



## Milford-on-Sea Directional Waverider Buoy

|                                          |                                                   |                                                                                    |                                                                                     |
|------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Location</b>                          |                                                   |  |  |
| OS                                       | 427245 E 90318 N                                  |                                                                                    |                                                                                     |
| WGS84                                    | Latitude: 50° 42.71' N<br>Longitude: 01° 36.93' W |                                                                                    |                                                                                     |
| <b>Instrument type</b>                   |                                                   |                                                                                    |                                                                                     |
| Datawell<br>Directional Waverider Mk III |                                                   |                                                                                    |                                                                                     |
| <b>Water depth</b>                       | ~10m CD                                           | Buoy in situ off Milford on Sea.<br>Photo courtesy of Fugro EMU Limited            | Location of buoy (Google mapping)                                                   |

### Data Quality

| Recovery rate (%) | Sample interval |
|-------------------|-----------------|
| 97                | 30 minutes      |

### Monthly Averages - 2015

All times are GMT

| Month     | H <sub>s</sub><br>(m) | T <sub>p</sub><br>(s) | T <sub>z</sub><br>(s) | Dir.<br>(°) | SST<br>(°C) | No. of<br>days |
|-----------|-----------------------|-----------------------|-----------------------|-------------|-------------|----------------|
| January   | 1.06                  | 9.1                   | 4.7                   | 213         | 8.6         | 31             |
| February  | 0.64                  | 11.1                  | 4.6                   | 208         | 6.5         | 27             |
| March     | 0.67                  | 10.8                  | 4.8                   | 211         | 7.8         | 31             |
| April     | 0.43                  | 9.3                   | 4.3                   | 209         | 10.3        | 30             |
| May       | 0.69                  | 6.4                   | 3.8                   | 213         | 12.6        | 31             |
| June      | 0.49                  | 6.1                   | 3.5                   | 209         | 15.3        | 28             |
| July      | 0.65                  | 6.5                   | 3.7                   | 215         | 17.9        | 30             |
| August    | 0.51                  | 6.3                   | 3.7                   | 214         | 18.0        | 30             |
| September | 0.47                  | 6.3                   | 3.6                   | 210         | 16.7        | 28             |
| October   | 0.45                  | 9.4                   | 4.2                   | 207         | 14.5        | 30             |
| November  | 1.13                  | 8.4                   | 4.5                   | 214         | 13.0        | 29             |
| December  | 1.46                  | 9.8                   | 4.7                   | 213         | 11.7        | 30             |

### Monthly Averages - All Years (November 2005 – December 2015)

| Month     | H <sub>s</sub><br>(m) | T <sub>p</sub><br>(s) | T <sub>z</sub><br>(s) | Dir.<br>(°) | SST<br>(°C) |
|-----------|-----------------------|-----------------------|-----------------------|-------------|-------------|
| January   | 0.87                  | 10.3                  | 4.7                   | 210         | 7.8         |
| February  | 0.75                  | 11.3                  | 4.8                   | 209         | 6.9         |
| March     | 0.60                  | 9.9                   | 4.5                   | 210         | 7.7         |
| April     | 0.47                  | 8.7                   | 4.1                   | 210         | 9.9         |
| May       | 0.54                  | 6.9                   | 3.8                   | 211         | 12.7        |
| June      | 0.49                  | 6.7                   | 3.8                   | 212         | 15.7        |
| July      | 0.56                  | 6.0                   | 3.6                   | 215         | 18.0        |
| August    | 0.58                  | 5.8                   | 3.6                   | 217         | 18.5        |
| September | 0.52                  | 7.3                   | 3.8                   | 212         | 17.4        |
| October   | 0.68                  | 8.0                   | 4.2                   | 213         | 15.3        |
| November  | 0.80                  | 8.7                   | 4.4                   | 212         | 12.3        |
| December  | 0.90                  | 9.4                   | 4.6                   | 212         | 9.3         |

## 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) |
|----------------------|--------------------|--------------------|--------------------|----------|-----------------------------|----------------------------|-----------------|------------------|-----------------|
| 31-Dec-2015<br>04:00 | 3.43               | 8.3                | 6.7                | 210      | 1.33                        | HW +1                      | 1.7             | 0.34             | 0.51            |
| 14-Jan-2015<br>23:00 | 3.13               | 8.3                | 6.1                | 216      | -                           | HW +5                      | ~1.0            | -                | -               |
| 15-Jan-2015<br>19:30 | 2.98               | 7.1                | 6.1                | 217      | -                           | HW                         | ~0.9            | -                | -               |
| 30-Dec-2015<br>12:00 | 2.96               | 11.8               | 6.5                | 214      | 0.68                        | HW -1                      | 1.6             | 0.27             | 0.49            |
| 12-Jan-2015<br>03:30 | 2.81               | 8.3                | 5.9                | 215      | -                           | HW                         | ~1.8            | -                | -               |

## 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) |
| 1996 | -                                     | -    | -    | -    | -    | -    | 28-Oct-1996 21:00             | 4.05                 |
| 1997 | 3.08                                  | 2.39 | 2.15 | 1.97 | 1.59 | 1.20 | 24-Feb-1997 23:00             | 3.32                 |
| 1998 | 2.89                                  | 2.47 | 2.28 | 2.00 | 1.66 | 1.37 | 27-Oct-1998 13:00             | 3.21                 |
| 1999 | 3.01                                  | 2.32 | 2.11 | 1.85 | 1.56 | 1.29 | 24-Dec-1999 22:00             | 3.23                 |
| 2000 | 3.90                                  | 2.85 | 2.50 | 2.19 | 1.74 | 1.41 | 31-Dec-2000 19:00             | 4.09                 |
| 2001 | 3.71                                  | 2.63 | 2.24 | 1.91 | 1.52 | 1.20 | 01-Jan-2001 00:00             | 4.07                 |
| 2002 | 3.54                                  | 2.92 | 2.61 | 2.35 | 1.96 | 1.62 | 15-Oct-2002 18:00             | 4.06                 |
| 2003 | 2.82                                  | 2.20 | 2.02 | 1.76 | 1.37 | 1.12 | 14-Nov-2003 15:00             | 2.92                 |
| 2004 | 3.21                                  | 2.49 | 2.29 | 2.05 | 1.69 | 1.42 | 31-Jan-2004 17:00             | 3.44                 |
| 2005 | 3.09                                  | 1.86 | 1.72 | 1.56 | 1.28 | 1.05 | 02-Dec-2005 18:30             | 3.53                 |
| 2006 | 2.89                                  | 2.46 | 2.31 | 2.10 | 1.73 | 1.41 | 03-Dec-2006 06:30             | 3.51                 |
| 2007 | 3.21                                  | 2.53 | 2.25 | 2.04 | 1.74 | 1.46 | 18-Jan-2007 12:00             | 3.64                 |
| 2008 | 3.09                                  | 2.40 | 2.16 | 1.96 | 1.70 | 1.42 | 10-Mar-2008 20:00             | 3.42                 |
| 2009 | 3.26                                  | 2.60 | 2.36 | 2.05 | 1.69 | 1.39 | 14-Nov-2009 15:00             | 4.08                 |
| 2010 | 2.68                                  | 2.17 | 1.91 | 1.59 | 1.29 | 1.04 | 31-Mar-2010 06:00             | 2.96                 |
| 2011 | 2.85                                  | 2.21 | 2.03 | 1.84 | 1.53 | 1.30 | 13-Dec-2011 01:00             | 3.24                 |
| 2012 | 3.39                                  | 2.33 | 2.14 | 1.93 | 1.61 | 1.31 | 03-Jan-2012 10:30             | 3.93                 |
| 2013 | 3.48                                  | 2.58 | 2.35 | 2.07 | 1.67 | 1.32 | 28-Oct-2013 05:30             | 3.93                 |
| 2014 | 4.04                                  | 3.12 | 2.73 | 2.25 | 1.81 | 1.49 | 14-Feb-2014 22:30             | 4.50                 |
| 2015 | 2.96                                  | 2.51 | 2.33 | 2.16 | 1.85 | 1.54 | 31-Dec-2015 04:00             | 3.43                 |

\* i.e. 5 % of the H<sub>s</sub> values measured in 2004 exceeded 1.69 m

\* Tidal information is obtained from the nearest recording tide gauge (the gauge on Royal Lympington Yacht Club starting platform). The surge shown is the residual at the time of the highest H<sub>s</sub>. The maximum tidal surge is the largest positive surge during the storm event.

## Distribution plots

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

- Annual time series of  $H_s$  (red line is 2.8 m storm threshold)
- Incidence of storm waves for 2015. 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 2015
- 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 from 17 November 2005

## 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 3-hourly records and are calculated for periods up to 10 times the record length, using a Weibull distribution.

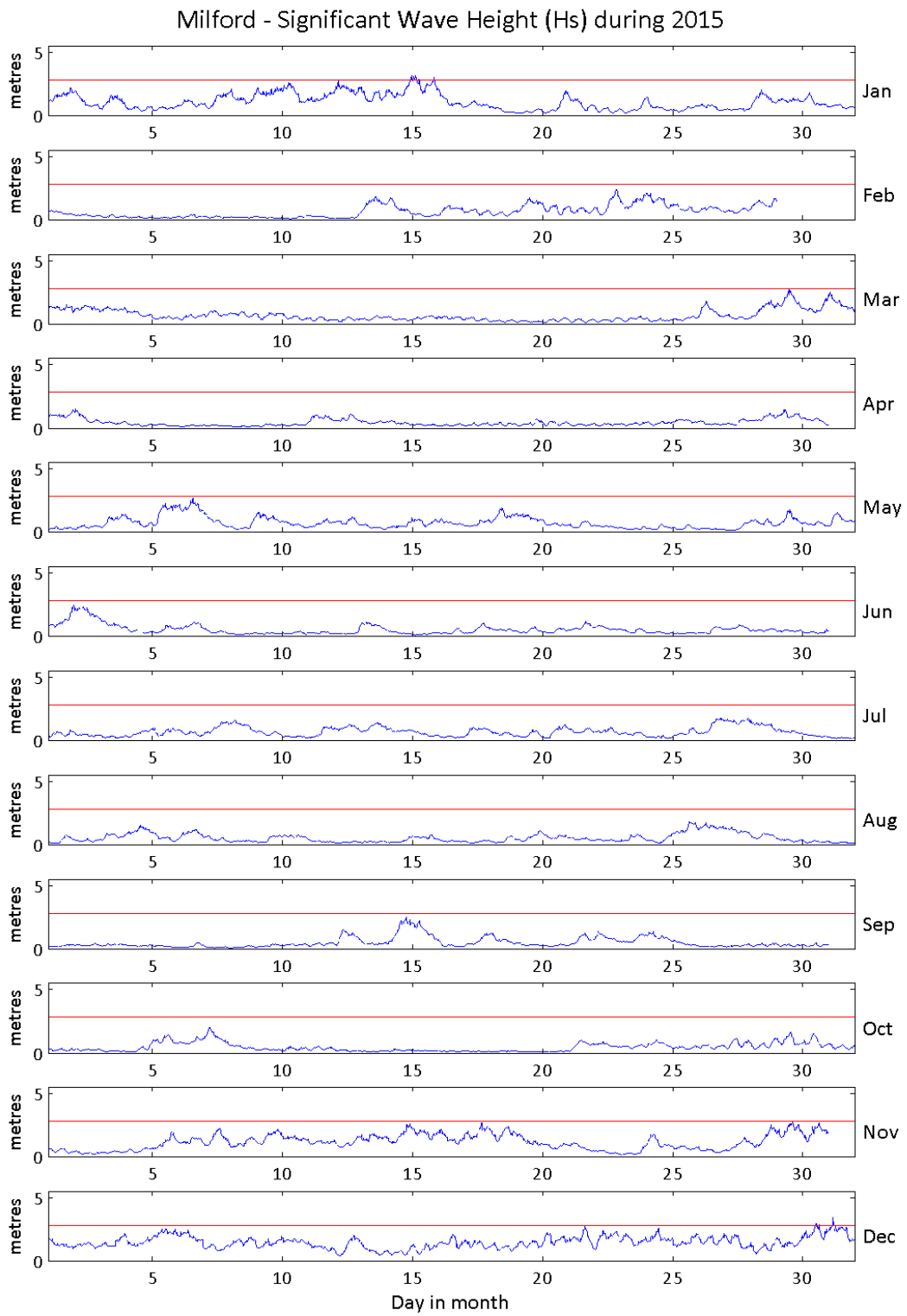
| Return period (years) | Significant wave height (m) | Comments              |
|-----------------------|-----------------------------|-----------------------|
| 1                     | 3.7                         | No depth limitation   |
| 2                     | 3.9                         |                       |
| 5                     | 4.2                         |                       |
| 10                    | 4.4                         | Depth-limited at MLWS |
| 20                    | 4.6                         |                       |
| 50                    | 4.9                         |                       |
| 100                   | 5.1                         |                       |

## General

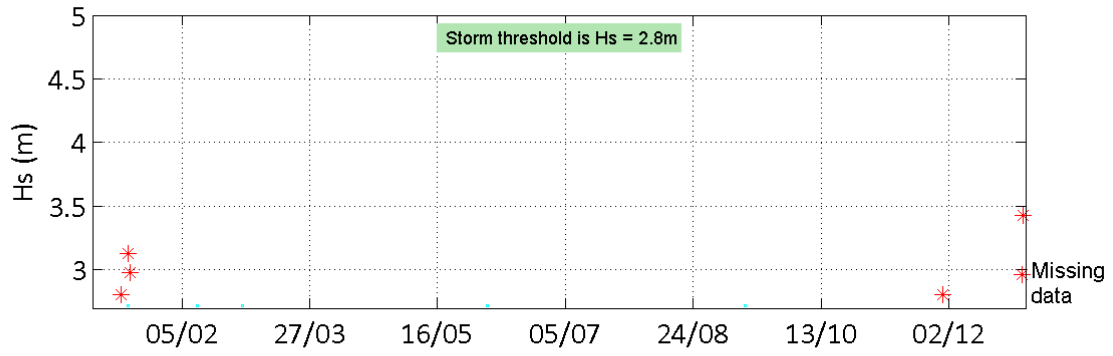
The buoy was first deployed on 20 May 1996. It was replaced with a Directional Waverider on 17 November 2005, at which time the magnetic declination at the site was 2.6° west, changing by 0.15° east per year.

## Acknowledgements

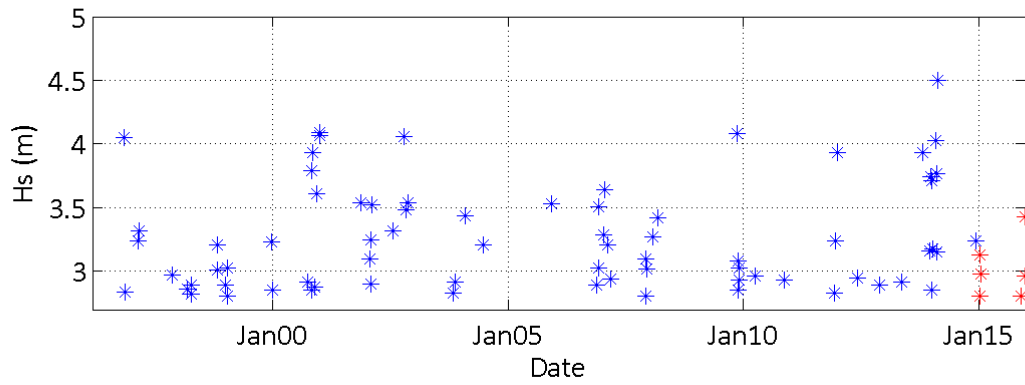
Tidal predictions for Lymington were supplied by EMU Limited.



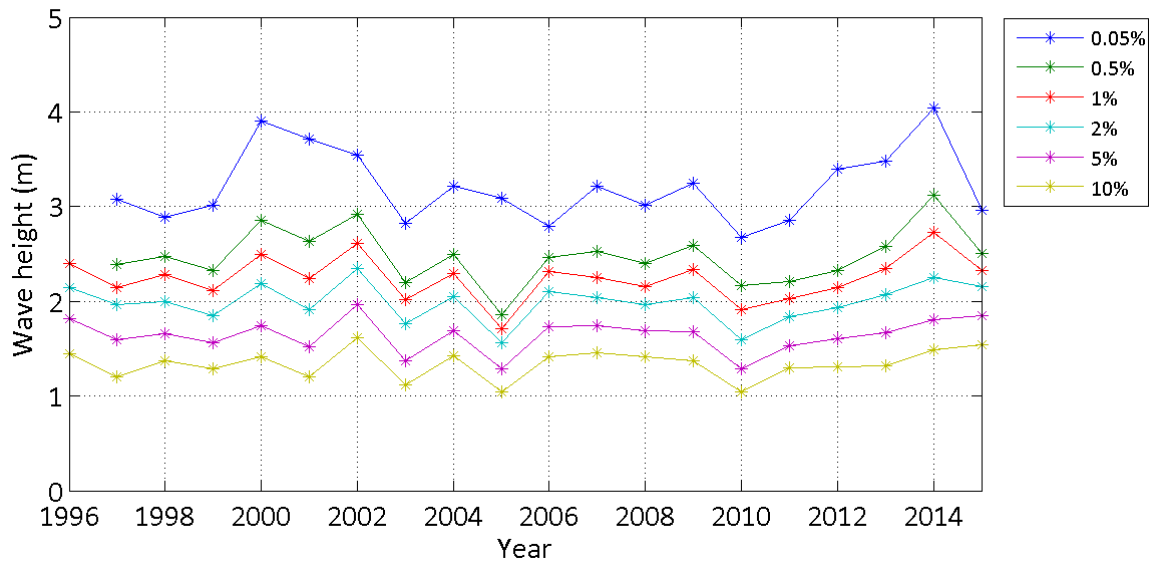
Storms at Milford during 2015



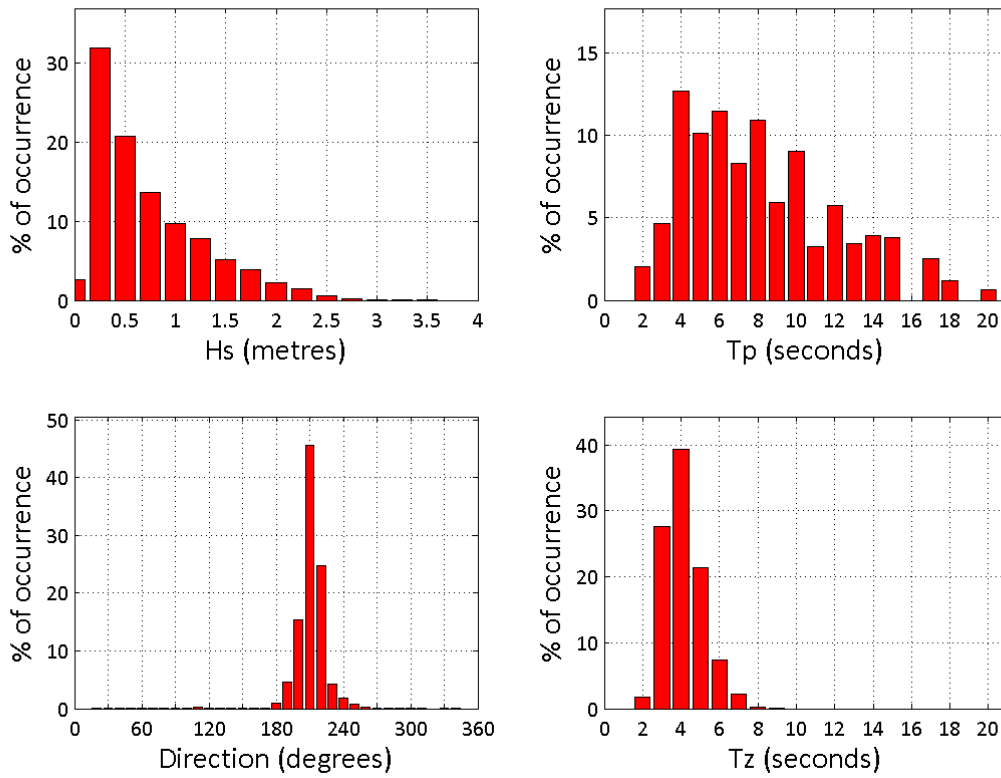
Storms at Milford - all years



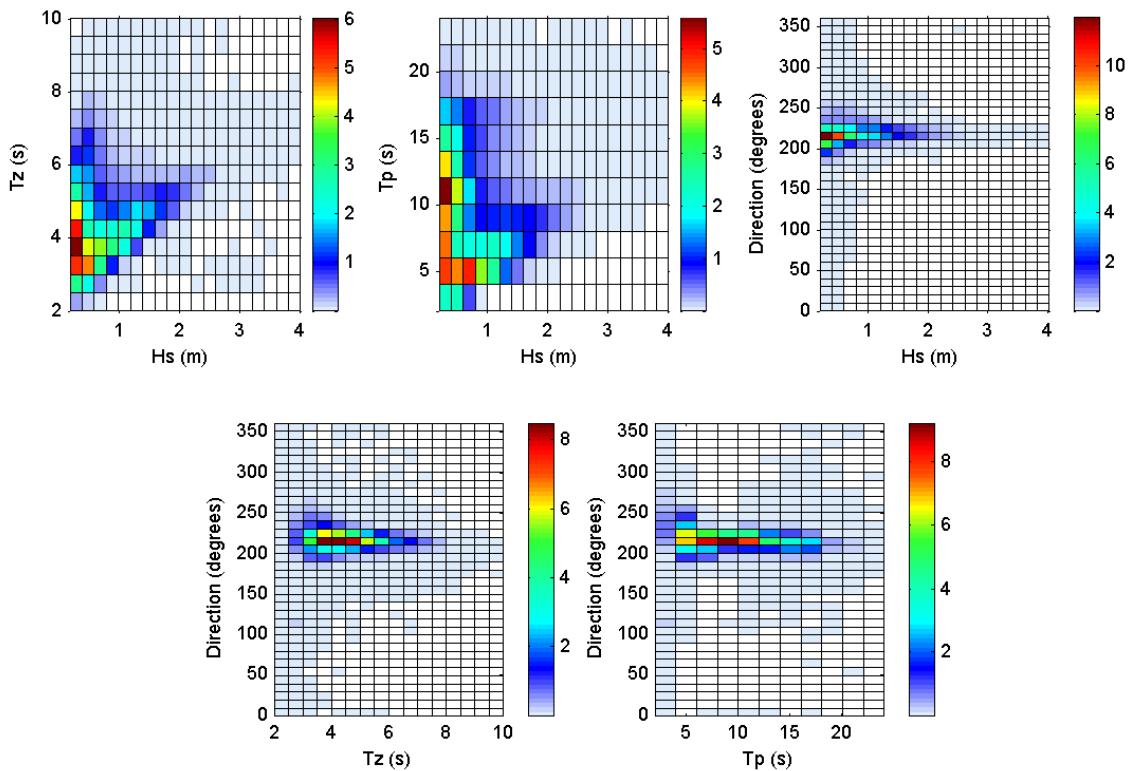
Milford - Wave height exceedance ( $H_s$ )



Milford 2015



Milford 1996 to 2015 - Joint distribution (% of occurrence)



### Offshore Wave Hs (m) Milford WB : 17/11/2005 - 31/12/2015

