

# Navy SBIR Topic N222-089, Reference 3

## Wilbur Marks Wind and Wave Scale (from NSWCCD-80-TR-2017/005 Table 2)

FULLY RISEN SEAS <sup>2</sup>											WIND		APPEARANCE OF THE SEA <sup>5</sup>
SEA STATE <sup>1</sup>	AVERAGE	SIGNIFICANT	WAVE HEIGHT (feet)	AVERAGE	HIGHEST	SIGNIFICANT RANGE	PERIODS	PERIOD	WIND SPEED	MINIMUM FETCH	BEAUFORT No. <sup>4</sup>	WIND DESCRIPTION	
	up to 1.2 sec.	(1/10 of 1st hgt peak)	(ft)	(sec)	(sec)	(ft)	(sec)	(sec)	(knots)	(ft)	(knots)		(knots)
0	0	0	~	~	~	~	~	~	0	CALM	<1	Sea like a mirror.	
	0.05	0.08	0.10	0.7	0.5	0.83	2	5	0.3	1	LIGHT AIRS	1-3	Ripples with the appearance of scales are formed, but without foam crests.
1	0.18	0.29	0.37	0.4-2.8	2.0	1.4	6.7	5	8	2	LIGHT BREEZE	4-6	Small wavelets, still short but more pronounced; crests have glassy appearance and do not break.
	0.6	1.0	1.2	0.8-5.0	3.4	2.4	20	8.5	9.8	3	GENTLE BREEZE	7-10	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
2	0.88	1.4	1.8	1.0-6.0	4.0	2.9	27	10	10	4	MODERATE BREEZE	11-16	Small waves, becoming longer; fairly frequent white horses.
	1.4	2.2	2.8	1.0-7.0	4.8	3.4	40	12	18	3			
3	1.8	2.9	3.7	1.4-7.6	5.4	3.9	52	13.5	24	4			
	2.0	3.3	4.2	1.5-7.8	5.6	4.0	59	14	28	5			
4	2.9	4.6	5.8	2.0-8.8	6.5	4.6	71	16	40	6			
	3.8	6.1	7.8	2.5-10.0	7.2	5.1	90	18	55	7			
5	4.3	6.9	8.7	2.8-10.6	7.7	5.4	99	19	65	8			
	5.0	8.0	10	3.0-11.1	8.1	5.7	111	20	75	9			
6	6.4	10	13	3.4-12.2	8.9	6.3	134	22	100	10			
	7.9	12	16	3.7-13.5	9.7	6.8	160	24	130	11			
7	8.2	13	17	3.8-13.6	9.9	7.0	164	24.5	140	12			
	9.6	15	20	4.0-14.5	10.5	7.4	188	26	180	13			
8	11	18	23	4.5-15.5	11.3	7.9	212	28	230	14			
	14	22	28	4.7-16.7	12.1	8.6	250	30	280	15			
9	14	23	29	4.8-17.0	12.4	8.7	258	30.5	290	16			
	16	26	33	5.0-17.5	12.9	9.1	285	32	340	17			
10	19	30	38	5.5-18.5	13.6	9.7	322	34	420	18			
	21	35	44	5.8-19.7	14.5	10.3	363	36	500	19			
11	23	37	46.7	6.0-20.5	14.9	10.5	376	37	530	20			
	25	40	50	6.2-20.8	15.4	10.7	392	38	600	21			
12	28	45	58	6.5-21.7	16.1	11.4	444	40	710	22			
	31	50	64	7.0-23.0	17.0	12.0	492	42	830	23			
13	36	58	73	7.0-24.2	17.7	12.5	534	44	960	24			
	40	64	81	7.0-25.0	18.6	13.1	590	46	1110	25			
14	44	71	90	7.5-26.0	19.4	13.8	650	48	1250	26			
	49	78	99	7.5-27.0	20.2	14.3	700	50	1420	27			
15	52	83	106	8.0-28.2	20.8	14.7	736	51.5	1560	28			
	54	87	110	8.0-28.5	21.0	14.8	750	52	1610	29			
16	59	95	121	8.0-29.5	21.8	15.4	810	54	1800	30			
	64	103	130	8.5-31.0	22.6	16.3	910	56	2100	31			
17	73	116	148	10.0-32.0	24	17.0	985	59.5	2500	32			
	>80	>128	>164	10-(35)	(26)	(18)	~	>64	~	~			
18										12	HURRICANE <sup>5</sup>	64-71	The air filled with foam and spray. Sea completely white with driving spray, visibility very seriously affected.

From a table compiled by Wilbur Marks, David Taylor Model Basin

<sup>1</sup>Sea states refer only to wind waves. Swells from distant or old storms are often superimposed on the wind wave pattern.

<sup>2</sup>Practical Methods of Observing and Forecasting Ocean Waves, Pierson, Neuman, James, H.O. Pub. 603, 1955.

<sup>3</sup>Wind required to create a fully risen sea. To attain a fully risen sea for a certain wind speed, the wind must blow at that speed over a minimum distance (fetch) for a minimum time (duration).

<sup>4</sup>The Beaufort Number is a wind force scale. While wind and seas are causally related, Beaufort Number and sea state are not the same. For example, it is common to have force 7 winds, but because of limited fetch or duration, a sea state of only 2.

<sup>5</sup>Manual of Seamanship, Vol. II, Admiralty, H.M. Stationary Office, 1952.

<sup>6</sup>For whole gale, storm, and hurricane winds (50 knots or more) the required durations and fetches are rarely attained. Seas are therefore not fully arisen.

<sup>7</sup>For such high winds the seas are confused. The wave crests are blown off, and the water and air mix.