

# BEACH MANAGEMENT PLAN REPORT

## Sandgate and Folkestone

2007

BMP 58 - Annex

February 2008

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**Beach Management Plan Site Report 2007  
4cMU08 & 4Cmu09 – Folkestone and Sandgate**

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## **Annex A**

### *Explanatory Notes*

## **1. Summary of method of conducting topographic and hydrographic surveys (based on the Environment Agency's National Specification Sections XII and XIII)**

Topographic cross-shore (profile) measurements are made at the intercept of the beach and a hard structure, at all changes of beach slope, at changes in surface sediment and at maximum defined intervals (every 5 metres). Each measurement is feature-coded with the type of surface material. Profiles are 100-500m apart, depending on management status. The seaward limit to be achieved is Mean Low Water Springs or 50 metres from the beach toe.

Topographic spot height (baseline) surveys are carried out annually at Beach Management Plan sites. Profiles are measured at 50m intervals, with the addition of spot heights at the toe of hard structures, the beach surface surrounding structures, all beach ridge crests, all other changes in slope and sediment changes, plus contour lines at a maximum spacing of 5m. All measurements are feature-coded with sediment type. Sufficient data points must be measured to generate a reliable Digital Terrain Model.

Hydrographic surveys are conducted with a single beam echo-sounder, with the position fixing requirement relaxed to DGPS. Soundings are taken along cross-shore profile lines 50m apart and extend 1km offshore. A minimum of 4 shore parallel tie lines are required (including one near the landward and seaward boundaries). The landward limit varies slightly across the region, due to the variation in tidal range, but in general is landward of Mean Sea Level, thus providing overlap with the topographic surveys. Tidal control may be by RTK GPS or by correction from tide gauges which are tied to the survey control network

## **2. Change in Cross-sectional Area (CSA)**

The annual change in cross-sectional area is calculated as the difference in CSA between two surveys, expressed as a percentage change compared to the earlier CSA.

$$\frac{CSA_1 - CSA_2}{CSA_2} * 100 \quad \text{Eqn (1)}$$

where  $CSA_1$  = most recent springtime survey and  $CSA_2$  = spring survey previous year. Therefore an annual change of -14% represents erosion during the last year of 14% of the area of last year's survey.

## **3. Method of derivation of Digital Ground and difference models**

The Digital Terrain Model is created by interpolating the points of a topographic baseline survey collected by using RTK GPS system. The interpolation method used to create the SECG DGMs is specified as Triangulation with smoothing and is applied in MapInfo Vertical Mapper to create a 1 metre resolution grid.

Triangulation is a process of grid generation that is usually applied to data that requires no regional averaging, such as elevation readings. The surface created by triangulation passes through all of the original data points while generating some degree of "overshoot" above local high values and "undershoot" below local low values. Elevation is an example of point values that are best "surfaced" with a technique that predicts some degree of over- and under- estimation. In modelling a topographic surface from scattered elevation readings, it is not reasonable to assume that data points were collected at the absolute top or bottom of each local rise or depression in the land surface.

Triangulation involves a process whereby all the original data points are connected in space by a network of triangular faces, drawn as equilaterally as possible. This network of triangular faces is referred to as a Triangular Irregular Network (TIN). Points are connected based on the nearest neighbour relationship (the Delaunay criterion) which states that a circumcircle drawn around any triangle will not enclose the vertices of any other triangle.

To visualise the resulting grid, the same colour scheme is applied, thus enabling comparison between grids of different geographic origin. The colour bands cover a elevation range between -4 to +12 metres OD with elevations lying between -2 and +5 metres OD are shown in 0.5 metres intervals, the remaining elevation bands shown in 1 metre intervals.

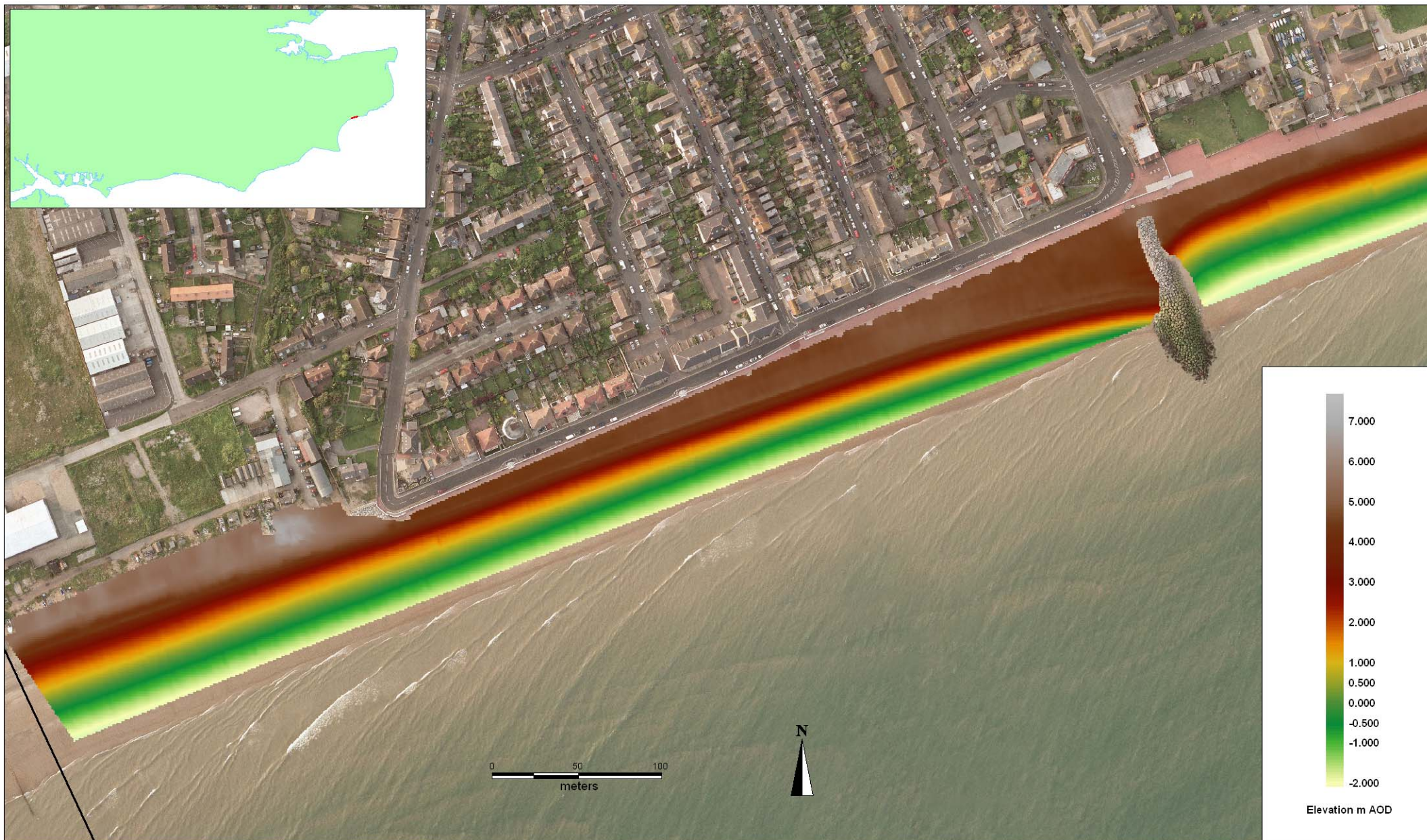
All difference models are created by using a grid calculator within the GIS system. For example the difference model of two baseline surveys is created by subtracting the earlier baseline grid from the most recent baseline grid:

$$Grid_1 - Grid_2 \qquad \text{Eqn (2)}$$

where  $Grid_1$  = most recent baseline grid and  $Grid_2$  = previous baseline grid. Therefore an annual change of  $-14m^2$  represents erosion during the last year of  $14m^2$ , whilst positive values represent accretion over the period.

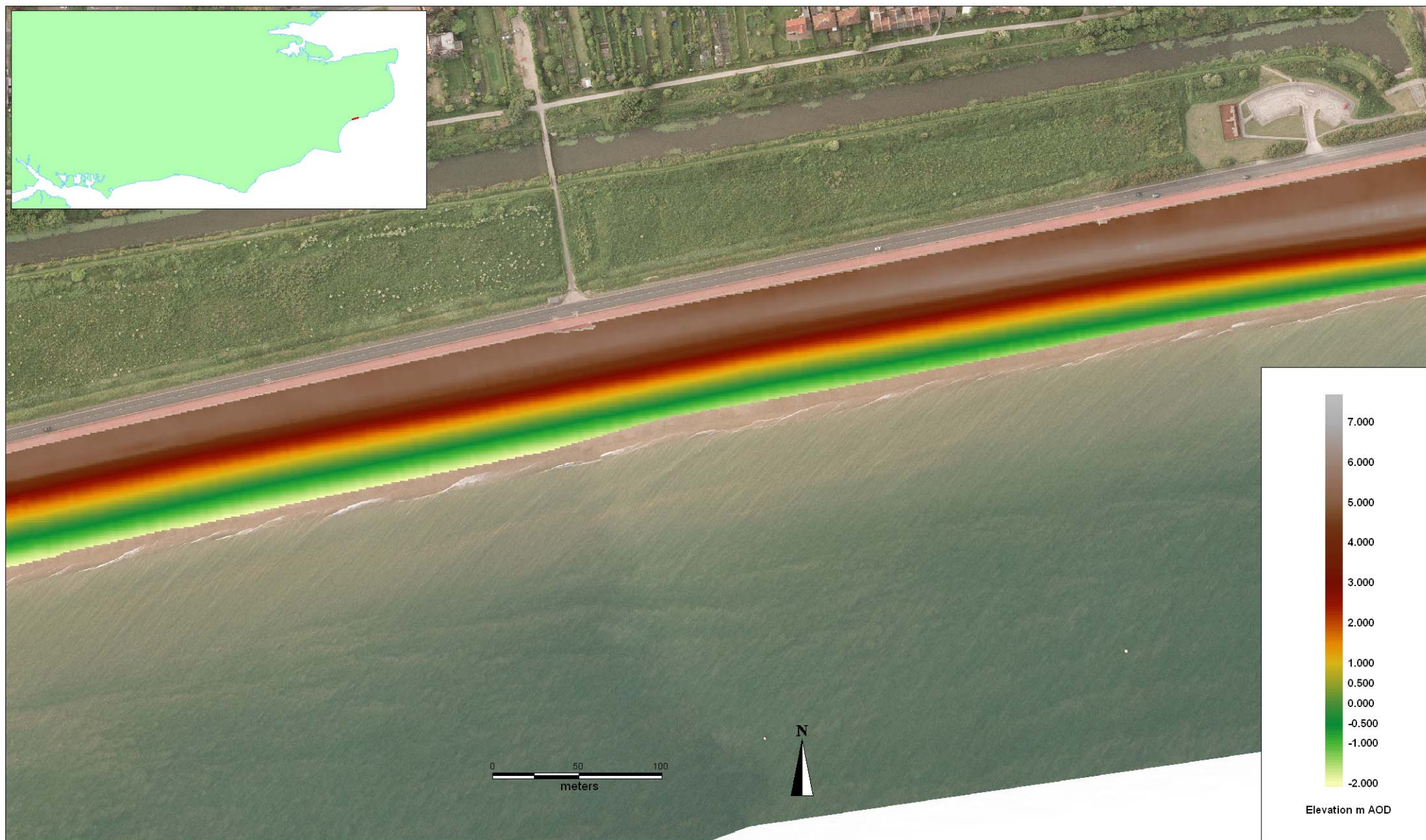
## **Annex B**

### *Digital Ground Models – Management Unit 09*







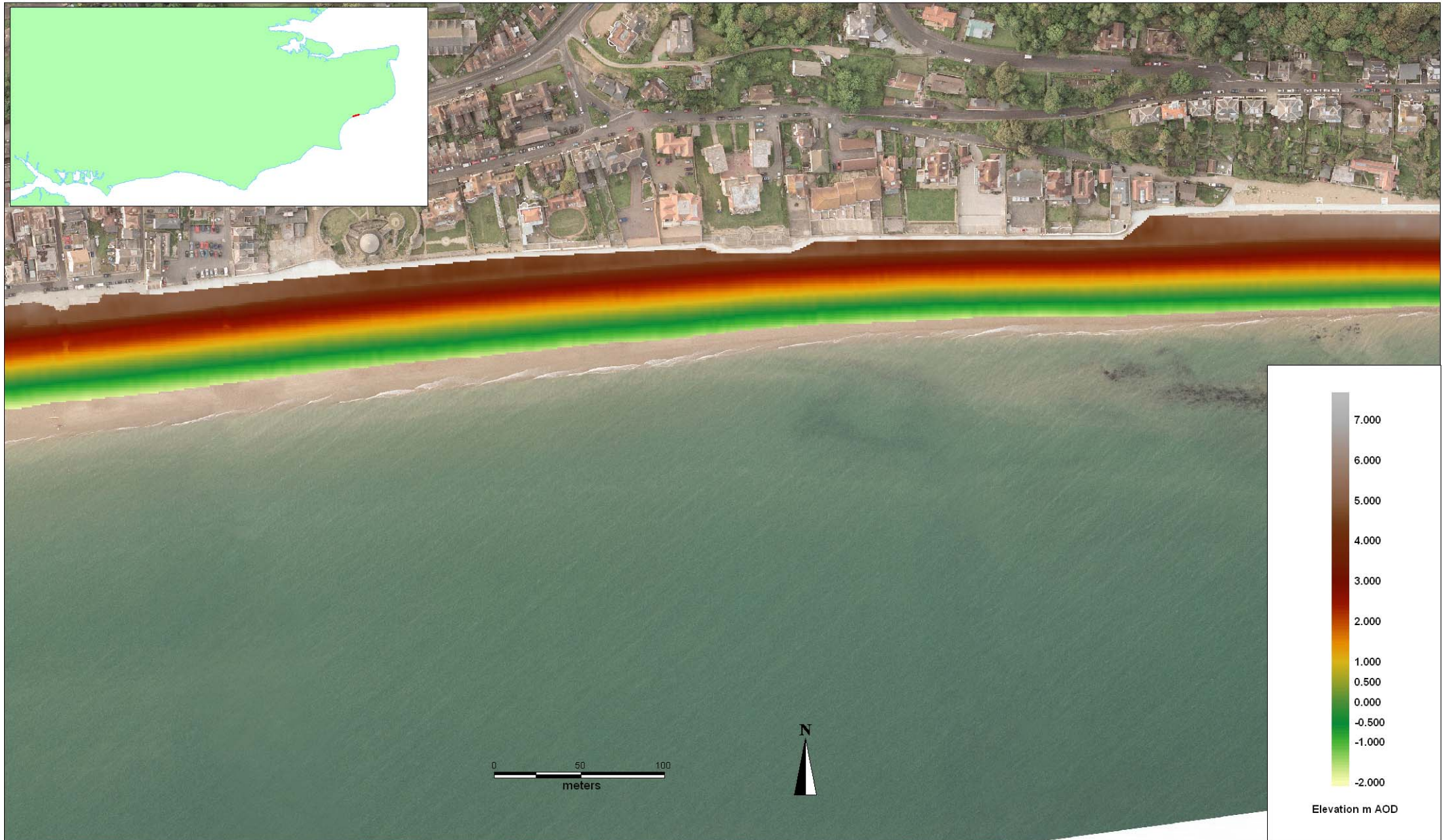


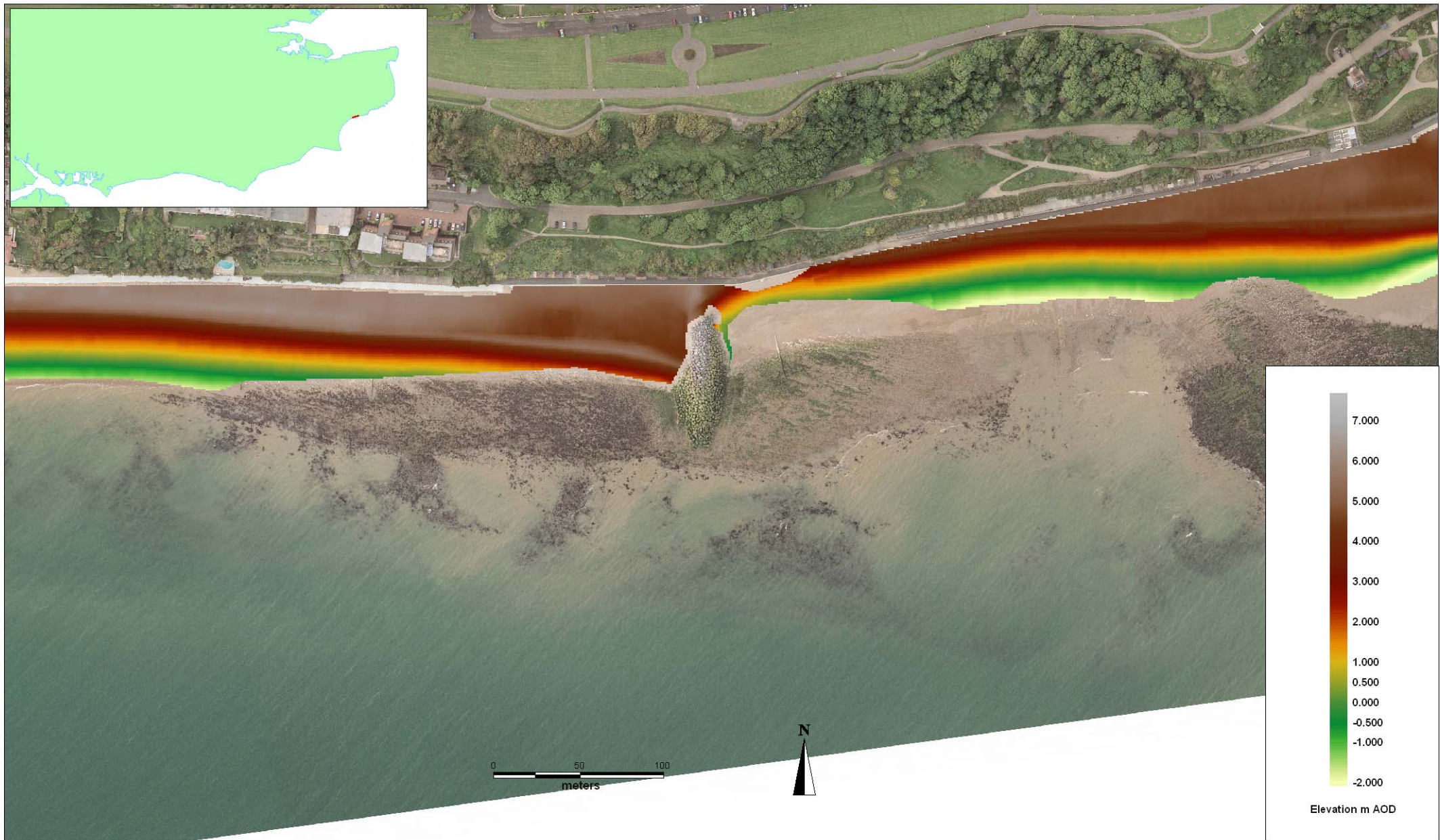


*Digital Ground Models – Management Unit 08*

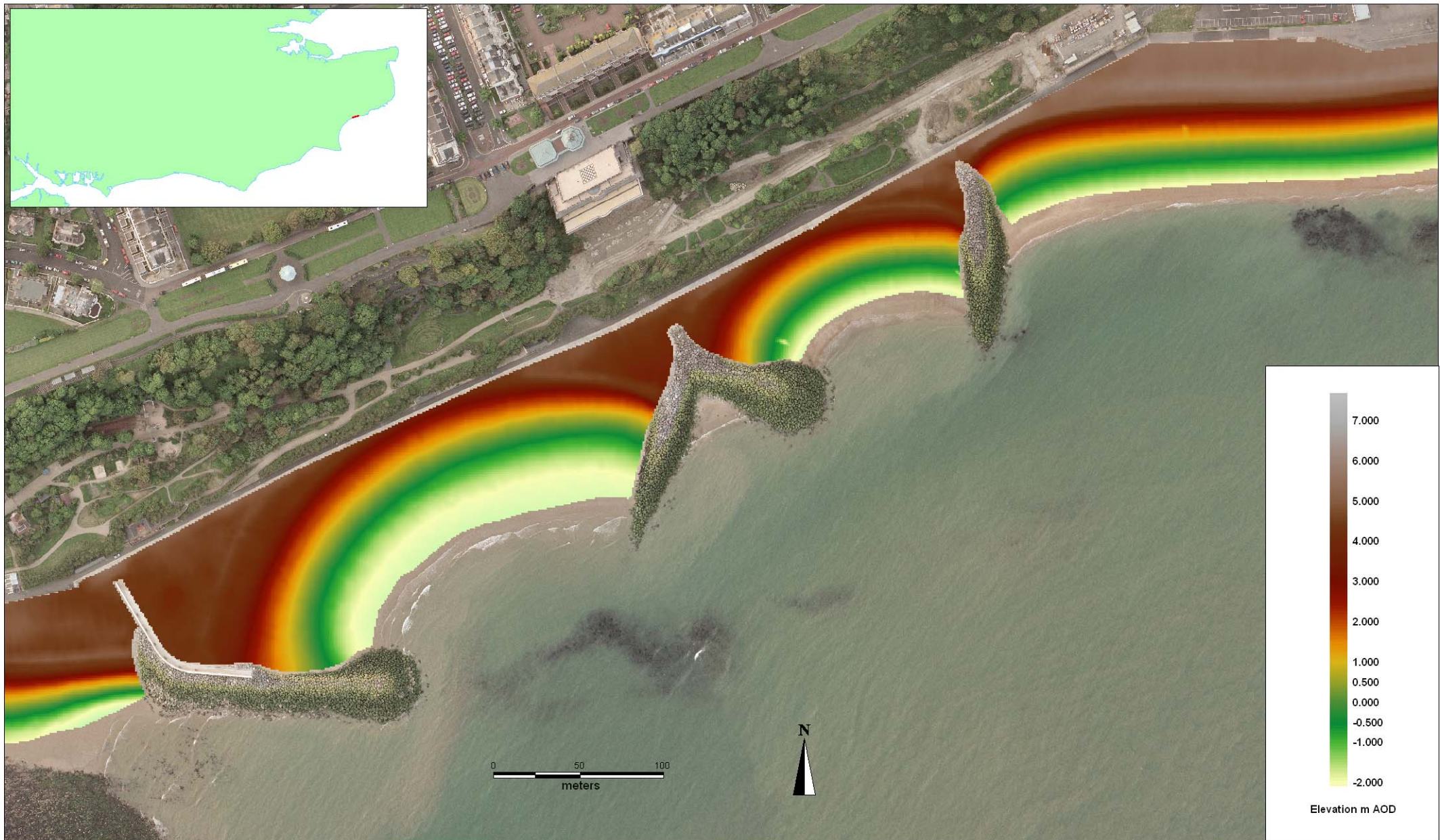
















## **Annex C**

*Folkestone WaveRider Buoy*

*July 2006 – June 2007*

## Folkestone WaveRider Buoy - July 2006 to June 2007

### Location

OS: 619711E 132538N  
WGS84: Latitude: 51°03.5335'N Longitude: 01°08.2988'E

### Water Depth

12.7m CD

### Instrument Type

Datawell Directional Waverider Buoy Mk III

### Data Quality

C1(%)	Sample interval
100	30 minutes

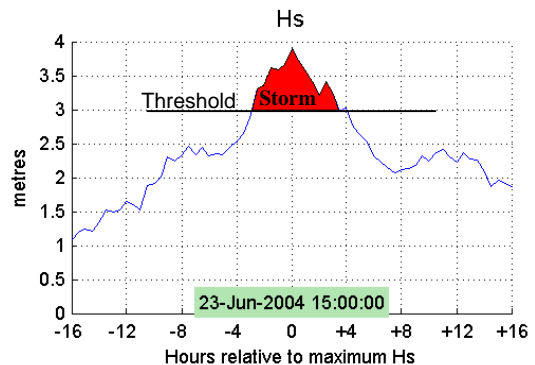
### Storm Analysis

All times are GMT

Highest events in 2006/7									
Date/Time	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	Dir.	Water level elevation* (OD)	Tidal stage (ref HW)	Tidal range (m)	Tidal surge* (m)	Max. surge* (m)
03-Dec-2006 09:00	3.13	7.1	5.3	180	2.30	HW	5.6	-0.44	-0.56
18-Jan-2007 13:00	2.59	-	4.4	-	-	HW -3	5.2	-	-
07-Dec-2006 06:00	2.57	7.1	4.9	177	-2.30	HW +5	5.9	-0.01	0.48
30-Dec-2006 05:30	2.55	7.1	4.8	179	1.15	HW -1	4.4	-0.60	-0.71

Table F1 Highest events during the reporting period, July 2006 to June 2007

A storm is defined using the Peaks-over-Threshold method (Figure F1). Each storm is then examined in detail, and covers the period 16 hours either side of the storm peak, so as to include both the build-up and decay of the storm. This is the procedure recommended by the CIRIA Beach Management Manual since it covers the build-up and decay typical of a mid-latitudes depression.



\* Tidal information is obtained from the nearest recording tide gauge (the National Network gauge at Dover). The tidal 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.

At present, the threshold for an individual site is derived empirically, since the measurements span only 2 years and, therefore, errs on the low side. Once the record length exceeds 5 years, a more realistic value of the Threshold can be derived, so as to identify 3 or 4 storms in an average year. The threshold used for Folkestone is 2.5m.

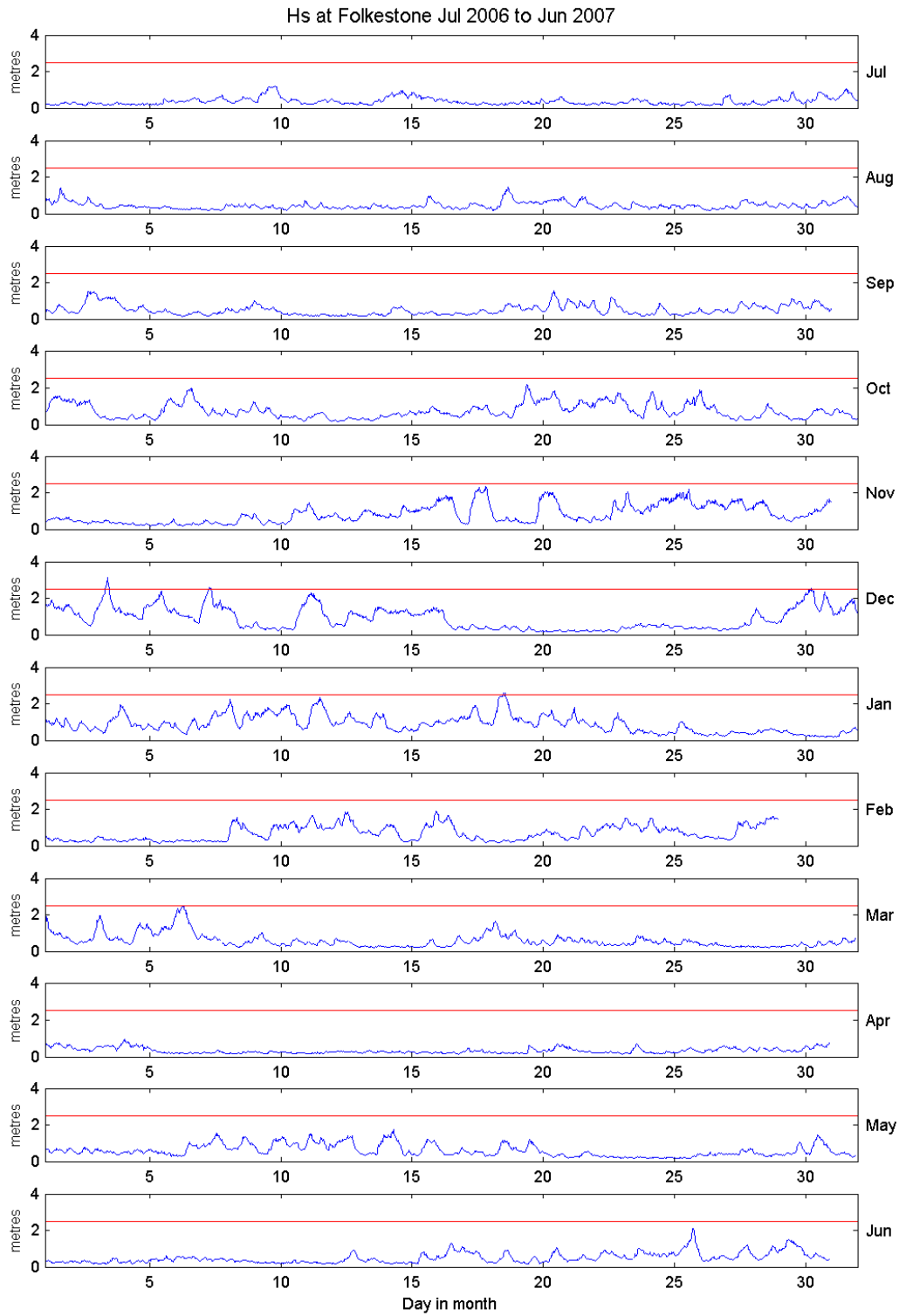
Figure F2 shows the monthly time series of  $H_s$ , with the threshold shown in red. The occurrence of storm waves in the current reporting period is also compared with similar storm waves in previous years in Figure F3. Subsequent figures show a time series of the wave conditions for each of the events listed in Table F1, together with the tidal conditions at the nearest tide gauge. Each graph is centred around the highest  $H_s$  of the individual event.

### Summary

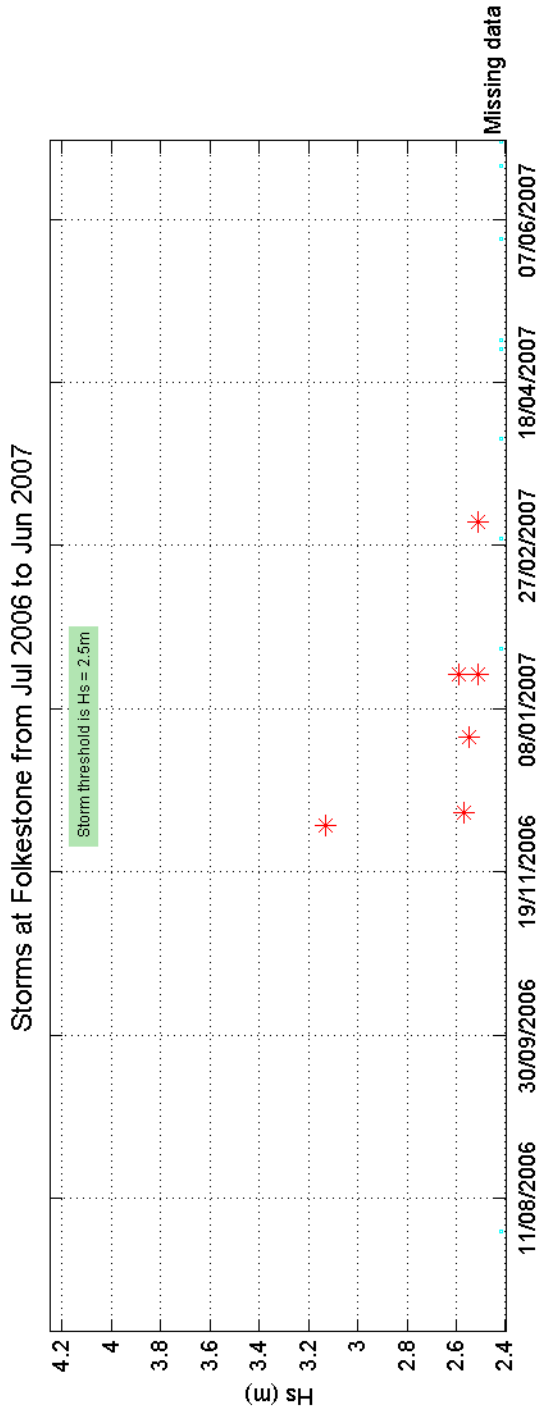
The current reporting period was similar to the last reporting year, in both the frequency and magnitude of storms. Only one storm exceeded 3m  $H_s$ . Storms were confined to the winter months and direction was predominantly from the south. Positive surge levels were small (< 0.5m) but larger, negative surges were more prevalent.

### Acknowledgements

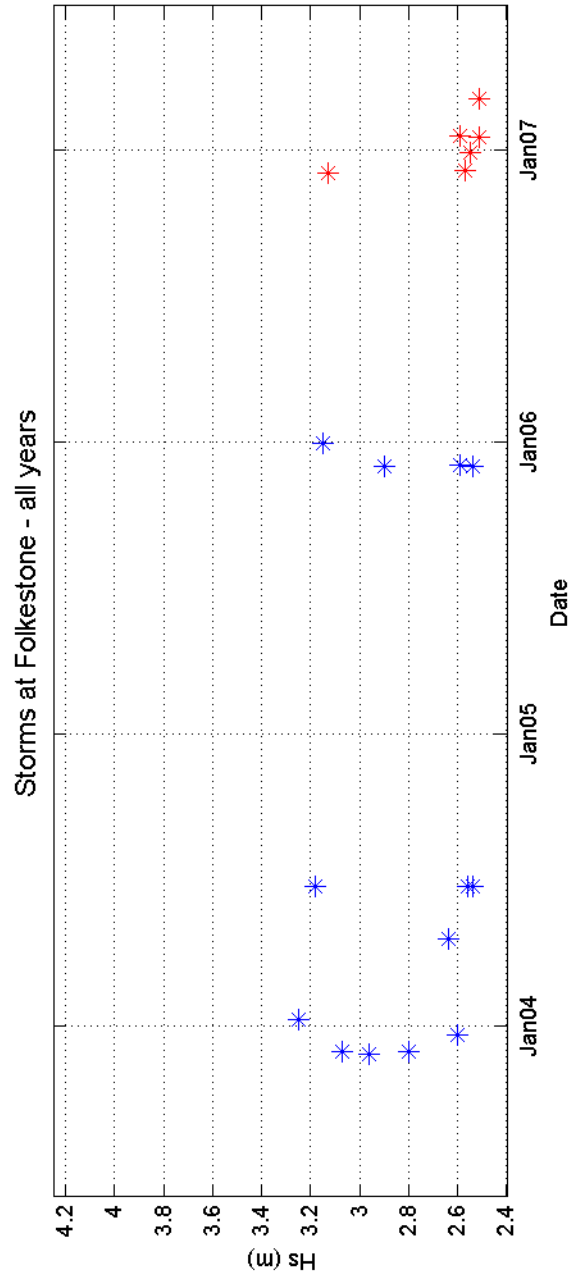
Tidal data were supplied by the British Oceanographic Data Centre as part of the function of the National Tidal and Sea Level Facility, hosted by the Proudman Oceanographic Laboratory and funded by DEFRA and the Natural Environment Research Council.



**Figure F2 Monthly time series of H<sub>s</sub> at Folkestone. Storm threshold, shown in red, is 2.5m.**



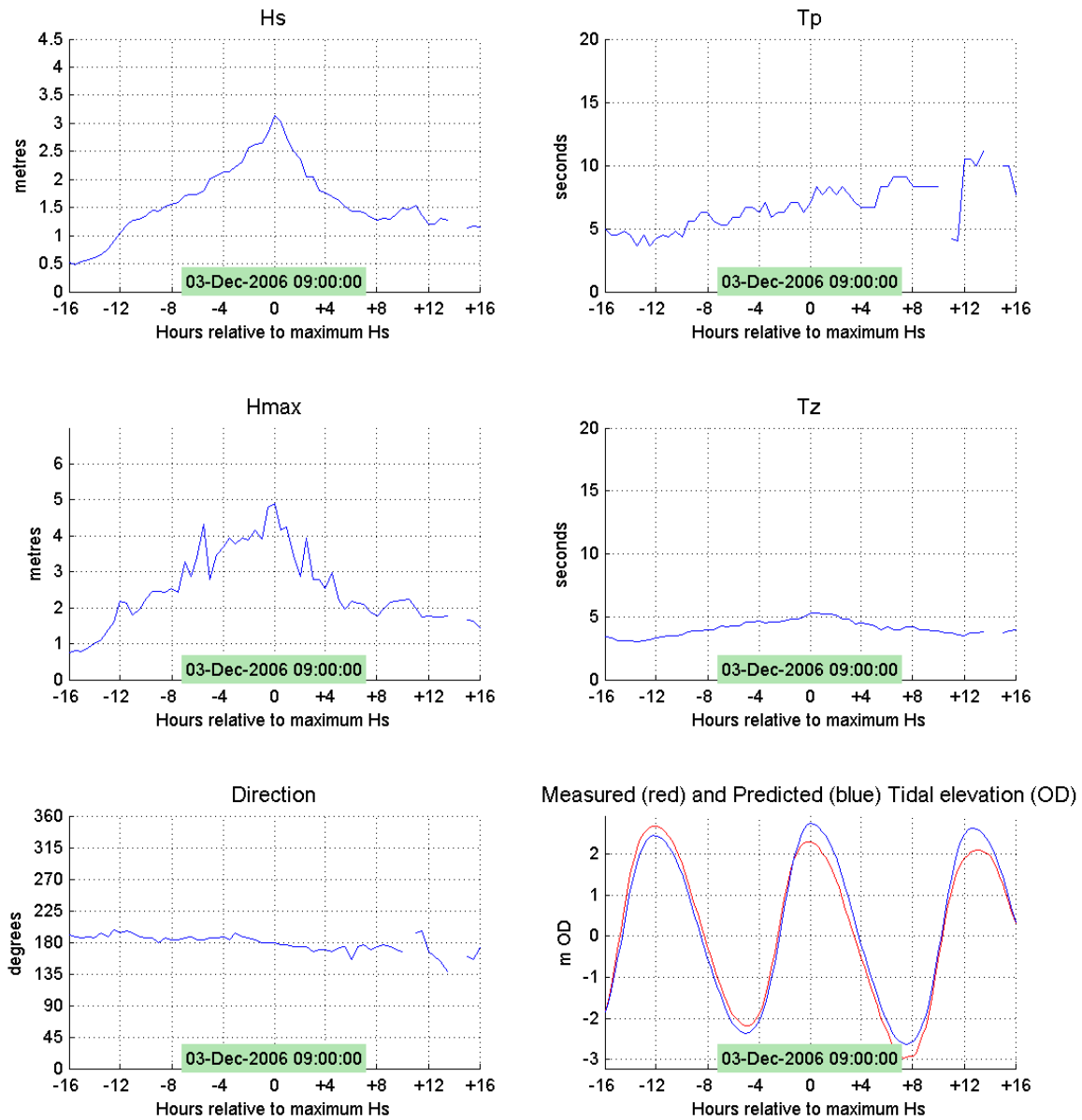
(a)



(b)



Folkestone - Storms during Jul 2006 to Jun 2007



**Figure F4 Highest event of reporting period**

The largest storm at Folkestone during this reporting period shows a classic storm development, generated by a deep depression tracking to the north-west of the British Isles (Figure F5).  $H_s$  increased from 0.5m to a short-lived peak of 3.1m over the course of 16hrs. With a steady southerly wave approach, the  $T_p$  increased steadily but remained below about 10s, indicating locally-generated waves. The negative storm surge of ~0.5m (at Dover) present at the storm peak continued during the following tidal cycle.

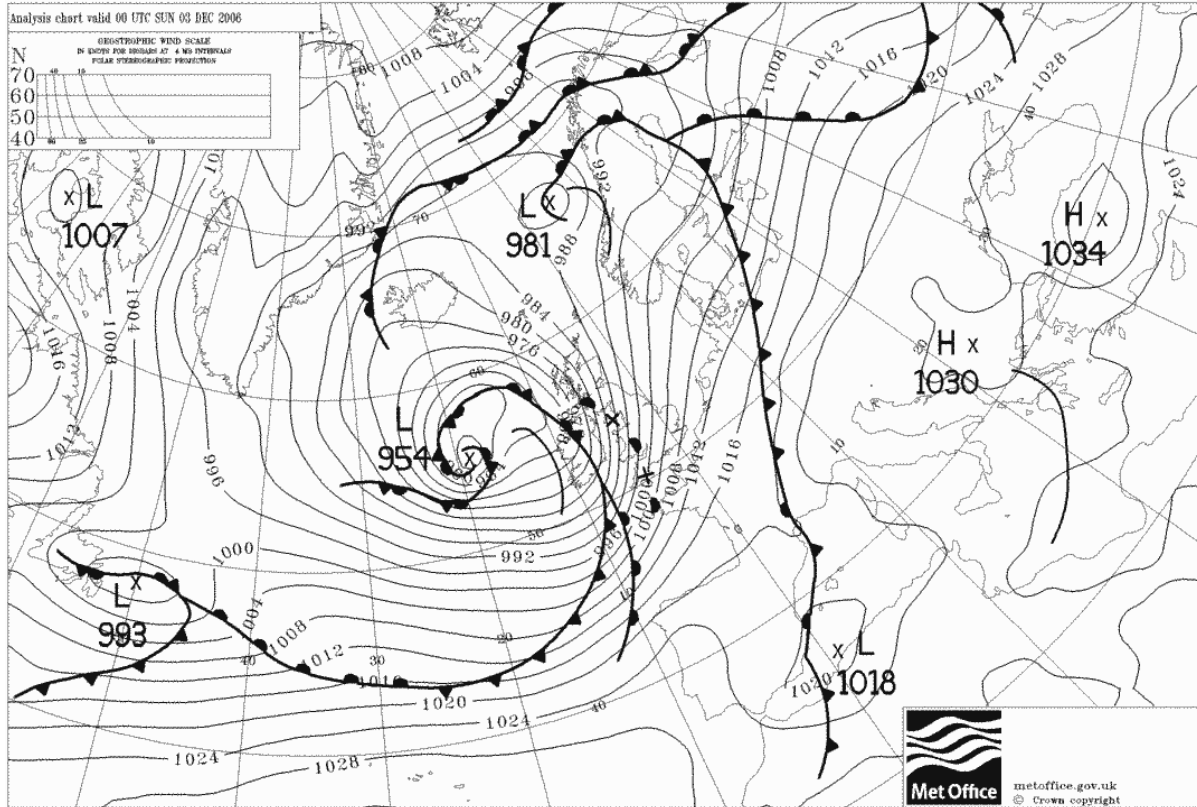
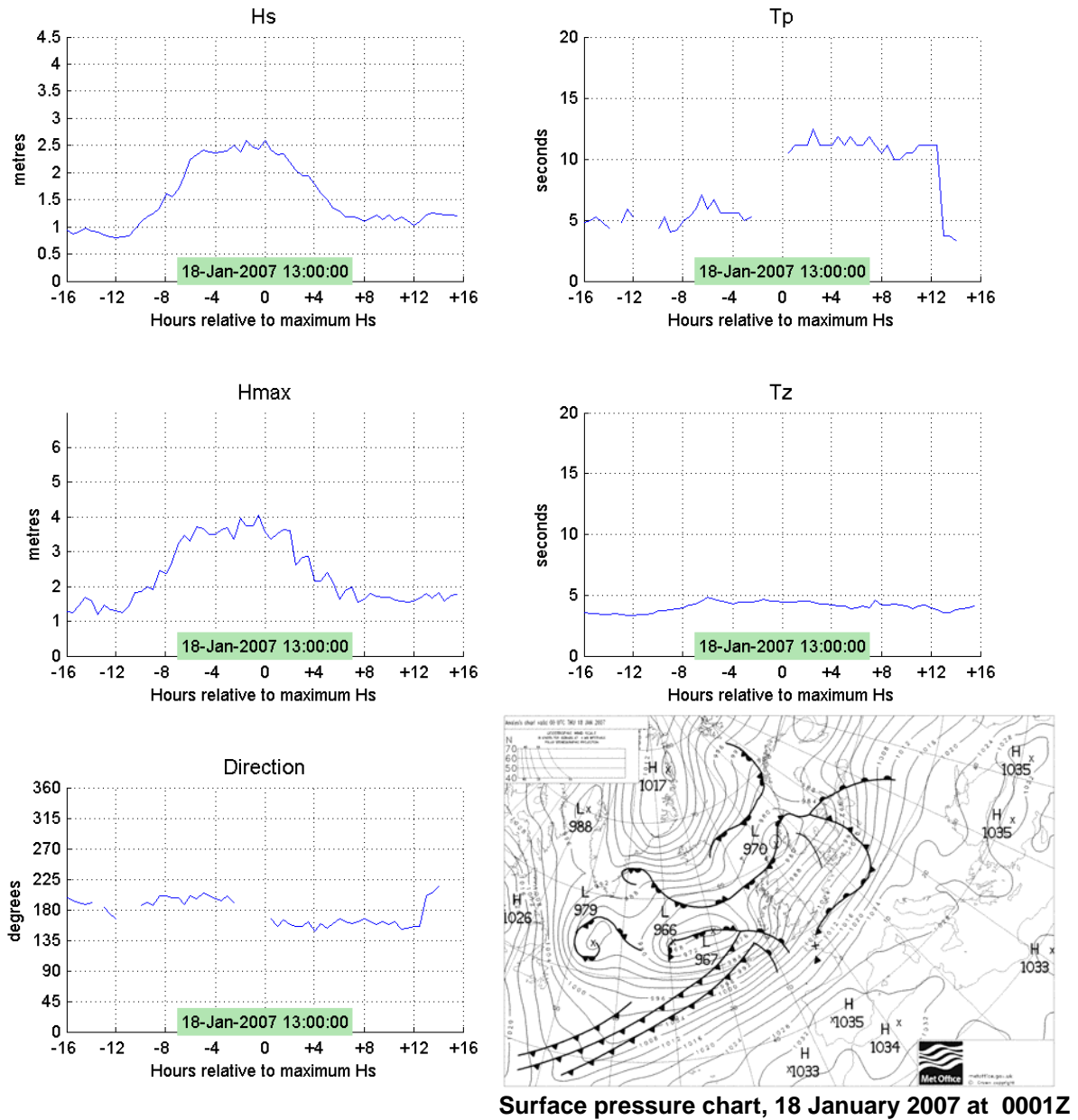


Figure F5 Surface pressure chart, 03 December 2006 at 0001Z

Folkestone - Storms during Jul 2006 to Jun 2007

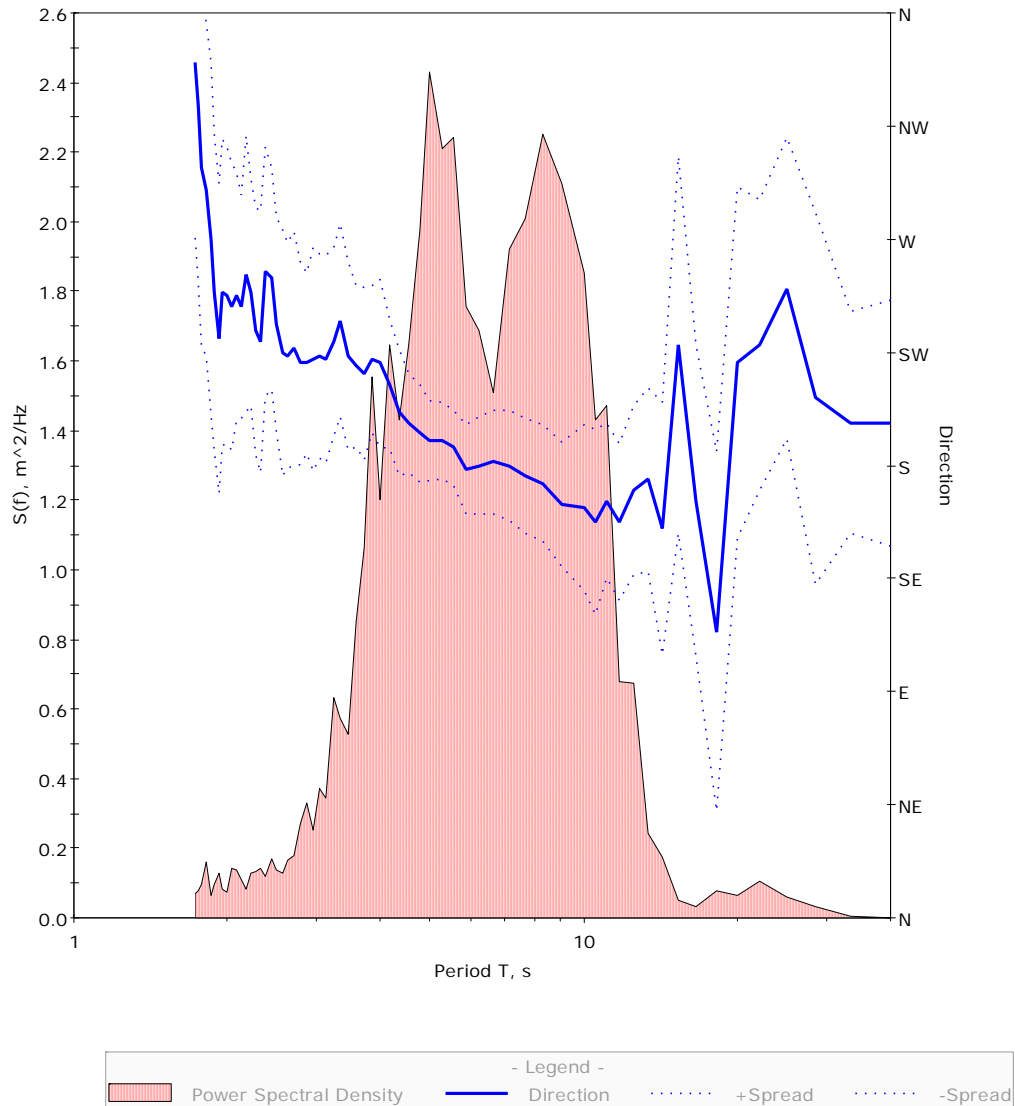


Surface pressure chart, 18 January 2007 at 0001Z

**Figure F6 Second highest event of reporting period**

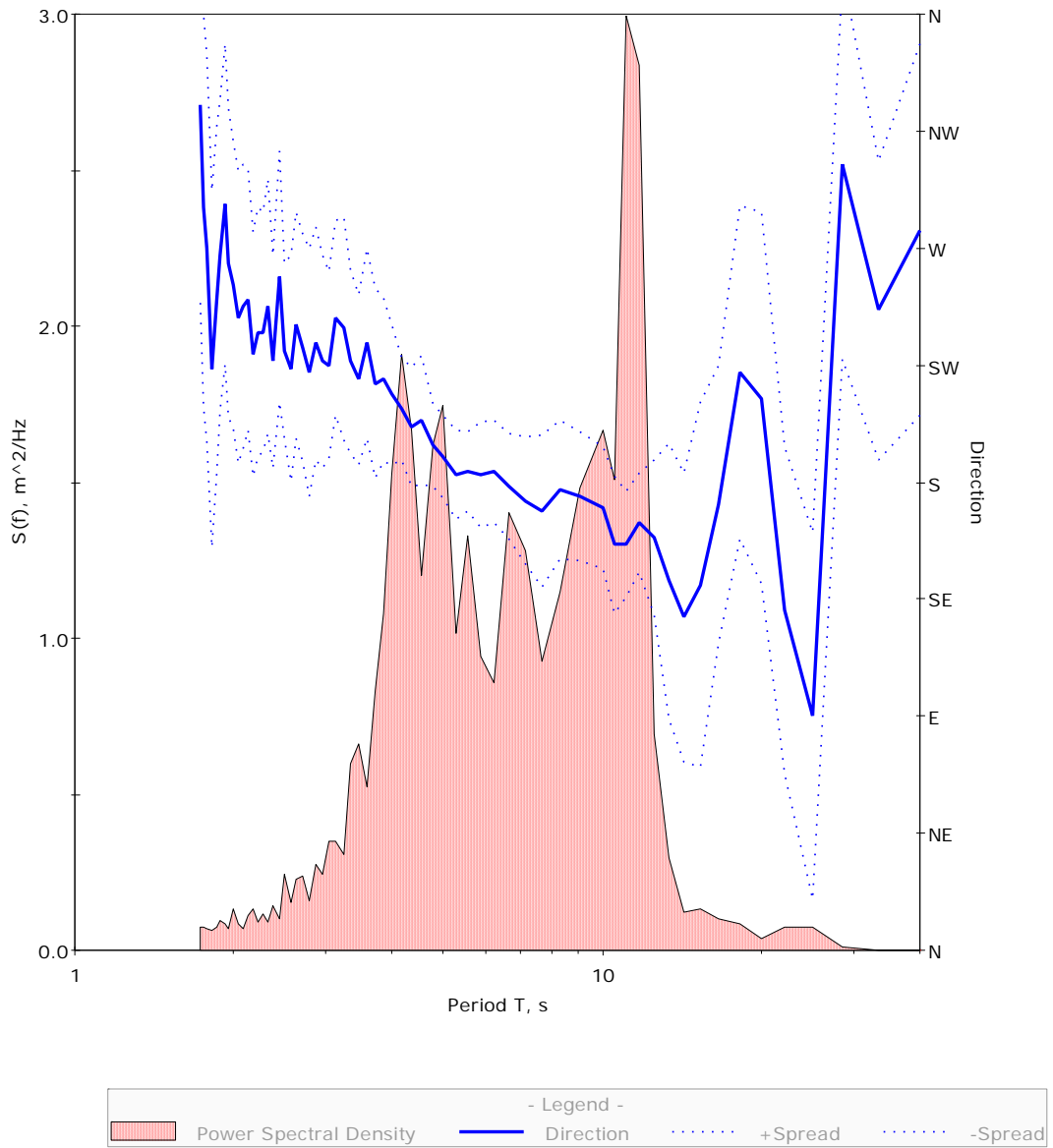
In this storm, although the peak  $H_s$  was lower than the first event, the southerly high waves were maintained for approximately 5 hours prior to the peak. There was evidence for longer period swell waves from the SSE for 12 hours after the storm peak, as shown in Figures F7 and F8. Although the total energy in the wind-wave spectrum (up to ~10s) remains higher than in the lower frequency band, these long period, SSE waves may be importance for understanding the beach behaviour.

Folkestone, 2007-01-18 13:02  
- buoy spectrum -



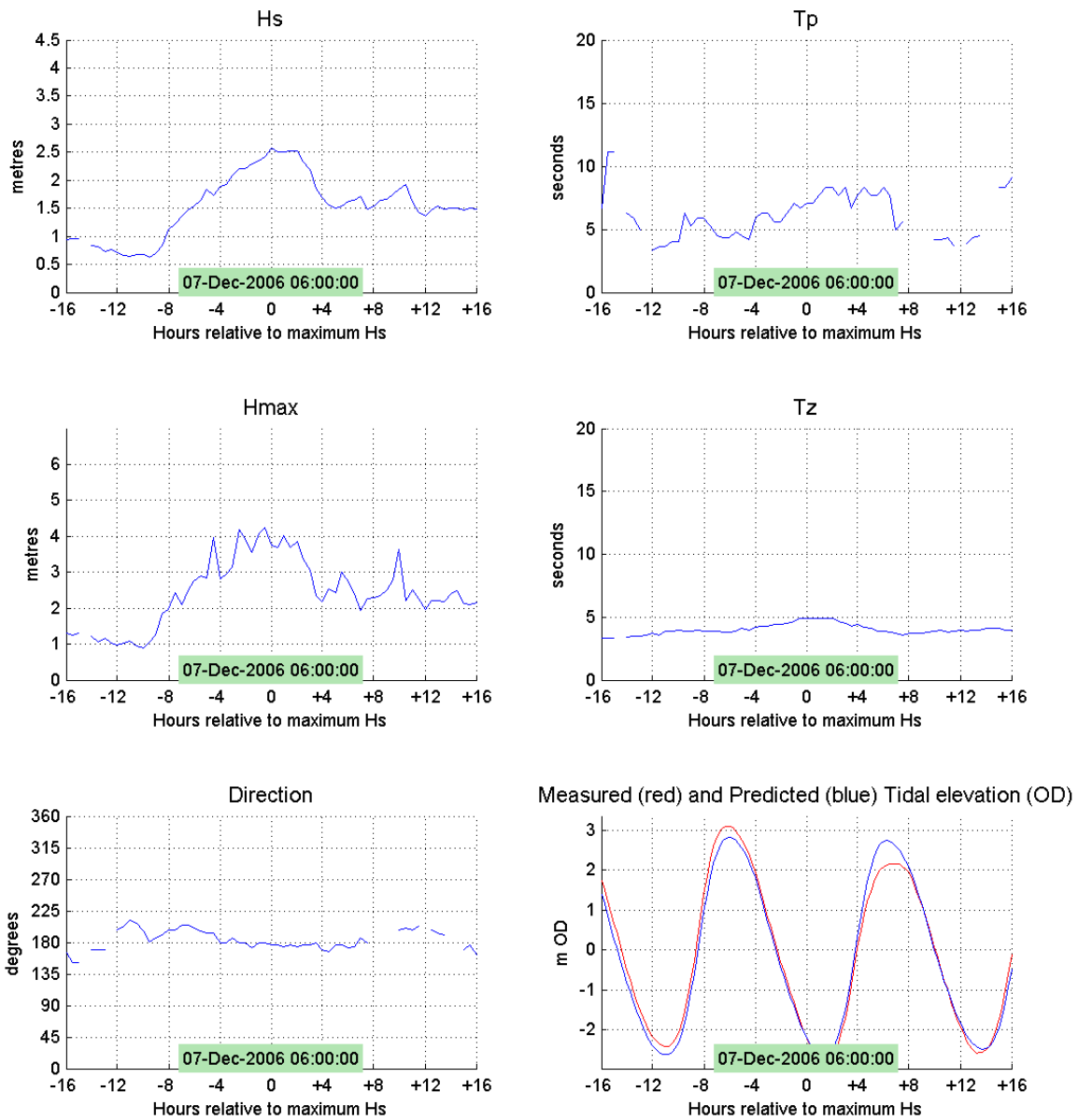
**Figure F7.** Wave spectrum at storm peak, showing bi-modal seas (two distinct wave trains, from the S and the SSE), but with broadly similar energies. The peak period is higher of the two peaks (~ 5s).

Folkestone, 2007-01-18 14:03  
- buoy spectrum -



**Figure F8.** Wave spectrum one hour after the storm peak. The lower frequency peak, from the SSE has increased in energy, is more narrow-banded and at its peak about 11s.

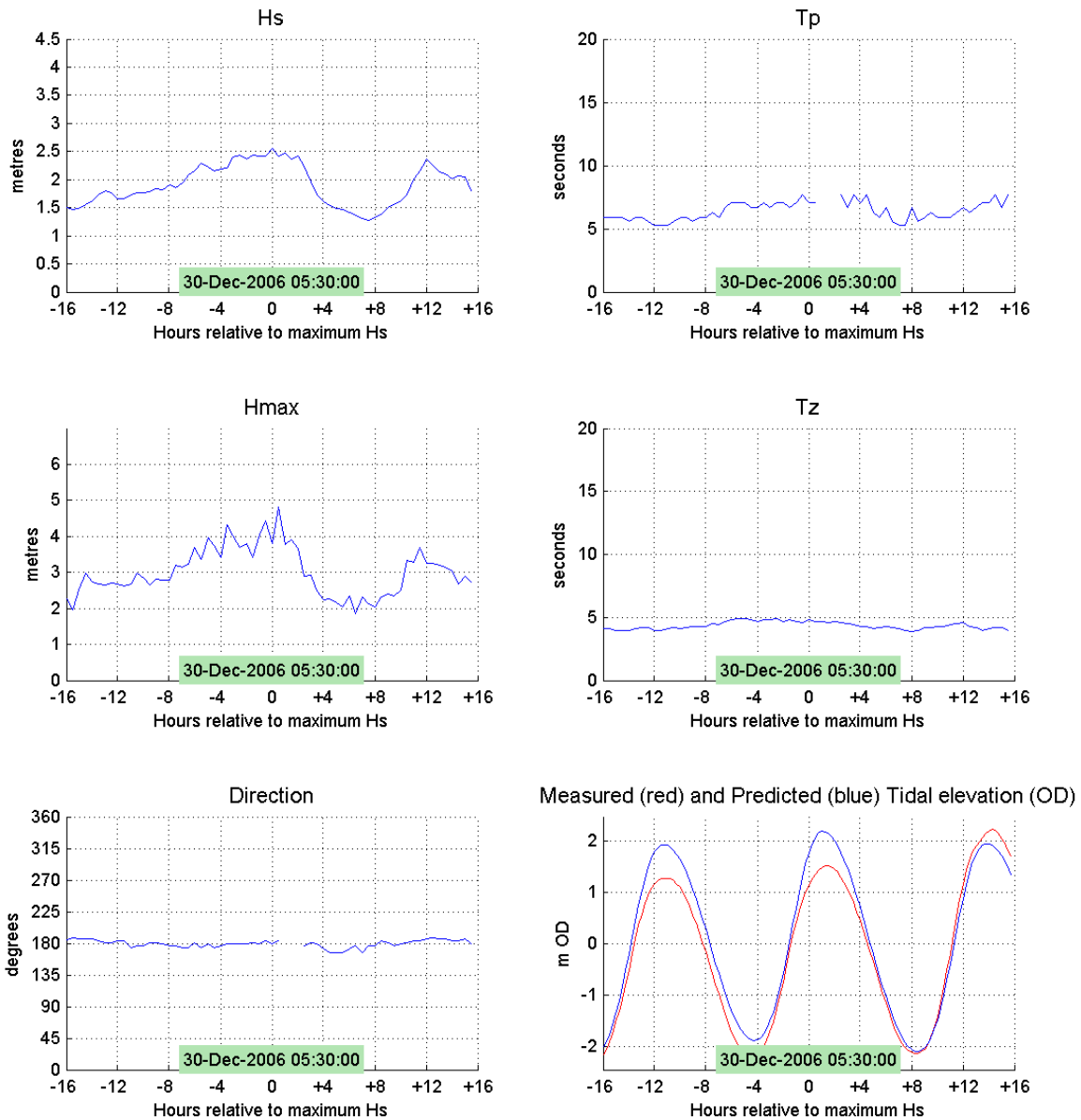
Folkestone - Storms during Jul 2006 to Jun 2007



**Figure F9 Third highest event of reporting period**

A fairly “typical” storm profile was experienced during the fourth event, with southerly waves producing a peak  $H_s$  just above the 2.5m threshold.

Folkestone - Storms during Jul 2006 to Jun 2007



**Figure F10 Fourth highest event of reporting period**

This storm, which was generated by an extensive, complex low pressure system embracing most of the North Atlantic (Figure F11), was only the fourth largest at Folkestone during this reporting period, despite producing the largest measured waves in the western English Channel.

Of interest during this storm is the double peaked nature, which is unlikely to be due to shallow water processes given both the time scale involved and the neap tides, and which coincided with a 6 hour period of lower winds, which first backed from SW to S, then veered to SW presumably with the passage of multiple fronts (Figures F12 and F13).

The sustained period of negative surge (~ -0.7m) prior to and during the storm peak does not appear to be generated by meteorological conditions (SSW, 45 kts), but has been observed in previous years.

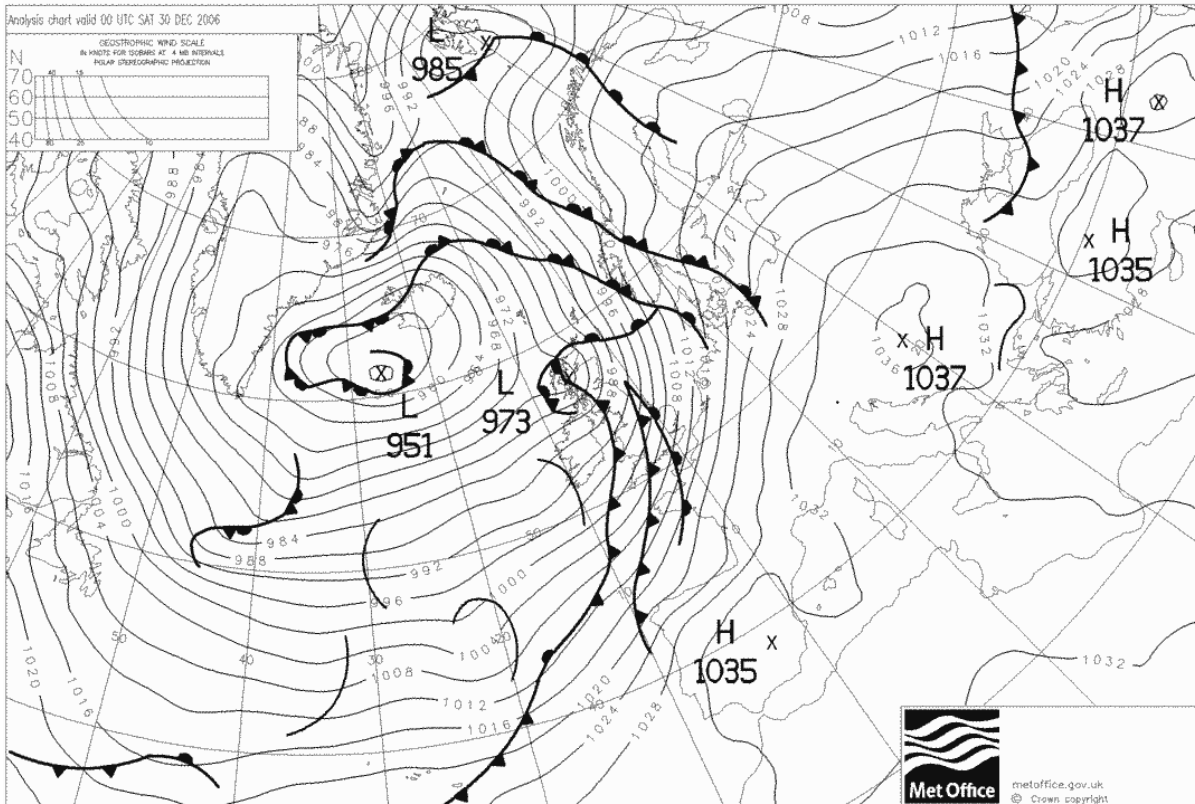


Figure F11 Surface pressure chart for 30 December 2006 at 0000Z



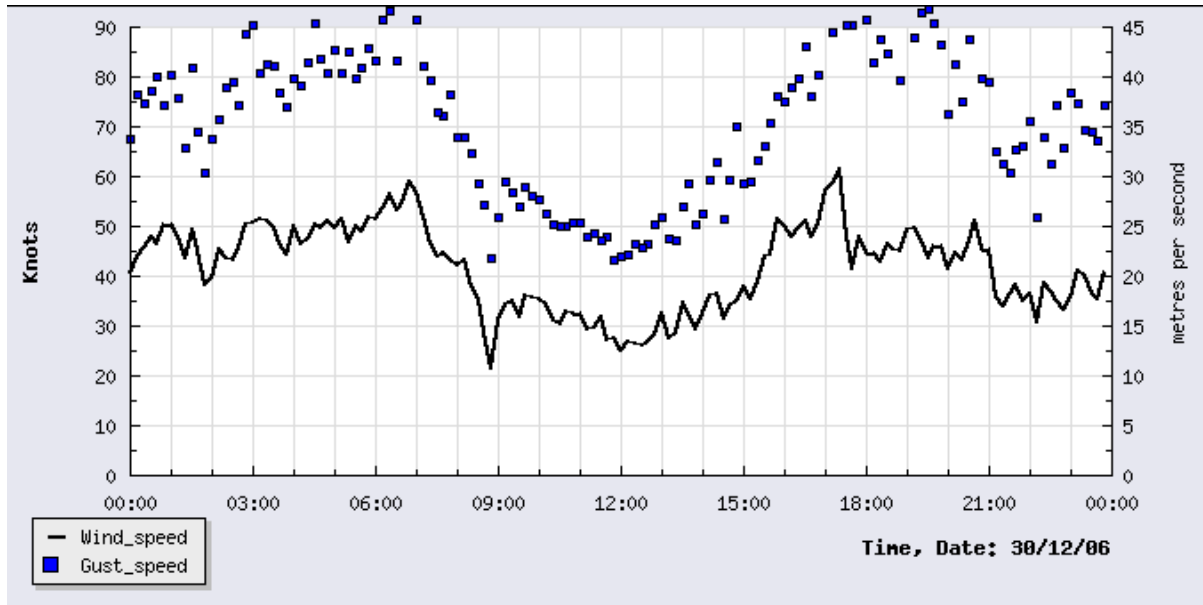


Figure F12 Wind and Gust speed at Folkestone Meteorological Station, 30 December 2006

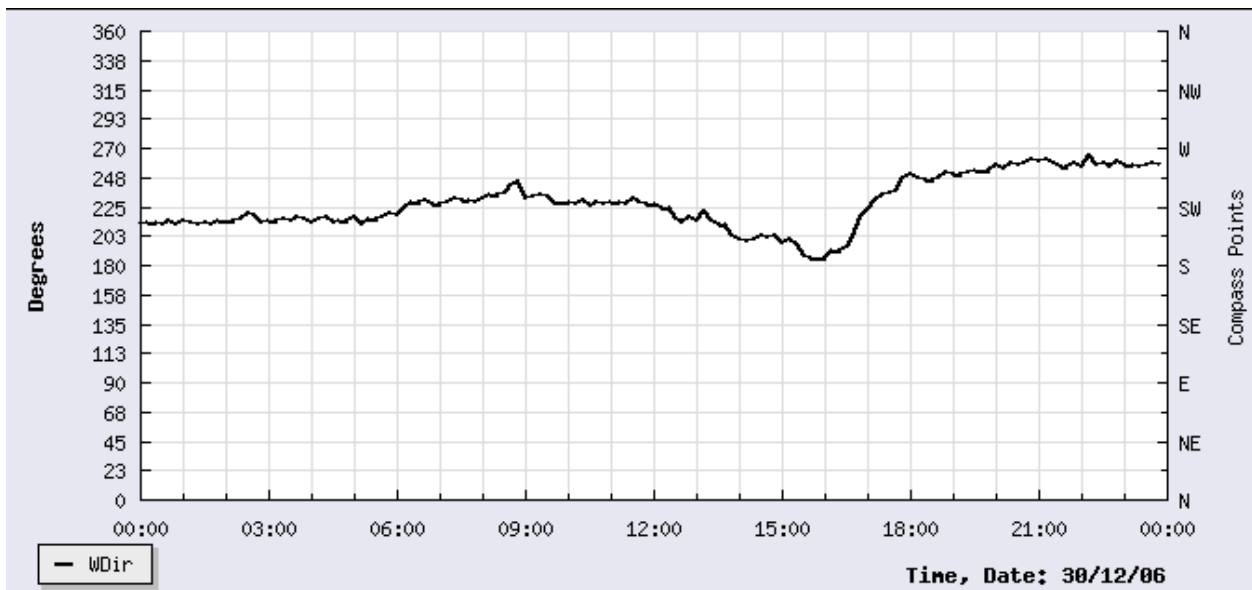


Figure F13 Wind direction at Folkestone Meteorological Station, 30 December 2006