

## Scarborough Directional Waverider Buoy

<b>Location</b>			
OS	509540 E 490003 N		
WGS84	Latitude: 54° 17.64' N Longitude: 00° 19.11' 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 EMU Limited	Location of buoy (Google mapping, image ©2016 Infoterra Ltd & Bluesky)

## Data Quality

<b>Recovery rate (%)</b>	<b>Sample interval</b>
93	30 minutes

## Monthly Averages - 2016

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	1.59	8.5	5.0	86	8.0	4	30
February	1.38	9.6	5.1	80	6.9	15	29
March	1.09	7.5	4.6	80	6.5	3	31
April	1.27	8.0	4.9	80	7.2	10	30
May	1.01	7.3	4.6	71	8.5	4	24
June	0.79	7.1	4.5	83	11.9	1	23
July	0.48	5.9	3.6	127	13.3	0	31
August	0.74	6.9	4.2	96	14.1	2	31
September	0.61	5.9	3.6	120	13.8	0	30
October	1.39	8.1	5.2	61	12.6	8	31
November	1.31	8.7	4.8	87	10.0	7	20
December	0.79	10.5	4.5	81	8.9	5	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)
06-Jan-2016 03:00	4.98	10.5	7.8	65	0.99	HW +2	2.62	-0.04	0.05
05-Nov-2016 16:00	4.62	11.1	7.3	8	0.71	HW -3	3.06	0.31	0.48
03-Jan-2016 10:00	4.60	11.1	8.0	59	0.99	HW +5	2.21	-0.25	-0.12
26-Apr-2016 04:00	4.45	10.0	7.0	1	1.20	HW -2	3.74	0.29	0.47
14-Jan-2016 15:30	4.45	9.1	6.8	356	0.14	HW -4	4.40	0.42	0.51
05-Jan-2016 23:30	4.31	10.0	7.3	68	1.08	HW -2	2.26	0.10	0.10
16-Jan-2016 02:30	4.29	11.1	7.8	14	-1.73	HW +7	4.45	0.30	0.49
21-Nov-2016 19:00	4.24	8.3	6.6	55	1.21	HW -2	2.70	0.36	0.40

\* Tidal information is obtained from the tide gauge at Scarborough. 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	-	4.93	4.46	3.76	2.89	2.12	10-Oct-2013 20:30	6.03
2014	3.91	3.16	2.95	2.63	2.22	1.84	14-Oct-2014 04:30	4.45
2015	6.17	4.35	3.57	3.12	2.31	1.81	21-Nov-2015 07:00	6.70
2016	4.46	3.96	3.56	2.99	2.44	2.08	06-Jan-2016 03:00	4.98

\*\* i.e. 5 % of the H<sub>s</sub> values measured in 2013 exceeded 2.89 m

## Distribution plots

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

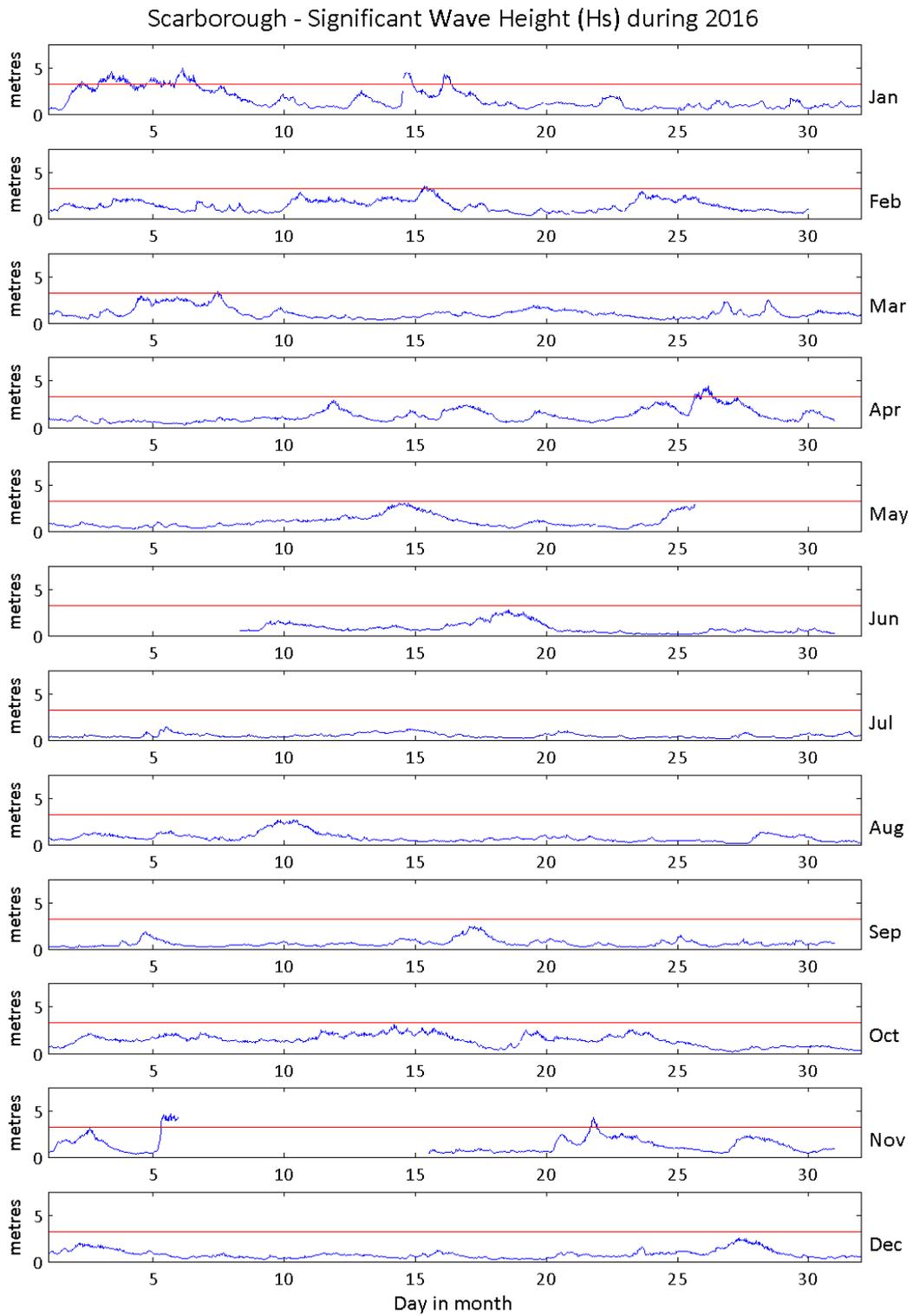
- Annual time series of  $H_s$  (red line is 3.25 m storm threshold)
- Incidence of storm waves for 2016. Storm events are defined using the Peaks-over-Threshold method. The highest  $H_s$  of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of  $H_s$ ,  $T_p$ ,  $T_z$  and Direction for 2016
- 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

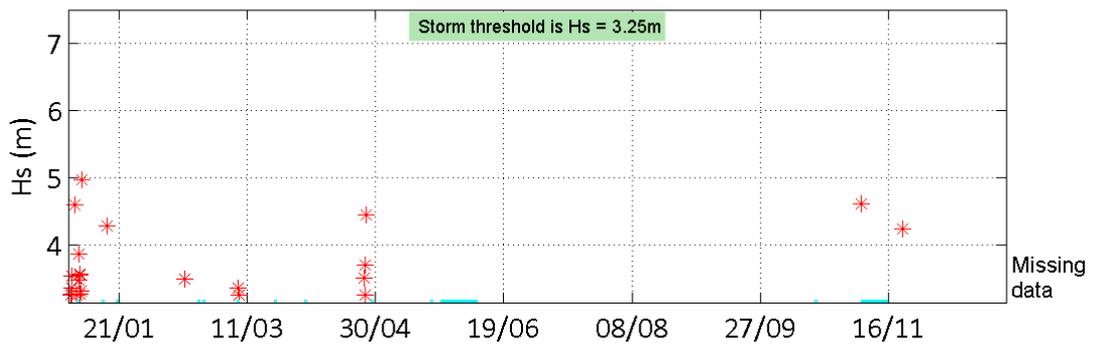
The buoy, owned by Scarborough Borough Council, was deployed on 18 January 2013, at which time the magnetic declination at the site was 1.66° west, changing by 0.18° east per year.

## Acknowledgements

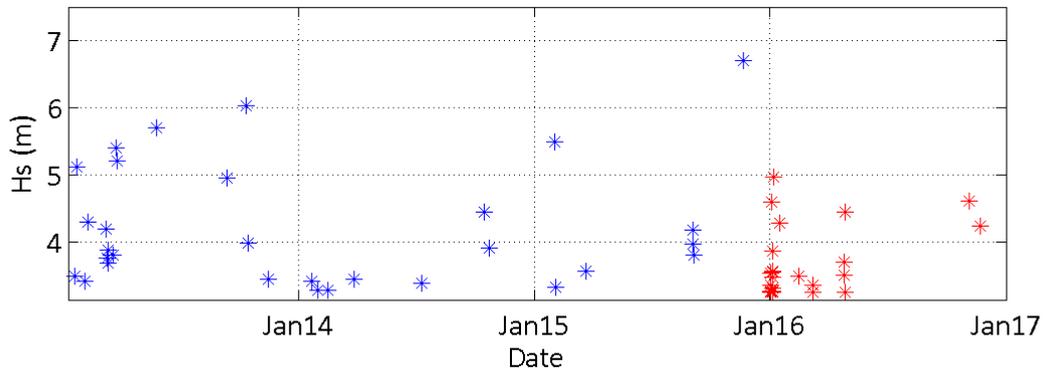
Tidal predictions were produced using the TASK windows edition software, kindly provided by the Marine Data Products team at the UK National Oceanography Centre (Liverpool).



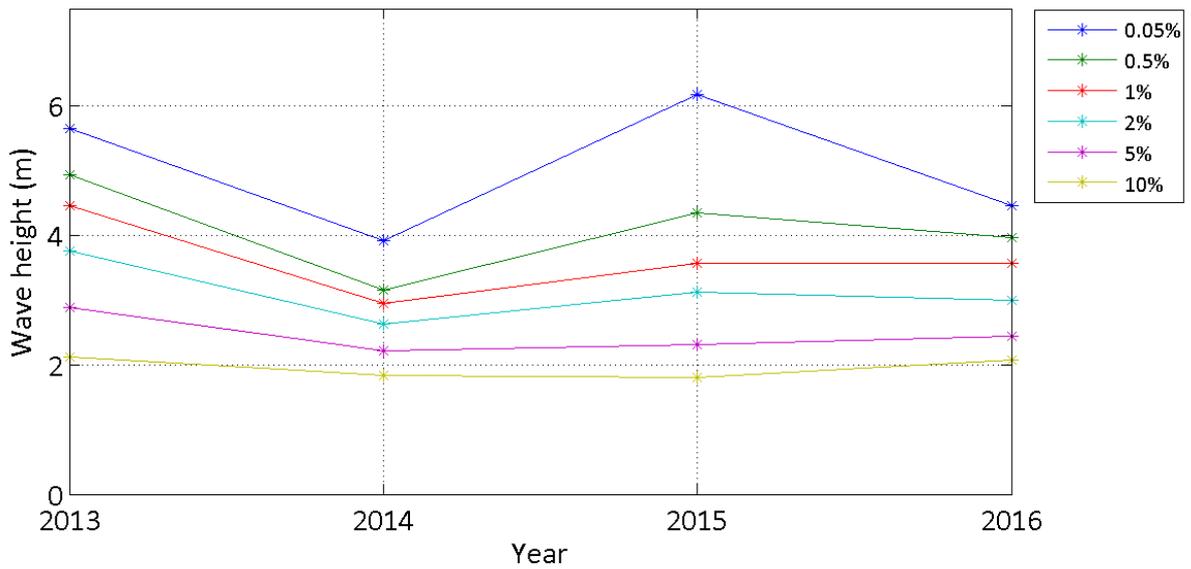
Storms at Scarborough during 2016



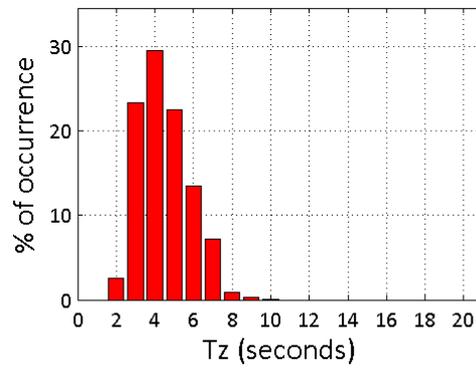
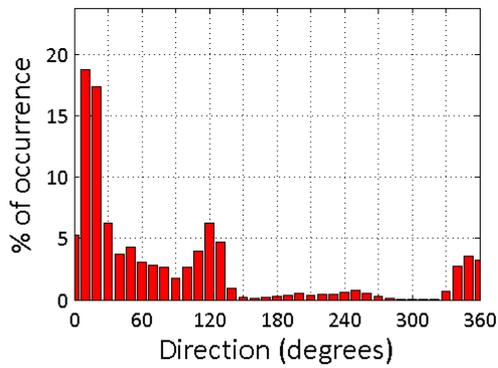
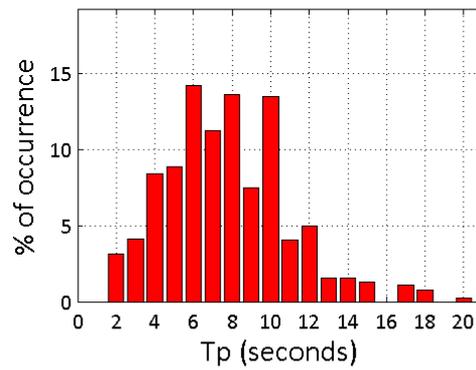
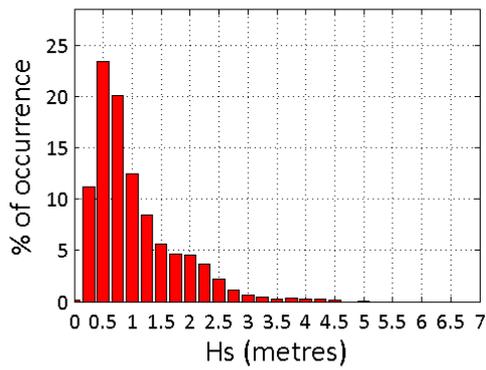
Storms at Scarborough - all years



Scarborough - Wave height exceedence ( $H_s$ )



Scarborough 2016



Scarborough 2013 to 2016 - Joint distribution (% of occurrence)

