



## Scarborough Directional Waverider Buoy

<b>Location</b>			
OS	509598 E 489943 N		
WGS84	Latitude: 54° 17.60' N Longitude: 00° 19.06' W		
<b>Instrument type</b>			
Datawell Directional Waverider Mk III			
<b>Water depth</b>	~19m CD	Buoy in situ off Scarborough beach. Photo courtesy of Fugro GB Marine Limited	Location of buoy (Google mapping, image ©2016 Infoterra Ltd & Bluesky)

## Data Quality

Recovery rate (%)	Sample interval
86	30 minutes

## Monthly Averages - 2019

All times are GMT

Month	H <sub>s</sub> (m)	T <sub>p</sub> (s)	T <sub>z</sub> (s)	Dir. (°)	SST (°C)	Bimodal seas (%)	No. of days
January	0.61	9.5	4.6	57	6.5	-	1
February	0.77	8.6	4.4	109	6.5	4	28
March	1.11	9.7	4.8	124	6.9	9	31
April	0.97	5.8	4.2	87	8.1	0	20
May	1.14	8.3	5.0	84	9.8	5	31
June	0.83	6.4	4.1	122	12.0	0	30
July	0.77	6.4	4.3	94	14.2	1	31
August	0.61	6.7	3.8	108	14.9	1	31
September	0.87	7.7	4.6	107	13.8	3	19
October	1.14	8.8	4.7	73	12.1	8	31
November	1.69	7.8	5.2	61	10.0	2	30
December	0.96	9.4	4.4	74	8.6	12	31

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

Month	H <sub>s</sub> (m)	T <sub>p</sub> (s)	T <sub>z</sub> (s)	Dir. (°)	SST (°C)	Bimodal seas (%)
January	1.30	8.8	4.8	103	7.1	8
February	1.25	8.5	4.7	92	6.2	6
March	1.33	8.6	4.9	89	6.0	6
April	1.09	7.6	4.6	84	6.5	7
May	0.91	7.4	4.4	78	9.1	2
June	0.79	6.8	4.4	84	11.6	1
July	0.63	5.9	3.9	103	13.8	0
August	0.64	6.6	11.1	112	14.0	1
September	0.86	7.0	4.3	103	13.5	2
October	1.20	8.0	4.7	96	12.6	5
November	1.35	8.3	4.8	95	10.7	6
December	1.08	9.3	4.6	88	8.7	10

## 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)
09-Dec-2019 10:00:00	4.57	10.0	7.1	0	0.09	HW -4	3.03	0.90	0.90
04-May-2019 09:30:00	4.47	10.0	7.5	11	-1.85	HW +6	4.00	-	-

\* Tidal information is obtained from the tide gauge at Scarborough and/or estimated from the predicted tide levels (Admiralty Total Tide). The surge shown is the residual at the time of the highest H<sub>s</sub>. The maximum tidal surge is the largest surge during the storm event.

## Annual Statistics

Year	Annual H <sub>s</sub> exceedance** (m)						Annual Maximum H <sub>s</sub>	
	0.05%	0.5%	1%	2%	5%	10%	Date	A <sub>max</sub> (m)
2013	5.49	4.91	4.44	3.74	2.88	2.12	10-Oct-2013 18:00:00	5.81
2014	3.91	3.16	2.95	2.63	2.22	1.84	14-Oct-2014 04:00:00	4.45
2015	5.79	4.28	3.57	3.10	2.30	1.82	21-Nov-2015 06:00:00	6.70
2016	4.46	4.00	3.65	3.07	2.45	2.09	06-Jan-2016 02:00:00	4.98
2017	5.97	4.29	3.91	3.45	2.79	2.16	13-Jan-2017 16:30:00	6.66
2018	6.13	5.16	4.58	3.92	2.73	2.10	01-Mar-2018 19:00:00	6.29
2019	4.19	3.58	3.28	3.02	2.4	1.89	09-Dec-2019 10:00:00	4.57

\*\* i.e. 5 % of the H<sub>s</sub> values measured in 2013 exceeded 2.88 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	4.24	No depth limitation
1	5.45	
2	5.89	
5	6.35	
10	6.62	
20	6.83	
50	7.06	

## Distribution plots

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

- Annual time series of  $H_s$  (red line is 4.24 m storm alert threshold)
- Incidence of storm waves for 2019. 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 2019
- 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

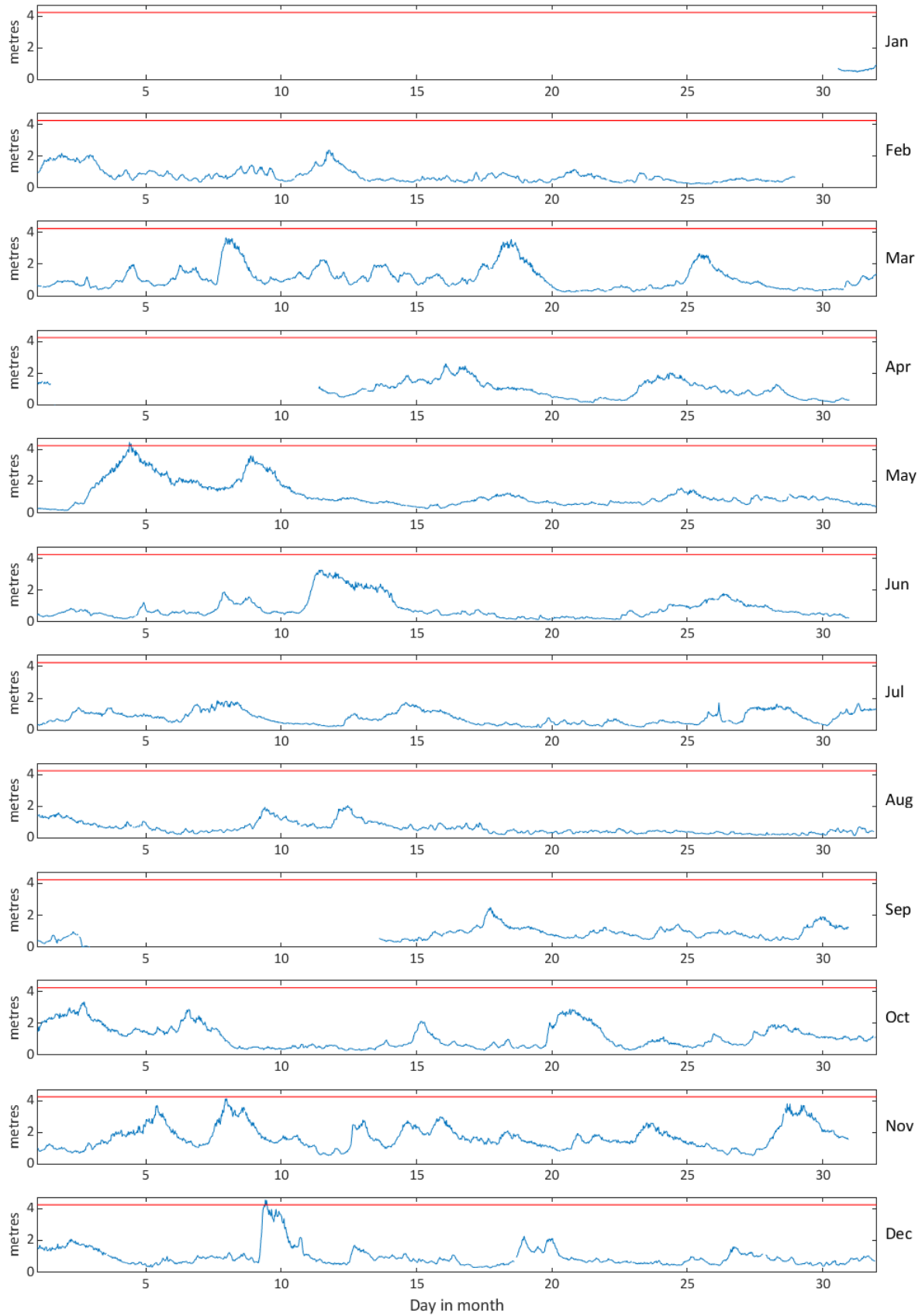
The buoy, owned by Scarborough Borough Council, was deployed on 18 January 2013, at which time the magnetic declination at the site was 1.66° west, changing by 0.18° east per year.

## Acknowledgements

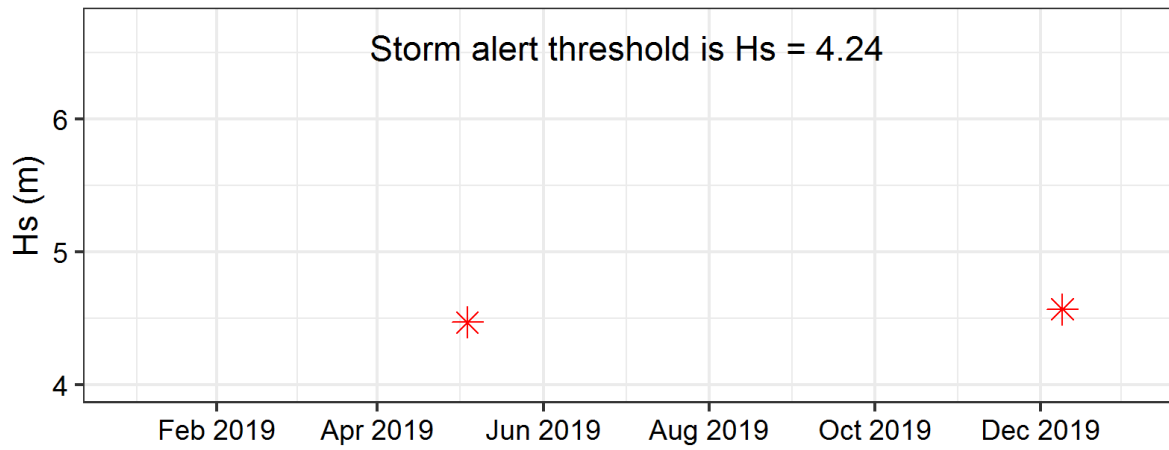
The shore station is kindly hosted by Scarborough Town Hall.

Tidal predictions were supplied by Fugro GB Marine Limited.

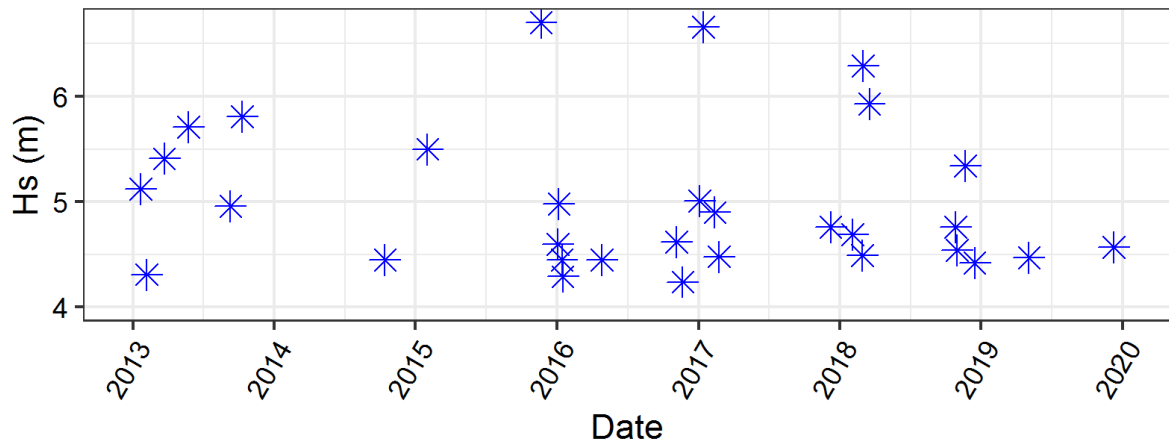
### Scarborough - Significant Wave Height (Hs) during 2019



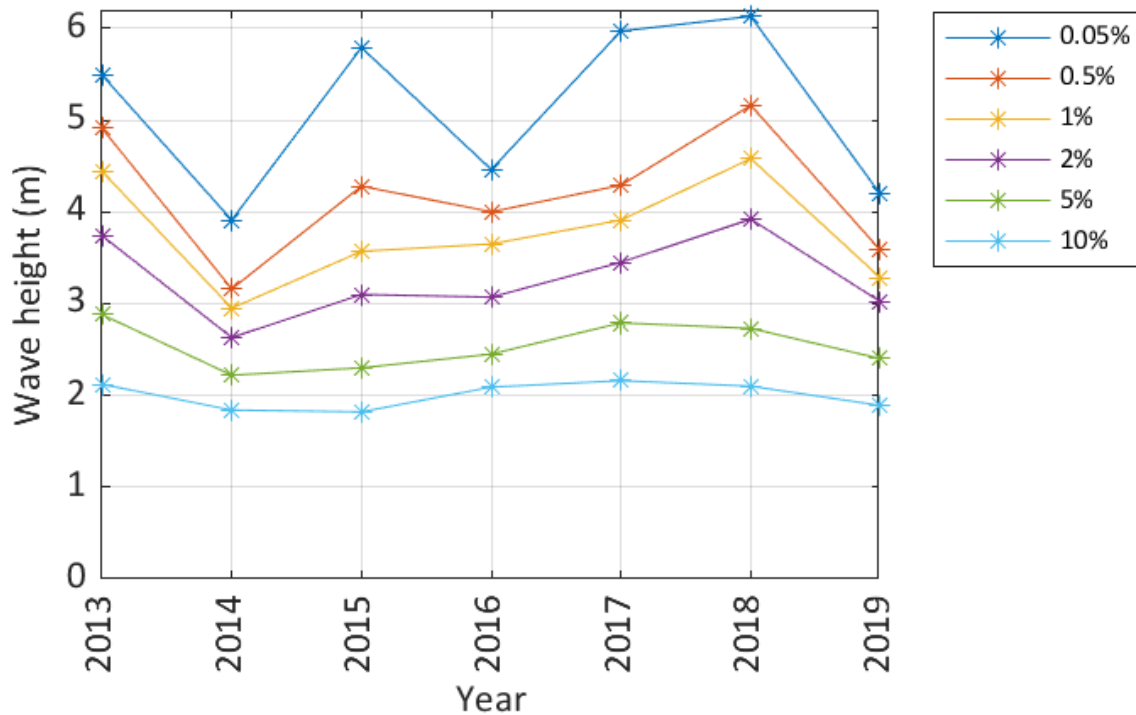
### Storms at Scarborough during 2019



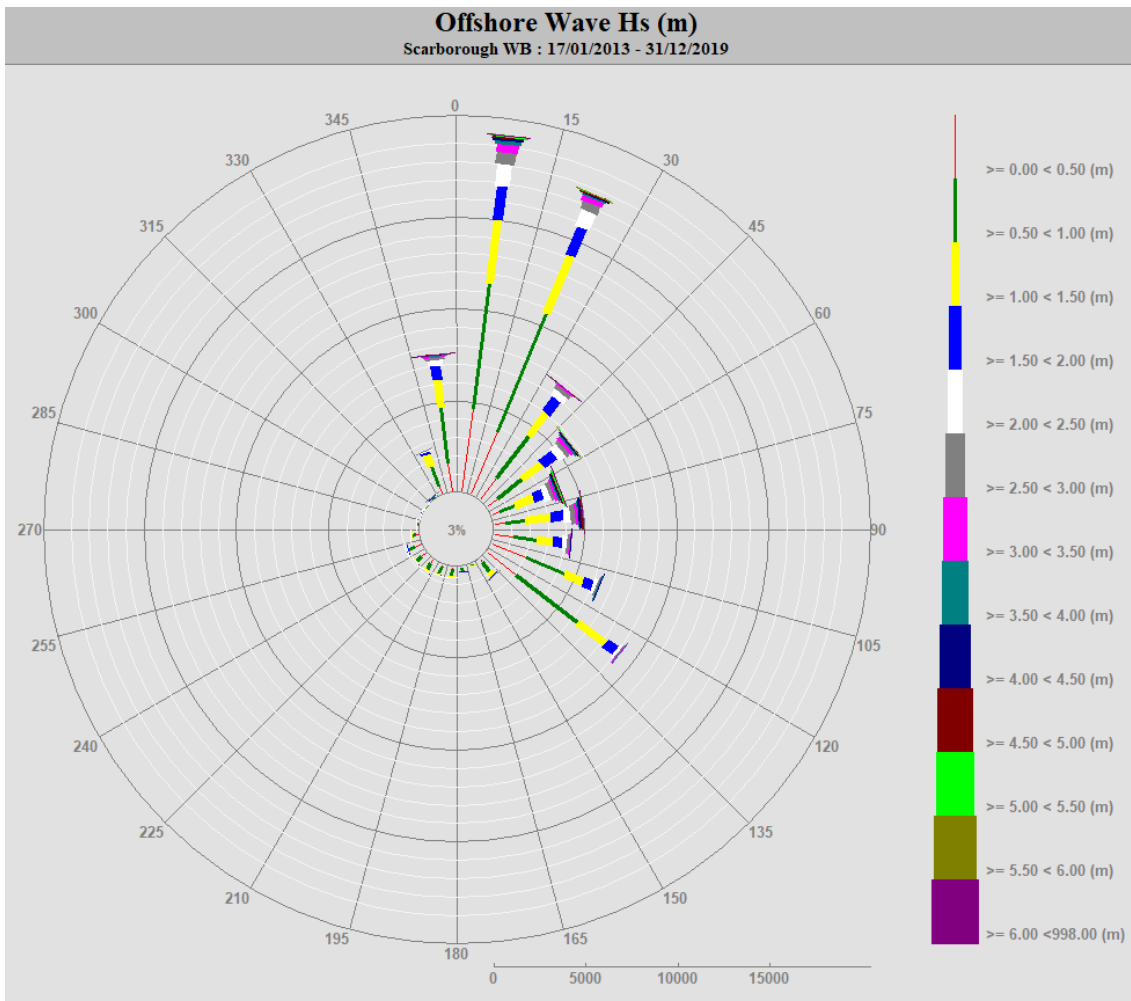
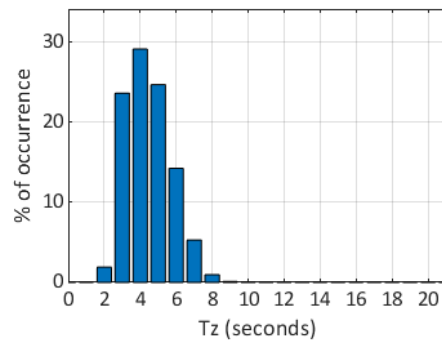
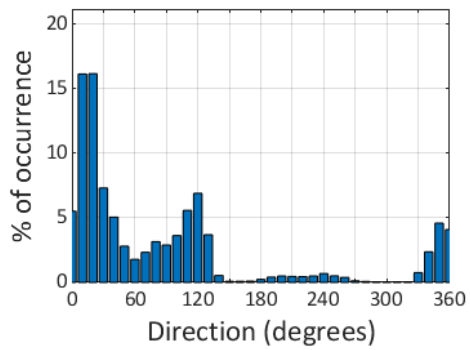
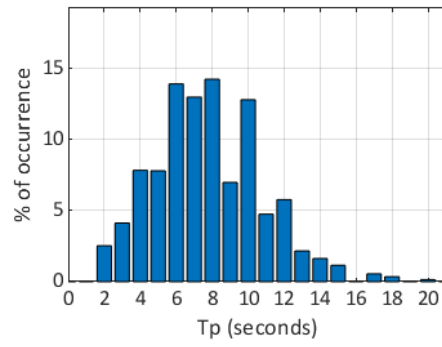
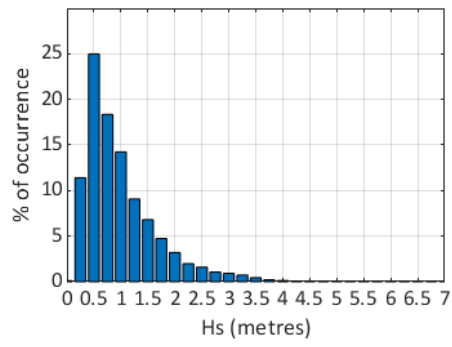
### Storms at Scarborough - all years



### Scarborough - Wave height exceedance (Hs)



Scarborough 2019



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

