North Well Directional Waverider Buoy

Location			
OS	565972 E 354111 N		
WGS84	*Latitude:* 53° 03.51' N *Longitude:* 00° 28.51' E		
Instrument type			
Datawell Directional Waverider Mk III			
Water depth	~31m 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 - 2009

All times are GMT

Month	**H_s (m)**	**T_p (s)**	**T_z (s)**	**Dir. (°)**	**SST (°C)**	**Bimodal seas (%)**	**No. of days**
January	0.63	4.3	3.2	137	4.6	-	30
February	0.58	5.1	3.6	81	3.8	-	28
March	0.53	4.6	3.4	118	5.9	-	31
April	0.55	4.4	3.3	98	8.9	-	30
May	0.61	4.0	3.1	143	11.5	-	31
June	0.57	4.7	3.4	76	14.6	-	30
July	0.53	3.8	3.0	158	16.9	-	31
August	0.58	4.0	3.2	174	18.5	-	31
September	0.62	4.0	3.2	141	15.9	-	30
October	0.64	5.1	3.5	100	13.5	-	31
November	0.80	4.4	3.4	173	10.8	-	30
December	0.81	4.7	3.5	124	7.1	-	31

Monthly Averages - All Years (September 2006 – December 2019)

Month	**H_s (m)**	**T_p (s)**	**T_z (s)**	**Dir. (°)**	**SST (°C)**	**Bimodal seas (%)**
January	0.72	4.6	3.4	135	5.6	-
February	0.64	4.8	3.5	117	5.1	-
March	0.62	4.7	3.5	113	6.0	-
April	0.59	4.7	3.4	97	8.5	-
May	0.61	4.5	3.4	101	11.5	-
June	0.55	4.5	3.4	96	14.4	-
July	0.50	4.2	3.2	124	16.9	-
August	0.53	4.0	3.1	140	17.6	-
September	0.59	4.4	3.3	125	16.1	-
October	0.67	4.5	3.3	131	13.6	-
November	0.76	4.7	3.5	134	10.3	-
December	0.75	4.6	3.4	149	7.2	-

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)
17-Dec-2009 21:00:00	3.19	8.3	6.6	45	1.25	HW +3	5.10	-	-
30-Nov-2009 12:30:00	2.33	5.6	4.6	27	-0.95	HW -4	4.50	-	-
28-Mar-2009 19:30:00	2.28	6.7	5.3	21	3.15	HW	6.10	-	-
30-Dec-2009 19:30:00	2.22	6.7	5.7	53	0.85	HW +3	4.70	-	-

** Tidal information is obtained from the predicted tide levels (Admiralty Total Tide).*

Annual Statistics

Year	Annual H_s exceedance** (m)						Annual Maximum H_s	
	0.05%	0.5%	1%	2%	5%	10%	Date	A_{max} (m)
2006	2.24	1.86	1.68	1.59	1.38	1.16	07-Dec-2006 20:00:00	2.38
2007	2.53	2.20	1.98	1.73	1.45	1.19	18-Jan-2007 15:00:00	3.03
2008	2.62	2.03	1.83	1.69	1.44	1.17	22-Mar-2008 04:00:00	2.94
2009	2.83	2.01	1.83	1.65	1.38	1.12	17-Dec-2009 21:00:00	3.19
2010	2.41	2.05	1.94	1.79	1.51	1.22	01-Dec-2010 16:30:00	2.48
2011	2.00	1.61	1.51	1.40	1.22	1.05	13-Dec-2011 20:00:00	2.27
2012	2.36	2.03	1.82	1.56	1.31	1.08	27-Oct-2012 05:00:00	2.58
2013	2.59	2.13	1.89	1.70	1.36	1.15	10-Oct-2013 21:00:00	3.01
2014	2.33	1.91	1.70	1.50	1.22	1.04	15-Feb-2014 06:00:00	2.40
2015	2.57	1.84	1.69	1.52	1.26	1.07	21-Nov-2015 08:30:00	3.21
2016	2.44	2.00	1.88	1.60	1.33	1.08	31-May-2016 09:30:00	2.61
2017	3.08	2.73	2.59	2.39	2.05	1.76	01-Dec-2017 03:30:00	3.13
2018	2.24	1.86	1.70	1.56	1.27	1.04	21-Sep-2018 01:30:00	2.28
2019	2.33	1.86	1.74	1.53	1.27	1.07	11-Jun-2019 02:00:00	2.52

*** i.e. 5 % of the H_s values measured in 2006 exceeded 1.38 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	September 2006 to December 2019	
Return period (years)	**Significant wave height (m)**	**Comments**
0.25	2.18	No depth limitation
1	2.60	
2	2.79	
5	3.01	
10	3.17	
20	3.31	
50	3.47	
100	3.59	

Distribution plots

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

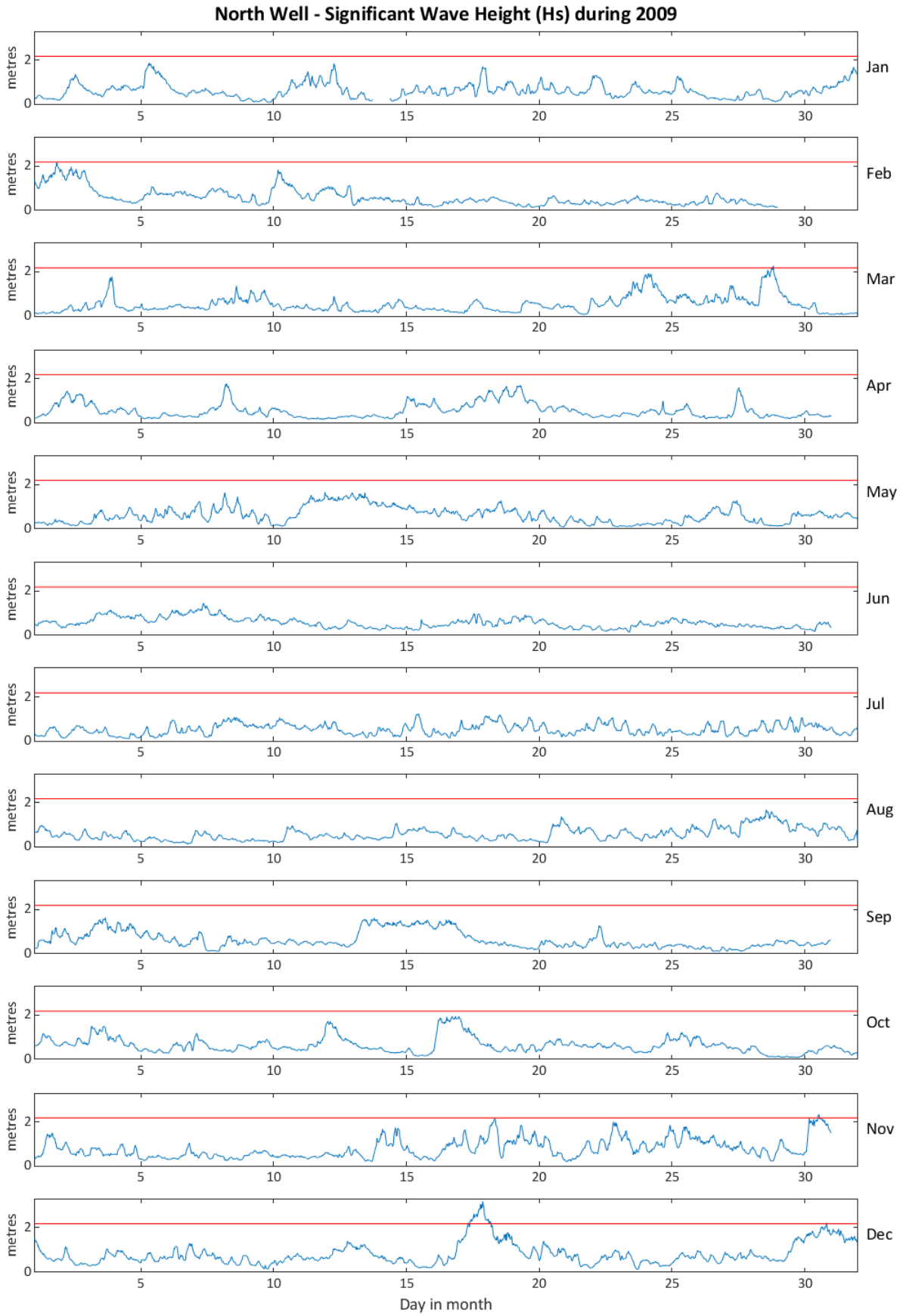
- Annual time series of H_s (red line is 2.18 m storm threshold)
- Incidence of storm waves for 2009. Storm events are defined using the Peaks-over-Threshold method. The highest H_s of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of H_s, T_p, T_z and Direction for 2009
- 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

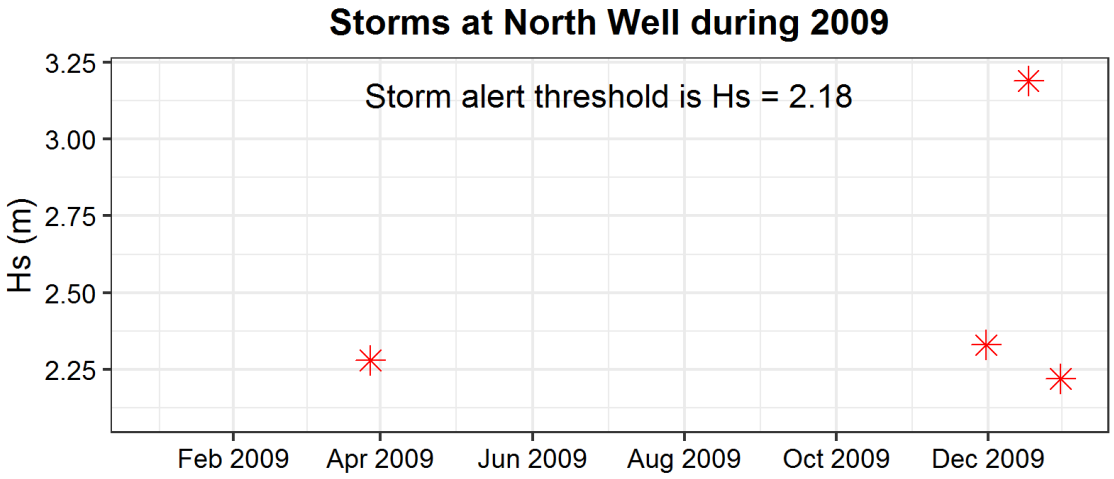
General

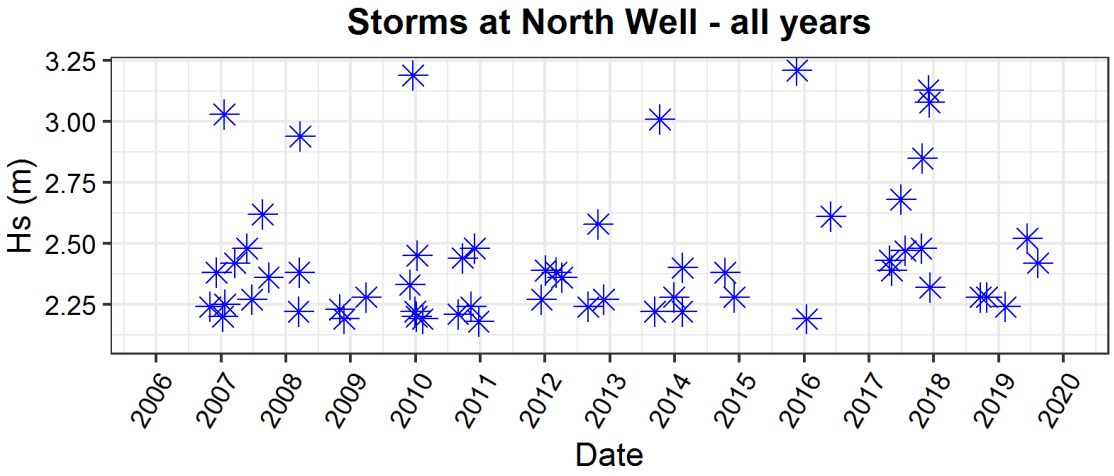
The buoy, owned by the Environment Agency, was first deployed on 25 September 2006, at which time the magnetic declination at the site was 2.38° west, changing by 0.14° east per year.

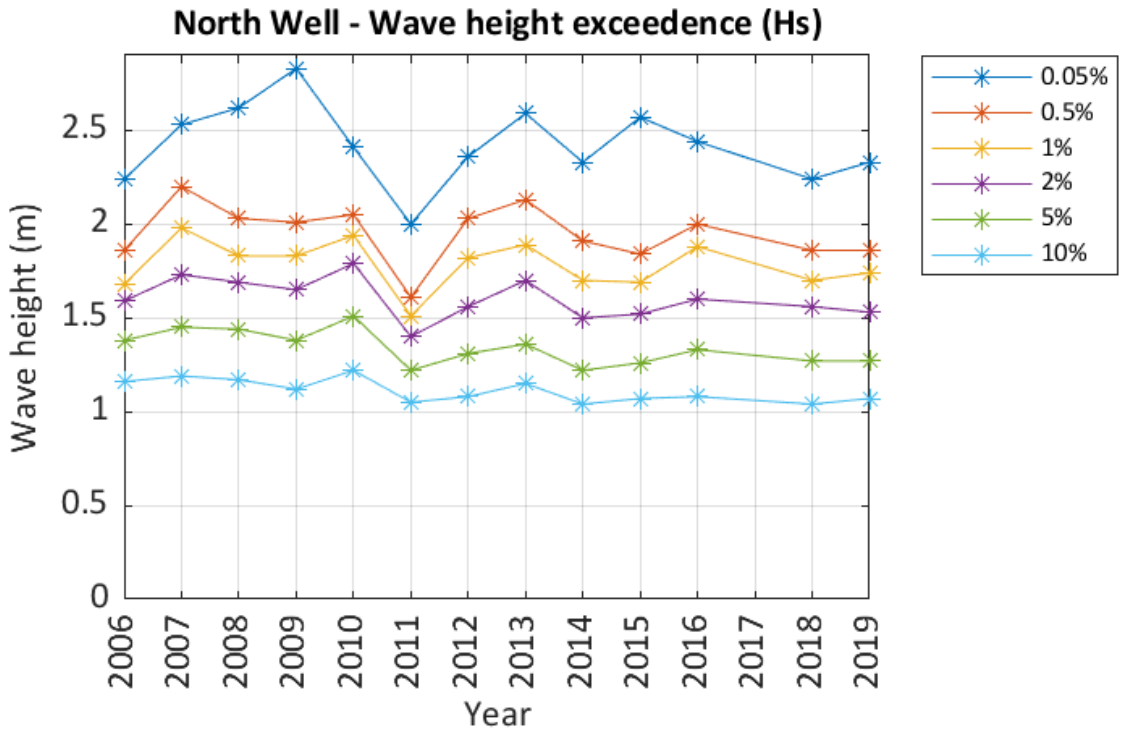
Acknowledgements

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

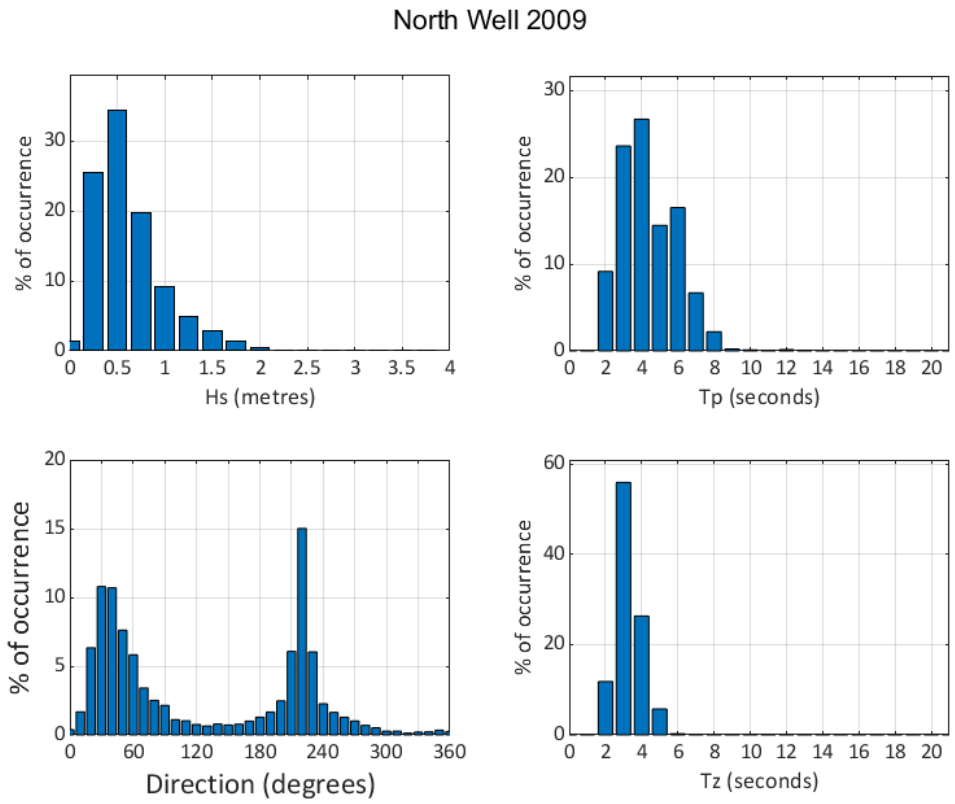

North Well - Significant Wave Height (Hs) during 2009
metres
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0
2
5
10
15
20
25
30
Day in month

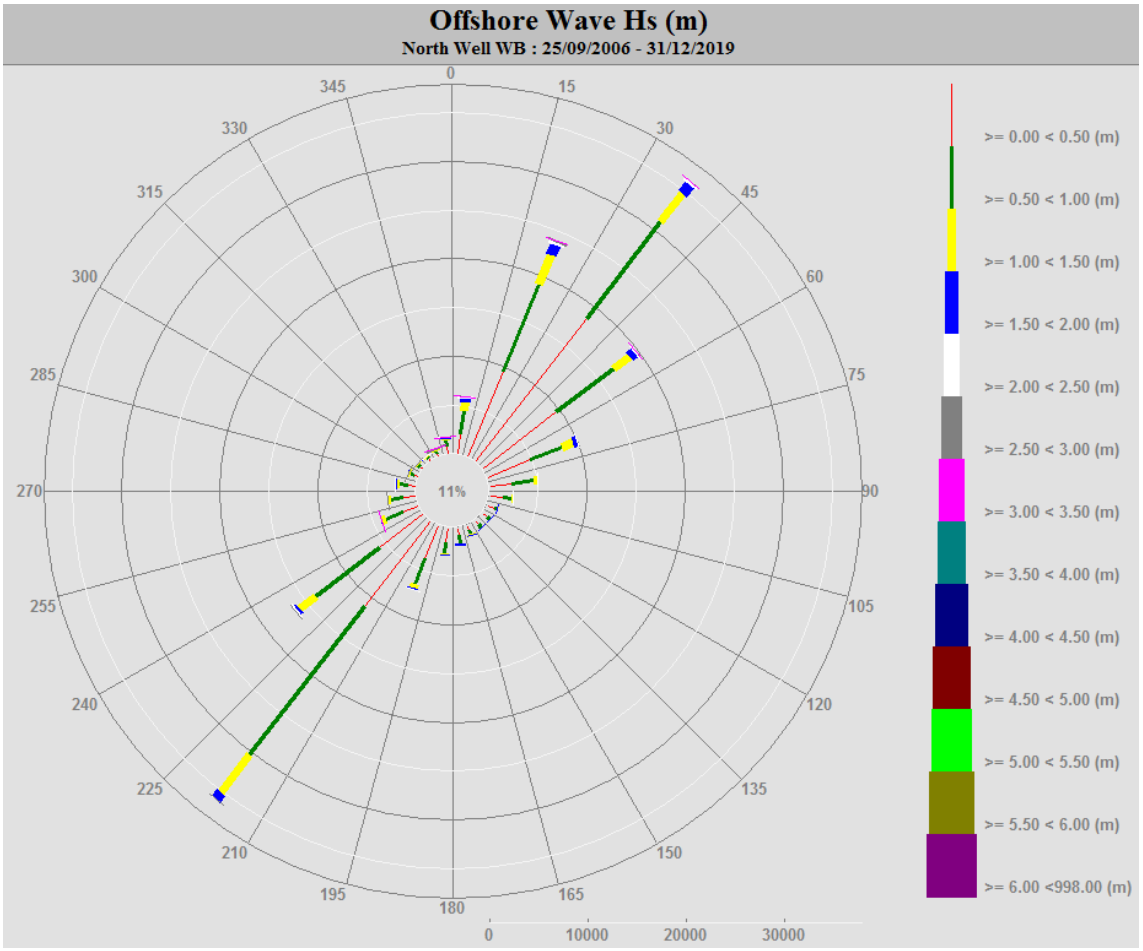


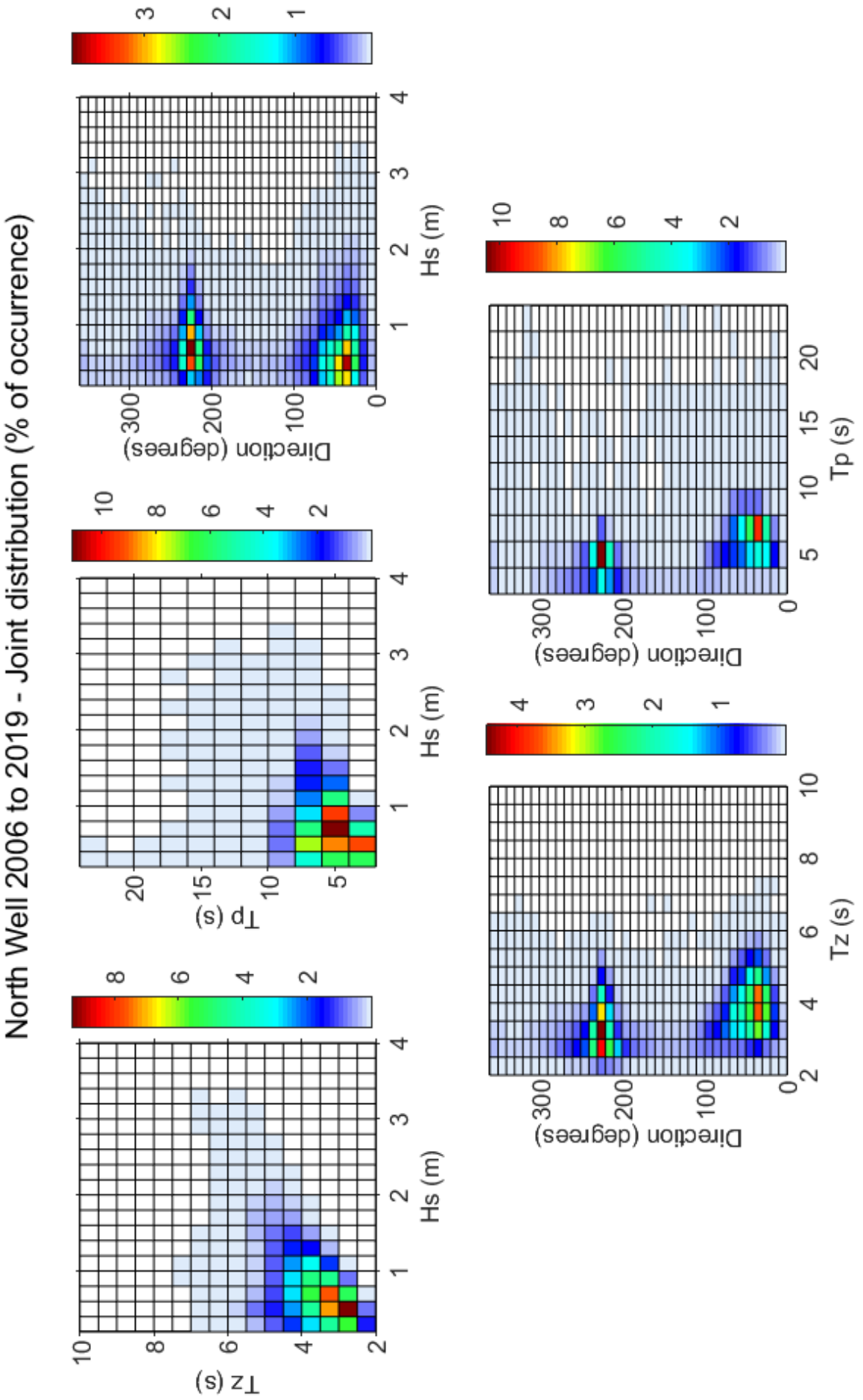




2017 was excluded from the wave height graph. During this year, a large number of storms (12) that exceeded the storm alert threshold were recorded, while only 30% of the total annual dataset was recovered, resulting in a very skewed picture. Nonetheless, 2017 should be considered as a year with very high wave heights.


North Well 2009
% of occurrence
Hs (metres)
Tp (seconds)
Direction (degrees)
Tz (seconds)


Offshore Wave Hs (m)
North Well WB : 25/09/2006 - 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)


North Well 2006 to 2019 - Joint distribution (% of occurrence)
Direction (degrees)
Hs (m)
Tp (s)
Tz (s)