
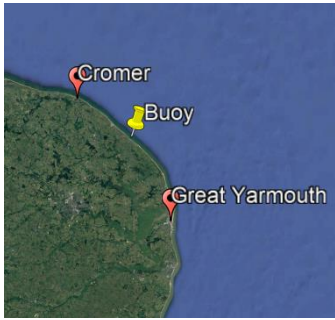


## Happisburgh Directional Waverider Buoy

<b>Location</b>			
OS	639248 E 331307 N		
WGS84	Latitude: 52° 49.58' N Longitude: 01° 32.97' E		
<b>Instrument type</b>			
Datawell Directional Waverider Mk III			
<b>Water depth</b>	~10m CD	Example buoy in situ. Photo courtesy of Fugro Marine GB Limited	Location of buoy (Google mapping, image ©2019 Landsat / Copernicus)

## Data Quality

<b>Recovery rate (%)</b>	<b>Sample interval</b>
17	30 minutes

## Monthly Averages - 2017

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
February	-	-	-	-	-	-	0
March	0.49	3.5	2.8	160	8.7	-	0
April	0.84	6.5	3.9	87	9.7	-	17
May	0.85	5.7	3.8	109	11.1	-	10
June	0.83	5.1	3.6	166	14.4	-	12
July	0.76	4.8	3.5	179	16.3	-	19
August	0.67	4.3	3.1	198	16.9	-	3
September	-	-	-	-	-	-	0
October	-	-	-	-	-	-	0
November	-	-	-	-	-	-	0
December	-	-	-	-	-	-	0

## Monthly Averages - All Years (May 2012 – December 2019)

Month	H <sub>s</sub> (m)	T <sub>p</sub> (s)	T <sub>z</sub> (s)	Dir. (°)	SST (°C)	Bimodal seas (%)
January	0.77	7.1	4.5	101	5.8	-
February	0.72	7.1	4.3	86	4.9	-
March	0.80	7.0	4.3	93	6.1	-
April	0.69	6.4	4.0	83	8.8	-
May	0.67	6.2	4.1	82	12.0	-
June	0.59	5.9	4.0	76	15.0	-
July	0.50	5.4	3.8	90	18.0	-
August	0.48	5.4	3.8	104	18.4	-
September	0.65	6.3	4.1	92	16.4	-
October	0.75	6.6	4.3	83	13.4	-
November	0.77	6.8	4.4	90	9.8	-
December	0.67	7.2	4.4	102	7.1	-

## 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)
28-Jun-2017 13:00:00	2.68	7.1	5.4	55	0.43	HW +4	4.23	0.37	0.46

\* Tidal information is obtained from the National Network gauge at Cromer. The surge shown is the residual at the time of the highest H<sub>s</sub>. The maximum tidal surge is the large 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)
2012	2.89	2.52	2.25	1.95	1.48	1.16	27-Oct-2012 03:00:00	3.16
2013	3.53	2.85	2.65	2.36	1.89	1.48	10-Oct-2013 21:00:00	4.06
2014	2.68	2.22	1.95	1.67	1.37	1.14	09-Jul-2014 14:30:00	3.00
2015	3.03	2.25	2.03	1.79	1.42	1.16	21-Nov-2015 11:00:00	3.84
2016	3.36	2.51	2.35	2.08	1.70	1.35	14-Jan-2016 20:30:00	3.60
2017	2.68	2.35	2.24	2.04	1.76	1.48	28-Jun-2017 13:00:00	2.68
2018	2.88	2.47	2.19	1.93	1.53	1.18	20-Nov-2018 04:00:00	3.00
2019	3.21	2.56	2.33	2.06	1.61	1.27	27-Jan-2019 22:30:00	3.62

\*\* i.e. 5 % of the H<sub>s</sub> values measured in 2012 exceeded 1.48 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	May 2012 to December 2019	
Return period (years)	Significant wave height (m)	Comments
0.25	2.66	No depth limitation
1	3.26	
2	3.49	
5	3.74	
10	3.89	
20	4.02	Depth-limited at MLWS
50	4.16	

## Distribution plots

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

- Annual time series of  $H_s$  (red line is 2.66 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
- 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

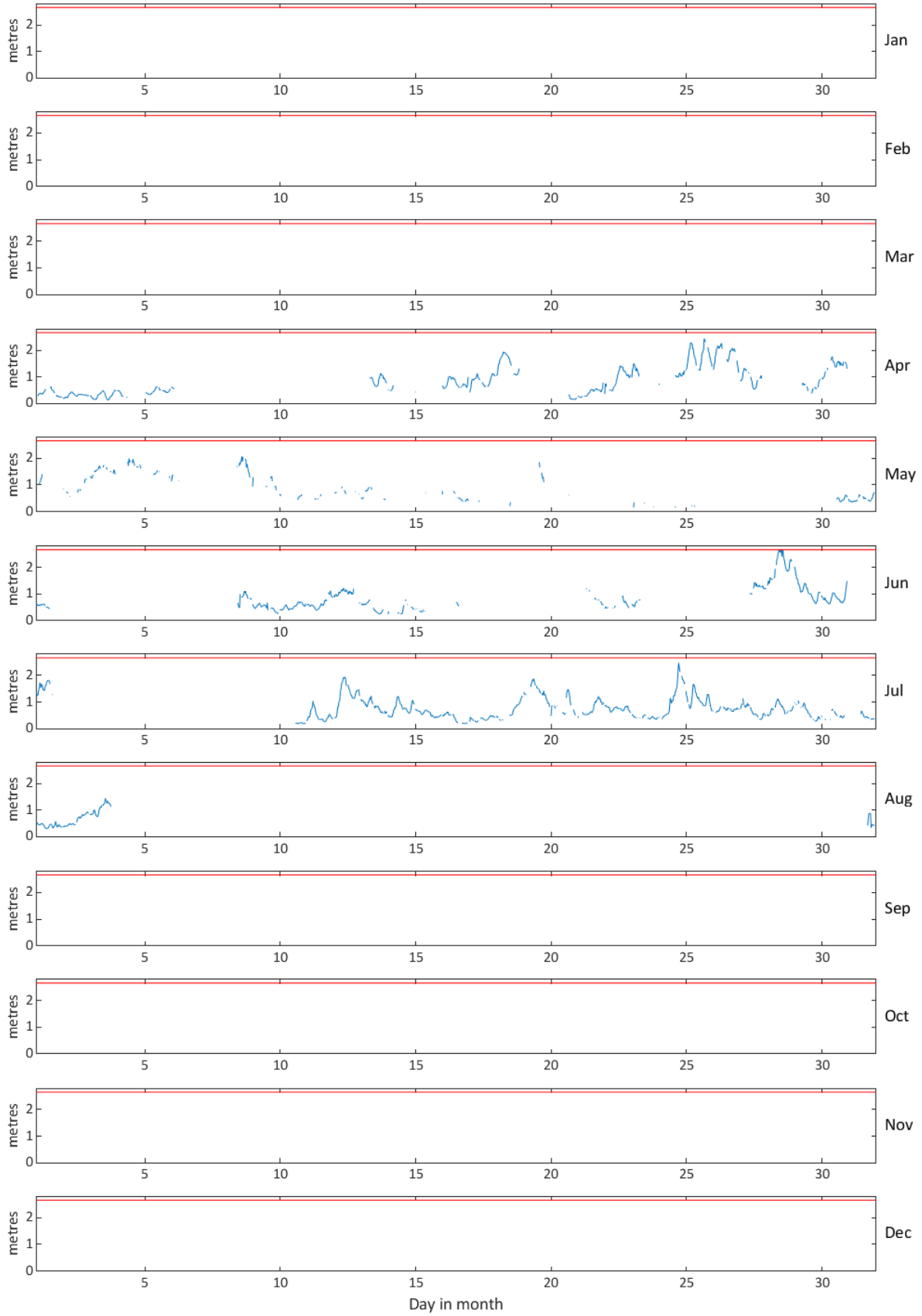
## General

The buoy, owned by the Environment Agency, was first deployed on 09 May 2012, at which time the magnetic declination at the site was  $1.04^\circ$  west, changing by  $0.17^\circ$  east per year.

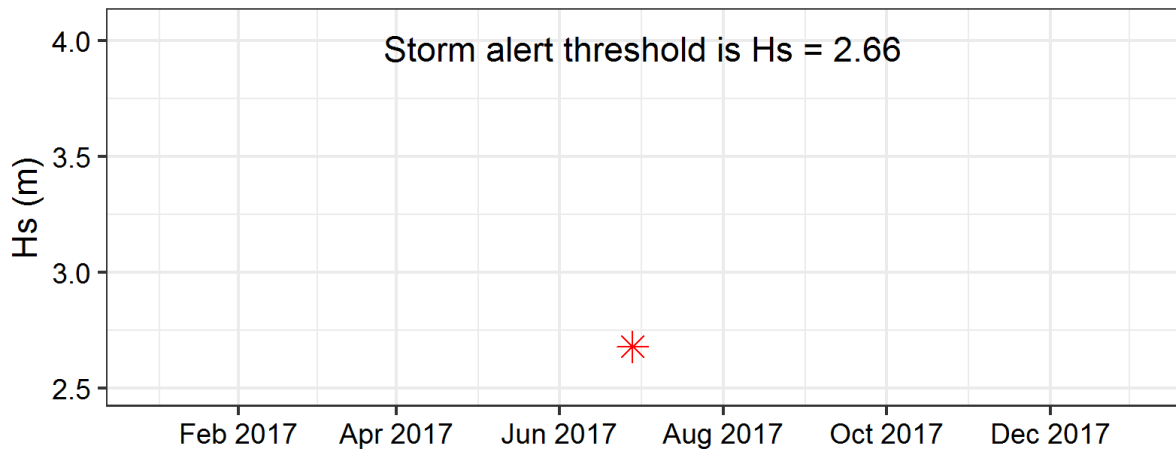
## Acknowledgements

The shore station is kindly hosted by Happisburgh RNLI Lifeboat Station.

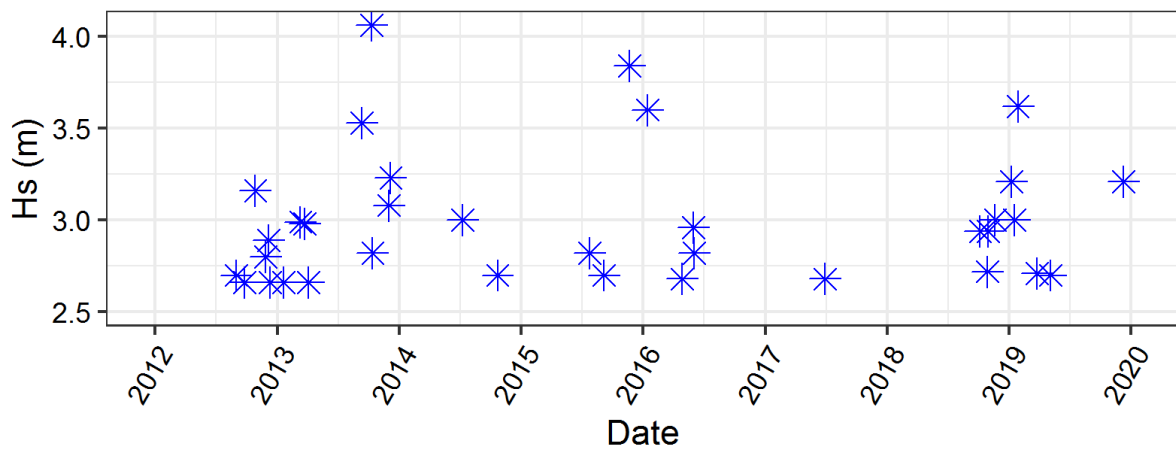
### Happisburgh - Significant Wave Height (Hs) during 2017



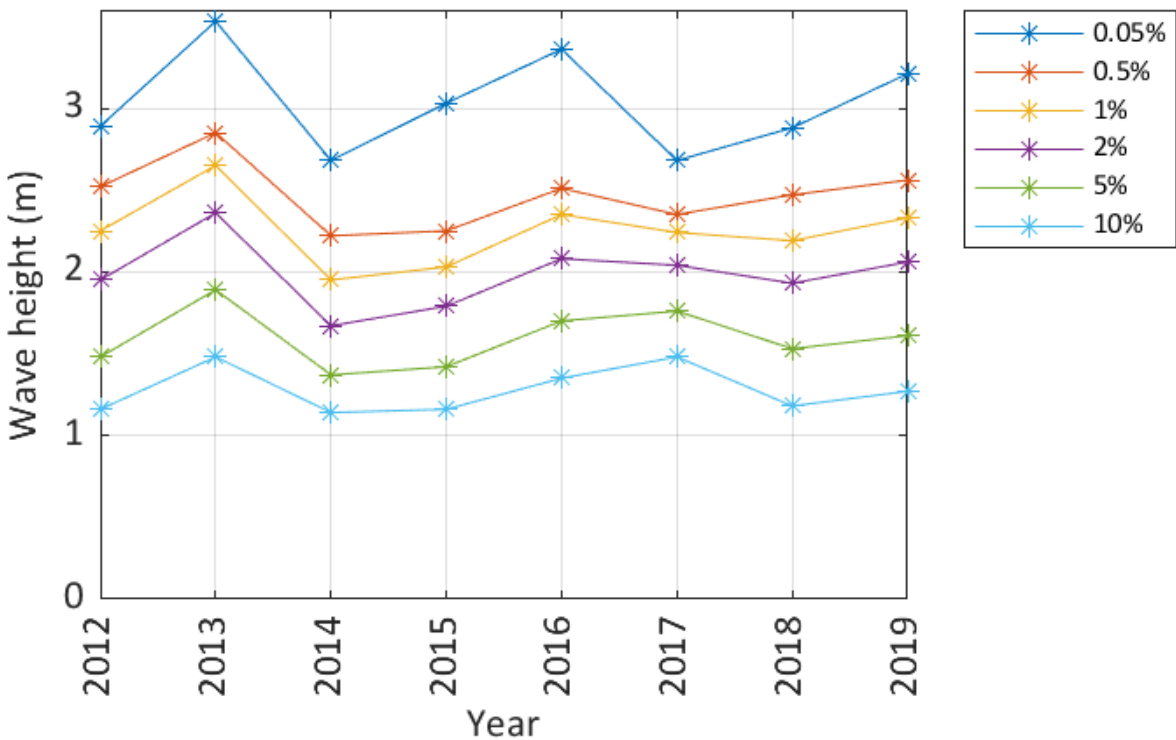
### Storms at Happisburgh during 2017



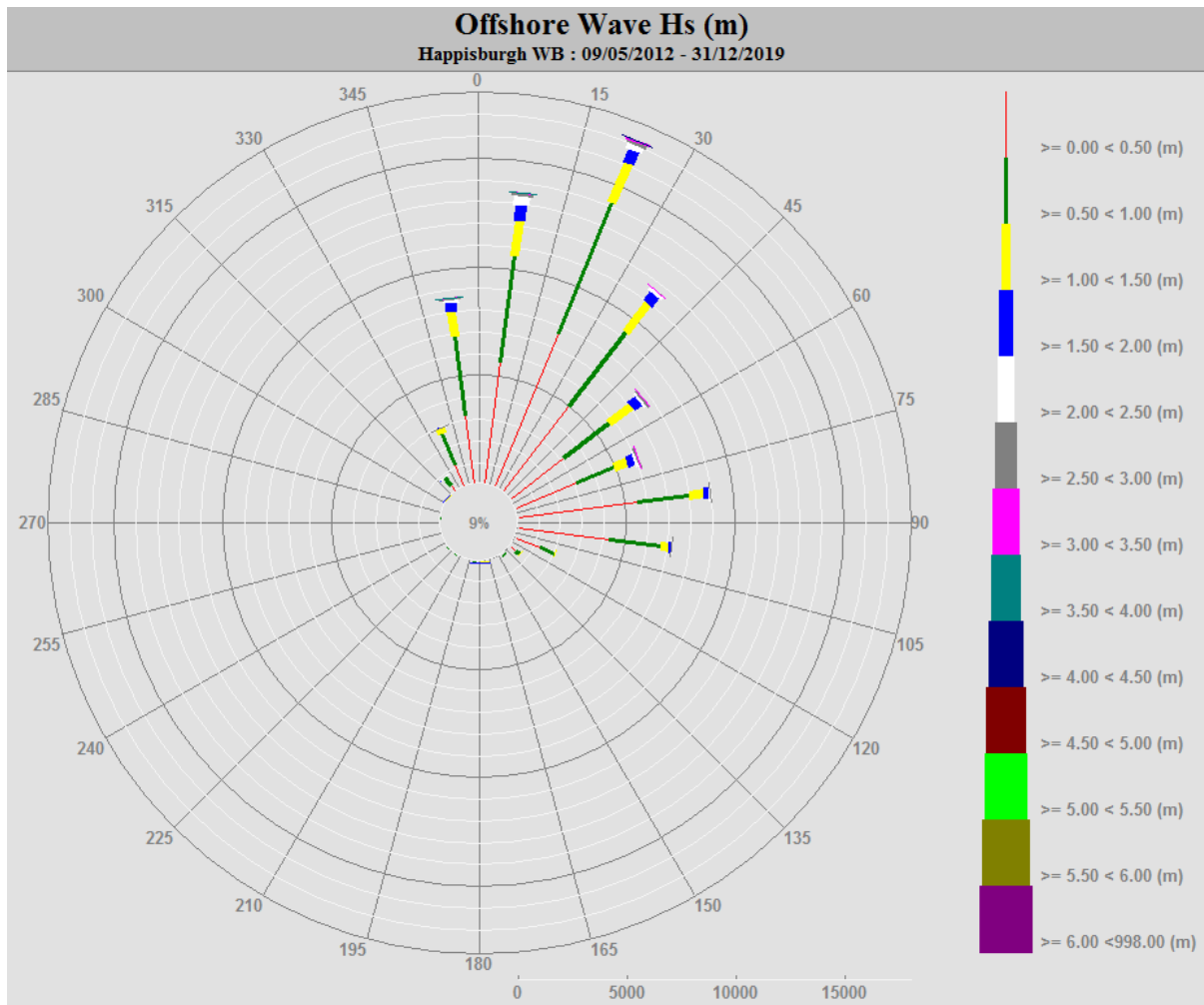
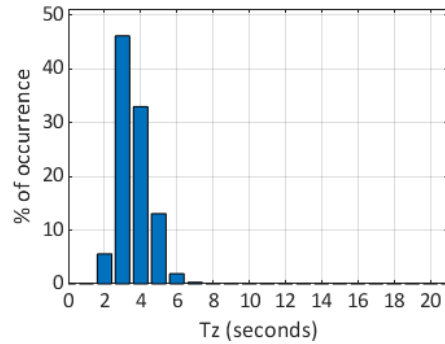
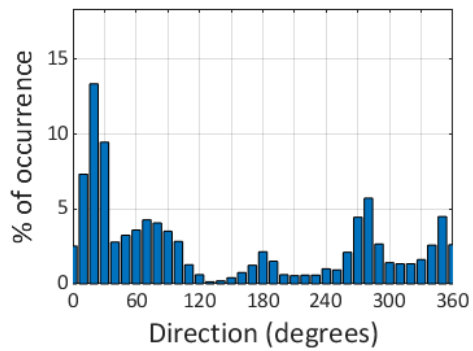
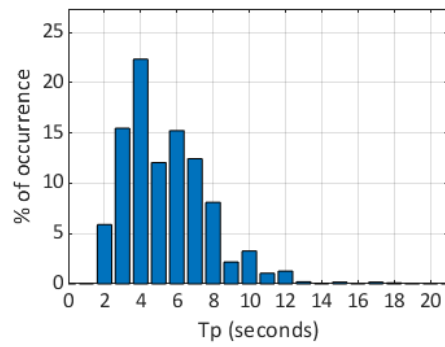
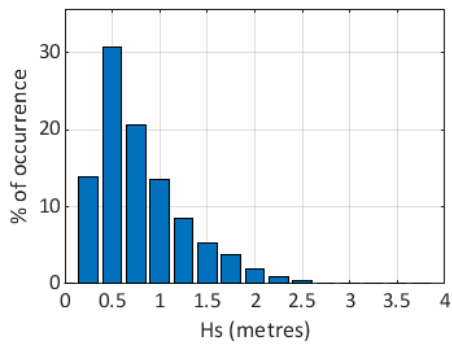
### Storms at Blakeney Overfalls - all years



### Happisburgh - Wave height exceedance (Hs)



### Happisburgh 2017



### Happisburgh 2012 to 2019 - Joint distribution (% of occurrence)

