Felixstowe Directional Waverider Buoy

Location			
OS	633378 E 232069 N		
WGS84	*Latitude:* 51° 56.29' N *Longitude:* 01° 23.63' E		
Instrument type			
Datawell Directional Waverider Mk III			
Water depth	~8m CD	Example buoy in situ. Photo courtesy of Fugro Marine GB Limited	Location of buoy (Google mapping, image ©2019 Landsat / Copernicus)

Data Quality

Recovery rate (%)	**Sample interval**
100	30 minutes

Monthly Averages - 2013

All times are GMT

Month	**H_s (m)**	**T_p (s)**	**T_z (s)**	**Dir. (°)**	**SST (°C)**	**Bimodal seas (%)**	**No. of days**
January	0.65	4.8	3.5	132	5.5	-	31
February	0.75	5.5	3.7	107	4.0	-	28
March	0.98	6.4	4.2	94	3.9	-	31
April	0.68	4.7	3.4	121	6.4	-	30
May	0.54	4.8	3.4	120	11.2	-	31
June	0.60	4.8	3.5	116	14.0	-	30
July	0.42	4.2	3.2	115	17.6	-	31
August	0.42	3.8	3.0	141	19.4	-	31
September	0.50	4.9	3.3	125	17.4	-	30
October	0.72	4.9	3.5	144	14.4	-	31
November	0.57	5.1	3.6	130	10.1	-	30
December	0.63	4.6	3.4	155	7.3	-	31

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

Month	**H_s (m)**	**T_p (s)**	**T_z (s)**	**Dir. (°)**	**SST (°C)**	**Bimodal seas (%)**
January	0.62	4.9	3.5	143	6.2	-
February	0.66	4.9	3.5	135	5.4	-
March	0.63	5.0	3.5	128	6.8	-
April	0.54	4.7	3.3	117	9.2	-
May	0.51	4.6	3.3	120	12.5	-
June	0.52	4.4	3.2	127	15.9	-
July	0.44	4.3	3.1	131	18.7	-
August	0.47	4.1	3.1	145	19.3	-
September	0.50	4.6	3.3	131	17.6	-
October	0.64	5.0	3.5	127	14.3	-
November	0.67	5.0	3.5	133	10.4	-
December	0.61	4.7	3.4	150	7.7	-

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)
11-Oct-2013 15:30:00	2.77	8.3	5.8	79	1.91	HW	3.35	0.19	0.25
11-Mar-2013 23:00:00	2.67	8.3	5.3	83	1.70	HW -1	3.40	-0.16	0.28
23-Mar-2013 06:30:00	2.53	8.3	5.4	86	0.14	HW -2	2.32	-0.38	-0.18
04-Apr-2013 13:30:00	2.36	7.7	4.8	80	-0.12	HW -4	2.18	0.35	0.35
24-Dec-2013 02:00:00	2.29	5.3	4.3	193	0.79	HW	2.54	-0.49	-0.48
28-Oct-2013 07:30:00	2.22	4.8	4.0	210	0.60	HW +3	2.28	0.05	0.20
10-Feb-2013 23:00:00	2.12	7.1	4.8	124	1.40	HW -1	3.31	-0.27	-0.09
21-Nov-2013 08:30:00	2.12	6.7	4.8	87	-1.02	HW -5	3.20	-	-
01-Apr-2013 22:30:00	2.09	6.7	4.6	73	-0.44	HW -5	3.31	0.35	0.38
20-Jan-2013 16:00:00	2.04	8.3	5.1	84	0.71	HW -2	2.30	0.09	0.23
27-Dec-2013 03:30:00	2.01	5.9	4.4	165	0.66	HW -2	1.55	0.10	0.28

** Tidal information is obtained from the National Network gauge at Harwich 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)
2012	1.95	1.64	1.52	1.38	1.14	0.94	23-Sep-2012 23:30:00	2.07
2013	2.59	2.27	2.12	1.91	1.45	1.15	11-Oct-2013 15:30:00	2.77
2014	2.18	1.72	1.58	1.43	1.20	1.00	28-Dec-2014 04:00:00	2.54
2015	1.86	1.51	1.37	1.28	1.12	0.98	06-Feb-2015 09:30:00	2.09
2016	2.26	1.87	1.70	1.51	1.24	1.00	07-Nov-2016 02:00:00	2.58
2017	1.79	1.61	1.44	1.27	1.08	0.92	13-Feb-2017 23:30:00	1.88
2018	2.52	1.90	1.67	1.43	1.15	0.94	19-Nov-2018 18:00:00	2.62
2019	1.94	1.60	1.48	1.32	1.12	0.97	02-Nov-2019 14:30:00	2.13

*** i.e. 5 % of the H_s values measured in 2012 exceeded 1.14 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	1.90	No depth limitation
1	2.32	
2	2.48	
5	2.64	
10	2.74	
20	2.82	
50	2.90	

Distribution plots

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

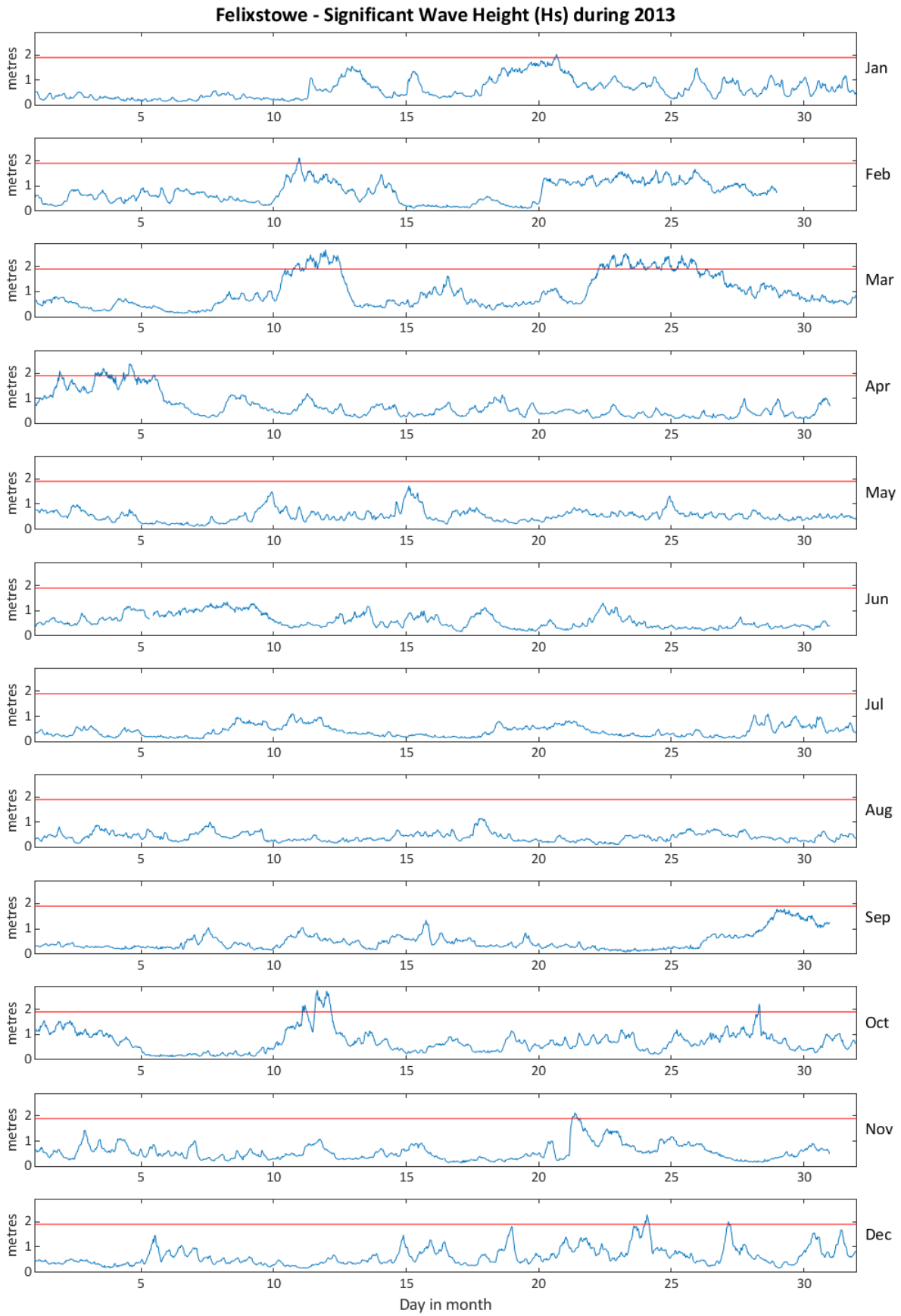
- Annual time series of H_s (red line is 1.90 m storm threshold)
- Incidence of storm waves for 2013. Storm events are defined using the Peaks-over-Threshold method. The highest H_s of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of H_s, T_p, T_z and Direction for 2013
- 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

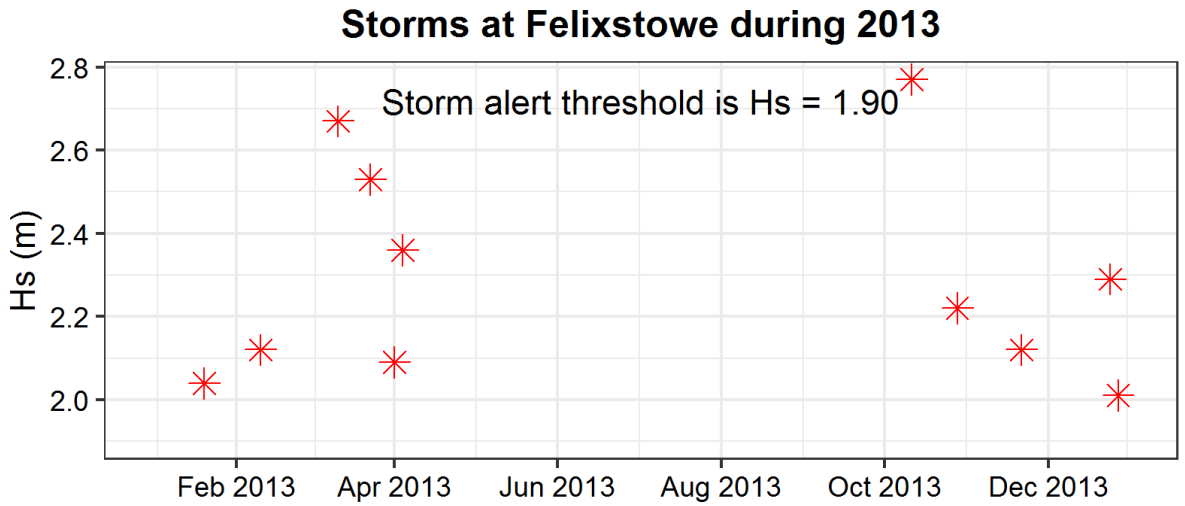
General

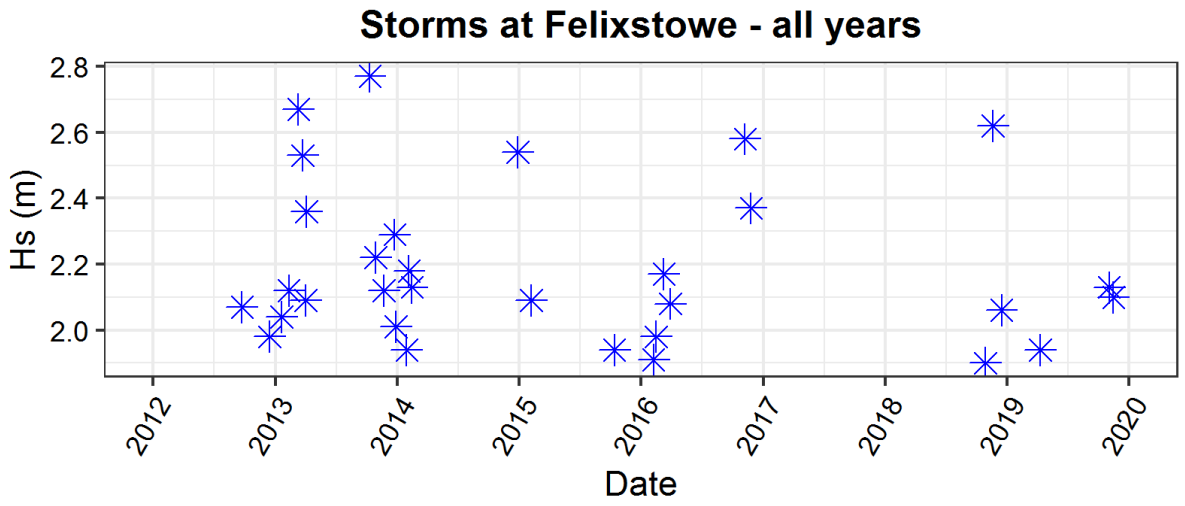
The buoy, owned by the Environment Agency, was first deployed on 13 May 2012, at which time the magnetic declination at the site was 0.89° west, changing by 0.17° east per year.

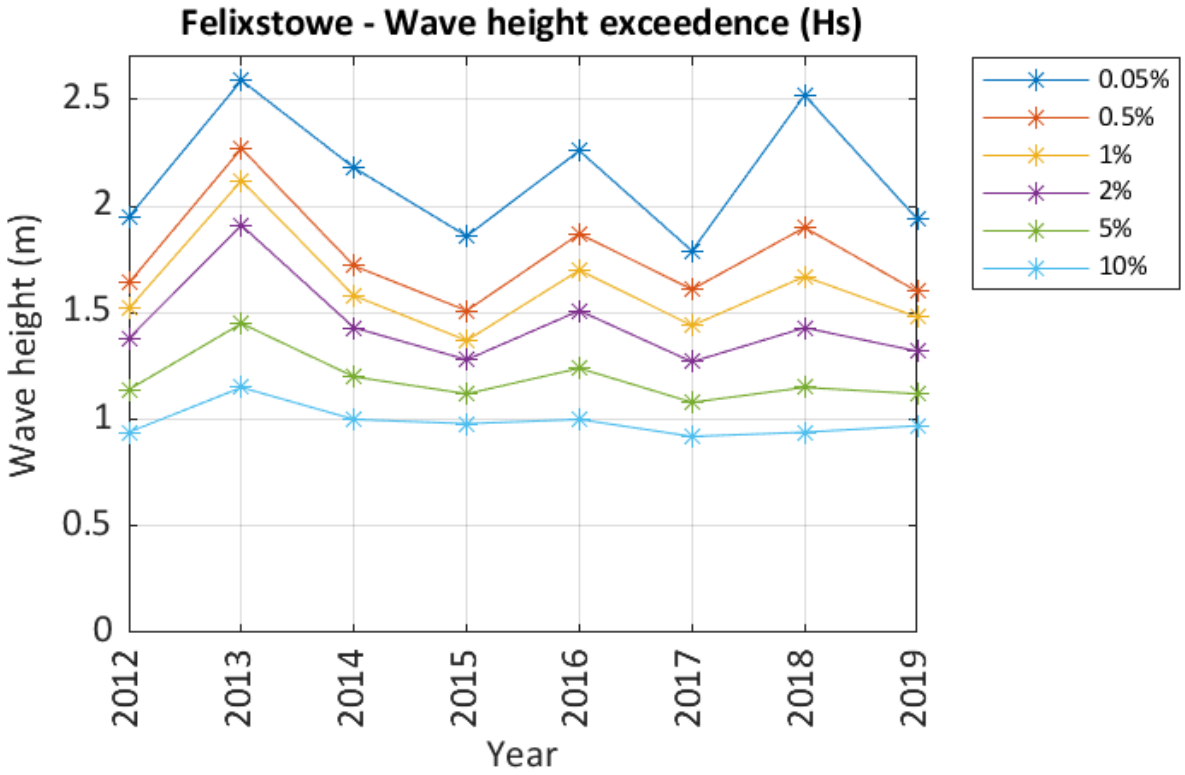
Acknowledgements

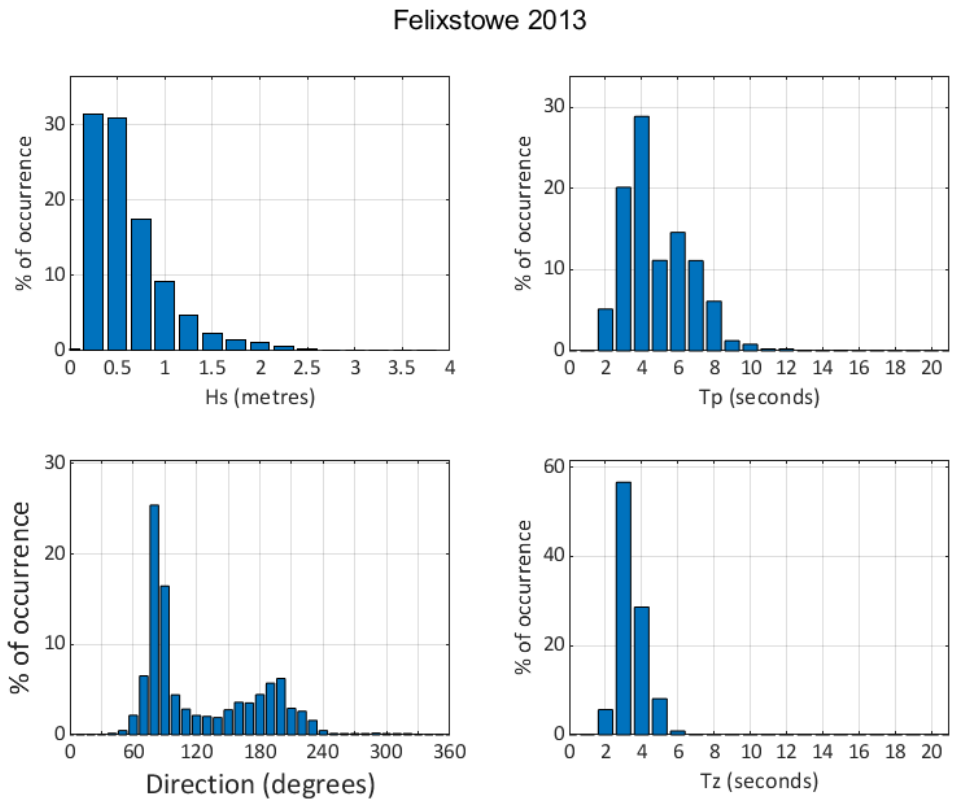
The shore station is kindly hosted by Clacton-on-the-Sea RNLI Lifeboat Station.

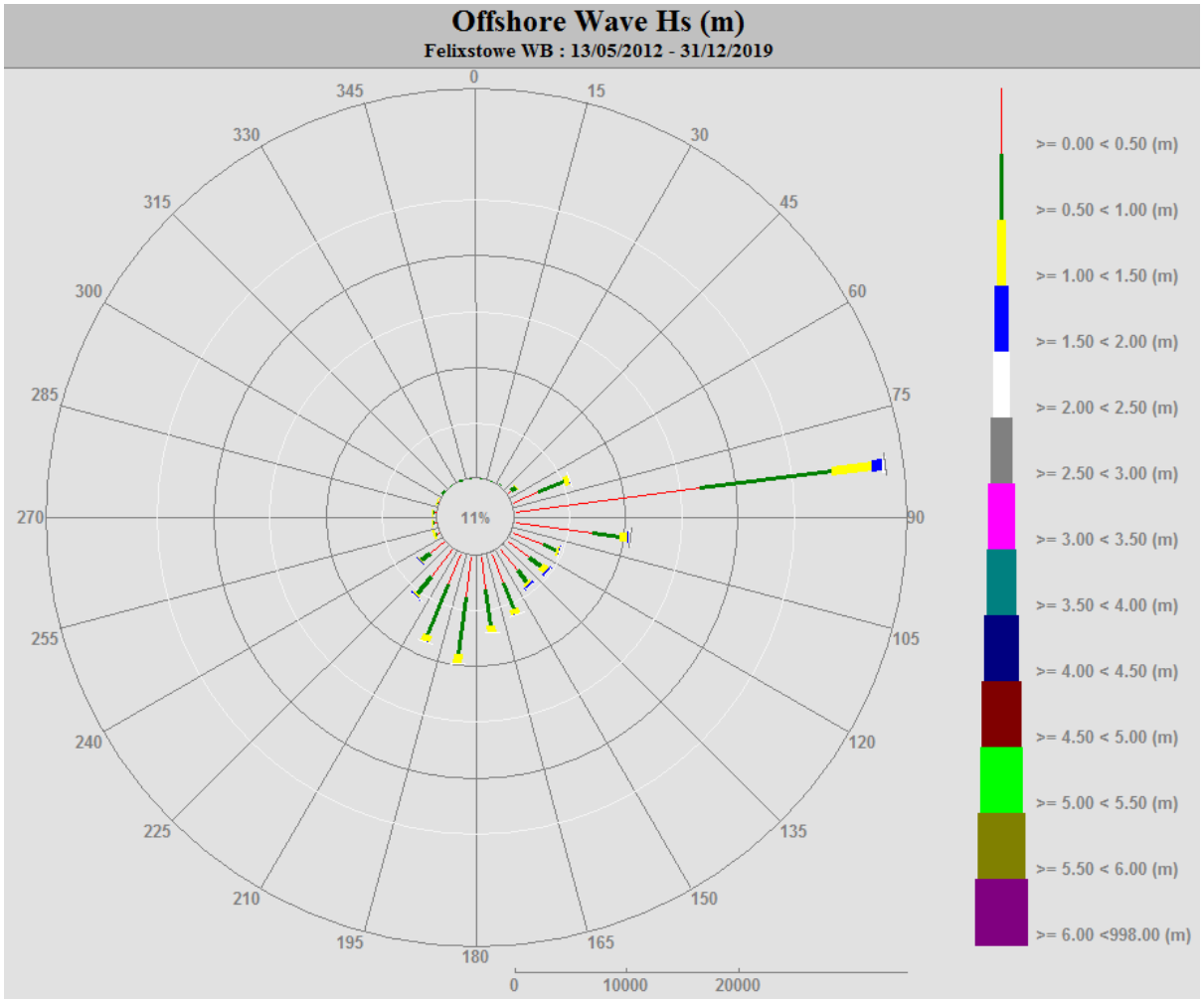

Felixstowe - Significant Wave Height (Hs) during 2013
metres
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0
1
2
5
10
15
20
25
30
Day in month

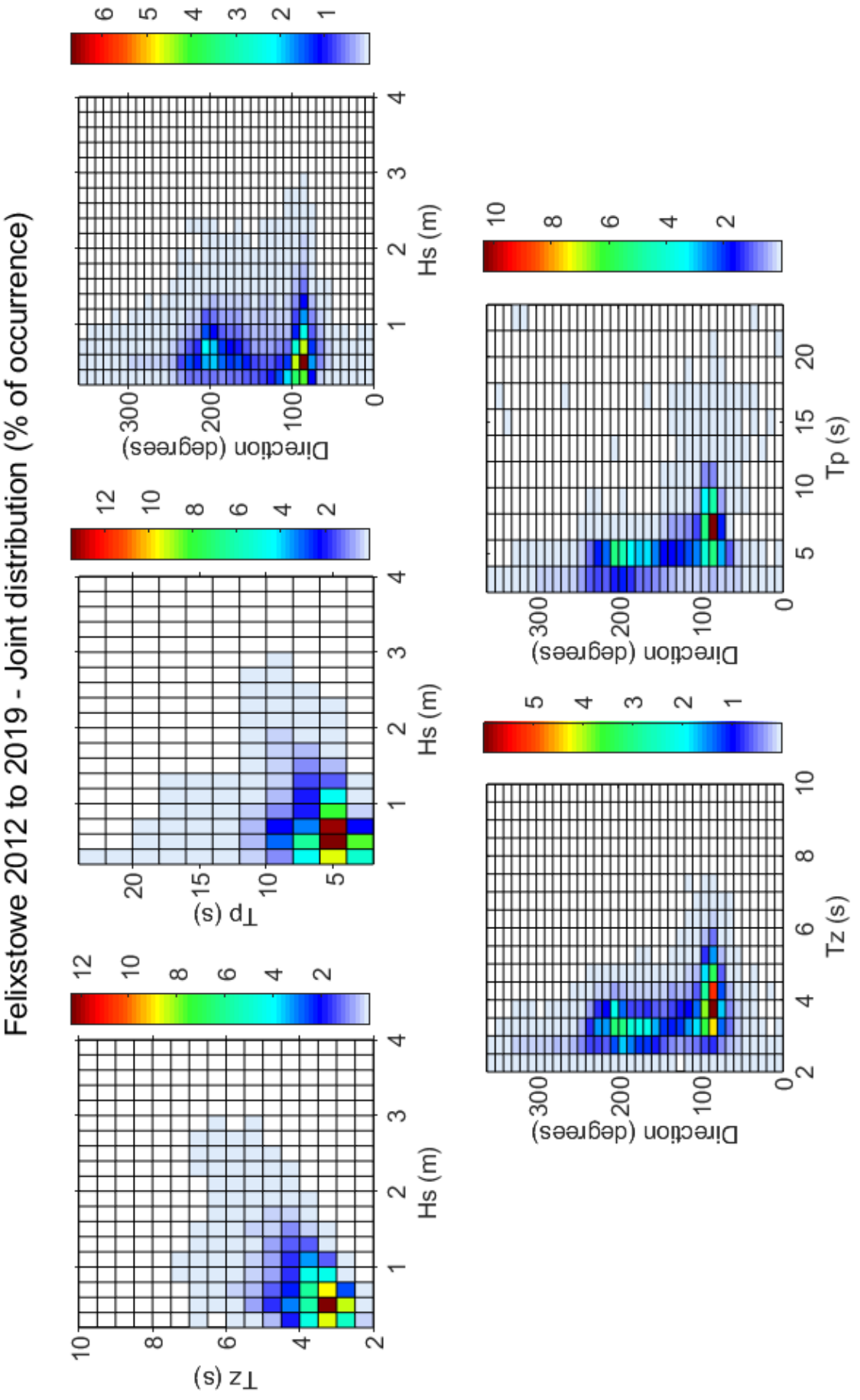

Storms at Felixstowe during 2013
Storm alert threshold is Hs = 1.90
Hs (m)
2.8
2.6
2.4
2.2
2.0
Feb 2013
Apr 2013
Jun 2013
Aug 2013
Oct 2013
Dec 2013


Storms at Felixstowe - all years
Hs (m)
2.8
2.6
2.4
2.2
2.0
2012
2013
2014
2015
2016
2017
2018
2019
2020
Date


Felixstowe - Wave height exceedence (Hs)
Wave height (m)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
Year
0.05%
0.5%
1%
2%
5%
10%


Felixstowe 2013
% of occurrence
Hs (metres)
Tp (seconds)
Direction (degrees)
Tz (seconds)


Offshore Wave Hs (m)
Felixstowe WB : 13/05/2012 - 31/12/2019
11%
>= 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)


Felixstowe 2012 to 2019 - Joint distribution (% of occurrence)
Direction (degrees)
Hs (m)
Tp (s)
Tz (s)