

# BEACH MANAGEMENT PLAN REPORT

## Hastings

2007

**BMP 53 - Annex**

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Author: A. Jeffery

Checked By C. Longmire

Approved By: N. Sangster

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## **Beach Management Plan Site Report 2007 Unit 24: Hastings**

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# **Annex A**

*Explanatory Notes*

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## **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 Ground 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 modeling a topographic surface from scattered elevation readings, it is not reasonable to assume that data points were

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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:

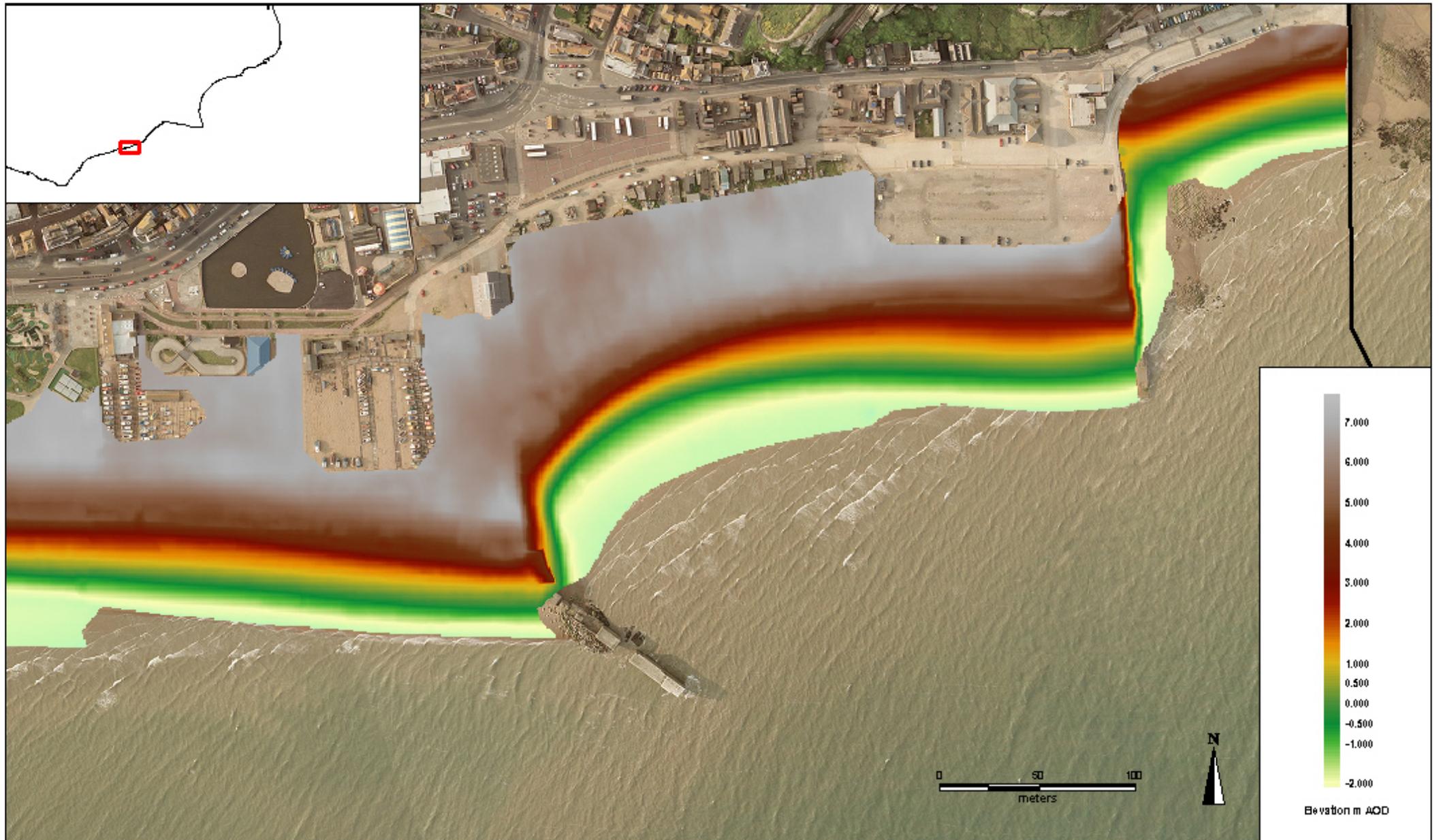
$$Grid_1 - Grid_2 \quad \text{Eqn (2)}$$

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.

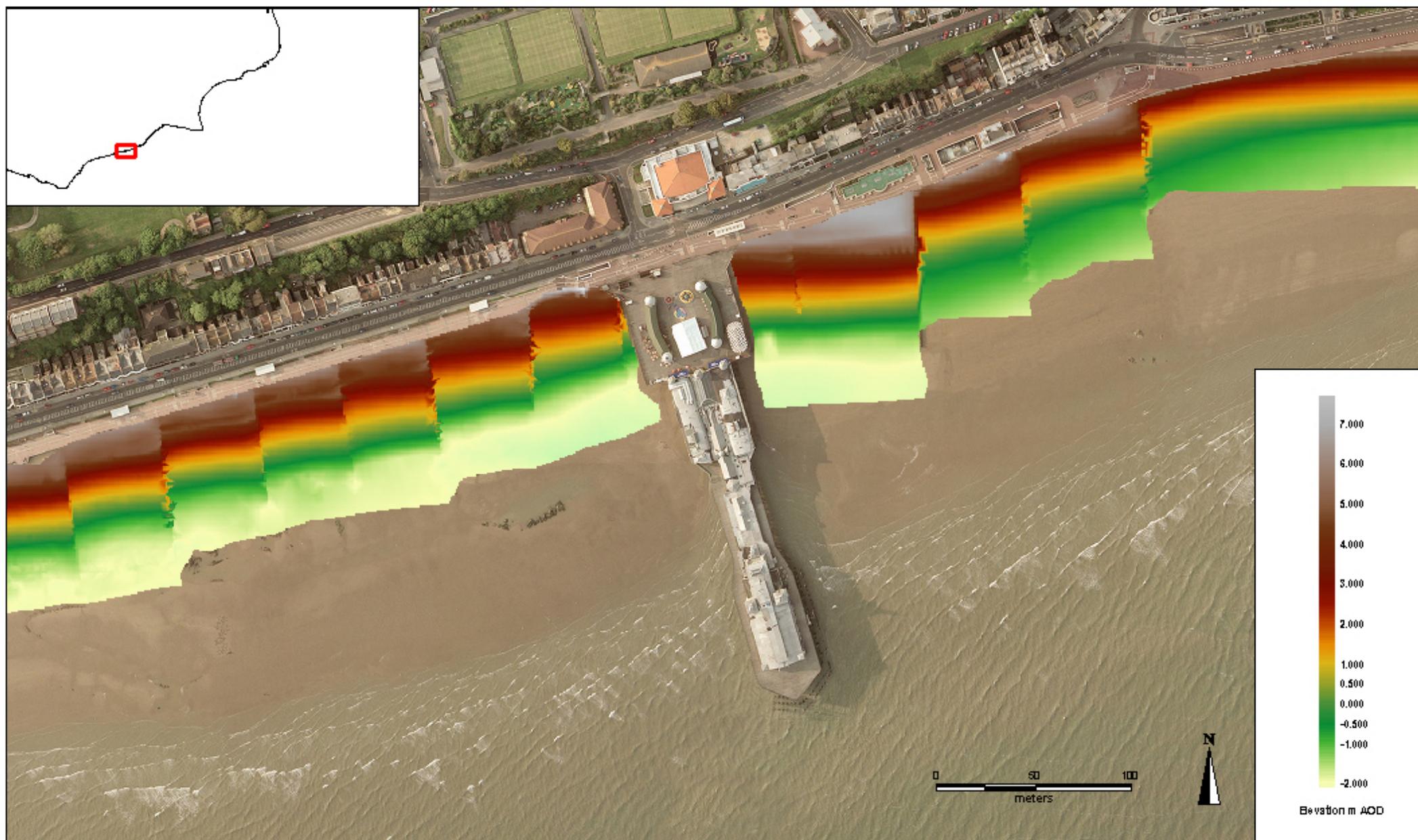
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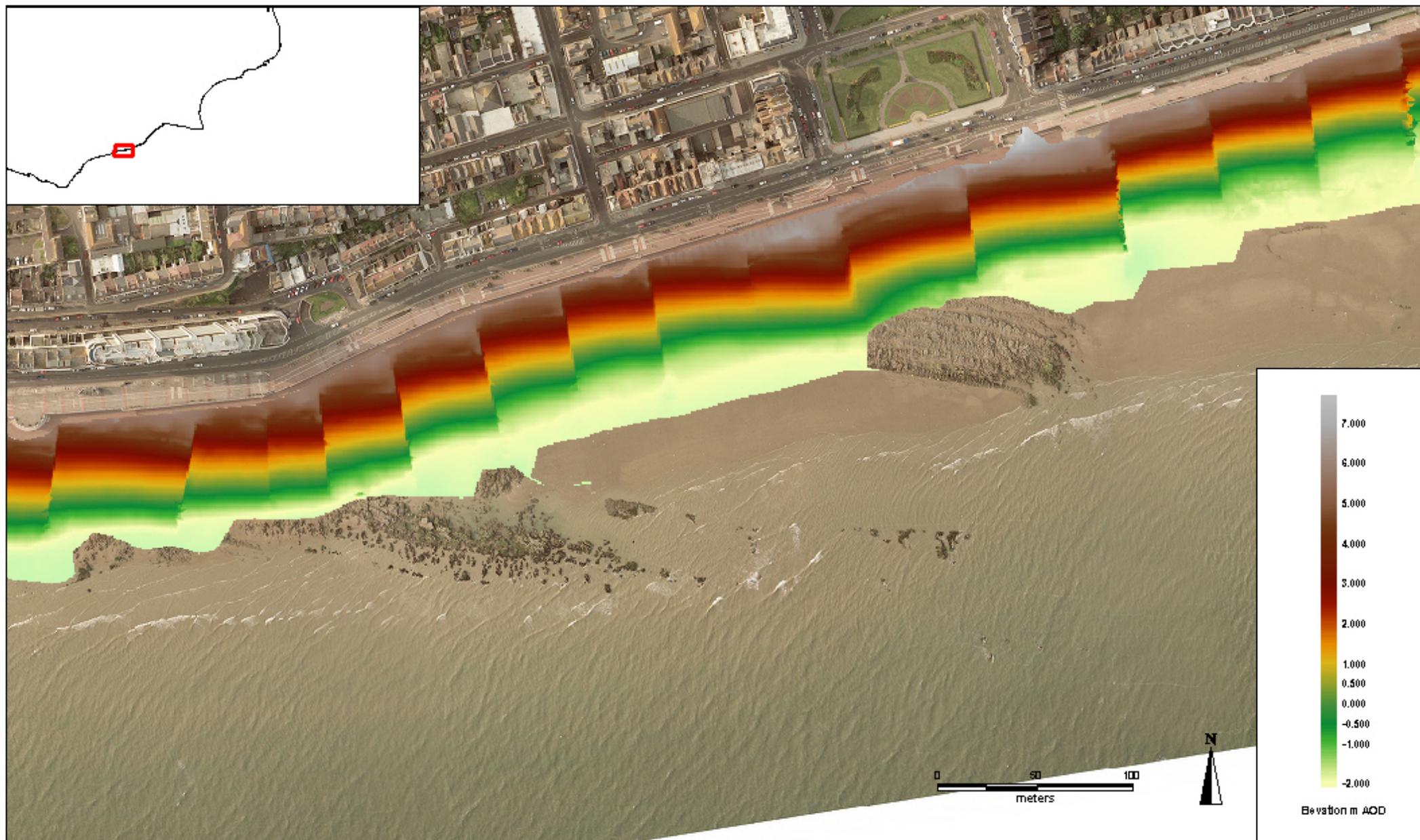
# **Annex B**

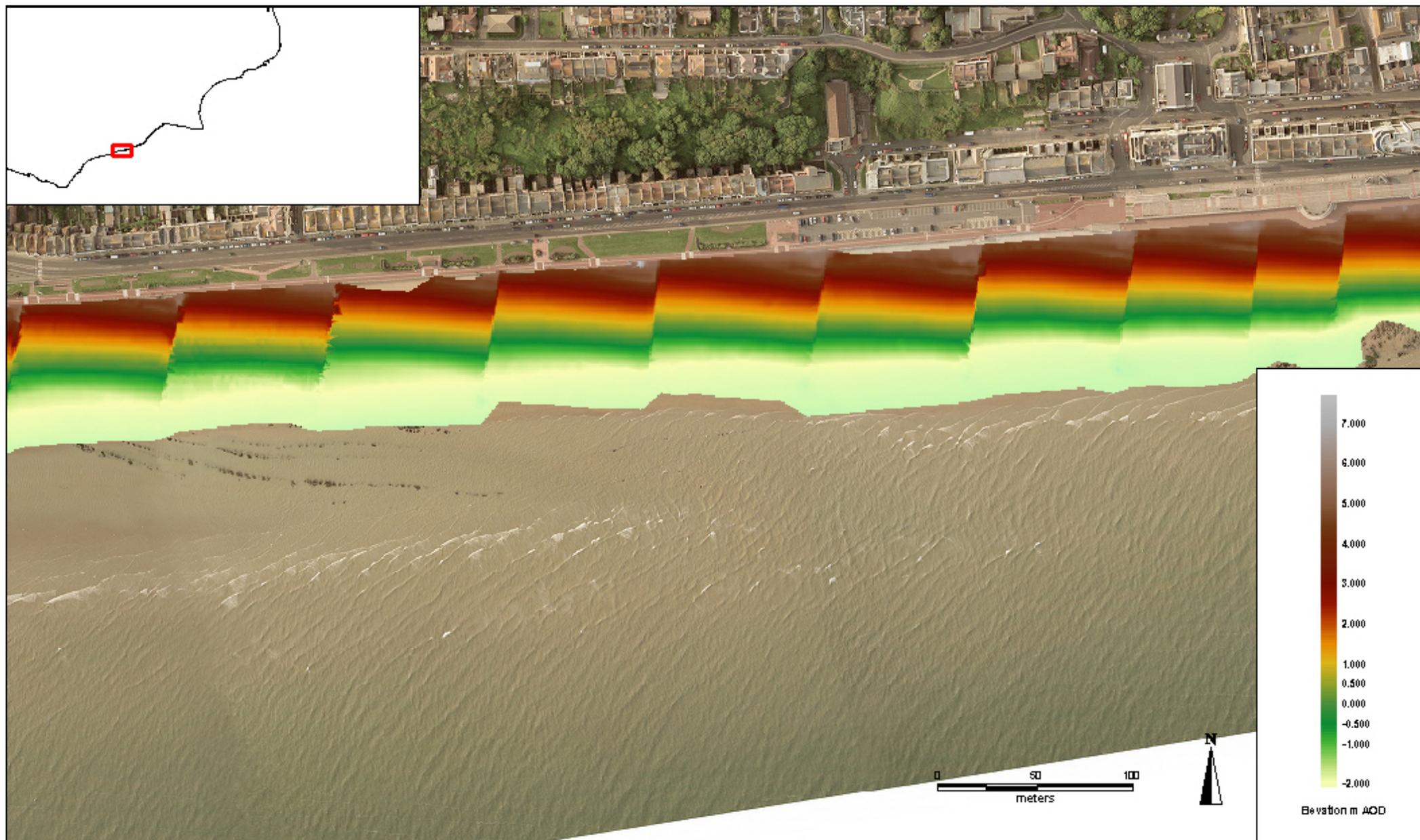
*Digital Ground Models*

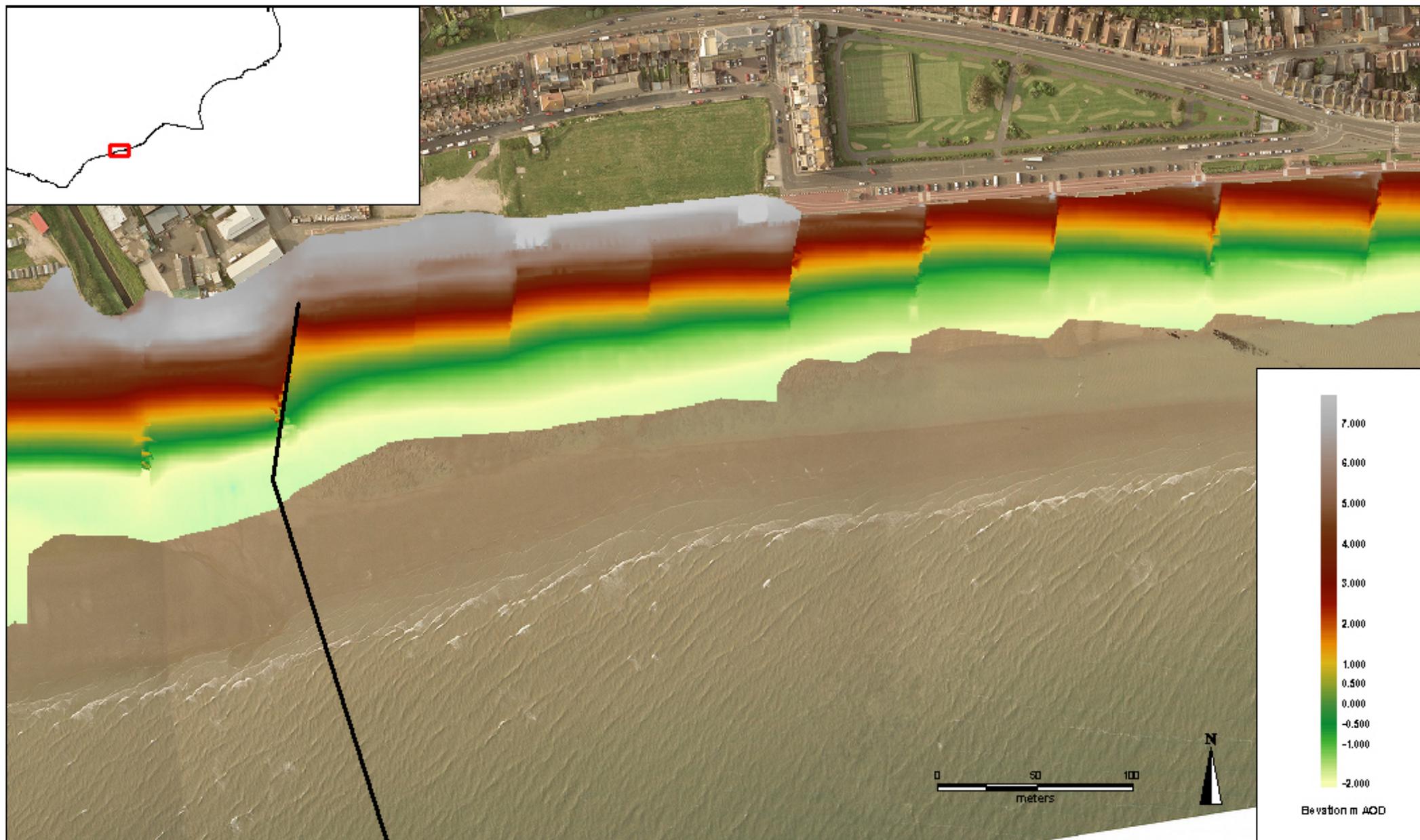












## **Annex C**

### *Recycling Logs*

## **Annex D**

*Pevensey Bay WaveRider Buoy*

*July 2006 – June 2007*

## Pevensy Bay Waverider Buoy - July 2006 to June 2007

### Location

OS: 569358E 99118N

WGS84: Latitude: 50° 47' 0.2"N Longitude: 00° 25' 1.5"E

### Water Depth

9.8m CD

### Instrument Type

Datawell Directional WaveRider Buoy Mk III

### Data Quality

C1(%)	Sample interval
99	30 minutes

### Storm Analysis

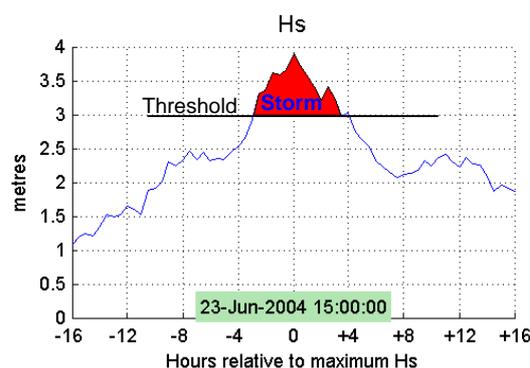
All times are GMT

Storm events in 2006/7									
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)
18-Jan-2007 12:00	4.23	10.0	6.8	222	2.42	HW -2	4.8	0.53	0.91
03-Dec-2006 09:30	4.10	9.1	6.6	205	3.15	HW	5.6	0.17	0.70
11-Jan-2007 14:00	3.60	10.0	6.2	211	0.77	HW -2	3.4	-0.03	0.77
30-Dec-2006 06:30	3.59	7.7	5.9	205	2.01	HW	4.2	-0.32	0.70
07-Dec-2006 08:00	3.36	9.1	6.1	208	-1.48	HW -4	5.5	0.12	0.45

**Table F1 Storm 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.

At present, the threshold for an individual site is derived empirically, since the measurements span only 4 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 Pevensy Bay is 3m.



**Figure F1 Storm definition**

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

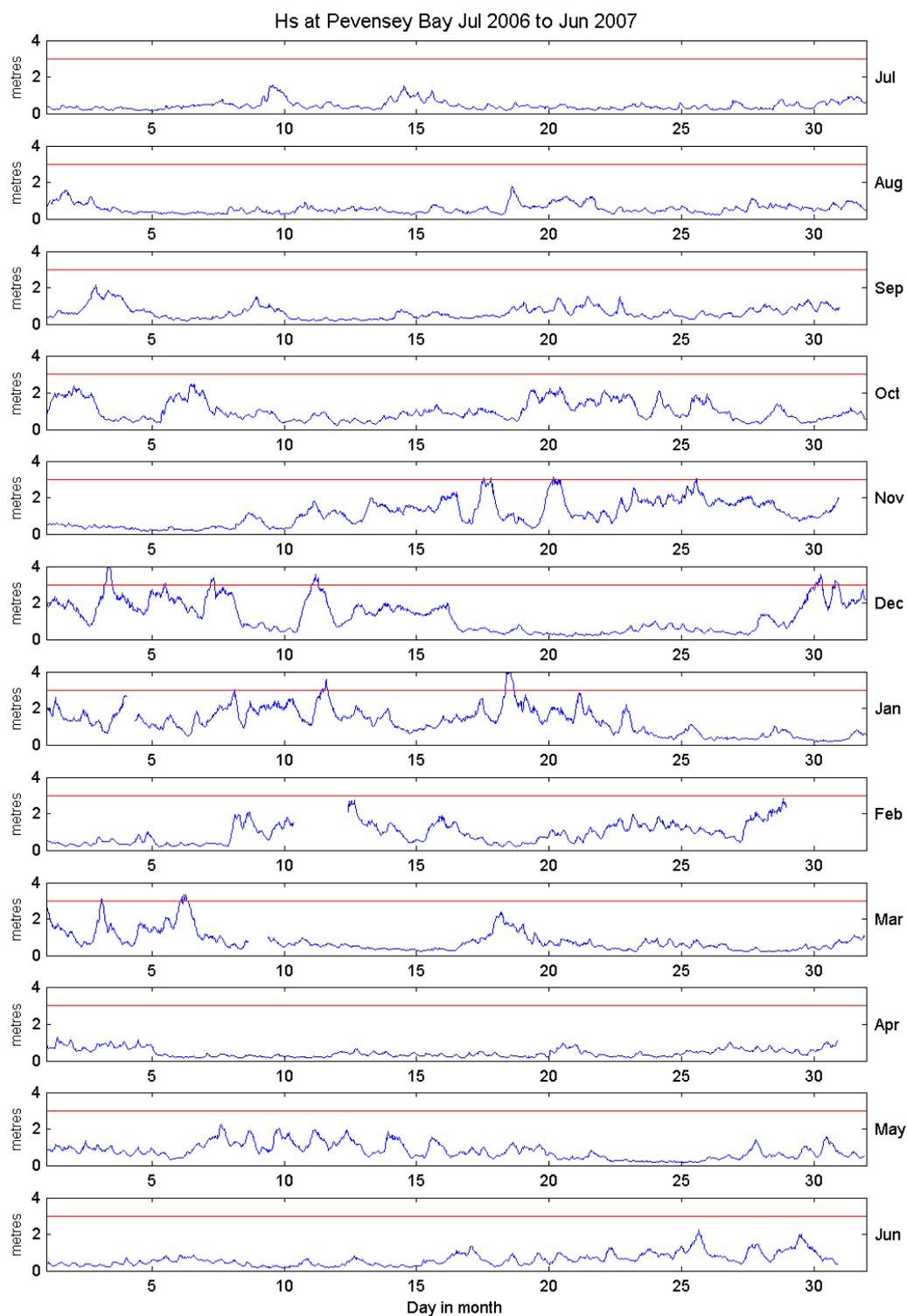
Figure F2 shows the monthly time series of  $H_s$ , with the threshold shown in red. The occurrence of storm waves in the current reporting period is also compared with similar storm waves in previous years in Figure F3. Subsequent figures show a time series of the wave conditions for each of the storms 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 storm.

### Summary

This was the "stormiest" year since measurements began in July 2003, including nearly twice as many storms as the previous reporting year. Mid-November to early January was a particularly rough period. Storm wave approach was consistently from the southwest. Storm surges (at Newhaven) were larger than observed during storms in all previous years, reaching ~0.9m during the largest storm, and occurring within 2 hours of High Water.

### 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  $H_s$  at Pevensey Bay. Storm threshold, shown in red, is 3m.**

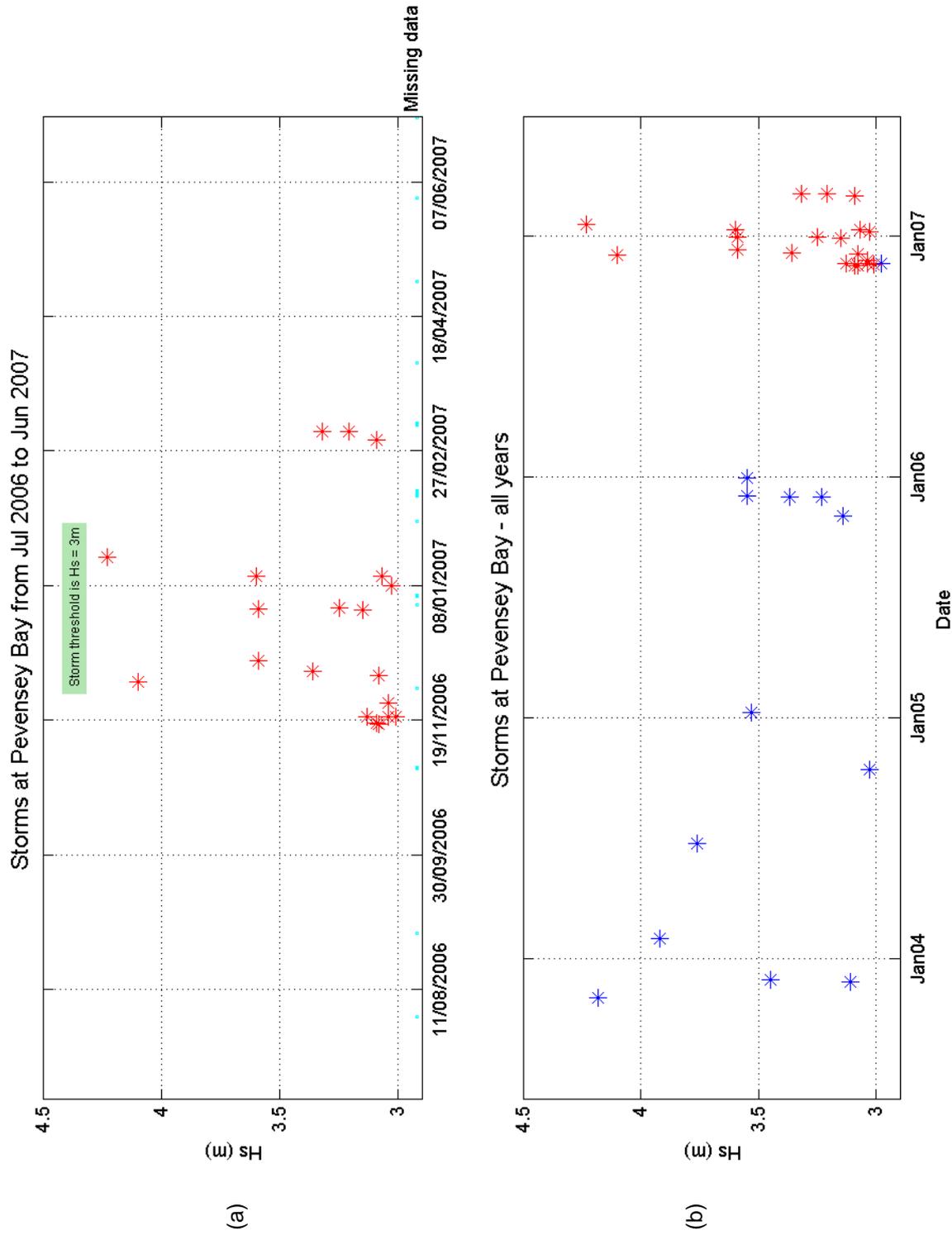


Figure F3 Incidence of storms during (a) reporting period and (b) since deployment

Pevensey Bay - Storms during Jul 2006 to Jun 2007

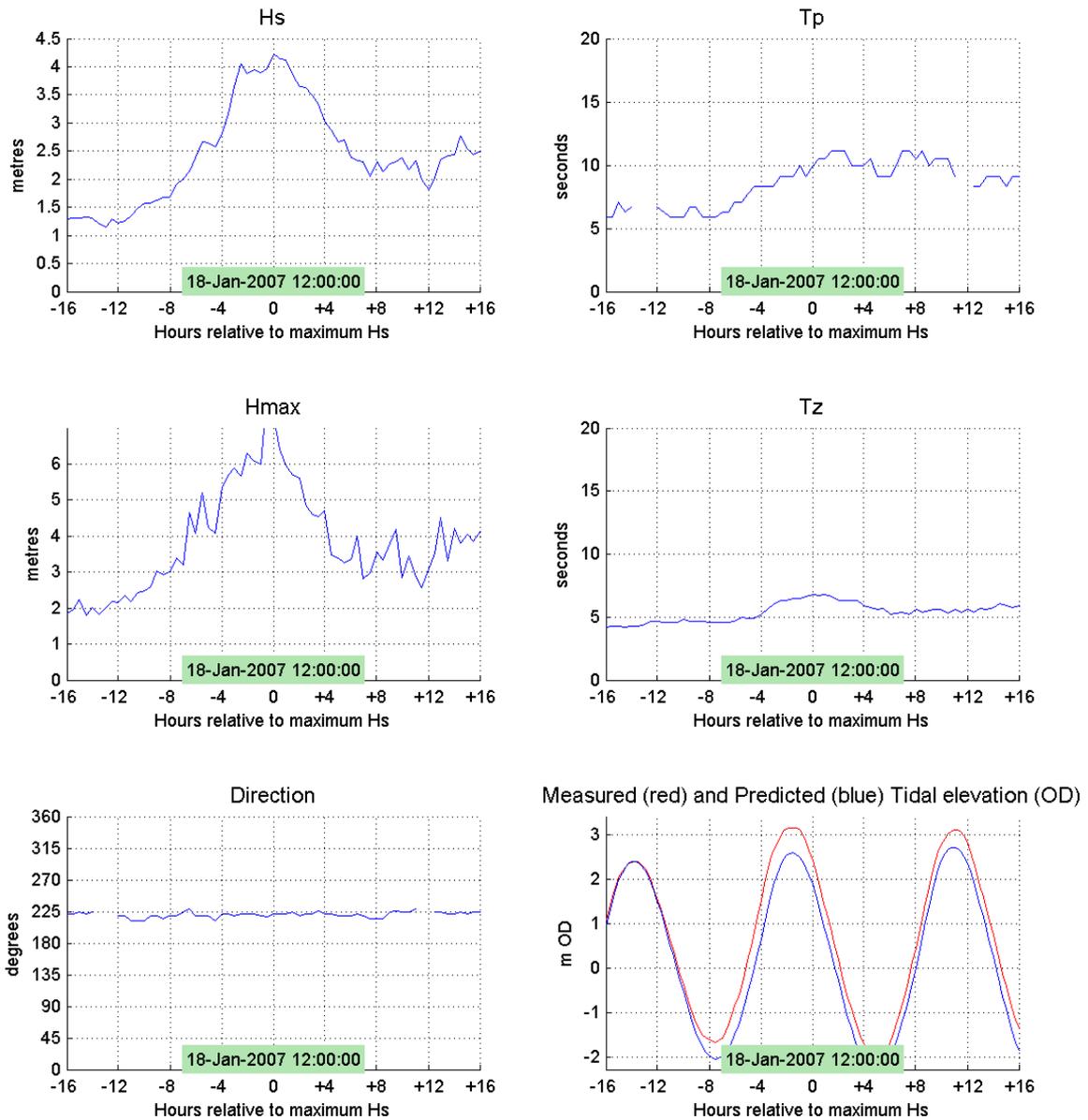
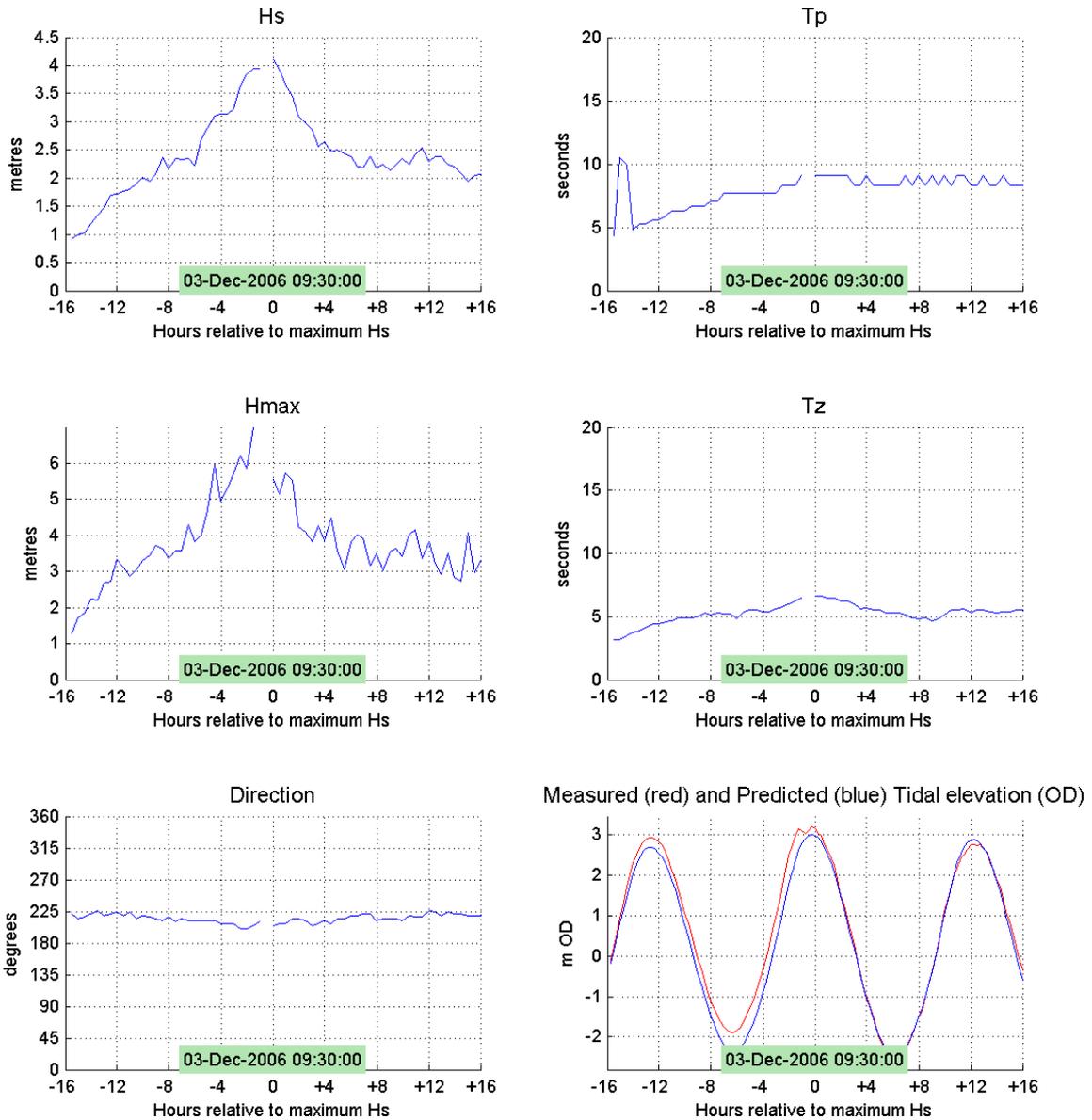


Figure F4 Highest storm of the reporting period

The largest storm of the current reporting period is a "typical" event, but is not preceded by long period swell as has sometimes occurred in storms of this type. A surge of ~ 0.6m was present (at Newhaven) throughout.

Pevensey Bay - Storms during Jul 2006 to Jun 2007



**Figure F5 Second highest storm of the reporting period**

This storm was generated by the passage of a well-developed frontal system (Figure F6). Although wave direction was predominantly from the southwest, there was less evidence of the storm being preceded by long period swell waves than has been observed on other occasions. Storm surge was negligible.

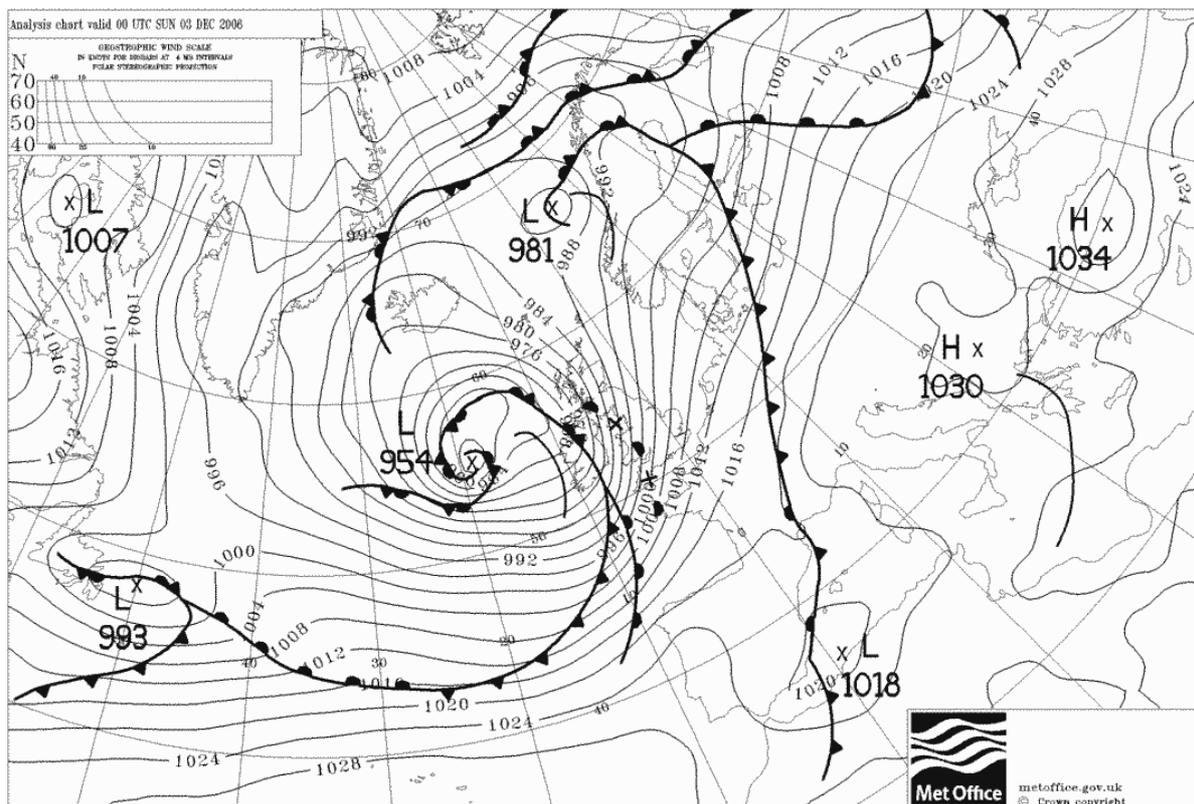
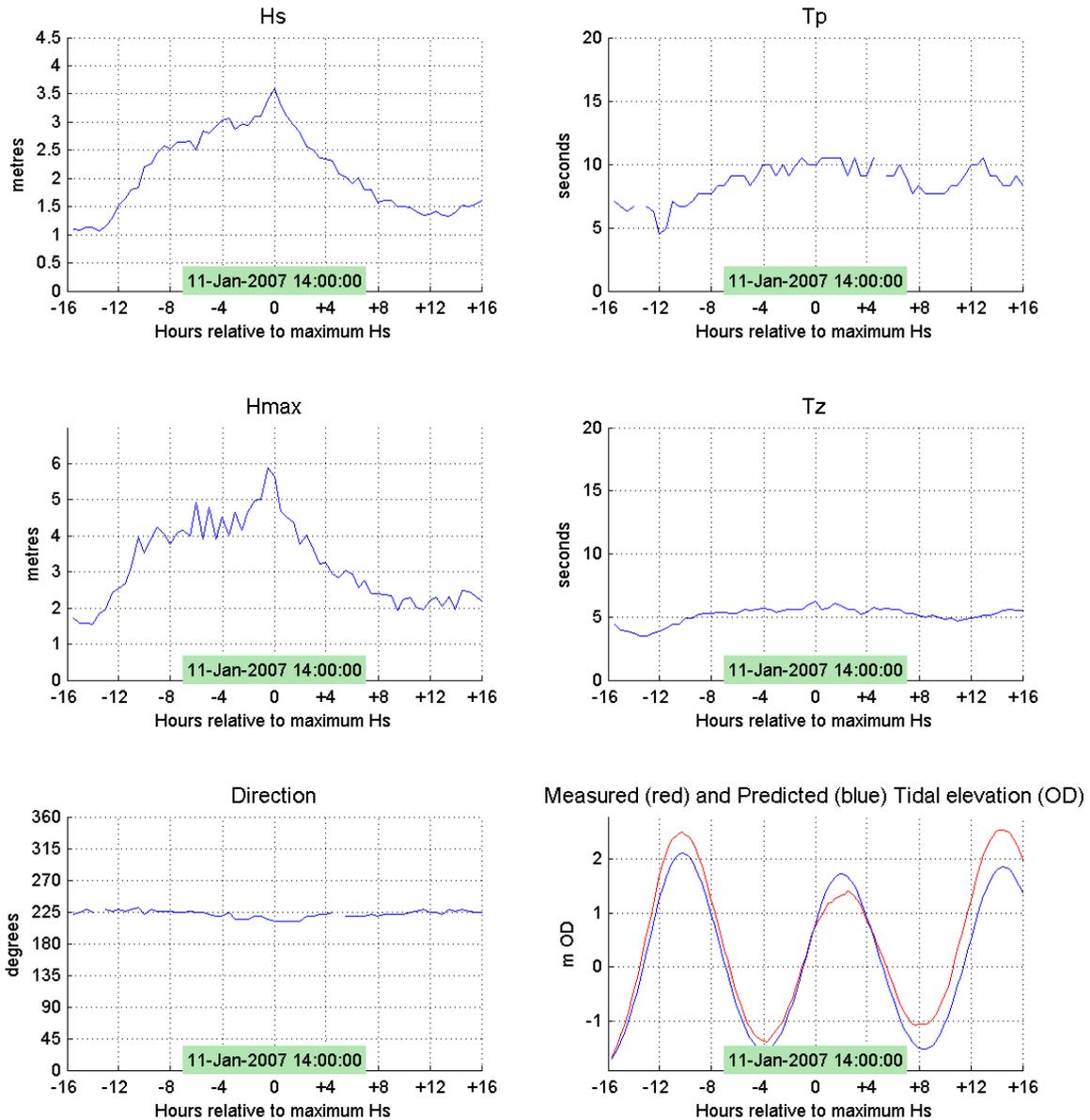


Figure F6 Surface Pressure chart 03 December 2006 at 0001Z

## Pevensey Bay - Storms during Jul 2006 to Jun 2007



**Figure F7 Third highest storm of the reporting period**

At Rustington, to the east, this storm was preceded by long-period swell waves and wave heights around 1m up to 12 hours prior to the storm peak, but the swell waves were not present at Pevensey Bay. Wave direction was from the southwest throughout. The storm occurred during neap tides and although the accompanying surge exceeded 0.75m, the surge peak followed the storm peak. It is possible that, on this small neap tide, the tide predictions may be slightly less accurate, giving an apparent negative surge around the High Water.

Pevensey Bay - Storms during Jul 2006 to Jun 2007

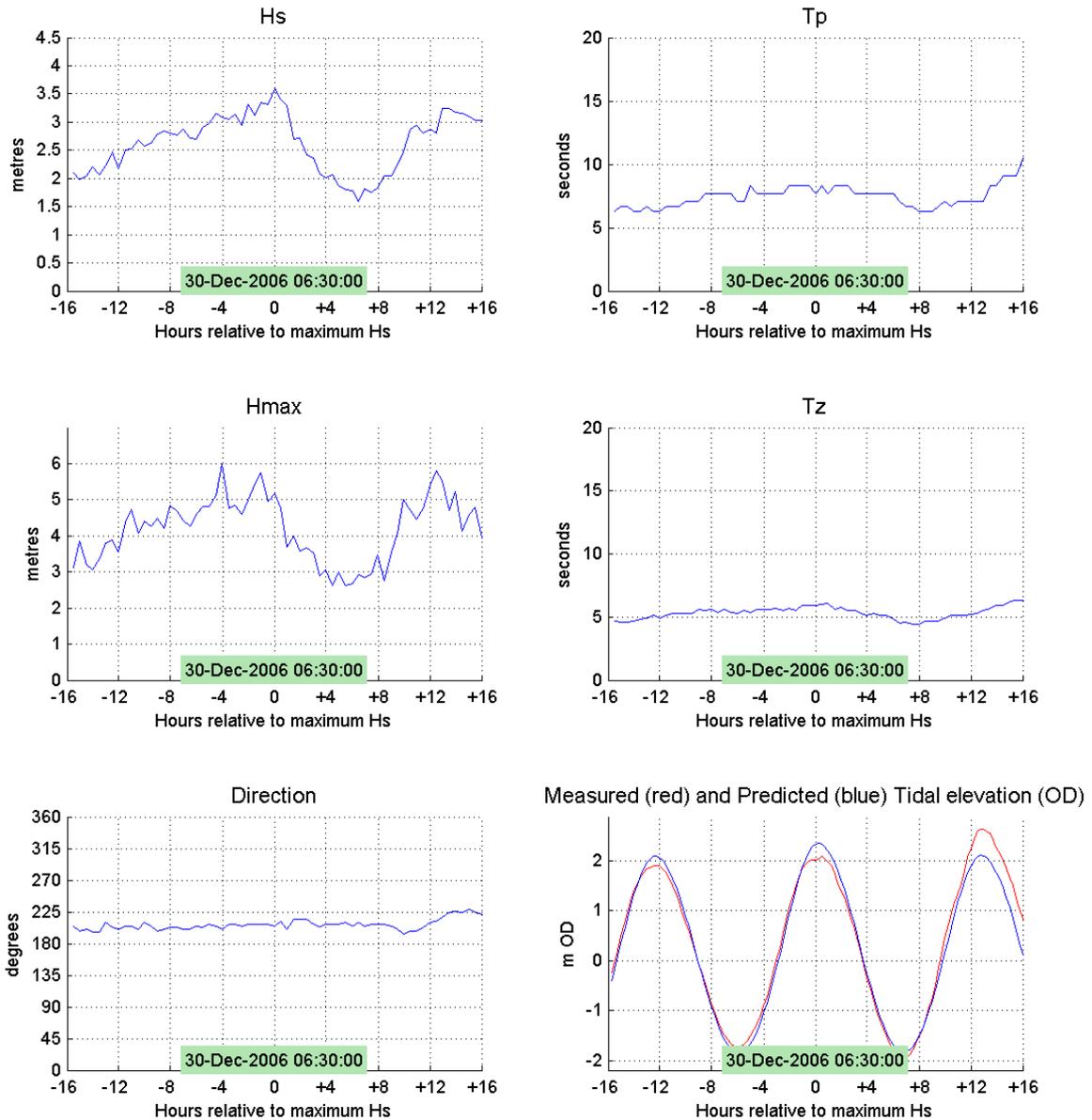


Figure F8 Fourth highest storm of the reporting period

The double-peaked nature of this storm appears to be due to meteorological conditions, despite being on the time scale of a tidal cycle. The surface pressure charts (Figure F9), however, do not indicate why such a drop in wave height occurred, neither can it be accounted for by a marked change in wave direction; the same storm pattern was observed at Rustington to the east.

