



Whitby Directional Waverider Buoy

Location			
OS	490311 E 513027 N		
WGS84	Latitude: 54° 30.27' N Longitude: 00° 36.41' W		
Instrument type			
Datawell Directional Waverider Mk III			
Water depth	~17m CD	Buoy in situ off Whitby beach. Photo courtesy of Fugro GB Marine Limited	Location of buoy (Google mapping, image ©2016 The GeoInformation Group)

Data Quality

Recovery rate (%)	Sample interval
99	30 minutes

Monthly Averages - 2016

All times are GMT

Month	H _s (m)	T _p (s)	T _z (s)	Dir. (°)	SST (°C)	Bimodal seas (%)	No. of days
January	1.43	9.0	5.3	76	7.9	3	31
February	1.26	10.2	5.3	65	6.7	14	29
March	0.98	7.7	4.8	74	6.5	3	31
April	1.20	8.1	5.1	65	7.3	10	30
May	1.02	7.4	4.8	67	9.3	4	31
June	0.97	7.6	4.9	55	12.0	1	30
July	0.46	6.1	3.9	122	13.7	0	31
August	0.71	6.9	4.4	87	14.2	2	31
September	0.54	6.5	3.9	111	13.9	0	30
October	1.38	8.6	5.4	59	12.5	8	31
November	1.34	8.6	5.1	69	9.8	5	30
December	0.71	11.3	4.9	53	8.9	5	30

Monthly Averages - All Years (January 2013 – December 2019)

Month	H _s (m)	T _p (s)	T _z (s)	Dir. (°)	SST (°C)	Bimodal seas (%)
January	1.27	9.7	5.2	82	7.0	9
February	1.15	9.2	5.0	75	6.1	6
March	1.26	9.2	5.2	72	6.2	7
April	1.01	8.0	4.8	72	7.2	7
May	0.96	7.6	4.7	63	9.3	2
June	0.80	7.0	4.6	67	11.6	1
July	0.58	6.0	4.0	98	13.9	1
August	0.64	6.7	4.3	96	14.0	1
September	0.82	7.2	4.5	93	13.5	2
October	1.10	8.7	5.0	80	12.2	5
November	1.34	9.1	5.3	77	10.2	8
December	0.95	10.3	5.0	69	8.3	8

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)
06-Nov-2016 20:00:00	5.05	11.8	7.7	48	1.71	HW	2.93	-0.17	-0.08
14-Jan-2016 14:30:00	4.85	10.0	7.0	10	-0.50	HW -4	3.99	0.45	0.52
03-Jan-2016 09:30:00	4.68	11.1	8.5	58	0.95	HW -1	2.24	-0.32	-0.27
21-Nov-2016 19:00:00	4.58	9.1	6.8	49	1.48	HW -2	2.76	0.45	0.45

* Tidal information is obtained from the pressure transducer at Whitby Harbour. The surge shown is the residual at the time of the highest H_s. 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)
2013	5.75	4.74	4.39	3.89	2.96	2.18	10-Oct-2013 16:00:00	6.00
2014	3.74	3.16	2.81	2.53	2.11	1.74	14-Oct-2014 05:00:00	4.10
2015	5.63	4.06	3.45	2.97	2.21	1.75	21-Nov-2015 03:30:00	7.72
2016	4.71	4.02	3.54	3.05	2.45	2.06	06-Nov-2016 20:00:00	5.05
2017	5.33	4.31	3.96	3.57	2.76	2.09	13-Jan-2017 14:00:00	7.26
2018	5.93	5.08	4.43	3.69	2.48	1.91	01-Mar-2018 15:00:00	6.45
2019	5.83	3.97	3.76	3.44	2.80	2.18	27-Jan-2019 16:00:00	6.60

** i.e. 5 % of the H_s values measured in 2013 exceeded 2.96 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	January 2013 to December 2019	
Return period (years)	Significant wave height (m)	Comments
0.25	4.35	No depth limitation
1	5.61	
2	6.01	
5	6.38	
10	6.59	
20	6.74	Depth-limited at MLWS
50	6.88	

Distribution plots

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

- Annual time series of H_s (red line is 4.35 m storm alert threshold)
- Incidence of storm waves for 2016. 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 2016
- Wave rose (percentage of occurrence of direction vs. H_s) for all measured data
- Joint distribution of all parameters for all measured data, given as percentage of occurrence

General

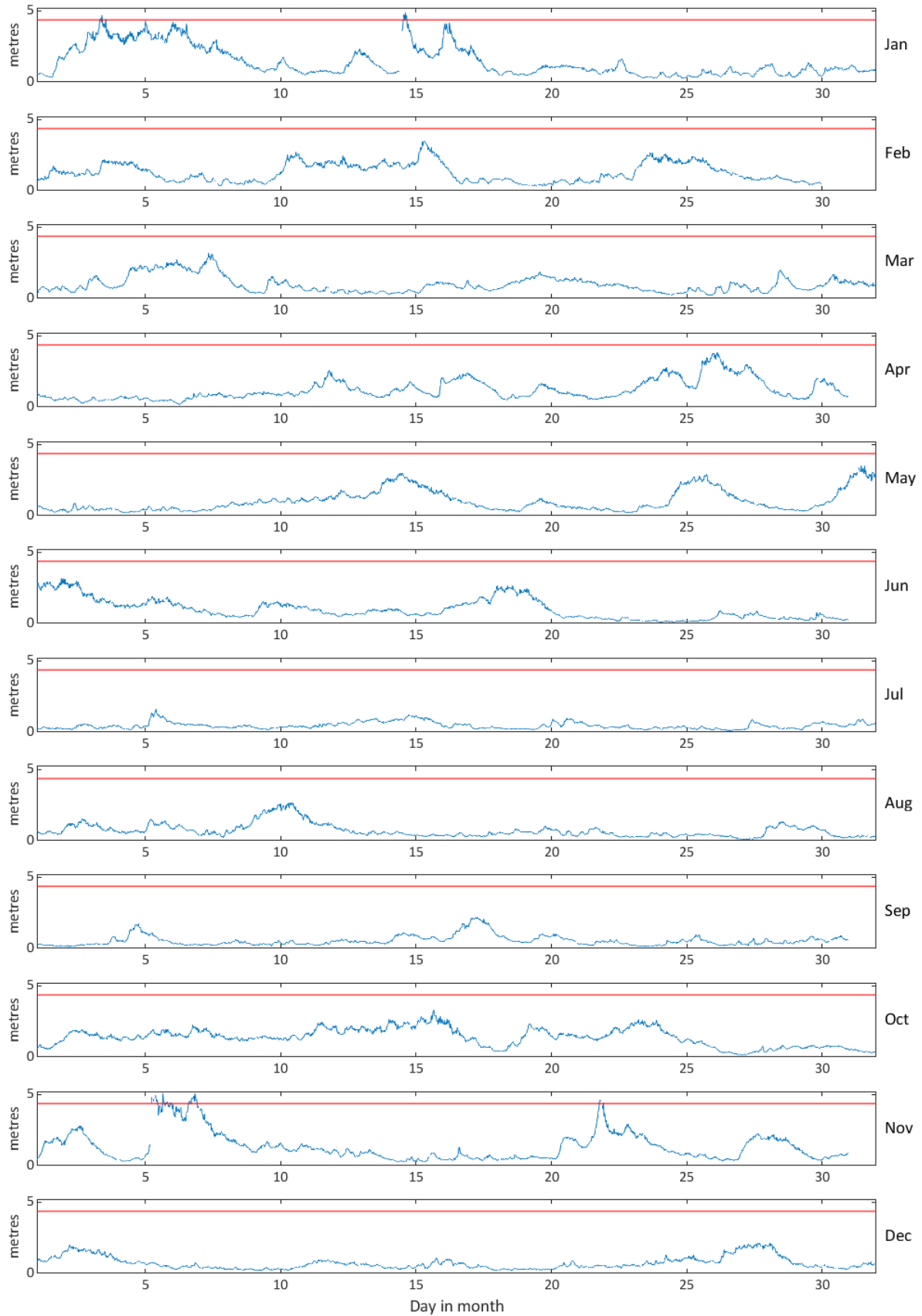
The buoy, owned by Scarborough Borough Council, was deployed on 18 January 2013, at which time the magnetic declination at the site was 1.8° west, changing by 0.18° east per year. A DWR had previously been deployed at this location from 20 May 2010 to 04 February 2011.

Acknowledgements

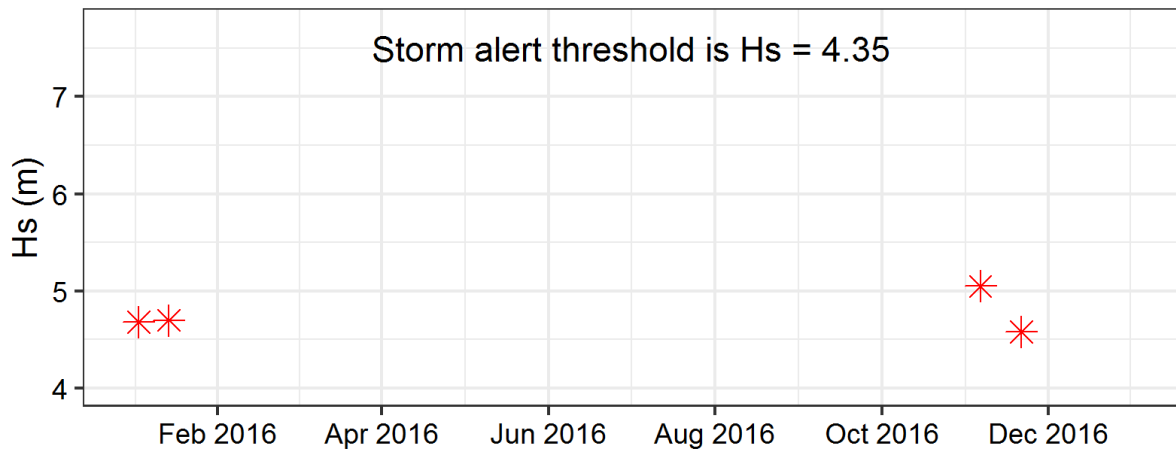
The shore station is kindly hosted by North Yorkshire County Council.

Tidal predictions were supplied by Fugro GB Marine Limited.

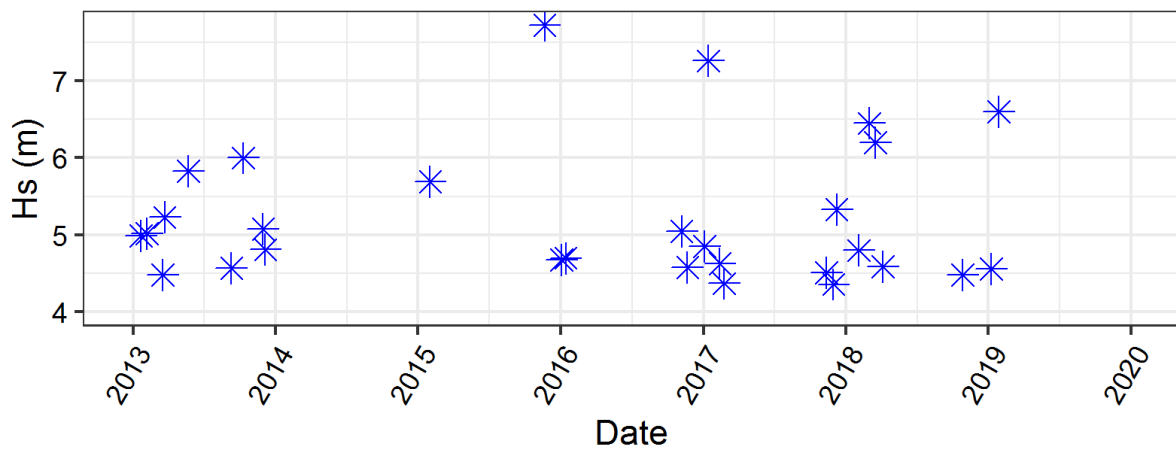
Whitby - Significant Wave Height (Hs) during 2016



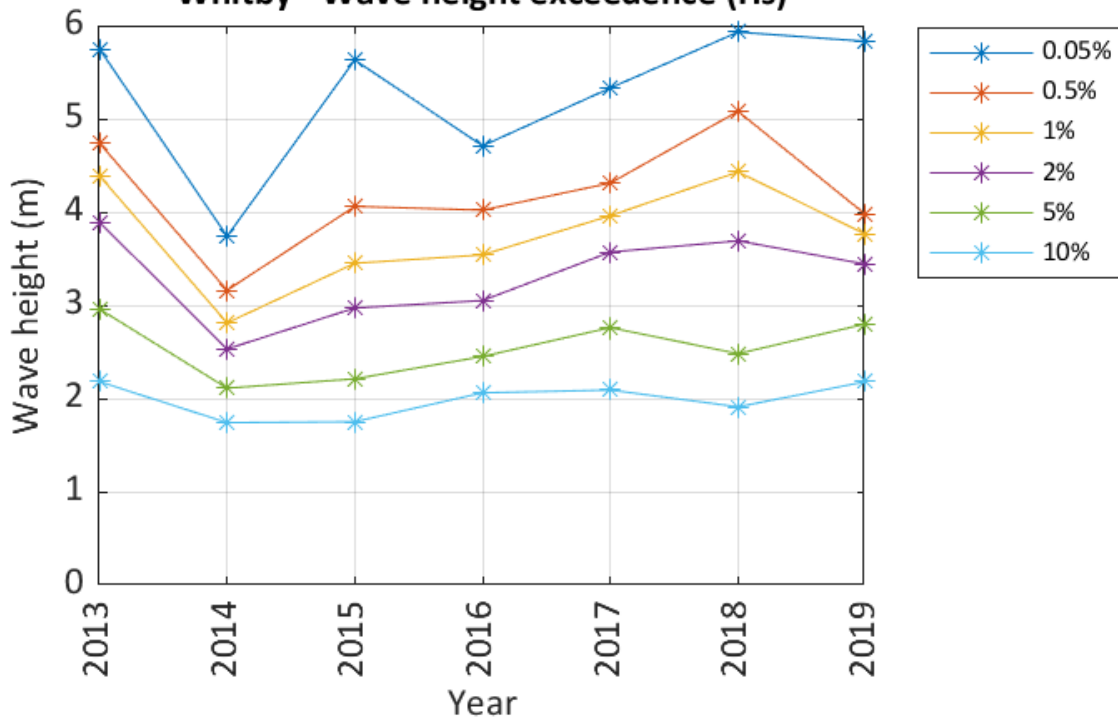
Storms at Whitby during 2016



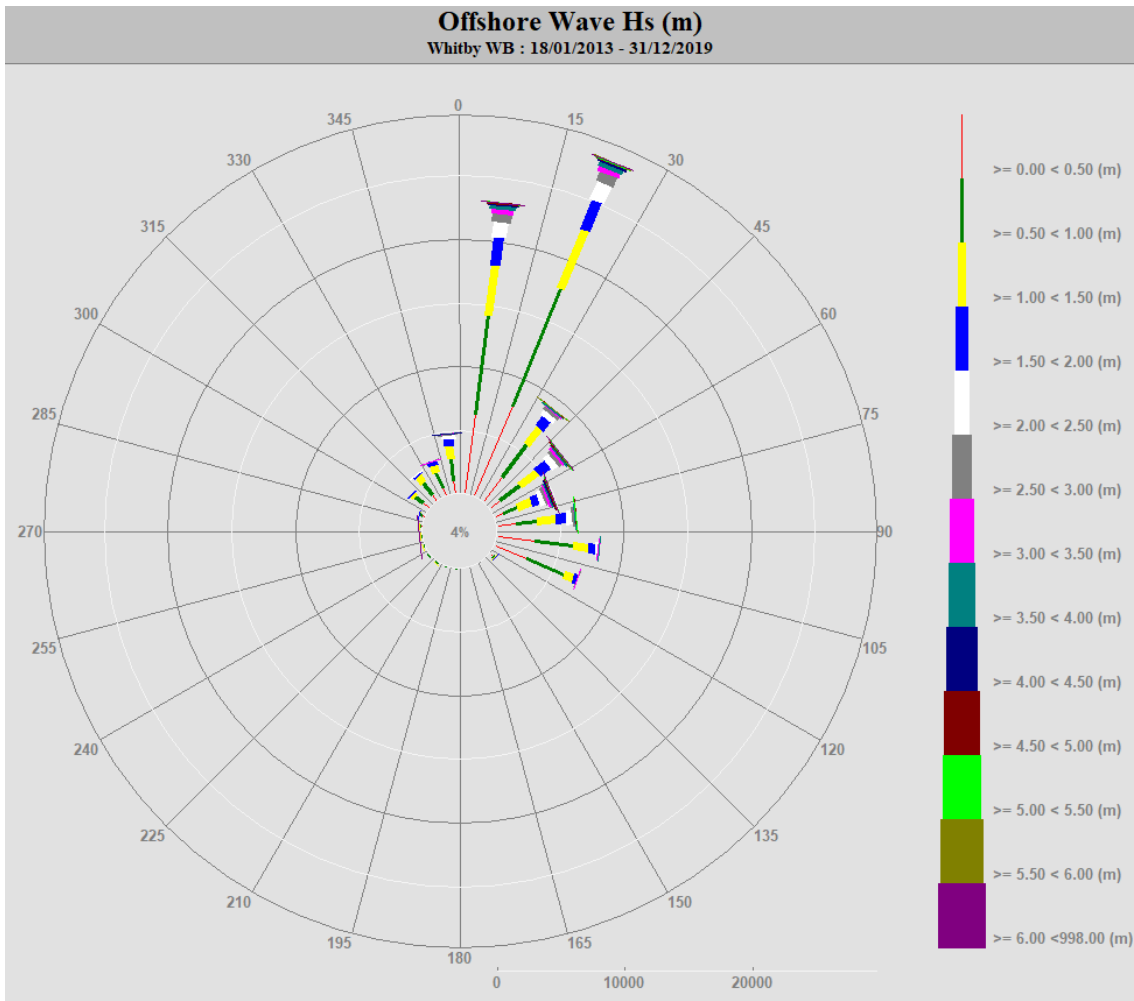
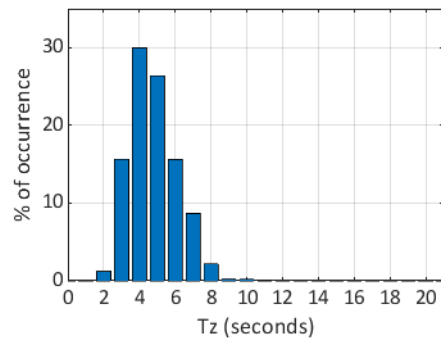
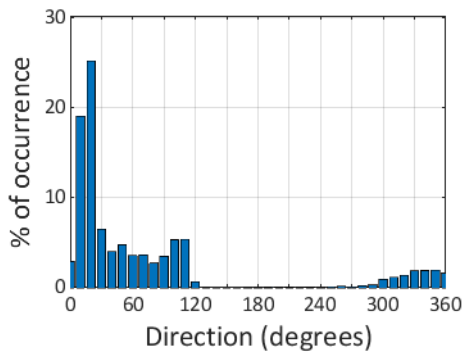
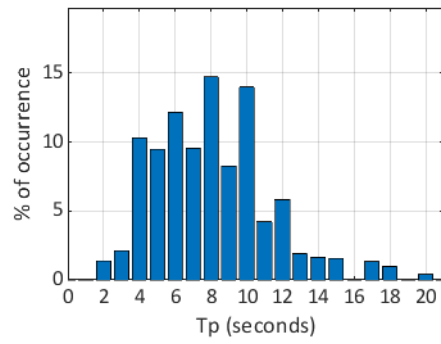
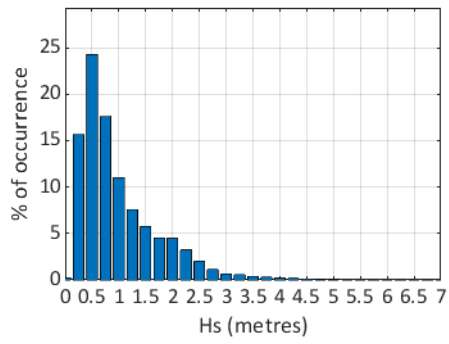
Storms at Whitby - all years



Whitby - Wave height exceedence (H_s)



Whitby 2016



Whitby 2013 to 2019 - Joint distribution (% of occurrence)

