90.2	95.7	82.2	95.5	84.2	87.7	93.2
	H_R	26.8	32.9	28.0	30.3	* *	36.5	47.1	38.3	41.4	46.7	45.6	61.5	47.9	51.9	58.7
	T_R	11.2	12.4	11.4	11.9	* *	13.3	15.1	13.6	14.2	15.0	15.1	17.5	15.4	16.1	17.1
5		Small R = 7					Medium R = 18					Large R = 40				
Lat ϕ = 31°	U_R	98.9					97.4					94.4				
	V	0	18.8	4.0	11.0	23.0	0	23.1	4.0	11.0	23.0	0	26.6	4.0	11.0	23.0
Δ P = 2.26 in Hg	U_{Rs}	85.5	94.9	87.5	91.0	79.0	84.2	95.8	86.2	89.7	95.7	81.7	95.0	83.7	87.2	93.2
	H_R	26.7	32.8	27.9	30.2	* *	37.0	47.8	38.8	42.0	47.8	45.8	62.0	48.1	52.2	59.6
	T_R	11.2	12.4	11.4	11.9	* *	13.4	15.3	13.7	14.3	15.2	15.1	17.6	15.5	16.1	17.2
6		Small R = 7					Medium R = 18					Large R = 40				
Lat ϕ = 32°	U_R	98.6					97.1					94.0				
	V	0	18.7	4.0	12.0	26.0		23.0	4.0	12.0	26.0	0	26.5	4.0	12.0	26.0
Δ P = 2.26 in Hg	U_{Rs}	85.3	94.7	87.2	91.3	98.3	84.0	95.5	86.0	90.0	97.0	81.4	94.7	83.4	87.4	94.4
	H_R	26.6	32.8	27.9	30.5	* *	36.8	47.5	38.5	42.2	* *	45.4	61.4	47.7	52.4	61.1
	T_R	11.1	12.4	11.4	11.9	* *	13.4	15.2	13.7	14.3	* *	15.0	17.5	15.4	16.2	17.5

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE V - 3
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR EAST COAST U.S. ZONE 3

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 7					Medium R = 18					Large R = 14				
Lat ϕ = 33°	U_R	98.6					97.1					93.9				
ΔP = 2.27 in Hg	V	0	18.7	4.0	13.0	30.0	0	23.0	4.0	13.0	30.0	0	26.4	4.0	13.0	30.0
	U_{Rs}	85.3	94.7	87.3	91.8	95.3	84.0	95.5	86.0	90.5	99.0	81.2	94.6	83.2	87.7	91.7
	H_R	26.6	32.8	27.9	30.8	* *	36.6	47.4	38.4	42.5	* *	45.2	61.1	47.4	52.7	* *
	T_R	11.1	12.4	11.4	12.0	* *	13.3	15.2	13.7	14.4	* *	15.0	17.4	15.4	16.2	* *
2		Small R = 7					Medium R = 17					Large R = 37				
Lat ϕ = 34°	U_R	99.5					98.0					95.1				
ΔP = 2.32 in Hg	V	0	18.8	5.0	15.0	34.0	0	22.8	5.0	15.0	34.0	0	26.2	5.0	15.0	34.0
	U_{Rs}	86.1	95.5	88.6	93.6	103.1	84.8	96.2	87.3	92.3	101.8	82.3	95.4	84.8	89.8	99.3
	H_R	26.8	33.0	28.4	31.7	* *	36.3	46.7	38.5	43.0	* *	44.7	60.0	47.4	53.2	* *
	T_R	11.2	12.4	11.5	12.2	* *	13.3	15.0	13.7	14.4	* *	14.9	17.3	15.4	16.3	* *
3		Small R = 7					Medium R = 17					Large R = 35				
Lat ϕ = 35°	U_R	99.9					98.4					96.7				
ΔP = 2.36 in Hg	V	0	18.9	5.0	17.0	38.0	0	22.8	5.0	17.0	38.0	0	26.0	5.0	17.0	38.0
	U_{Rs}	86.4	95.4	88.9	94.9	105.4	85.1	96.5	87.6	93.6	104.1	82.8	95.8	85.3	91.3	101.8
	H_R	27.0	33.3	28.6	32.6	* *	36.4	46.9	38.6	44.1	* *	44.3	59.2	47.0	53.8	* *
	T_R	11.2	12.5	11.6	12.3	* *	13.3	15.1	13.7	14.6	* *	14.8	17.1	15.3	16.3	* *
4		Small R = 7					Medium R = 17					Large R = 34				
Lat ϕ = 35.5°	U_R	99.9					98.3					95.8				
ΔP = 2.37 in Hg	V	0	18.9	5.0	18.0	40.0	0	22.8	5.0	18.0	40.0	0	25.8	5.0	18.0	40.0
	U_{Rs}	86.4	95.9	88.9	95.4	106.4	85.1	96.5	87.6	94.1	105.1	82.8	105.7	85.3	91.8	102.8
	H_R	27.1	33.3	28.7	33.0	* *	36.4	46.9	38.6	44.5	* *	43.9	58.7	46.6	54.0	* *
	T_R	11.2	12.5	11.6	12.4	* *	13.3	15.1	13.7	14.7	* *	14.8	17.1	15.2	16.4	* *
5		Small R = 7					Medium R = 17					Large R = 34				
Lat ϕ = 36°	U_R	99.6					98.1					95.5				
ΔP = 2.37 in Hg	V	0	18.9	6.0	20.0	42.0	0	22.8	6.0	20.0	42.0	0	25.8	6.0	20.0	42.0
	U_{Rs}	86.2	95.7	89.3	96.2	107.2	84.8	96.2	87.8	94.8	104.8	82.6	95.5	85.6	92.6	103.8
	H_R	27.0	33.3	28.9	* *	* *	36.3	46.7	38.9	45.4	* *	43.7	58.5	47.0	55.0	* *
	T_R	11.2	12.5	11.6	* *	* *	13.3	15.1	13.7	14.8	* *	14.7	17.0	15.3	16.5	* *
6		Small R = 7					Medium R = 17					Large R = 35				
Lat ϕ = 37°	U_R	98.7					97.2					94.3				
ΔP = 2.35 in Hg	V	0	18.8	7.0	22.0	45.0	0	22.7	7.0	22.0	45.0	0	25.8	7.0	22.0	45.0
	U_{Rs}	85.4	94.8	88.9	96.4	107.9	84.0	95.4	87.5	95.0	105.9	81.6	104.5	85.1	92.6	104.1
	H_R	26.8	33.1	29.1	* *	* *	35.9	46.3	39.0	46.0	* *	43.4	58.2	47.2	55.9	* *
	T_R	11.2	12.4	11.7	* *	* *	13.2	15.0	13.8	14.9	* *	14.7	17.0	15.3	16.7	* *

* *FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE V - 4
DEEP WATER WAVES
STANDARD PROJECT HURRICANES FOR EAST COAST U.S. ZONE 4

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 7					Medium R = 18					Large R = 37				
Lat ϕ = 38°	U_R	97.6					95.8					92.7				
ΔP = 2.32 in Hg	V	0	18.8	9.0	25.0	47.0	0	22.8	9.0	25.0	47.0	0	25.8	9.0	25.0	47.0
	U_{Rs}	84.4	93.8	88.9	96.9	107.9	82.9	94.3	97.4	95.3	106.4	80.2	93.1	84.7	92.7	103.5
	H_R	26.6	32.8	29.5	* *	* *	36.1	46.7	40.1	* *	* *	43.2	58.3	48.2	* *	* *
	T_R	11.2	12.4	11.8	* *	* *	13.3	15.1	14.0	* *	* *	14.7	17.0	15.5	* *	* *
2		Small R = 7					Medium R = 19					Large R = 39				
Lat ϕ = 39°	U_R	95.9					93.9					90.6				
ΔP = 2.27 in Hg	V	0	18.7	11.0	27.0	49.0	0	22.9	11.0	27.0	49.0	0	25.8	11.0	27.0	49.0
	U_{Rs}	82.9	92.3	98.4	96.4	107.4	81.2	92.7	86.7	94.7	106.7	78.4	101.3	83.9	91.9	102.9
	H_R	26.2	32.5	29.8	* *	* *	36.0	46.8	41.0	* *	* *	42.7	57.9	48.9	* *	* *
	T_R	11.1	12.3	11.8	* *	* *	13.3	15.1	14.2	* *	* *	14.6	17.0	15.6	* *	* *
3		Small R = 8					Medium R = 21					Large R = 43				
Lat ϕ = 40°	U_R	93.8					91.6					87.9				
ΔP = 2.21 in Hg	V	0	19.1	14.0	32.0	50.0	0	23.2	14.0	32.0	50.0	0	25.8	14.0	32.0	50.0
	U_{Rs}	81.2	90.8	88.2	79.2	106.2	79.3	90.9	86.3	95.3	104.3	76.0	88.9	83.0	92.0	101.0
	H_R	26.9	33.7	31.8	* *	* *	36.2	47.6	42.9	* *	* *	42.4	58.0	50.5	* *	* *
	T_R	11.3	12.6	12.3	* *	* *	13.3	15.3	14.5	* *	* *	14.6	17.0	15.9	* *	* *
4		Small R = 8					Medium R = 22					Large R = 45				
Lat ϕ = 40.5°	U_R	92.9					90.5					86.6				
ΔP = 2.18 in Hg	V	0	19.1	14.0	33.0	51.0	0	23.3	14.0	33.0	51.0	0	25.8	14.0	33.0	51.0
	U_{Rs}	80.3	89.9	87.3	96.8	105.8	78.3	90.0	85.3	94.8	103.8	74.9	87.8	81.9	91.4	100.4
	H_R	26.7	33.4	31.5	* *	* *	36.3	47.9	43.1	* *	* *	42.2	57.9	50.4	* *	* *
	T_R	11.2	12.6	12.2	* *	* *	13.4	15.4	14.6	* *	* *	14.5	17.1	15.9	* *	* *
5		Small R = 8					Medium R = 24					Large R = 48				
Lat ϕ = 41°	U_R	91.7					88.9					84.8				
ΔP = 2.14 in Hg	V	0	19.0	15.0	34.0	51.0	0	23.4	15.0	34.0	51.0	0	25.9	15.0	34.0	51.0
	U_{Rs}	79.3	88.8	86.8	96.3	104.8	76.9	88.6	84.4	93.9	102.0	73.4	86.4	78.9	90.4	98.9
	H_R	26.3	33.0	31.5	* *	* *	36.5	48.4	43.9	* *	* *	41.9	58.0	50.9	* *	* *
	T_R	11.2	12.5	12.2	* *	* *	13.4	15.5	14.7	* *	* *	14.5	17.1	16.0	* *	* *
6		Small R = 8					Medium R = 27					Large R = 52				
Lat ϕ = 42°	U_R	89.6					86.2					81.9				
ΔP = 2.07 in Hg	V	0	18.8	16.0	36.0	52.0	0	23.6	16.0	36.0	52.0	0	25.8	16.0	36.0	52.0
	U_{Rs}	77.5	86.9	85.5	95.5	103.5	74.6	86.4	82.6	92.6	100.6	70.8	81.7	76.8	86.8	96.8
	H_R	25.7	32.3	31.3	* *	* *	36.4	48.9	44.6	* *	* *	41.1	57.4	50.9	* *	* *
	T_R	11.1	12.4	12.2	* *	* *	13.4	15.6	14.9	* *	* *	14.4	17.0	16.0	* *	* *
7		Small R = 9					Medium R = 31					Large R = 57				
Lat ϕ = 43°	U_R	87.0					83.1					78.5				
ΔP = 1.99 in Hg	V	0	19.0	17.0	37.0	52.0	0	23.8	17.0	37.0	52.0	0	25.6	17.0	37.0	52.0
	U_{Rs}	75.3	84.8	83.8	93.8	101.3	71.9	83.8	80.4	90.4	97.9	67.9	80.7	76.4	86.4	93.9
	H_R	25.9	32.9	32.1	* *	* *	36.3	49.3	45.4	* *	* *	40.0	56.4	50.6	* *	* *
	T_R	11.2	12.6	12.4	* *	* *	13.5	15.7	15.1	* *	* *	14.2	16.9	16.0	* *	* *

* *FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE VI - 1
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR EAST COAST U.S. ZONE 1

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 4					Medium R = 7					Large R = 10				
Lat ϕ = 23°	U_R	132.6					132.3					132.0				
ΔP = 3.98 in Hg	V	0	18.4	3.0	10.0	16.0	0	21.4	3.0	10.0	16.0	0	23.5	3.0	10.0	16.0
	U_{RS}	114.7	123.9	116.2	119.7	122.7	114.5	125.2	116.0	119.5	122.5	114.2	126.0	115.7	119.2	122.2
	H_R	29.2	34.0	29.9	31.8	33.4	37.0	44.2	38.0	40.3	42.3	43.0	52.3	44.1	46.8	49.2
	T_R	11.3	12.2	11.4	11.7	12.0	12.9	14.1	13.1	13.5	13.8	14.1	15.5	14.3	14.7	15.1
2		Small R = 4					Medium R = 7					Large R = 11				
Lat ϕ = 24°	U_R	132.5					132.1					131.7				
ΔP = 3.97 in Hg	V	0	18.4	3.0	10.0	17.0	0	21.3	3.0	10.0	17.0	0	24.1	3.0	10.0	17.0
	U_{RS}	114.6	123.8	116.1	119.6	123.1	114.3	125.0	115.8	119.3	122.8	113.9	126.0	115.4	118.9	122.4
	H_R	29.0	33.9	29.8	31.6	33.5	36.8	44.0	37.8	40.1	42.5	44.5	54.4	45.7	48.5	51.4
	T_R	11.2	12.1	11.4	11.7	12.1	12.9	14.1	13.0	13.4	13.8	14.4	15.9	14.6	15.0	15.4
3		Small R = 4					Medium R = 7					Large R = 12				
Lat ϕ = 25°	U_R	130.9					130.6					130.0				
ΔP = 3.88 in Hg	V	0	18.3	3.0	10.0	17.0	0	21.2	3.0	10.0	17.0	0	24.5	3.0	10.0	17.0
	U_{RS}	113.3	123.8	114.8	118.3	121.8	113.0	223.6	114.6	118.0	121.5	112.5	124.8	114.0	117.5	121.0
	H_R	28.6	33.4	29.4	31.2	33.0	36.3	43.4	37.2	39.5	41.9	45.5	55.9	46.7	49.6	52.6
	T_R	11.2	12.1	11.3	11.6	12.0	12.8	14.0	13.0	13.4	13.8	14.6	16.1	14.8	15.2	15.7
4		Small R = 4					Medium R = 8					Large R = 12				
Lat ϕ = 25.5°	U_R	130.4					130.0					129.4				
ΔP = 3.85 in Hg	V	0	18.2	3.0	10.0	17.0	0	21.9	3.0	10.0	17.0	0	24.9	3.0	10.0	17.0
	U_{RS}	112.8	121.9	114.3	117.8	121.3	112.4	123.4	113.9	117.4	120.9	111.9	124.4	113.4	116.9	120.4
	H_R	28.4	33.2	29.2	31.0	32.9	38.1	45.9	39.2	41.6	44.1	46.8	57.8	48.0	51.0	54.1
	T_R	11.1	12.0	11.3	11.6	12.0	13.2	14.5	13.4	13.8	14.2	14.8	16.4	15.0	15.5	15.9
5		Small R = 4					Medium R = 8					Large R = 14				
Lat ϕ = 26°	U_R	129.7					129.3					128.5				
ΔP = 3.81 in Hg	V	0	18.2	4.0	11.0	17.0	0	21.8	4.0	11.0	17.0	0	25.3	4.0	11.0	17.0
	U_{RS}	112.2	121.3	114.2	117.7	120.7	111.8	122.7	113.8	117.3	120.3	111.2	123.9	113.2	116.7	119.7
	H_R	28.2	33.0	29.3	31.1	32.7	37.9	45.6	39.2	41.7	43.9	47.9	59.4	49.6	52.7	55.5
	T_R	11.1	12.0	11.3	11.6	11.9	13.1	14.4	13.4	13.8	14.1	15.0	16.7	15.3	15.8	16.2
6		Small R = 5					Medium R = 10					Large R = 18				
Lat ϕ = 27°	U_R	127.6					127.0					126.1				
ΔP = 3.7 in Hg	V	0	19.1	4.0	11.0	16.0	0	23.0	4.0	11.0	16.0	0	26.4	4.0	11.0	16.0
	U_{RS}	110.4	120.0	112.4	115.9	118.4	109.9	121.4	111.9	115.4	117.9	109.0	122.2	111.0	114.5	117.0
	H_R	30.5	36.0	31.6	33.6	35.1	40.8	50.0	42.3	45.0	47.0	50.8	63.8	52.6	56.0	58.5
	T_R	11.6	12.6	11.8	12.2	12.5	13.7	15.2	14.0	14.4	14.7	15.5	17.4	15.8	16.3	16.7

TABLE VI - 2
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR EAST COAST U.S. ZONE 2

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 6					Medium R = 12					Large R = 25				
Lat ϕ = 28°	U_R	124.6					123.8					122.2				
ΔP = 3.54 in Hg	V	0	19.9	4.0	11.0	19.0	0	23.9	4.0	11.0	19.0	0	27.8	4.0	11.0	19.0
	U_{RS}	107.8	117.8	109.8	113.3	117.3	107.1	119.1	109.1	112.6	115.6	105.7	119.6	109.7	111.2	115.2
	H_R	32.1	38.3	33.3	35.4	38.0	42.9	53.0	44.5	47.4	50.9	54.5	69.7	56.5	60.3	64.7
	T_R	12.0	13.1	12.2	12.6	13.1	14.2	15.8	14.4	14.9	15.4	15.2	18.4	16.5	17.1	17.7
2		Small R = 7					Medium R = 15					Large R = 32				
Lat ϕ = 29°	U_R	122.0					121.0					118.8				
ΔP = 3.41 in Hg	V	0	20.5	4.0	11.0	20.0	0	24.8	4.0	11.0	20.0	0	28.8	4.0	11.0	20.0
	U_{RS}	106.0	116.3	108.0	111.5	116.0	104.7	117.1	104.7	110.2	114.7	102.8	117.2	106.8	108.3	112.8
	H_R	33.5	40.3	34.7	37.0	40.1	45.1	56.4	46.8	50.0	54.1	56.9	74.0	59.2	63.2	68.5
	T_R	12.3	13.5	12.6	13.0	13.5	14.6	16.4	14.9	15.4	16.0	16.7	19.0	17.0	17.6	18.3
3		Small R = 7					Medium R = 17					Large R = 38				
Lat ϕ = 30°	U_R	119.6					118.2					115.5				
ΔP = 3.28 in Hg	V	0	20.3	4.0	11.0	21.0	0	25.1	4.0	11.0	21.0	0	29.3	4.0	11.0	21.0
	U_{RS}	103.4	113.6	105.4	108.9	119.4	102.3	124.9	104.3	107.8	112.8	99.9	114.6	101.9	105.4	110.4
	H_R	32.7	39.4	34.0	36.2	* *	45.6	57.5	47.4	50.6	55.4	58.0	76.3	60.3	64.6	70.8
	T_R	12.2	13.4	12.4	12.9	* *	14.8	16.6	15.0	15.5	16.3	16.9	19.4	17.2	17.8	18.7
4		Small R = 7					Medium R = 17					Large R = 38				
Lat ϕ = 30.5°	U_R	118.7					117.4					114.6				
ΔP = 3.24 in Hg	V	0	20.2	4.0	11.0	22.0	0	25.0	4.0	11.0	22.0	0	29.2	4.0	11.0	22.0
	U_{RS}	102.7	110.8	104.7	108.2	113.7	101.5	114.0	103.5	107.0	112.5	99.1	113.7	101.1	104.6	110.1
	H_R	32.4	39.1	33.7	36.0	* *	45.1	56.9	46.9	50.2	55.4	57.4	75.5	59.7	63.9	70.8
	T_R	12.2	13.4	12.4	12.8	* *	14.7	16.5	15.0	15.5	16.3	16.8	19.3	17.1	17.7	18.7
5		Small R = 7					Medium R = 18					Large R = 40				
Lat ϕ = 31°	U_R	117.8					116.3					113.4				
ΔP = 3.2 in Hg	V	0	20.2	4.0	11.0	23.0	0	25.2	4.0	11.0	23.0	0	29.2	4.0	11.0	23.0
	U_{RS}	101.9	112.0	103.9	107.4	113.4	100.6	113.2	102.6	106.1	112.1	98.1	112.7	100.1	103.6	109.6
	H_R	32.2	38.9	33.4	35.7	* *	45.5	57.6	47.3	50.6	56.5	57.2	75.5	59.5	63.8	71.4
	T_R	12.1	13.3	12.4	12.8	* *	14.8	16.6	15.1	15.6	16.4	16.8	19.3	17.1	17.7	18.8
6		Small R = 7					Medium R = 18					Large R = 40				
Lat ϕ = 32°	U_R	116.4					114.9					111.9				
ΔP = 3.14 in Hg	V	0	20.1	4.0	12.0	26.0	0	25.0	4.0	12.0	26.0	0	29.0	4.0	12.0	26.0
	U_{RS}	100.7	110.8	102.7	106.7	113.7	99.4	111.9	103.4	105.4	112.4	96.8	111.3	98.8	102.8	109.8
	H_R	31.8	38.4	33.0	35.7	* *	44.7	56.7	46.5	50.3	* *	56.0	74.1	58.4	63.2	72.1
	T_R	12.1	13.3	12.3	12.8	* *	14.6	16.5	14.9	15.5	* *	16.6	19.1	17.0	17.7	18.9

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE VI - 3
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR EAST COAST U.S. ZONE 3

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1				*Small* R = 7					*Medium* R = 18					Large R = 40		
Lat ϕ = 33°	U_R	115.4					113.9					110.7				
	V	0	20.0	4.0	13.0	30.0	0	24.8	4.0	13.0	30.0	0	28.7	4.0	13.0	30.0
Δ P = 3.1 in Hg	U_{Rs}	99.9	109.9	101.9	106.4	114.9	98.5	110.9	100.5	115.0	113.5	95.8	110.2	97.8	102.3	110.8
	H_R	31.5	38.1	32.7	35.7	* *	44.1	56.0	45.9	50.1	* *	55.1	72.9	57.5	62.9	* *
	T_R	12.0	13.2	12.2	12.8	* *	14.5	16.4	14.8	15.5	* *	16.5	19.0	16.8	17.6	* *
2				Small R = 7					Medium R = 17					Large R = 37		
Lat ϕ = 34°	U_R	114.4					113.0					110.0				
	V	0	19.9	5.0	15.0	34.0	0	24.4	5.0	15.0	34.0	0	28.2	5.0	15.0	34.0
Δ P = 3.1 in Hg	U_{Rs}	99.0	109.0	101.5	106.5	116.0	97.7	109.9	100.2	105.2	114.7	95.2	109.1	97.7	102.7	112.2
	H_R	31.2	37.8	32.8	36.1	* *	42.8	54.1	45.0	49.6	* *	53.3	70.3	56.2	62.1	* *
	T_R	12.0	13.2	12.3	12.9	* *	14.3	16.1	14.7	15.4	* *	16.2	18.6	16.6	17.5	* *
3				Small R = 7					Medium R = 17					Large R = 35		
Lat ϕ = 35°	U_R	113.3					111.8					109.1				
	V	0	19.9	5.0	17.0	38.0	0	24.3	5.0	17.0	38.0	0	27.8	5.0	17.0	38.0
Δ P = 3.03 in Hg	U_{Rs}	98.0	108.0	100.5	106.5	117.0	96.7	108.9	109.2	105.2	115.7	94.4	107.7	96.4	102.9	113.9
	H_R	30.9	37.5	32.5	36.5	* *	42.3	53.6	44.5	50.1	* *	51.9	68.3	54.7	61.7	* *
	T_R	11.9	13.1	12.2	13.0	* *	14.2	16.0	14.6	15.5	* *	16.0	18.3	16.4	17.4	* *
4				Small R = 7					Medium R = 17					Large R = 34		
Lat ϕ = 35.5°	U_R	112.7					111.2					108.6				
	V	0	19.9	5.0	18.0	40.0	0	24.2	5.0	18.0	40.0	0	27.5	5.0	18.0	40.0
Δ P = 3.01 in Hg	U_{Rs}	97.5	107.5	100.0	106.5	117.5	96.2	108.3	98.7	104.2	116.2	93.9	107.7	96.4	102.9	113.9
	H_R	30.8	37.4	32.4	36.7	* *	42.0	53.6	44.2	50.3	* *	51.1	67.2	53.9	61.4	* *
	T_R	11.9	13.1	12.2	13.0	* *	14.2	16.0	14.6	15.5	* *	15.9	18.2	16.3	17.4	* *
5				Small R = 7					Medium R = 17					Large R = 34		
Lat ϕ = 36°	U_R	112.0					110.5					107.9				
	V	0	19.8	6.0	20.0	42.0	0	24.1	6.0	20.0	42.0	0	27.4	6.0	20.0	42.0
Δ P = 2.99 in Hg	U_{Rs}	96.9	106.8	99.9	106.8	117.9	95.6	107.7	98.6	105.6	116.6	93.3	107.0	96.3	103.3	114.3
	H_R	30.6	37.2	32.6	* *	* *	41.7	52.9	44.4	50.9	* *	50.7	66.7	54.0	62.2	* *
	T_R	11.9	13.1	12.2	* *	* *	14.1	15.9	14.6	15.6	* *	15.8	18.1	16.3	17.5	* *
6				*Small* R = 7					*Medium* R = 17					*Large* R = 35		
Lat ϕ = 37°	U_R	110.8					109.2					106.3				
	V	0	19.8	7.0	22.0	45.0	0	24.0	7.0	22.0	45.0	0	27.4	7.0	22.0	45.0
Δ P = 2.95 in Hg	U_{Rs}	95.8	105.7	99.3	10.8	119.3	94.4	106.4	97.9	104.4	116.9	92.0	105.7	95.5	103.0	114.5
	H_R	30.4	36.9	32.6	* *	* *	41.2	52.3	44.3	51.3	* *	50.2	66.3	54.1	63.0	* *
	T_R	11.8	13.0	12.3	* *	* *	14.1	15.9	14.6	15.7	* *	15.7	18.1	16.3	17.6	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE VI - 4
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR EAST COAST U.S. ZONE 4

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
1		Small R = 7					Medium R = 18					Large R = 37				
Lat ϕ = 38°	U_R	109.0					107.3					104.2				
Δ P = 2.89 in Hg	V	0	19.7	9.0	25.0	47.0	0	24.1	9.0	25.0	47.0	0	27.4	9.0	25.0	47.0
	U_{RS}	94.3	104.1	98.8	106.8	117.8	92.8	104.9	97.3	105.3	116.3	90.1	103.8	94.6	102.6	113.6
	H_R	30.0	36.5	32.9	* *	* *	41.2	52.6	45.3	* *	* *	49.8	66.1	54.9	* *	* *
	T_R	11.8	13.0	12.3	* *	* *	14.1	15.9	14.8	* *	* *	15.7	18.1	16.5	* *	* *
2		Small R = 7					Medium R = 19					Large R = 39				
Lat ϕ = 39°	U_R	107.2					105.2					101.9				
Δ P = 2.83 in Hg	V	0	19.6	11.0	27.0	49.0	0	24.2	11.0	27.0	49.0	0	27.3	11.0	27.0	49.0
	U_{RS}	92.7	102.5	98.2	106.2	117.2	91.0	103.1	96.5	104.5	115.5	88.2	101.9	93.7	101.7	112.7
	H_R	29.5	36.1	33.2	* *	* *	41.1	52.7	46.2	* *	* *	49.3	65.8	55.6	65.5	* *
	T_R	11.7	12.9	12.4	* *	* *	14.1	16.0	15.0	* *	* *	15.6	18.0	16.6	18.0	* *
3		Small R = 8					Medium R = 21					Large R = 43				
Lat ϕ = 40°	U_R	104.8					102.6					98.9				
Δ P = 2.75 in Hg	V	0	20.2	14.0	32.0	50.0	0	24.5	14.0	32.0	50.0	0	27.4	14.0	32.0	50.0
	U_{RS}	90.7	100.8	97.7	106.7	115.7	88.8	101.1	95.8	104.8	113.8	85.6	99.3	92.6	101.6	110.6
	H_R	30.6	37.8	35.5	* *	* *	41.4	53.5	48.1	* *	* *	48.9	65.9	57.3	* *	* *
	T_R	12.0	13.3	12.9	* *	* *	14.2	16.1	15.3	* *	* *	15.6	18.1	16.9	* *	* *
4		Small R = 8					Medium R = 22					Large R = 45				
Lat ϕ = 40.5°	U_R	103.7					101.3					97.4				
Δ P = 2.71 in Hg	V	0	20.1	14.0	33.0	51.0	0	24.6	14.0	33.0	51.0	0	27.4	14.0	33.0	51.0
	U_{RS}	89.7	99.8	96.7	106.2	115.3	87.6	99.9	94.6	104.1	113.1	84.2	97.9	91.1	100.7	109.7
	H_R	30.3	37.4	35.2	* *	* *	41.4	53.8	48.3	* *	* *	48.7	65.8	57.1	* *	* *
	T_R	11.9	13.2	12.8	* *	* *	14.2	16.2	15.4	* *	* *	15.6	18.1	16.9	* *	* *
5		Small R = 8					Medium R = 24					Large R = 48				
Lat ϕ = 41°	U_R	102.4					99.6					95.5				
Δ P = 2.66 in Hg	V	0	20.0	15.0	34.0	51.0	0	24.8	15.0	34.0	51.0	0	27.5	15.0	34.0	51.0
	U_{RS}	88.6	98.5	96.0	105.5	114.4	86.2	98.6	93.7	103.2	112.0	82.6	96.4	90.1	99.5	108.4
	H_R	29.9	37.0	35.2	* *	* *	41.9	54.8	49.5	* *	* *	48.4	65.9	57.6	* *	* *
	T_R	11.8	13.2	12.8	* *	* *	14.3	16.4	15.6	* *	* *	15.6	18.1	17.0	* *	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED

TABLE VI - 4
DEEP WATER WAVES
PROBABLE MAXIMUM HURRICANES FOR EAST COAST U.S. ZONE 4

CONTINUED

		Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast	Stat	Crit	Slow	Med	Fast
6		Small R = 8					Medium R = 27					Large R = 52				
Lat ϕ = 42°	U_R	100.0					96.6					92.2				
Δ P = 2.57 in Hg	V	0	19.8	16.0	36.0	52.0	0	25.0	16.0	36.0	52.0	0	27.4	16.0	36.0	52.0
	U_{RS}	86.5	96.9	94.5	104.5	112.5	83.6	96.0	91.5	101.5	109.6	79.8	93.5	87.8	97.8	105.8
	H_R	29.2	36.2	34.8	* *	* *	41.8	55.2	50.2	* *	* *	47.5	65.3	57.6	* *	* *
	T_R	11.7	13.1	12.8	* *	* *	14.4	16.5	15.7	* *	* *	15.4	18.1	17.0	* *	* *
7		Small R = 9					Medium R = 31					Large R = 57				
Lat ϕ = 43°	U_R	97.4					93.4					88.8				
Δ P = 2.48 in Hg	V	0	20.1	17.0	37.0	52.0	0	25.2	17.0	37.0	52.0	0	27.3	17.0	37.0	52.0
	U_{RS}	84.2	94.3	92.7	102.7	110.2	80.8	93.4	89.3	99.3	106.8	76.8	90.5	85.3	95.3	102.8
	H_R	29.5	37.0	39.8	* *	* *	41.8	55.9	51.1	* *	* *	46.6	64.7	57.5	* *	* *
	T_R	11.8	13.3	13.0	* *	* *	14.4	16.7	15.9	* *	* *	15.3	18.0	17.0	* *	* *
8		Small R = 9					Medium R = 36					Large R = 61				
Lat ϕ = 44°	U_R	94.7					89.8					85.2				
Δ P = 2.38 in Hg	V	0	19.9	18.0	38.0	53.0	0	25.4	18.0	38.0	53.0	0	27.1	18.0	38.0	53.0
	U_{RS}	81.9	91.9	90.9	100.9	108.4	77.7	90.4	86.7	96.7	104.2	73.7	87.3	82.7	92.7	100.2
	H_R	28.7	36.1	35.3	* *	* *	41.7	56.5	51.9	* *	* *	45.1	63.2	50.6	* *	* *
	T_R	11.7	13.1	13.0	* *	* *	14.4	16.8	16.1	* *	* *	15.1	17.9	16.9	* *	* *
9		Small R = 9					Medium R = 41					Large R = 66				
Lat ϕ = 45°	U_R	91.6					85.7					81.1				
Δ P = 2.26 in Hg	V	0	19.6	19.0	39.0	53.0	0	25.4	19.0	39.0	53.0	0	26.7	19.0	39.0	53.0
	U_{RS}	79.3	89.1	88.8	98.8	105.9	74.1	86.8	83.6	93.6	100.6	70.1	83.5	79.6	89.6	96.6
	H_R	27.7	35.0	34.8	* *	* *	40.9	56.2	52.1	* *	* *	43.3	61.4	55.8	* *	* *
	T_R	11.5	12.9	12.9	* *	* *	14.3	16.8	16.2	* *	* *	14.8	17.6	16.8	* *	* *

* * FORWARD SPEED GREATER THAN CRITICAL FORWARD SPEED