Cleveleys Directional Waverider Buoy

Location			
OS	321475 E 444975 N		
WGS84	*Latitude:* 53° 53.70' N *Longitude:* 03° 11.78' W		
Instrument type			
Datawell Directional Waverider Mk III			
Water depth	~10 m CD	Example buoy in situ. Photo courtesy of Fugro Marine GB Limited	Location of buoy (Google mapping, image ©2016 TerraMetrics)

Data Quality

Recovery rate (%)	**Sample interval**
92	30 minutes

Monthly Averages - 2017

All times are GMT

Month	**H_s (m)**	**T_p (s)**	**T_z (s)**	**Dir. (°)**	**SST (°C)**	**Bimodal seas (%)**	**No. of days**
January	1.07	5.3	3.9	267	6.7	-	18
February	1.00	5.0	3.8	228	5.8	-	18
March	0.81	4.5	3.5	228	7.3	0	31
April	0.73	4.3	3.4	267	9.2	0	30
May	0.49	3.9	3.0	194	12.2	0	31
June	0.91	4.5	3.6	246	15.7	0	30
July	0.73	4.2	3.3	246	16.8	0	31
August	0.85	4.6	3.7	245	17.1	-	23
September	0.93	4.7	3.6	247	15.6	0	30
October	1.39	5.5	4.1	255	13.5	1	31
November	1.22	5.3	4.0	275	10.8	0	30
December	1.18	5.4	4.0	264	7.6	-	31

Monthly Averages - All Years (June 2011 – December 2019)

Month	**H_s (m)**	**T_p (s)**	**T_z (s)**	**Dir. (°)**	**SST (°C)**	**Bimodal seas (%)**
January	1.22	5.5	4.0	242	5.9	0
February	1.01	5.2	3.7	239	5.1	1
March	0.81	4.9	3.5	224	6.1	0
April	0.67	4.6	3.3	222	8.0	0
May	0.63	4.2	3.2	223	11.2	0
June	0.64	4.2	3.2	243	14.8	0
July	0.64	4.1	3.2	251	17.1	0
August	0.84	4.5	3.5	249	17.4	0
September	0.91	4.7	3.6	246	15.8	0
October	0.96	4.8	3.6	222	13.3	0
November	1.01	4.9	3.6	232	10.2	0
December	1.34	5.7	4.1	252	7.3	1

Storm Analysis

Date/Time	H_s (m)	T_p (s)	T_z (s)	Dir. (°)	Water level elevation* (OD)	Tidal stage (hours re. HW)	Tidal range (m)	Tidal surge (m)	Max. surge (m)
16-Oct-2017 20:30:00	4.53	10.0	6.8	263	4.48	HW	5.96	0.59	1.85
23-Feb-2017 12:00:00	4.36	11.8	7.1	280	0.00	HW +3	4.90	-	-

** Tidal information is obtained from the National Network gauge at Heysham and/or estimated from the predicted tide levels (Admiralty Total Tide). The surge shown is the residual at the time of the highest Hs. The maximum tidal surge is the largest 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)
2011	4.14	3.51	3.29	3.07	2.64	2.24	09-Dec-2011 00:30:00	4.32
2012	3.99	2.96	2.71	2.45	2.03	1.66	05-Jan-2012 00:00:00	5.03
2013	4.18	3.46	3.12	2.75	2.20	1.75	05-Dec-2013 13:00:00	4.71
2014	4.53	3.41	2.99	2.70	2.27	1.82	12-Feb-2014 19:00:00	4.84
2015	3.99	3.50	3.28	3.02	2.55	2.09	29-Nov-2015 18:30:00	4.52
2016	4.10	3.23	2.98	2.63	2.14	1.71	02-Feb-2016 02:30:00	4.60
2017	4.09	3.16	2.89	2.63	2.19	1.81	16-Oct-2017 20:30:00	4.53
2018	4.02	3.27	2.93	2.53	1.99	1.66	03-Jan-2018 03:30:00	4.63
2019	4.20	3.31	3.04	2.68	2.11	1.72	13-Mar-2019 01:00:00	5.01

*** i.e. 5 % of the H_s values measured in 2011 exceeded 2.64 m*

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 0.5 hourly records and are calculated for periods up to 10 times the record length using a peaks-over-threshold method and Generalised Pareto Distribution (GPD).

Observation period	June 2011 to December 2019	
Return period (years)	**Significant wave height (m)**	**Comments**
0.25	3.74	No depth limitation
1	4.43	
2	4.66	Depth-limited at MLWS
5	4.87	
10	4.99	
20	5.08	
50	5.16	

Distribution plots

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

- Annual time series of H_s (red line is 3.74 m storm threshold)
- Incidence of storm waves for 2017. Storm events are defined using the Peaks-over-Threshold method. The highest H_s of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of H_s, T_p, T_z and Direction for 2017
- Joint distribution of all parameters for all measured data, given as percentage of occurrence
- Wave rose (percentage of occurrence of direction vs. H_s) for all measured data

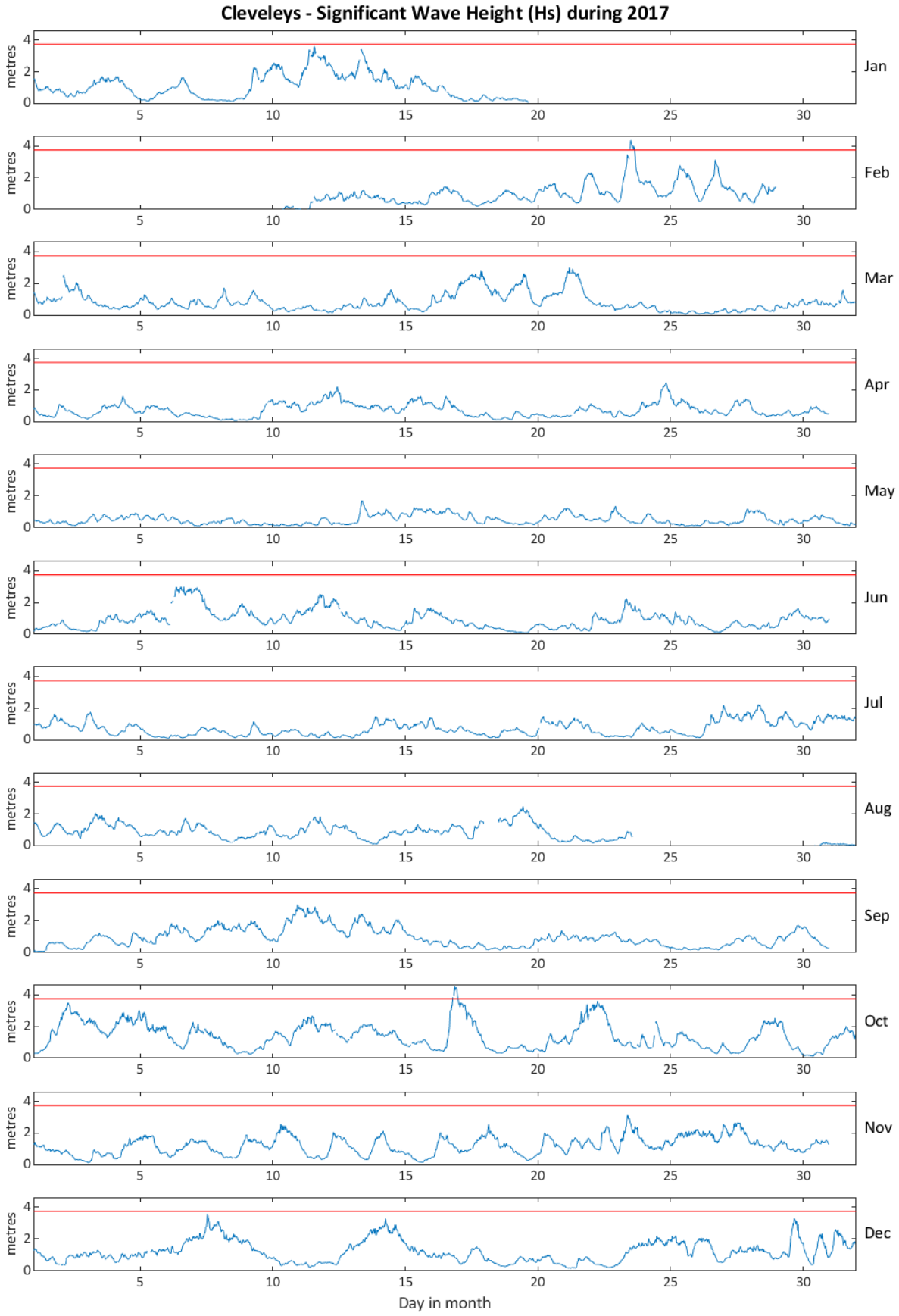
General

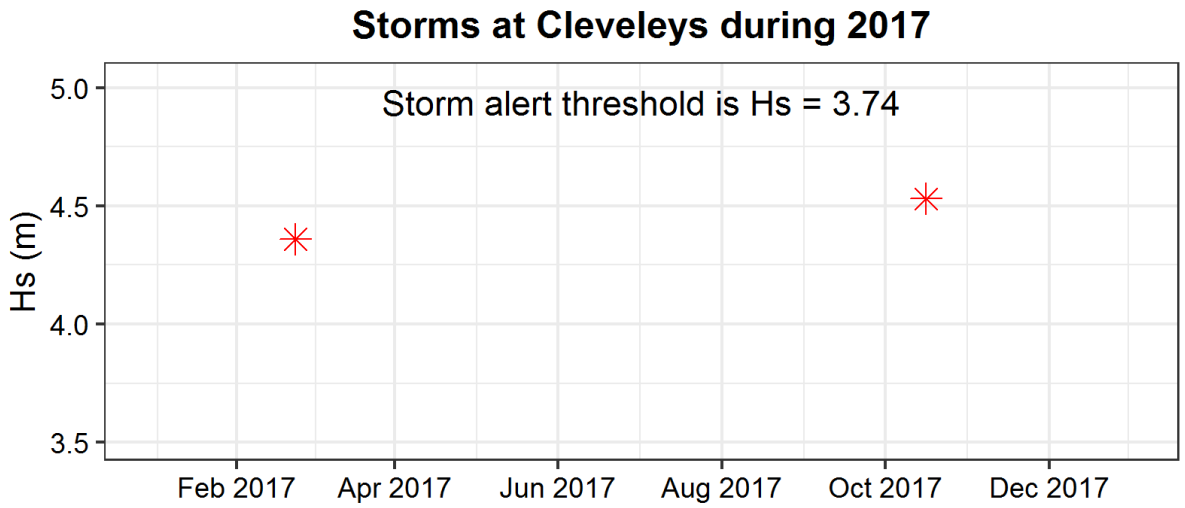
The wave buoy at Cleveleys, owned by Sefton Council, was deployed on 30 June 2011, at which time the magnetic declination at the site was 3.0° west, changing by 0.16° east per year.

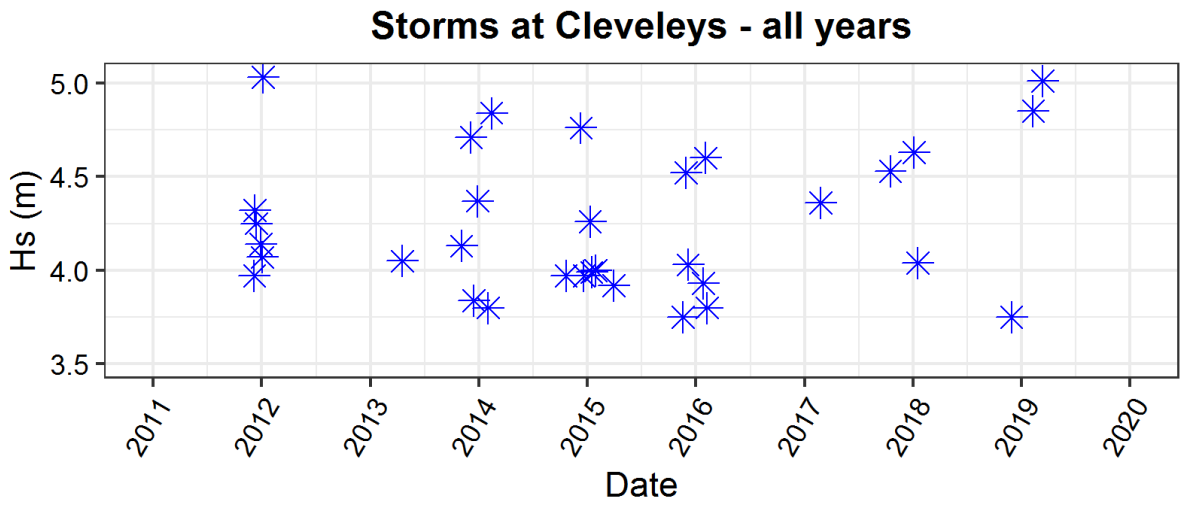
Acknowledgements

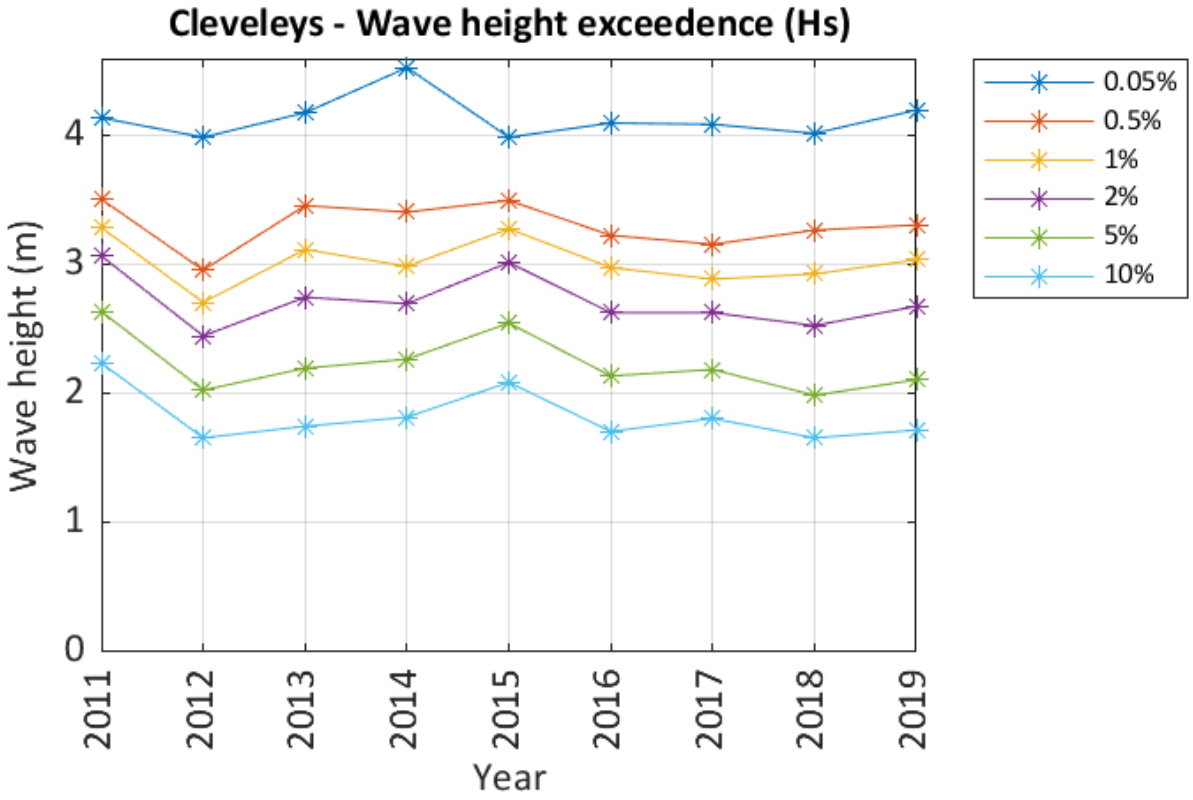
The shore station is kindly hosted by Café Cove, Cleveleys.

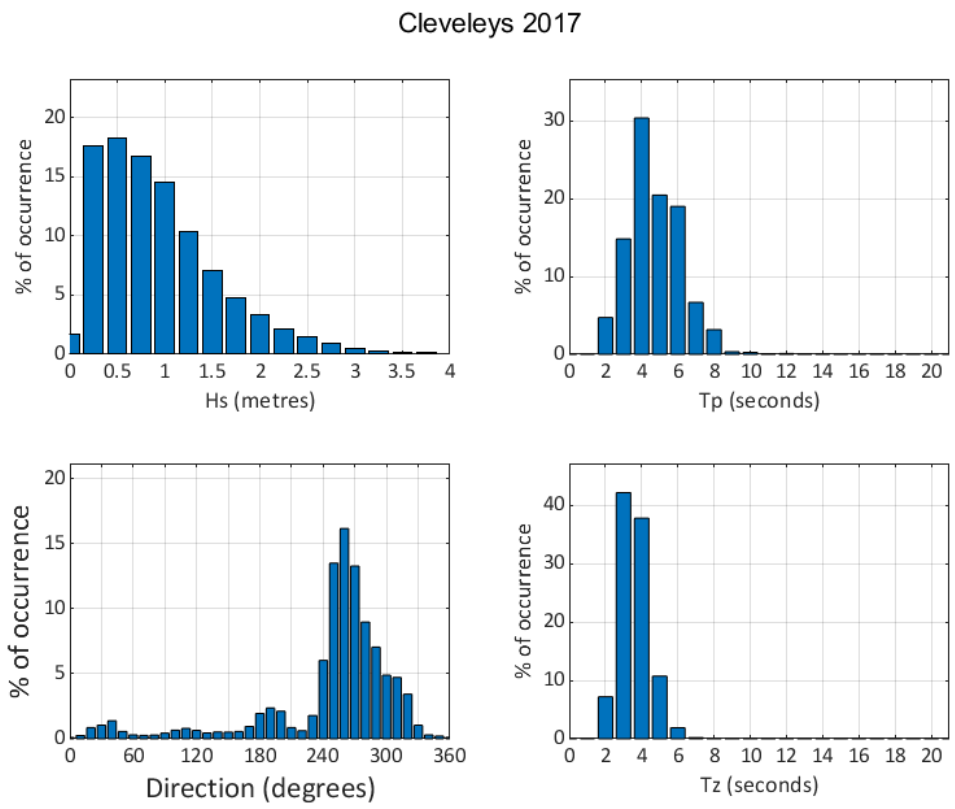
Tidal data at Heysham were provided by the British Oceanographic Data Centre from the UK national tide gauge network, owned and operated by the Environment Agency.

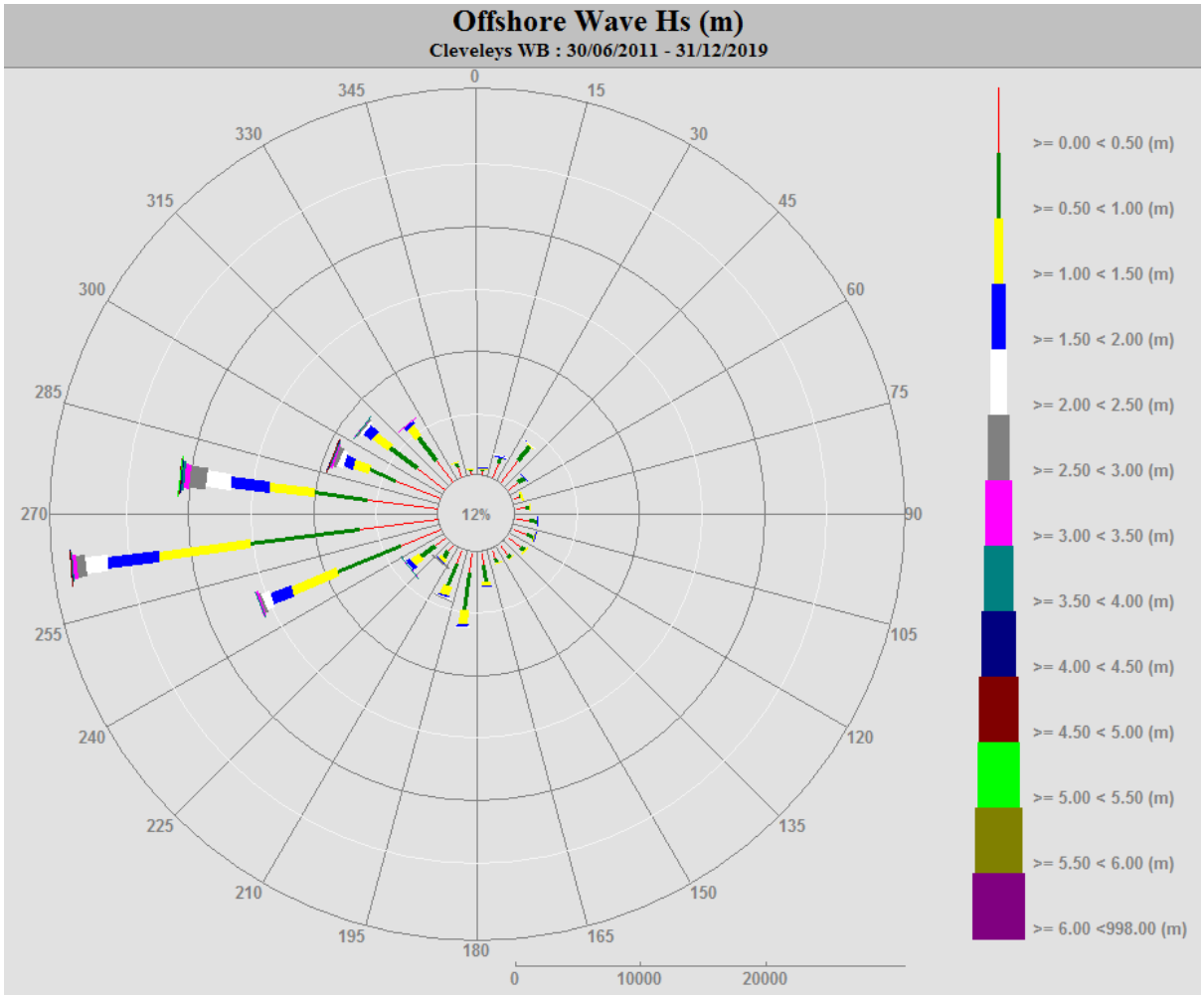

Cleveleys - Significant Wave Height (Hs) during 2017
metres
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0
2
4
5
10
15
20
25
30
Day in month

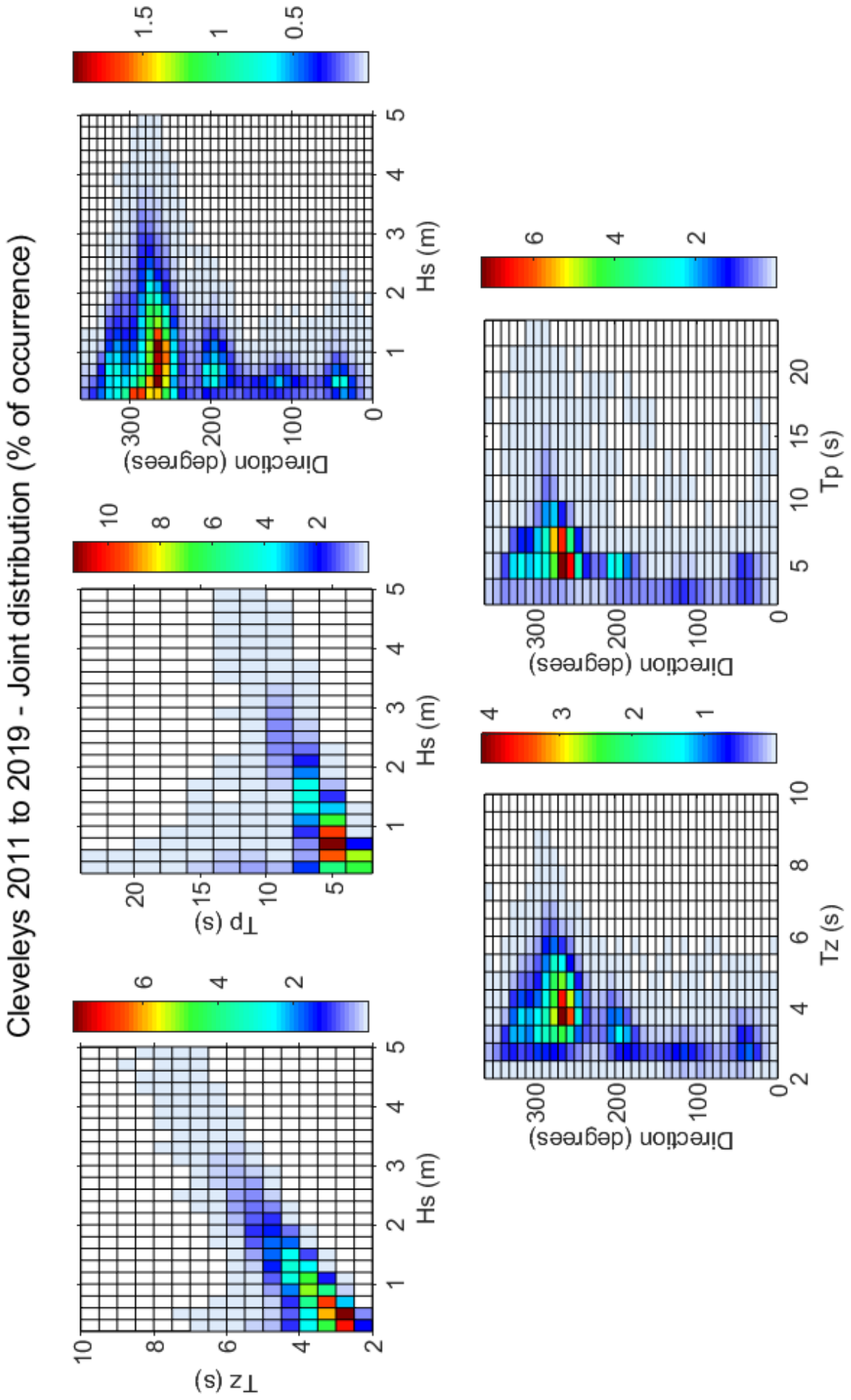

Storms at Cleveleys during 2017
Storm alert threshold is Hs = 3.74
Hs (m)
5.0
4.5
4.0
3.5
Feb 2017
Apr 2017
Jun 2017
Aug 2017
Oct 2017
Dec 2017


Storms at Cleveleys - all years
Hs (m)
5.0
4.5
4.0
3.5
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Date


Cleveleys - Wave height exceedence (Hs)
Wave height (m)
4
3
2
1
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year
0.05%
0.5%
1%
2%
5%
10%


Cleveleys 2017
% of occurrence
Hs (metres)
Tp (seconds)
Direction (degrees)
Tz (seconds)


Offshore Wave Hs (m)
Cleveleys WB : 30/06/2011 - 31/12/2019
12%
>= 0.00 < 0.50 (m)
>= 0.50 < 1.00 (m)
>= 1.00 < 1.50 (m)
>= 1.50 < 2.00 (m)
>= 2.00 < 2.50 (m)
>= 2.50 < 3.00 (m)
>= 3.00 < 3.50 (m)
>= 3.50 < 4.00 (m)
>= 4.00 < 4.50 (m)
>= 4.50 < 5.00 (m)
>= 5.00 < 5.50 (m)
>= 5.50 < 6.00 (m)
>= 6.00 <998.00 (m)


Cleveleys 2011 to 2019 - Joint distribution (% of occurrence)
Direction (degrees)
Hs (m)
Tp (s)
Tz (s)