



## Gwynt y Môr Directional Waverider Buoy

|  |   |  |   |
|--|---|--|---|
| <b>Location</b>                          |   |  |  |
| OS                                       | 300222 E 398884 N                                 |  |   |
| WGS84                                    | Latitude: 53° 28.38' N<br>Longitude: 03° 30.18' W |  |   |
| <b>Instrument type</b>                   |   |  |   |
| Datawell<br>Directional Waverider Mk III |   |  |   |
| <b>Water depth</b>                       | ~10m CD   | Example buoy in situ. Photo courtesy of Fugro EMU Limited                          | Location of buoy (Google mapping, image ©2016 Bluesky)                              |

## Data Quality

|                          |                        |
|--------------------------|------------------------|
| <b>Recovery rate (%)</b> | <b>Sample interval</b> |
| 86                       | 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   | -                  | -                  | -                  | -        | -        | -                | 0           |
| February  | 0.87               | 4.3                | 3.4                | 239      | 7.2      | 0                | 12          |
| March     | 0.74               | 4.4                | 3.4                | 255      | 7.0      | 0                | 30          |
| April     | 0.82               | 4.8                | 3.5                | 239      | 8.6      | 0                | 30          |
| May       | 0.54               | 4.0                | 3.1                | 226      | 10.9     | 0                | 31          |
| June      | 0.43               | 4.1                | 3.1                | 222      | 14.6     | 0                | 30          |
| July      | 0.63               | 4.0                | 3.2                | 265      | 16.2     | 0                | 31          |
| August    | 0.75               | 4.2                | 3.3                | 247      | 17.2     | 0                | 31          |
| September | 0.75               | 4.3                | 3.4                | 261      | 17.2     | 0                | 30          |
| October   | 0.63               | 3.8                | 3.1                | 159      | 14.6     | 0                | 31          |
| November  | 1.06               | 4.8                | 3.7                | 243      | 10.9     | 0                | 30          |
| December  | 0.81               | 4.4                | 3.4                | 231      | 9.0      | 0                | 31          |

## Monthly Averages - All Years (Jan 2009 – December 2014)

| Month     | H <sub>s</sub> (m) | T <sub>p</sub> (s) | T <sub>z</sub> (s) | Dir. (°) | SST (°C) | Bimodal seas (%) |
|-----------|--------------------|--------------------|--------------------|----------|----------|------------------|
| January   | 0.92               | 4.6                | 3.5                | 222      | 6.5      | 0                |
| February  | 0.92               | 4.7                | 3.5                | 226      | 6.1      | 0                |
| March     | 0.70               | 4.3                | 3.3                | 223      | 6.5      | 0                |
| April     | 0.63               | 4.3                | 3.2                | 217      | 8.2      | 0                |
| May       | 0.73               | 4.3                | 3.3                | 229      | 10.5     | 0                |
| June      | 0.54               | 4.0                | 3.1                | 224      | 13.6     | 0                |
| July      | 0.59               | 4.0                | 3.1                | 246      | 15.8     | 0                |
| August    | 0.75               | 4.3                | 3.3                | 258      | 16.6     | 0                |
| September | 0.86               | 4.4                | 3.4                | 247      | 15.8     | 0                |
| October   | 0.95               | 4.6                | 3.5                | 228      | 13.9     | 0                |
| November  | 1.06               | 4.8                | 3.6                | 233      | 11.5     | 1                |
| December  | 1.33               | 5.3                | 3.9                | 252      | 8.5      | 0                |

## 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) |
|-------------------|--------------------|--------------------|--------------------|----------|-----------------------------|----------------------------|-----------------|------------------|-----------------|
| 03-Mar-2016 01:00 | 4.01               | 8.3                | 6.5                | 325      | -1.12                       | HW -4                      | 3.28            | -0.22            | 0.02            |
| 26-Dec-2016 05:30 | 3.48               | 7.7                | 5.7                | 288      | -0.45                       | HW -3                      | 5.1             | -                | -               |
| 07-Apr-2016 08:00 | 3.20               | 7.1                | 5.4                | 286      | 1.52                        | HW -2                      | 7.79            | 0.06             | 0.21            |
| 18-Oct-2016 18:00 | 3.07               | 7.7                | 6.2                | 300      | -3.75                       | HW +6                      | 8.1             | -                | -               |
| 06-Apr-2016 17:00 | 3.00               | 8.3                | 6.0                | 294      | -3.22                       | HW -5                      | 7.53            | 0.26             | 0.26            |

\* Tidal information is obtained from the National Network gauges at Liverpool and/or Llandudno 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) |
| 2009 | 3.14                                   | 2.85 | 2.7  | 2.51 | 2.11 | 1.71 | 03-Sep-2009 06:00             | 3.34                 |
| 2010 | 4.45                                   | 2.85 | 2.41 | 2.07 | 1.7  | 1.39 | 12-Nov-2010 03:30             | 4.87                 |
| 2011 | 3.93                                   | 3.37 | 3.08 | 2.8  | 2.32 | 1.84 | 07-Dec-2011 14:30             | 4.1                  |
| 2012 | 3.22                                   | 2.91 | 2.61 | 2.32 | 1.96 | 1.58 | 26-Nov-2012 20:30             | 3.45                 |
| 2013 | 4.18                                   | 3.48 | 3.23 | 2.86 | 2.25 | 1.73 | 05-Dec-2013 13:30             | 4.61                 |
| 2014 | 4.43                                   | 3.36 | 2.93 | 2.55 | 2.06 | 1.66 | 12-Feb-2014 19:30             | 4.72                 |
| 2015 | 4.28                                   | 3.57 | 3.25 | 2.94 | 2.43 | 1.93 | 29-Nov-2015 18:30             | 4.49                 |
| 2016 | 3.44                                   | 2.77 | 2.58 | 2.32 | 1.86 | 1.42 | 03-Mar-2016 00:30             | 4.01                 |

\*\* i.e. 5 % of the H<sub>s</sub> values measured in 2009 exceeded 2.11 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 and 3-hourly records and are calculated for periods up to 10 times the record length, using a Weibull distribution.

| 0.5-hourly records January 2009 – December 2016 |                             |                       |
|---|-----------------------------|-----------------------|
| Return period (years)                           | Significant wave height (m) | Comments              |
| 1   | 4.8                         | Depth-limited at MLWS |
| 2   | 5.0                         |                       |
| 5   | 5.2                         | Depth-limited at MHWS |
| 10  | 5.3                         |                       |
| 20  | 5.4                         |                       |
| 50  | 5.6                         |                       |

| 3-hourly records January 2009 – December 2016 |                             |                       |
|---|-----------------------------|-----------------------|
| Return period (years)                         | Significant wave height (m) | Comments              |
| 1   | 4.3                         | Depth limited at MLWS |
| 2   | 4.5                         |                       |
| 5   | 4.8                         |                       |
| 10  | 5.0                         |                       |
| 20  | 5.1                         |                       |
| 50  | 5.4                         | Depth limited at MHWS |

## Distribution plots

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

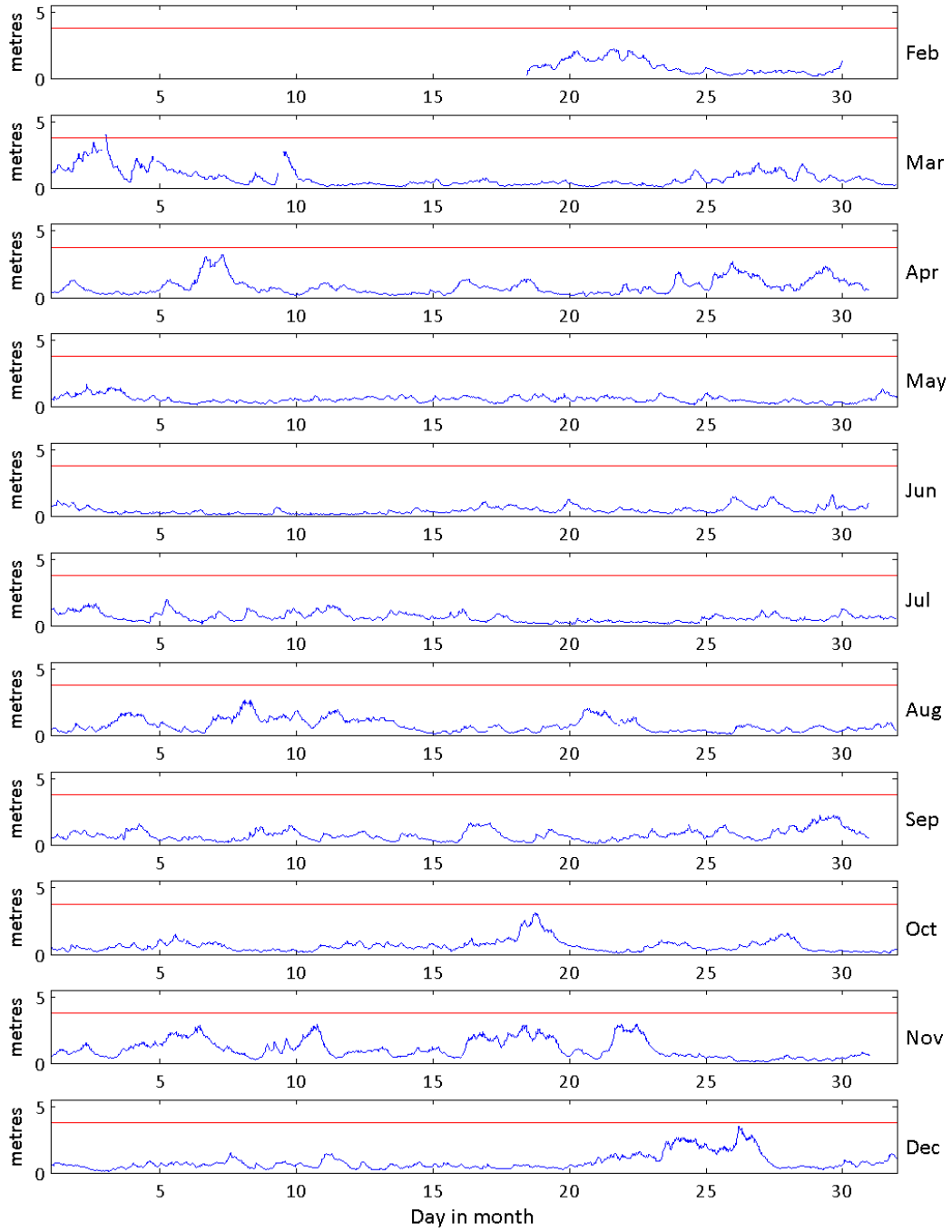
- Annual time series of  $H_s$  (red line is 3.75 m storm threshold)
- Incidence of storm waves for 2016. Storm events are defined using the Peaks-over-Threshold method. The highest  $H_s$  of each storm event is shown
- Wave height exceedance each year since deployment
- Percentage of occurrence of  $H_s$ ,  $T_p$ ,  $T_z$  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

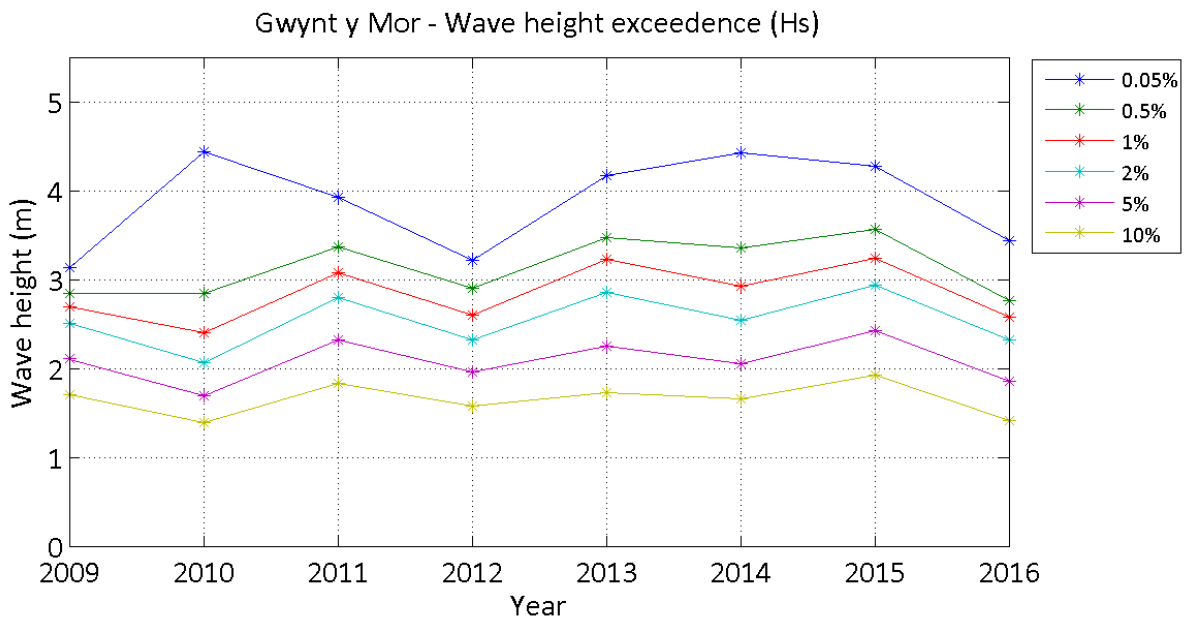
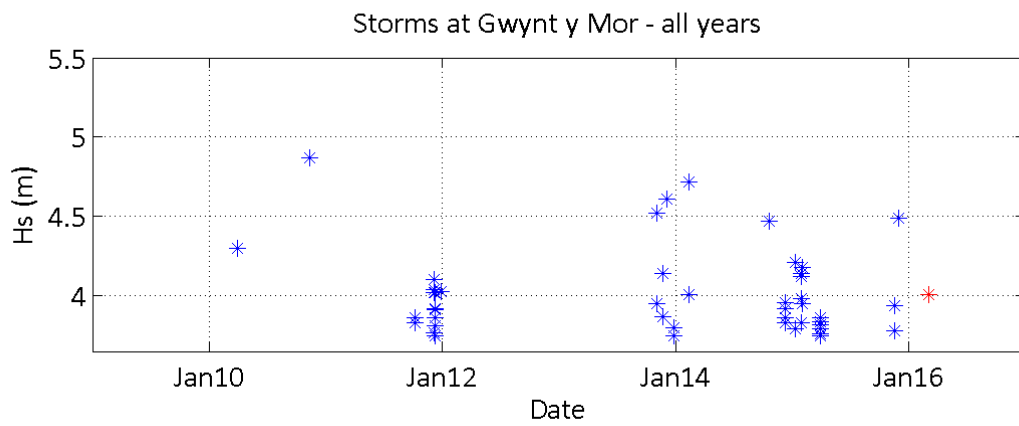
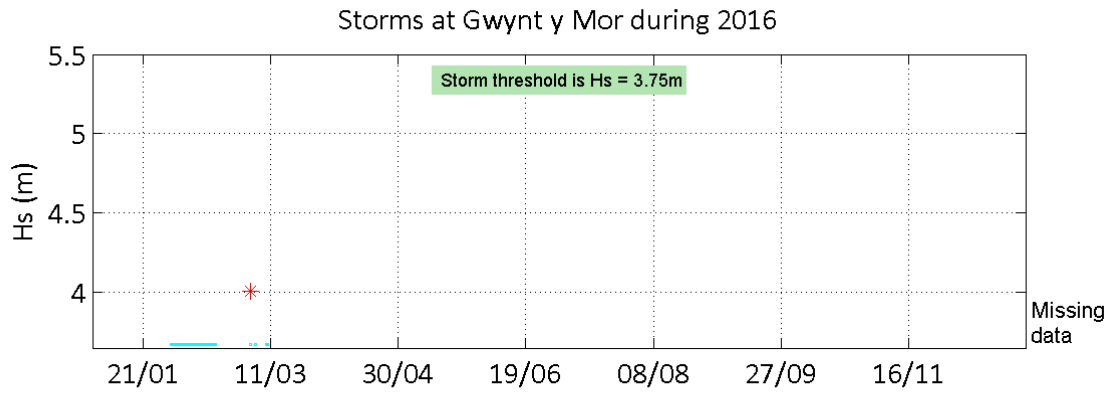
## General

The buoy was first deployed on 27 April 2007, at which time the magnetic declination at the site was 3.79° west, changing by 0.16° east per year.

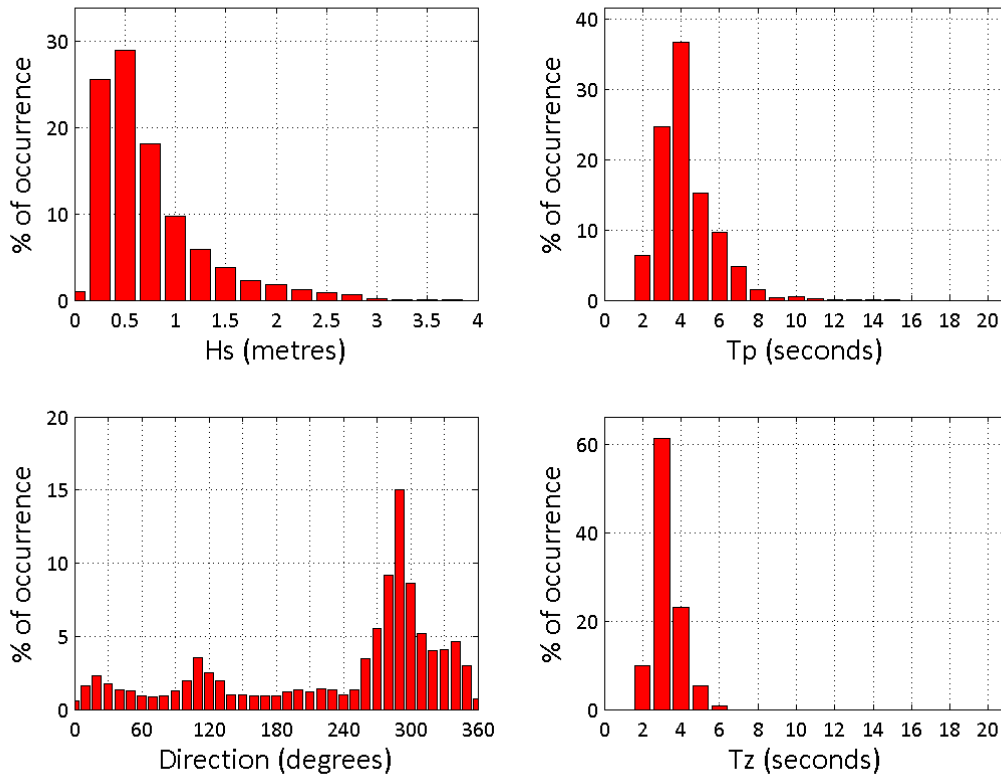
## Acknowledgements

The Datawell Directional Waverider Mk III is owned by RWE Innogy UK Limited, who have kindly agreed to make both real-time and archived data freely available under the Open Government Licence, via the Channel Coastal Observatory website. Tidal data were supplied by the British Oceanographic Centre as part of the function of the National Tide and Sea Level Facility, hosted by the Proudman Oceanographic laboratory and funded by DEFRA and the Natural Environment Research Council.





Gwynt y Mor 2016



Gwynt y Mor 2009 to 2016 - Joint distribution (% of occurrence)

