

## Hornsea Directional Waverider Buoy

### Location

OS: 527071E 448459N  
 WGS84: Latitude: 53° 55.003' N Longitude: 00° 04.004' W

### Water Depth

~12 m CD

### Instrument Type

Datawell Directional Waverider Mk III

### Data Quality

Recovery rate (%)	Sample interval
98	30 minutes

### Statistics - 2013

All times are GMT

Month	H <sub>s</sub> (m)	T <sub>p</sub> (s)	T <sub>z</sub> (s)	Dir. (°)	SST (°C)	No. of days
January	0.96	7.7	4.0	83	6.1	30
February	1.15	7.7	4.5	65	4.9	27
March	1.71	8.4	5.2	60	4.6	30
April	0.86	7.5	4.0	85	5.5	29
May	0.78	6.9	3.9	72	8.0	30
June	0.57	5.7	3.9	75	11.1	29
July	0.38	5.6	3.5	77	13.5	31
August	0.45	5.5	3.4	103	14.6	30
September	0.71	7.1	3.8	77	14.2	30
October	1.16	7.6	4.2	87	13.0	30
November	0.90	9.6	4.4	56	10.2	29
December	0.93	7.9	4.0	96	8.1	31

### Storm Analysis

Date/Time	H <sub>s</sub> (m)	T <sub>p</sub> (s)	T <sub>z</sub> (s)	Dir. (°)	Water level elevation (OD)	Tidal stage (hours re. HW)	Tidal range (m)	Tidal surge* (m)	Max. surge* (m)
23-Mar-2013 07:00	4.52	10.0	7.0	76	-0.51	HW +4	2.9	-0.02	0.00
24-Mar-2013 11:00	4.31	10.0	6.9	82	-1.40	HW -5	4.0	-0.05	0.05
10-Oct-2013 22:30	4.16	12.5	7.4	30	2.69	HW +1	5.0	0.30	0.64

\* Tidal information is obtained from the nearest recording tide gauge (the National Network gauge at Immingham). The surge shown is the residual at the time of the highest H<sub>s</sub>. The maximum tidal surge is the largest positive surge during the storm event.

## Annual Statistics

Year	Annual $H_s$ exceedance* (m)						Annual Maximum $H_s$	
	0.05%	0.5%	1%	2%	5%	10%	Date	$A_{max}$ (m)
2008	-	3.03	2.78	2.52	1.77	1.44	22-Nov-2008 13:30	3.78
2009	4.34	3.37	2.93	2.34	1.77	1.44	17-Dec-2009 14:30	4.87
2010	3.78	3.39	3.12	2.77	2.24	1.80	10-Jan-2010 04:00	4.08
2011	2.83	2.41	2.17	1.93	1.65	1.38	23-Jul-2011 21:00	2.99
2012	4.30	3.08	2.73	2.34	1.88	1.51	04-Apr-2012 04:30	4.99
2013	4.22	3.74	3.34	2.90	2.32	1.76	23-Mar-2013 07:00	4.52

\* i.e. 5 % of the  $H_s$  values measured in 2008 exceeded 1.77 m

## Distribution plots

The distribution of wave parameters are shown in the accompanying graphs/tables of:

- Annual time series of  $H_s$  (red line is 3.75 m storm threshold)
- Wave rose (percentage of occurrence of Direction vs.  $H_s$ ) for all measured data
- Percentage of occurrence of  $H_s$ ,  $T_p$ ,  $T_z$  and Direction for 2013
- Incidence of storm waves for 2013. Storm events are defined using the Peaks-over-Threshold method. The highest  $H_s$  of each storm event is shown
- Joint distribution of all parameters for all measured data, given as percentage of occurrence
- Incidence of combined  $H_s$  and  $T_p$ , and  $H_s$  and  $T_z$

## Significant wave height return periods

Return periods for significant wave height can be calculated since the buoy has been deployed for more than 5 years. The return periods are based on 3-hourly records and are calculated for periods up to 10 times the record length, using a Weibull distribution.

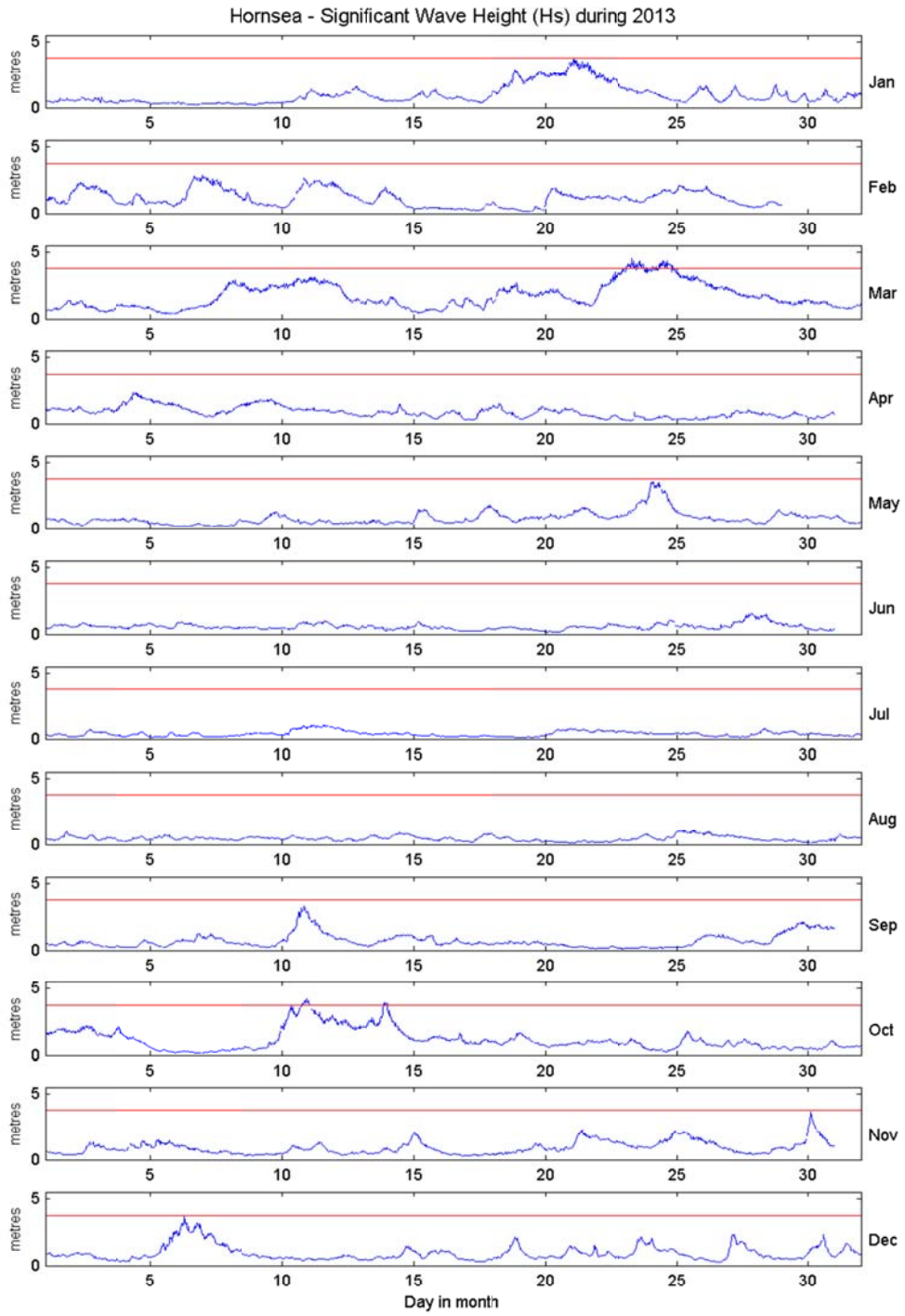
Return period (years)	Significant wave height (m)	Comments
1	4.4	No depth limitation
2	4.6	
5	4.8	
10	5.0	
20	5.1	Depth-limited at MLWS
50	5.3	

## General

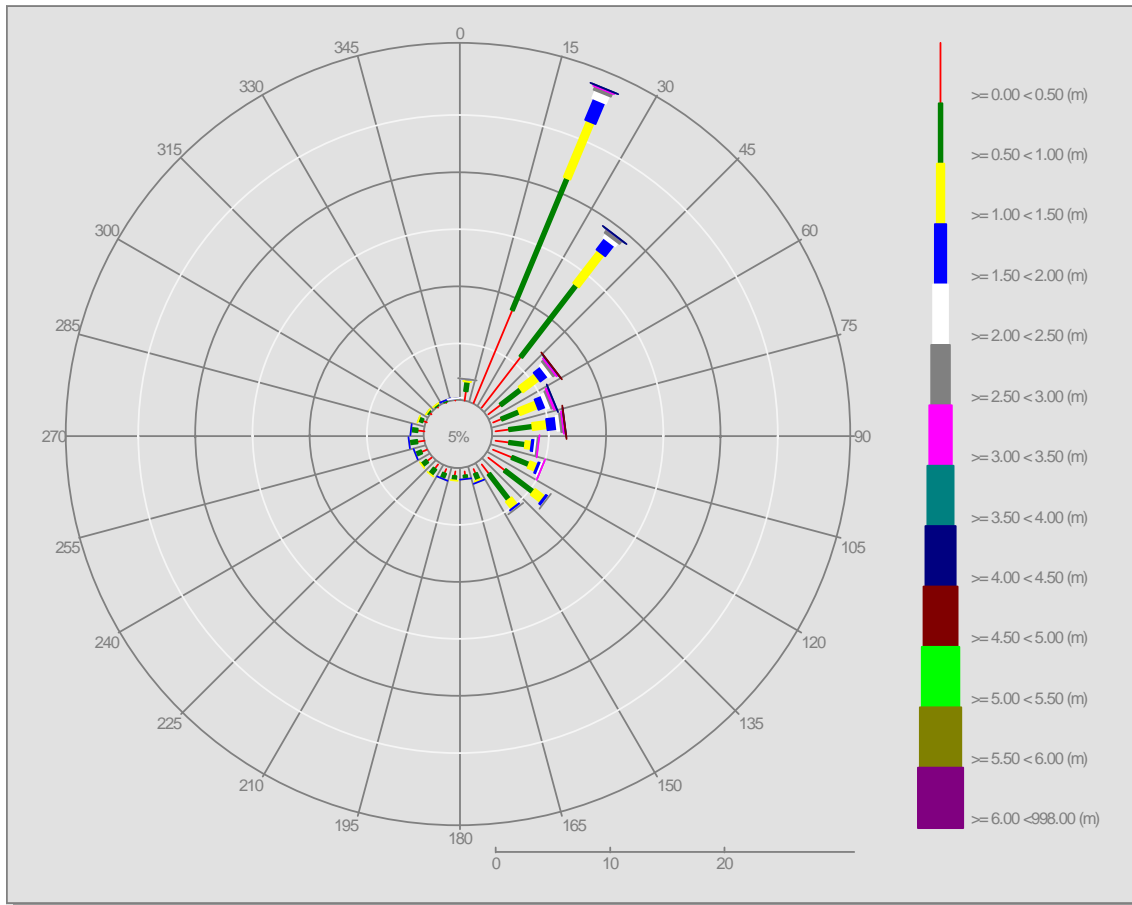
The buoy, owned by East Riding of Yorkshire Council, was deployed on 5 June 2008 at which time the magnetic declination at the site was 2.2° west, changing by 0.15° east per year.

## Acknowledgements

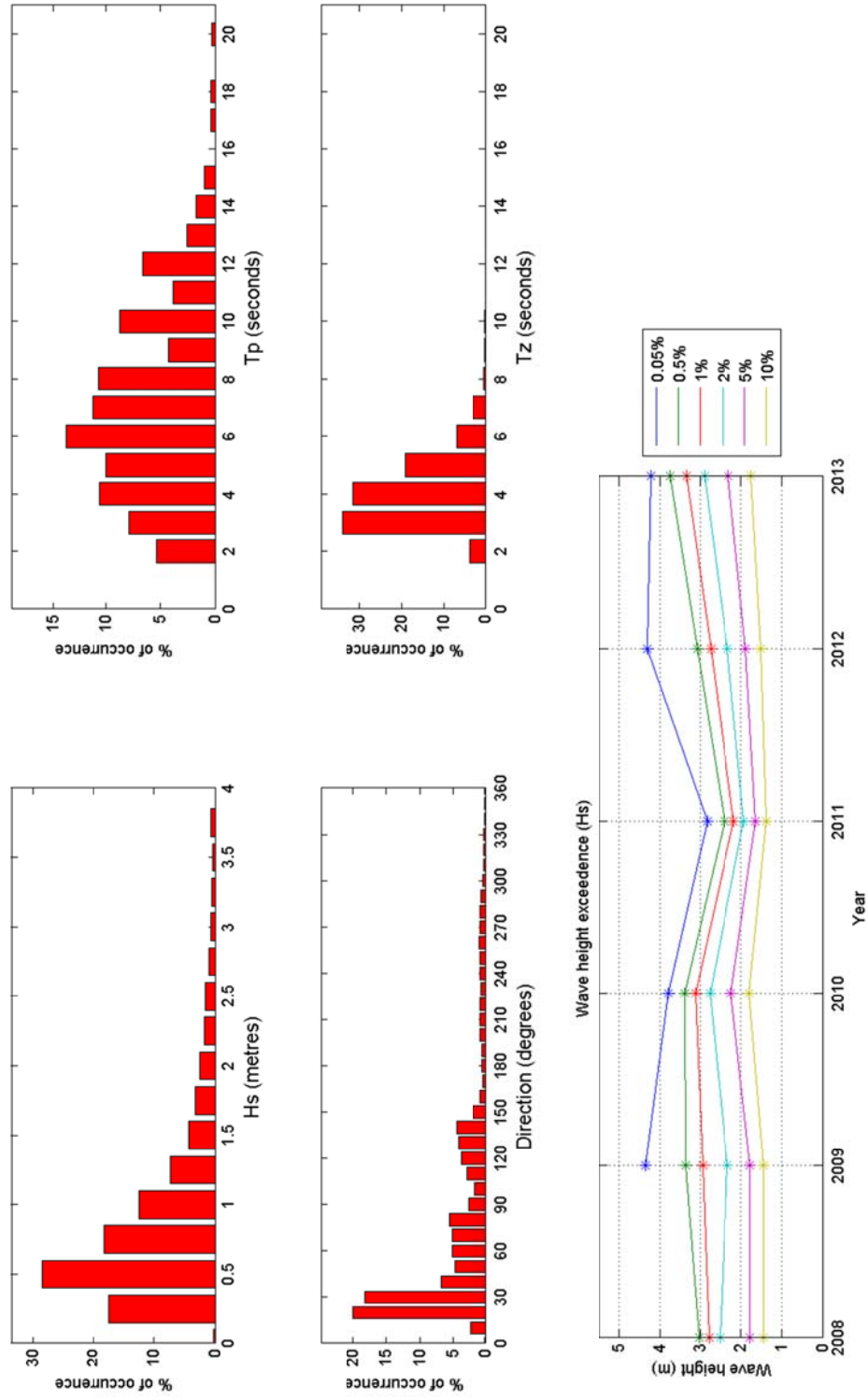
Tidal data were supplied by the British Oceanographic Data Centre as part of the function of the National Tidal and Sea Level Facility, hosted by the Proudman Oceanographic Laboratory and funded by DEFRA and the Natural Environment Research Council.

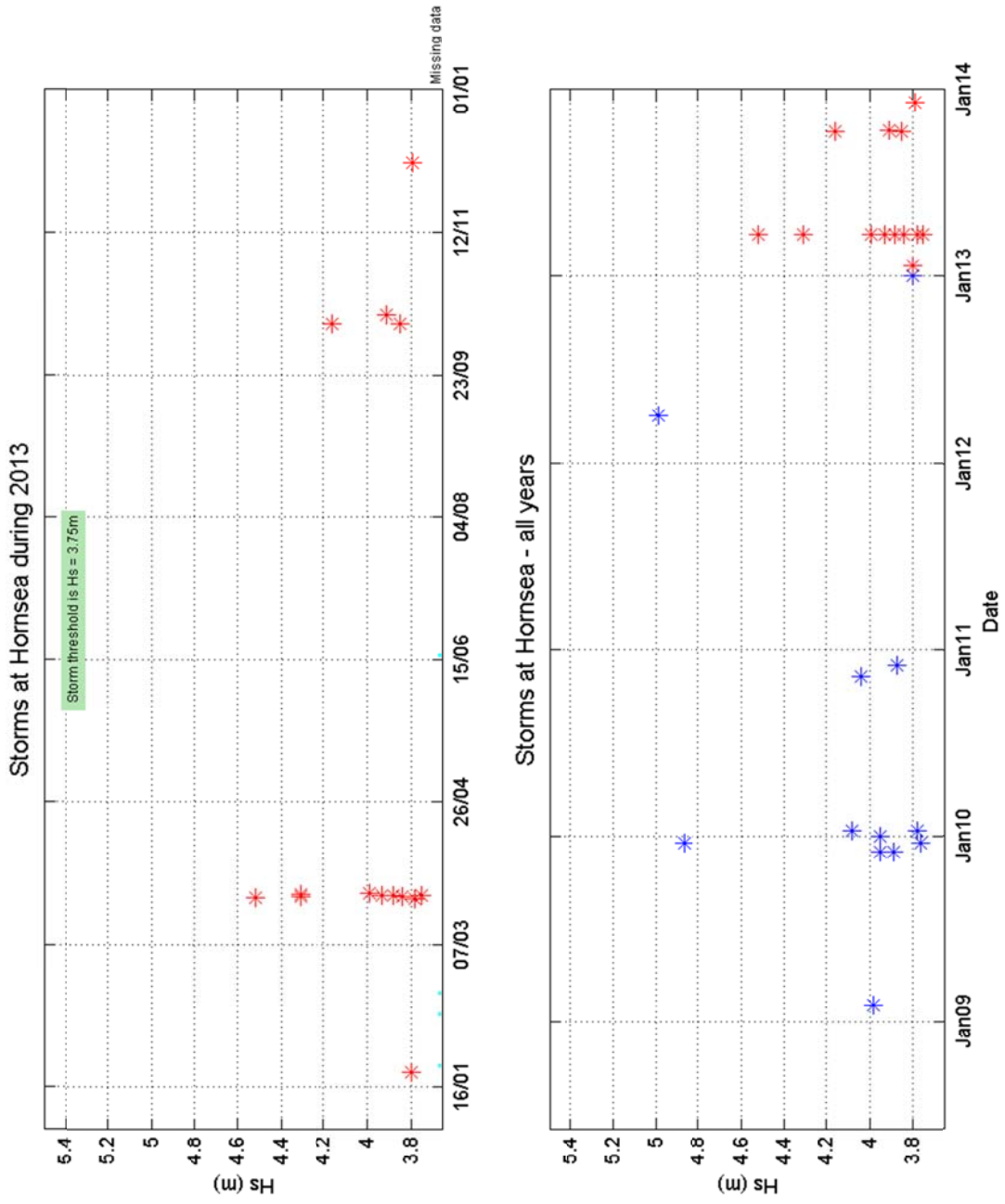


### Offshore Wave Hs (m) Hornsea WB : 10/06/2008 - 31/12/2013

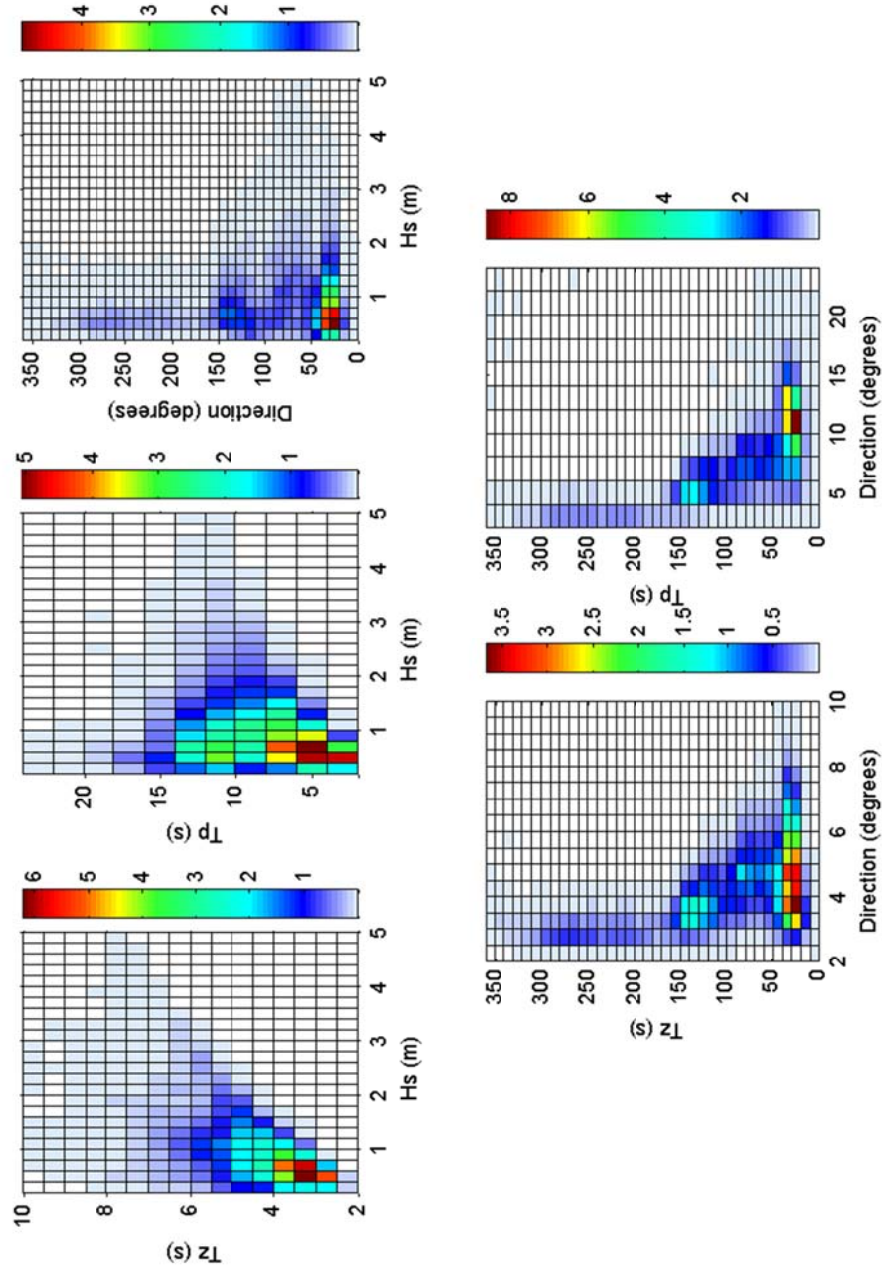


Hornsea 2013





Hornsea 2008 to 2013 - Joint distribution (% of occurrence)



Incidence of combined Hs and Tp at Hornsea (June 2008 to December 2013)																
m	s	No.	% of	Directional bins (degrees N)												
				Hs>=	Tp>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255
0.25	6	53161	55.487		40.093	7.730	4.483	1.684	0.138					0.002		0.003
0.25	8	34410	35.916		31.677	2.461	0.841	0.062						0.002		0.003
0.25	10	23861	24.905		23.519	0.761	0.069	0.001						0.002		0.003
0.25	12	6303	6.579		6.233	0.145	0.008	0.001						0.002		0.003
0.25	14	2301	2.402		2.163	0.117	0.008							0.002		0.003
0.25	16	722	0.754		0.650	0.053	0.003							0.002		0.003
0.25	18	397	0.414		0.351	0.031								0.002		0.003
0.25	20	149	0.156		0.124	0.015								0.002		0.003
0.25	22	19	0.020		0.014	0.003								0.002		0.001
0.25	24	2	0.002											0.002		
0.5	6	42570	44.433		30.552	7.183	4.239	1.548	0.138							0.001
0.5	8	26454	27.611		24.012	2.310	0.821	0.058								0.001
0.5	10	17805	18.584		17.649	0.651	0.061									0.001
0.5	12	4018	4.194		4.092	0.054	0.001									0.001
0.5	14	1133	1.183		1.118	0.038	0.001									0.001
0.5	16	370	0.386		0.350	0.023										0.001
0.5	18	238	0.248		0.222	0.017										0.001
0.5	20	103	0.108		0.092	0.009										0.001
0.5	22	12	0.013		0.010	0.001										0.001
0.5	24															
0.75	6	30983	32.339		20.516	6.291	3.685	1.352	0.137							
0.75	8	18730	19.550		16.421	2.144	0.758	0.046								
0.75	10	12063	12.591		11.883	0.577	0.059									
0.75	12	2530	2.641		2.613	0.022										
0.75	14	554	0.578		0.567	0.009										
0.75	16	89	0.093		0.089	0.003										
0.75	18	60	0.063		0.058	0.003										
0.75	20	32	0.033		0.030	0.002										
0.75	22	7	0.007		0.007											
0.75	24															



Incidence of combined Hs and Tp at Hornsea (June 2008 to December 2013)																		
m	s	No.	% of	Directional bins (degrees N)														
				Hs>=	Tp>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315
1	6	21118	22.042		12.745	4.979	2.955	1.083	0.126									
1	8	12657	13.211		10.420	1.938	0.737	0.037										
1	10	7934	8.281		7.657	0.533	0.058											
1	12	1500	1.566		1.553	0.010												
1	14	278	0.290		0.285	0.005												
1	16	12	0.013		0.013													
1	18	2	0.002		0.002													
1	20																	
1	22																	
1	24																	
1.25	6	14280	14.905		7.859	3.758	2.360	0.749	0.096									
1.25	8	8771	9.155		6.625	1.741	0.710	0.030										
1.25	10	5439	5.677		5.083	0.517	0.057											
1.25	12	980	1.023		1.015	0.007												
1.25	14	166	0.173		0.171	0.002												
1.25	16	9	0.009		0.009													
1.25	18	2	0.002		0.002													
1.25	20																	
1.25	22																	
1.25	24																	
1.5	6	9544	9.962		4.806	2.665	1.854	0.525	0.067									
1.5	8	6184	6.455		4.231	1.511	0.654	0.030										
1.5	10	3716	3.879		3.337	0.475	0.057											
1.5	12	599	0.625		0.622	0.003												
1.5	14	106	0.111		0.109	0.002												
1.5	16	9	0.009		0.009													
1.5	18	2	0.002		0.002													
1.5	20																	
1.5	22																	
1.5	24																	



Incidence of combined Hs and Tp at Hornsea (June 2008 to December 2013)																			
m	s	No.	% of	Directional bins (degrees N)															
				Hs>=	Tp>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315	315-345
2.5	6	2049	2.139																
2.5	8	1846	1.927																
2.5	10	1058	1.104																
2.5	12	109	0.114																
2.5	14	7	0.007																
2.5	16	1	0.001																
2.5	18	1	0.001																
2.5	20																		
2.5	22																		
2.5	24																		
2.75	6	1309	1.366																
2.75	8	1256	1.311																
2.75	10	736	0.768																
2.75	12	70	0.073																
2.75	14	6	0.006																
2.75	16	1	0.001																
2.75	18	1	0.001																
2.75	20																		
2.75	22																		
2.75	24																		
3	6	839	0.876																
3	8	822	0.858																
3	10	530	0.553																
3	12	42	0.044																
3	14																		
3	16																		
3	18																		
3	20																		
3	22																		
3	24																		

Incidence of combined Hs and Tp at Hornsea (June 2008 to December 2013)																			
m	s	No.	% of	Directional bins (degrees N)															
				Hs>=	Tp>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315	315-345
3.25	6	513	0.535																
3.25	8	509	0.531																
3.25	10	370	0.386																
3.25	12	25	0.026																
3.25	14																		
3.25	16																		
3.25	18																		
3.25	20																		
3.25	22																		
3.25	24																		
3.5	6	294	0.307																
3.5	8	294	0.307																
3.5	10	234	0.244																
3.5	12	11	0.011																
3.5	14																		
3.5	16																		
3.5	18																		
3.5	20																		
3.5	22																		
3.5	24																		
3.75	6	156	0.163																
3.75	8	156	0.163																
3.75	10	135	0.141																
3.75	12	9	0.009																
3.75	14																		
3.75	16																		
3.75	18																		
3.75	20																		
3.75	22																		
3.75	24																		

Incidence of combined Hs and Tp at Hornsea (June 2008 to December 2013)																		
m	s	No.	% of	Directional bins (degrees N)														
				Hs>=	Tp>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315
4	6	73	0.076															
4	8	73	0.076															
4	10	68	0.071															
4	12	4	0.004															
4	14																	
4	16																	
4	18																	
4	20																	
4	22																	
4	24																	
4.25	6	29	0.030															
4.25	8	29	0.030															
4.25	10	26	0.027															
4.25	12																	
4.25	14																	
4.25	16																	
4.25	18																	
4.25	20																	
4.25	22																	
4.25	24																	
4.5	6	11	0.011															
4.5	8	11	0.011															
4.5	10	11	0.011															
4.5	12																	
4.5	14																	
4.5	16																	
4.5	18																	
4.5	20																	
4.5	22																	
4.5	24																	

Incidence of combined Hs and Tp at Hornsea (June 2008 to December 2013)															
m Hs>=	s Tp>=	No. Occ.	% of Meas.	Directional bins (degrees N)											
				345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315	315-345
4.75	6	7	0.007			0.007									
4.75	8	7	0.007			0.007									
4.75	10	7	0.007			0.007									
4.75	12														
4.75	14														
4.75	16														
4.75	18														
4.75	20														
4.75	22														
4.75	24														

Incidence of combined Hs and Tz at Hornsea (June 2008 to December 2013)																
m	s	No. Hs>=	% of Tz>=	No. Occ.	% of Meas.	Directional bins (degrees N)										
						345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315
0.25	2	91099	95.085			44.403	11.298	8.994	10.196	6.056	1.340	1.921	1.970	2.317	1.050	0.488
0.25	3	76629	79.982			41.777	10.965	8.571	8.664	4.188	0.375	0.498	0.393	0.419	0.204	0.164
0.25	4	46404	48.434			29.268	8.558	5.623	2.742	0.491	0.002	0.002		0.001		0.001
0.25	5	20906	21.821			15.833	3.379	1.642	0.221	0.005						
0.25	6	8024	8.375			6.902	0.907	0.253								
0.25	7	2064	2.154			1.930	0.095	0.007								
0.25	8	410	0.428			0.401	0.002									
0.25	9	63	0.066			0.061										
0.25	10	2	0.002			0.001										
0.5	2	66788	69.710			33.101	9.666	7.085	7.123	4.663	0.717	1.142	1.057	1.233	0.526	0.262
0.5	3	61537	64.230			32.521	9.579	7.018	6.670	3.741	0.303	0.481	0.390	0.416	0.204	0.148
0.5	4	40491	42.263			24.890	7.954	5.072	2.441	0.478	0.002	0.002		0.001		0.001
0.5	5	18939	19.768			14.006	3.297	1.622	0.214	0.005						
0.5	6	7279	7.597			6.179	0.896	0.253								
0.5	7	1826	1.906			1.702	0.093	0.007								
0.5	8	356	0.372			0.353	0.002									
0.5	9	60	0.063			0.058										
0.5	10	2	0.002			0.001										
0.75	2	43038	44.921			21.813	7.918	5.148	4.122	2.538	0.257	0.421	0.356	0.428	0.163	0.086
0.75	3	42629	44.494			21.801	7.917	5.148	4.111	2.439	0.191	0.325	0.321	0.366	0.148	0.080
0.75	4	32823	34.259			19.223	7.061	4.290	2.120	0.456	0.002	0.002		0.001		0.001
0.75	5	16328	17.042			11.643	3.131	1.532	0.196	0.005						
0.75	6	6435	6.717			5.374	0.858	0.249								
0.75	7	1580	1.649			1.460	0.093	0.007								
0.75	8	284	0.296			0.284	0.002									
0.75	9	48	0.050			0.049										
0.75	10	1	0.001			0.001										

Incidence of combined Hs and Tz at Hornsea (June 2008 to December 2013)																
m	s	No.	% of	Directional bins (degrees N)												
				Hs>=	Tz>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255
1	2	27127	28.314			13.361	5.996	3.721	2.446	1.266	0.084	0.124	0.130	0.113	0.037	0.037
1	3	27125	28.312			13.361	5.996	3.721	2.446	1.266	0.084	0.122	0.130	0.113	0.037	0.037
1	4	23999	25.049			12.786	5.706	3.457	1.810	0.436	0.002	0.002		0.001		0.001
1	5	12626	13.178			8.498	2.734	1.329	0.175	0.005						
1	6	5365	5.600			4.364	0.786	0.240								
1	7	1347	1.406			1.225	0.092	0.007								
1	8	203	0.212			0.201	0.002									
1	9	24	0.025			0.025										
1	10	1	0.001			0.001										
1.25	2	17065	17.812			8.091	4.236	2.702	1.408	0.599	0.027	0.044	0.019	0.029	0.018	0.005
1.25	3	17065	17.812			8.091	4.236	2.702	1.408	0.599	0.027	0.044	0.019	0.029	0.018	0.005
1.25	4	16419	17.137			8.030	4.202	2.676	1.271	0.359	0.002	0.002		0.001		0.001
1.25	5	9404	9.815			5.837	2.332	1.172	0.137	0.005						
1.25	6	4278	4.465			3.333	0.716	0.233								
1.25	7	1156	1.207			1.029	0.092	0.007								
1.25	8	156	0.163			0.152	0.002									
1.25	9	17	0.018			0.018										
1.25	10	1	0.001			0.001										
1.5	2	10638	11.103			4.874	2.820	1.987	0.762	0.230	0.002	0.003	0.002	0.006	0.003	0.002
1.5	3	10638	11.103			4.874	2.820	1.987	0.762	0.230	0.002	0.003	0.002	0.006	0.003	0.002
1.5	4	10565	11.027			4.872	2.820	1.987	0.746	0.193	0.001			0.001		0.001
1.5	5	7101	7.412			3.992	1.993	1.053	0.113	0.005						
1.5	6	3393	3.541			2.491	0.676	0.229								
1.5	7	916	0.956			0.792	0.092	0.007								
1.5	8	114	0.119			0.109	0.002									
1.5	9	12	0.013			0.013										
1.5	10	1	0.001			0.001										







Incidence of combined Hs and Tz at Hornsea (June 2008 to December 2013)																			
m	s	No.	% of	Directional bins (degrees N)															
				Hs>=	Tz>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315	315-345
3.25	2	516	0.539																
3.25	3	516	0.539																
3.25	4	516	0.539																
3.25	5	516	0.539																
3.25	6	513	0.535																
3.25	7	103	0.108																
3.25	8	1	0.001																
3.25	9																		
3.25	10																		
3.5	2	296	0.309																
3.5	3	296	0.309																
3.5	4	296	0.309																
3.5	5	296	0.309																
3.5	6	296	0.309																
3.5	7	78	0.081																
3.5	8	1	0.001																
3.5	9																		
3.5	10																		
3.75	2	156	0.163																
3.75	3	156	0.163																
3.75	4	156	0.163																
3.75	5	156	0.163																
3.75	6	156	0.163																
3.75	7	65	0.068																
3.75	8	1	0.001																
3.75	9																		
3.75	10																		

Incidence of combined Hs and Tz at Hornsea (June 2008 to December 2013)																			
m	s	No.	% of	Directional bins (degrees N)															
				Hs>=	Tz>=	Occ.	Meas.	345-15	15-45	45-75	75-105	105-135	135-165	165-195	195-225	225-255	255-285	285-315	315-345
4	2	73	0.076																
4	3	73	0.076																
4	4	73	0.076																
4	5	73	0.076																
4	6	73	0.076																
4	7	50	0.052																
4	8																		
4	9																		
4	10																		
4.25	2	29	0.030																
4.25	3	29	0.030																
4.25	4	29	0.030																
4.25	5	29	0.030																
4.25	6	29	0.030																
4.25	7	26	0.027																
4.25	8																		
4.25	9																		
4.25	10																		
4.5	2	11	0.011																
4.5	3	11	0.011																
4.5	4	11	0.011																
4.5	5	11	0.011																
4.5	6	11	0.011																
4.5	7	11	0.011																
4.5	8																		
4.5	9																		
4.5	10																		

