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Beach Management Plan Site Report 2007 4cMU13 – Dungeness Power Station

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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.

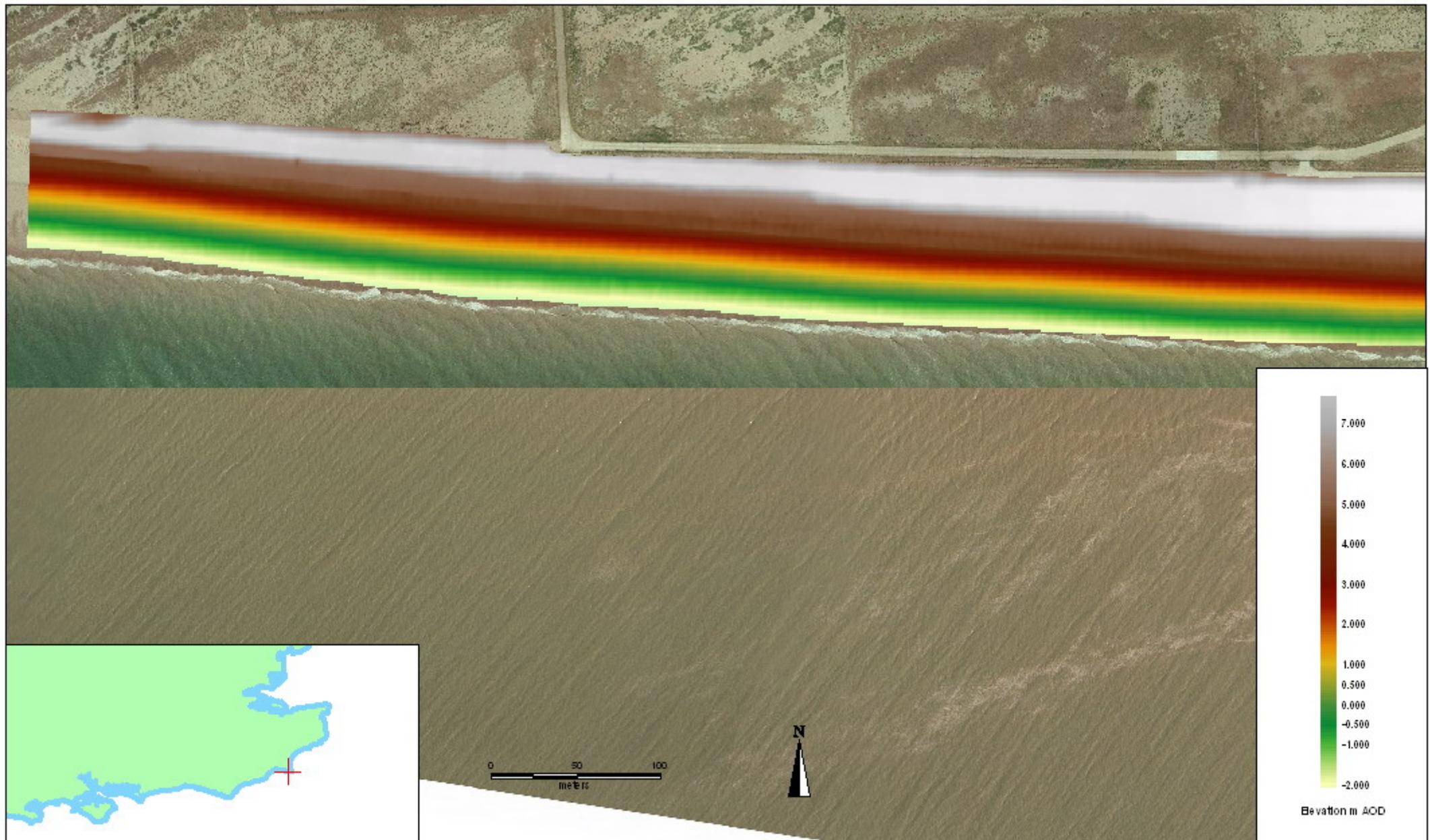
All difference models are created by using a grid calculator within the GIS system. For example the difference model of two baseline surveys is created by subtracting the earlier baseline grid from the most recent baseline grid:

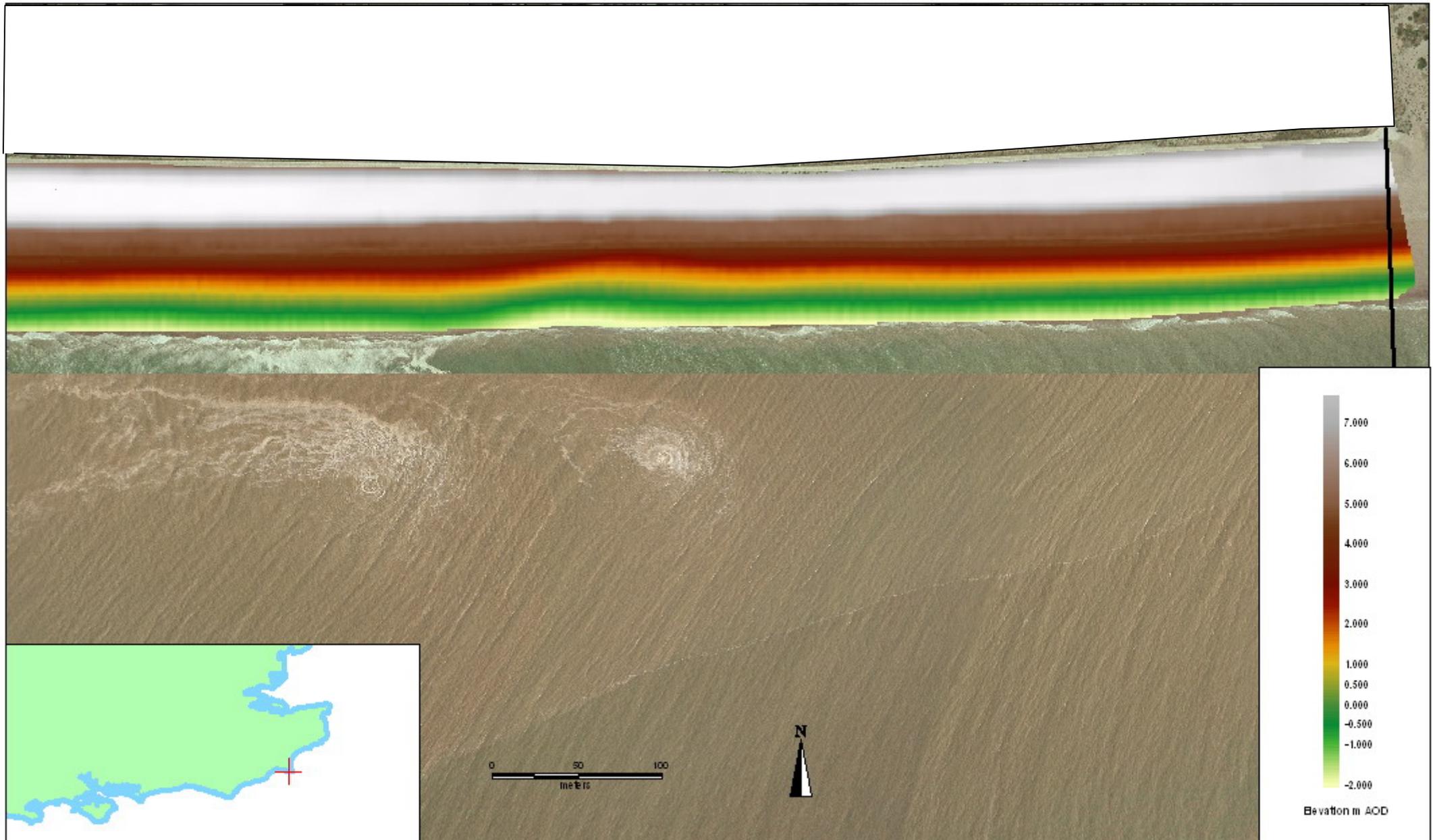
$$Grid_1 - Grid_2 \qquad \text{Eqn (2)}$$

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





Annex C

Folkestone WaveRider Buoy

July 2007 – June 2008

Folkestone Waverider Buoy - July 2007 to June 2008

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
99	30 minutes

Storm Analysis

All times

are GMT

Highest events in 2007/8									
Date/Time	H _s	T _p	T _z	Dir.	Water level elevation* (OD)	Tidal stage (ref HW)	Tidal range (m)	Tidal surge* (m)	Max. surge* (m)
10-Mar-2008 10:30	3.58	8.3	6.1	177	0.54	HW - 2	6.2	0.38	0.45
15-Jan-2008 14:30	2.98	8.3	5.3	186	1.55	HW - 1	4.6	-0.31	-0.50
08-Dec-2007 17:00	2.86	7.7	5.4	183	-2.20	HW - 6	4.6	-0.02	0.34
31-Jan-2008 14:30	2.60	7.1	4.9	179	-1.05	HW	3.0	-1.09	-1.20
18-Nov-2007 22:00	2.57	7.1	5.3	170	-1.08	HW + 5	2.9	-0.24	-0.57

Table F1 Highest events during the reporting period, July 2007 to June 2008

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.

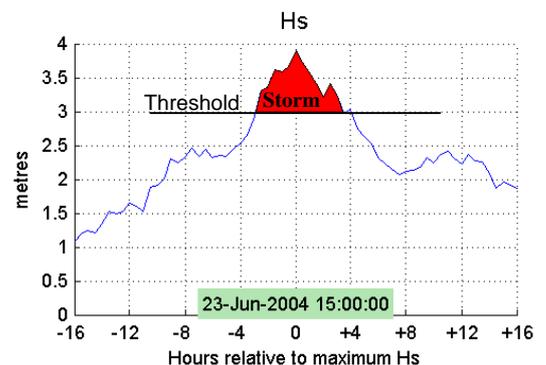


Figure F1 Storm definition

* 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_s. 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

This reporting year saw an increase in both the number and magnitude of storms and included the highest wave conditions experienced since the Waverider buoy was first deployed in 2003. In common with previous years, storms are concentrated around the winter and early spring months.

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.

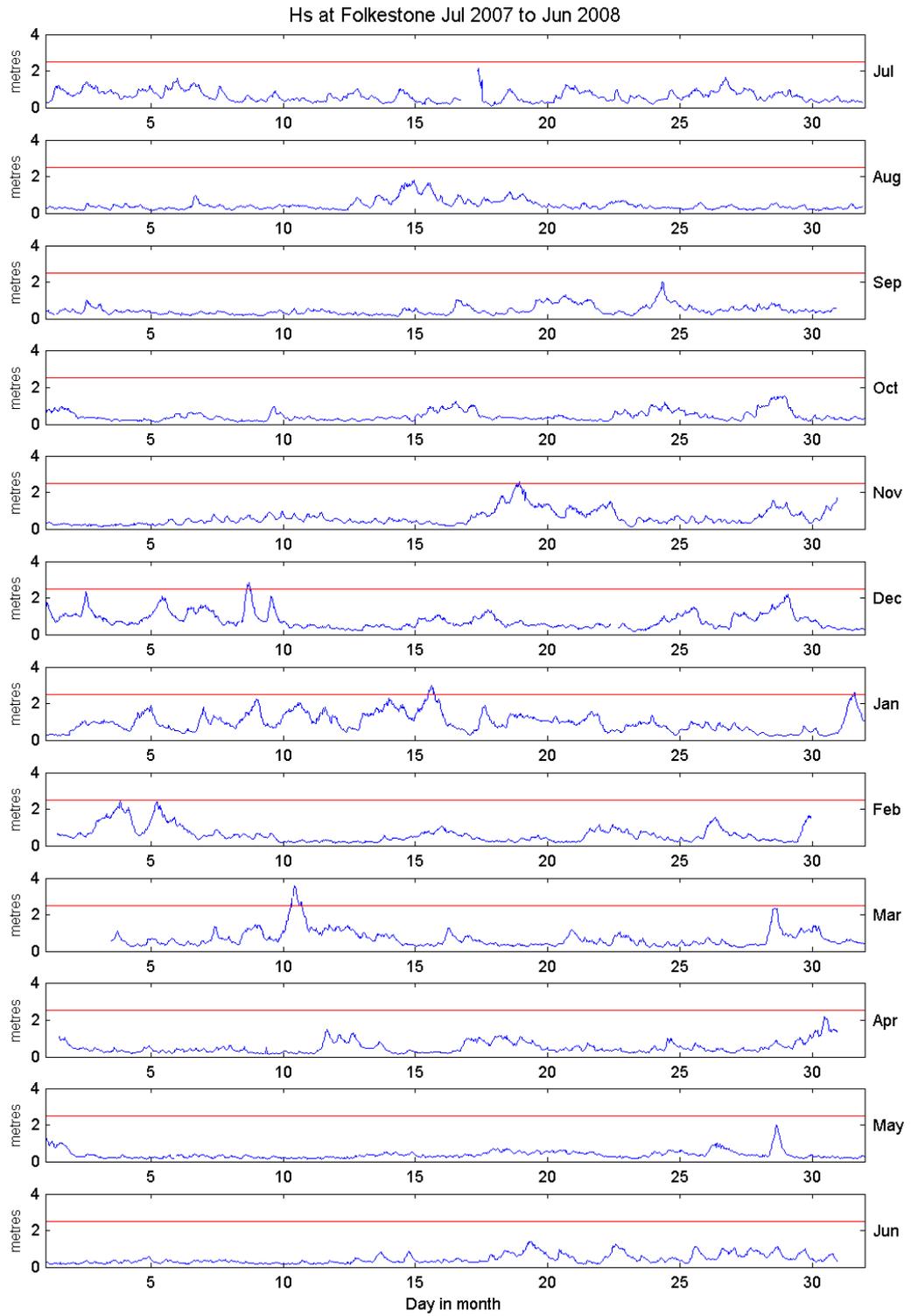
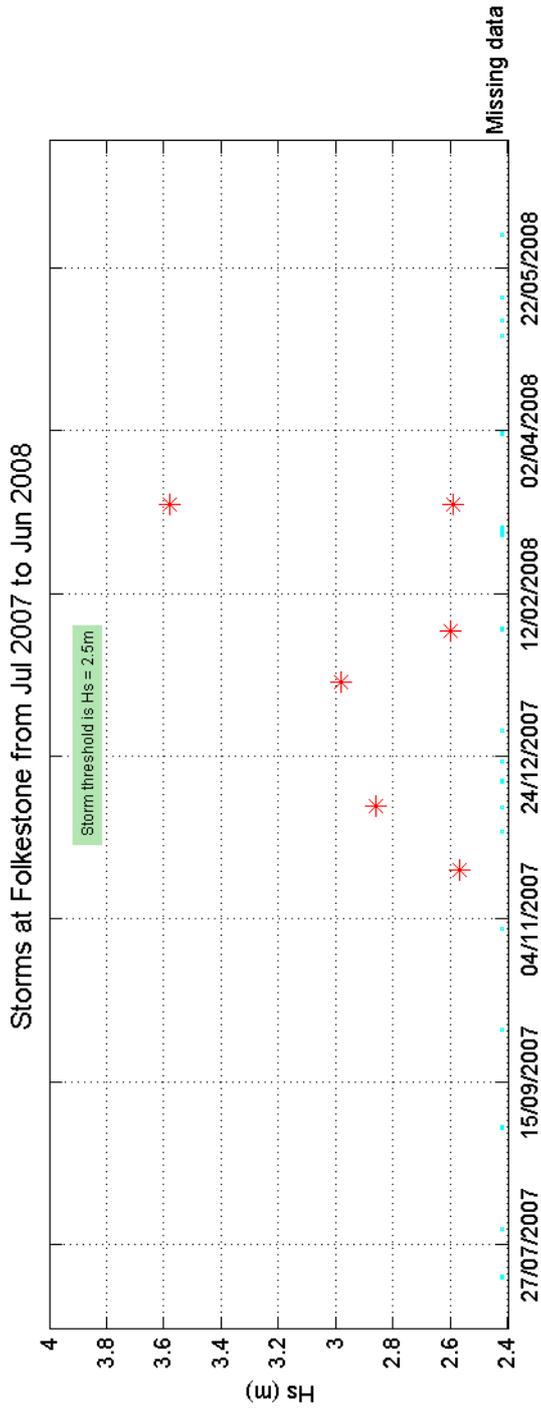
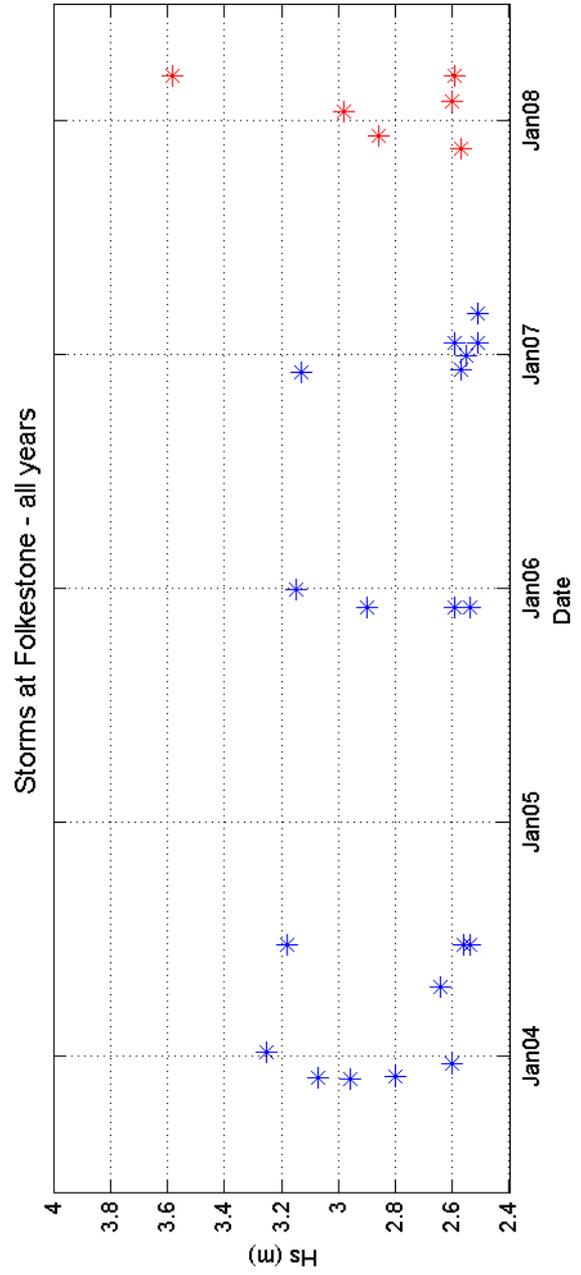


Figure F2 Monthly time series of H_s at Folkestone. Storm threshold, shown in red, is 2.5m.



(a)



(b)

Folkestone - Storms during Jul 2007 to Jun 2008

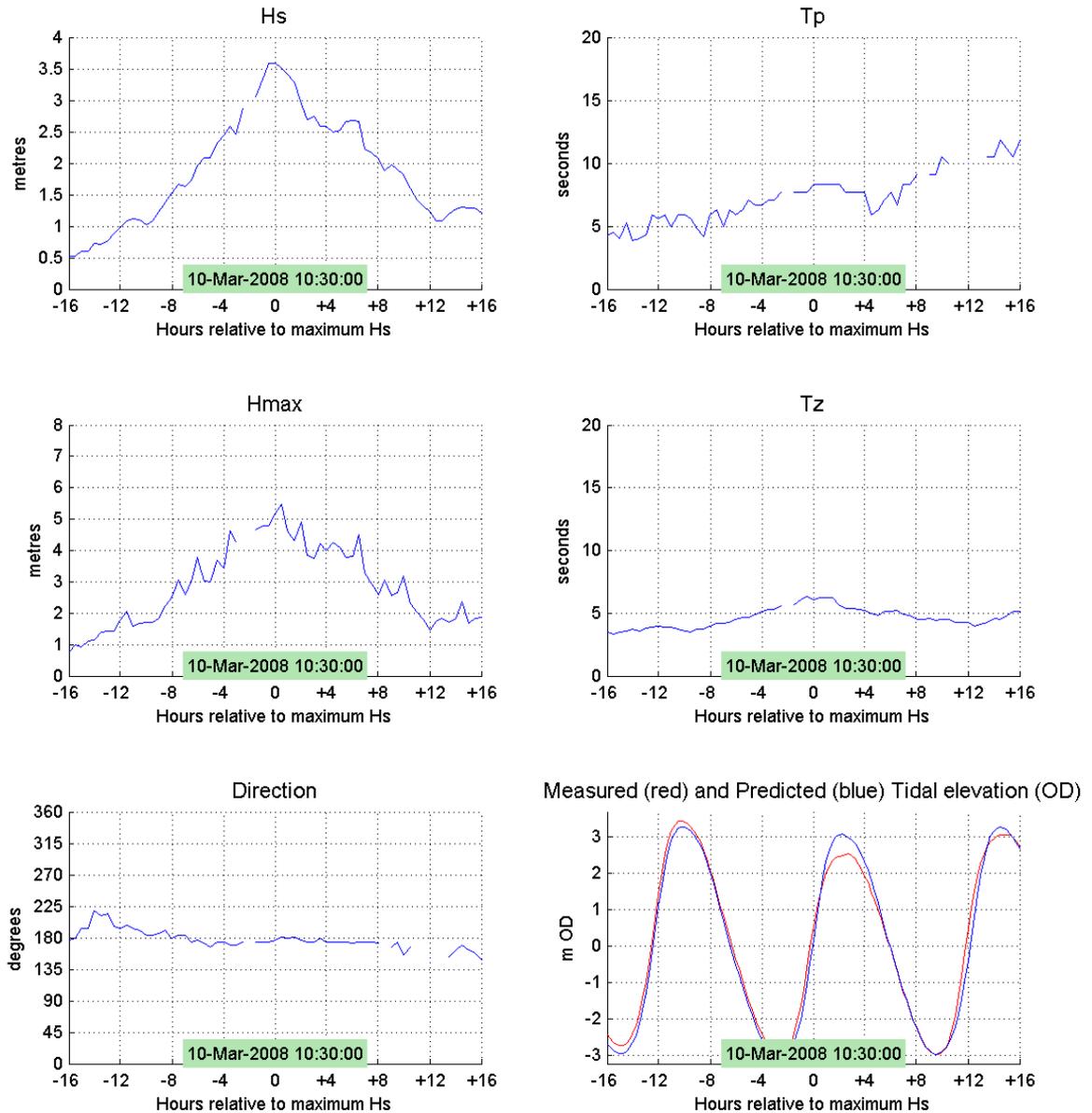
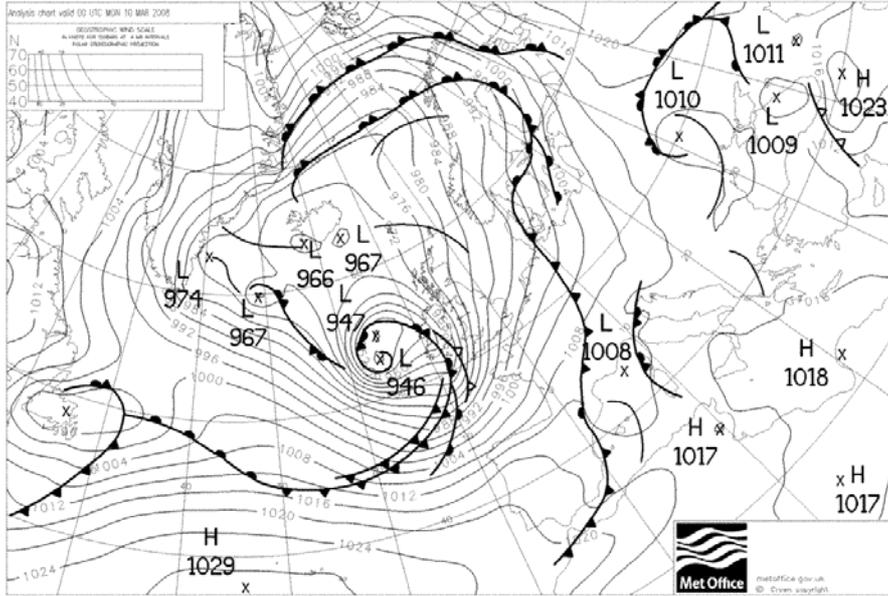


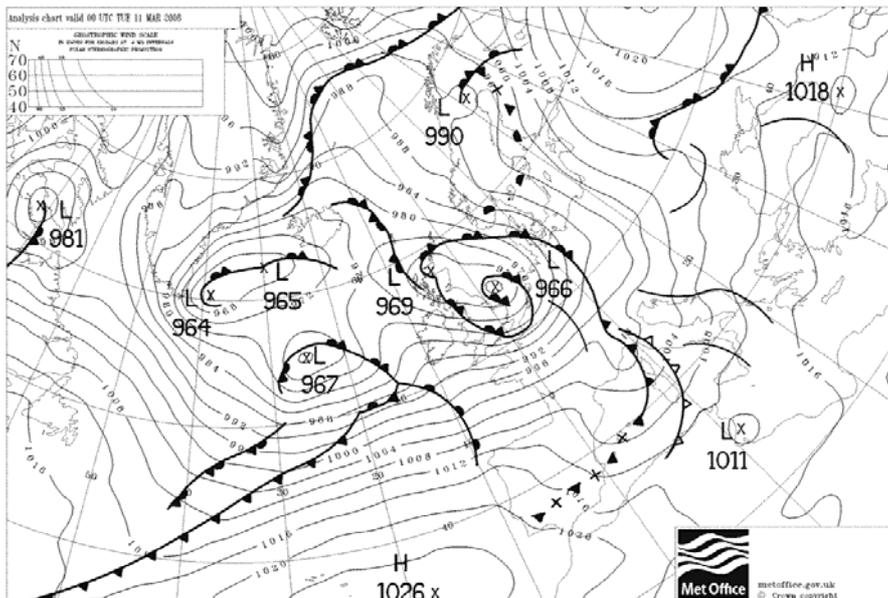
Figure F4 Highest event of reporting period

This storm caused considerable coastal flooding and damage in the English Channel e.g. Jersey, since it coincided with near-equinoctial spring tides. The storm generated the highest significant wave height at Folkestone since the buoy was first deployed in 2003. A small surge was associated with the storm peak but, in common with that observed in previous years, the largest was negative (-0.6m), some 2 hours after the storm peak. The storm pattern was typical of the passage of a depression, when a period of 24 hours saw wave heights increase from 1m to 3.5m, then decaying back to 1m. The storm was the result of the rapid passage of a deep depression (central pressure 946hPa) across central England (see Figure F5) and associated with several frontal systems and steadily veering winds, although wave direction remained from the south. Average wind speeds of up to 80kts ($\sim 40\text{ms}^{-1}$), Hurricane Force 12, were observed at the met station at Folkestone, although it must be

noted that the met station is at an elevation of ~120m OD; surface winds could be up to 20-30% lower than this (~ Storm Force 10).



00:00Z, 10
March 2008



00:00Z, 11
March 2008

Figure F5 Surface pressure charts

Folkestone - Storms during Jul 2007 to Jun 2008

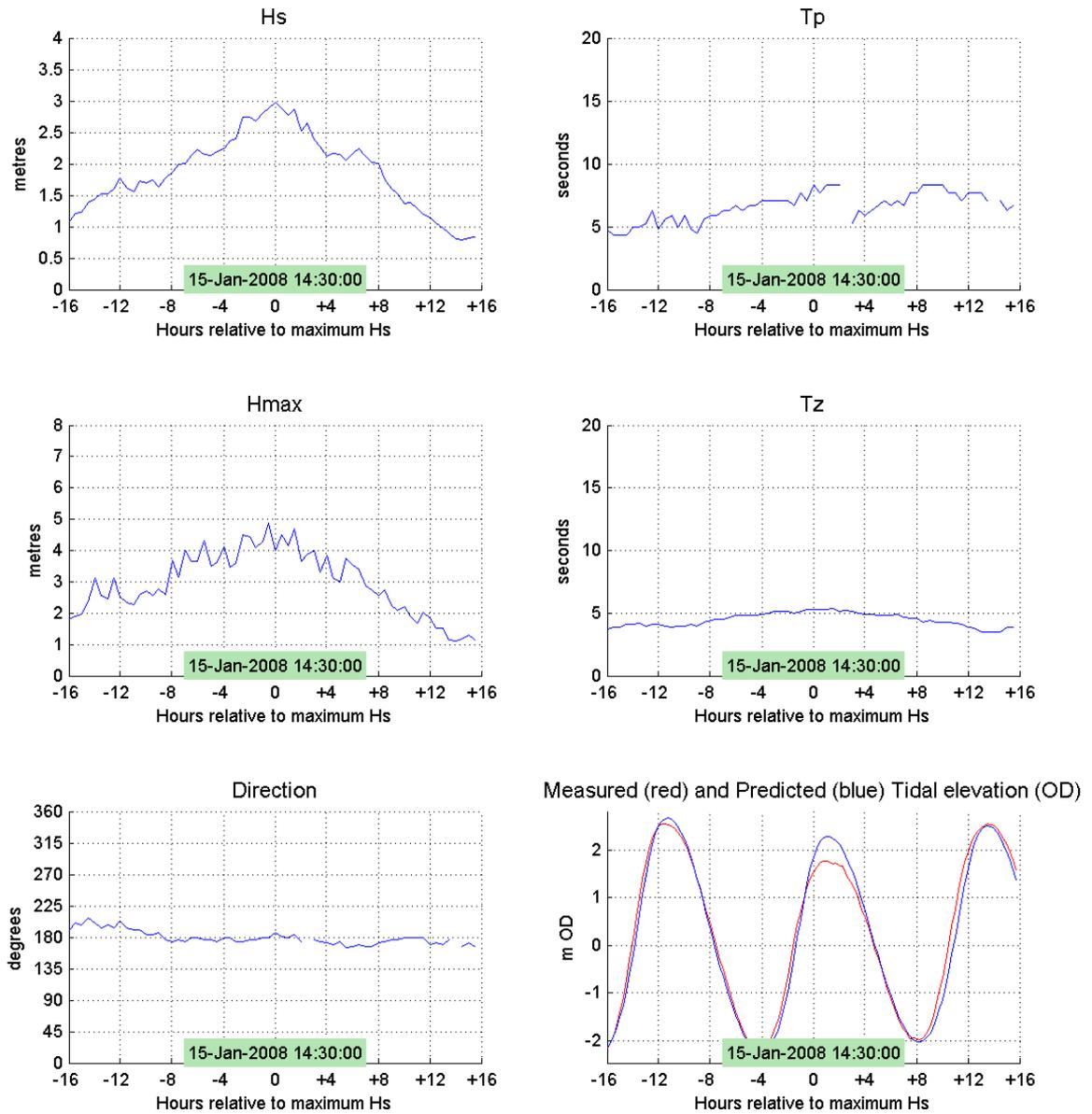


Figure F6 Second highest event of reporting period

The pattern of this storm was very similar to the highest storm, although the depression system was less deep (central pressure 972hPa) and more complex, leading to lower average wind speeds (between 60 and 70kts at the storm peak – measured at ~120m OD elevation).

Folkestone - Storms during Jul 2007 to Jun 2008

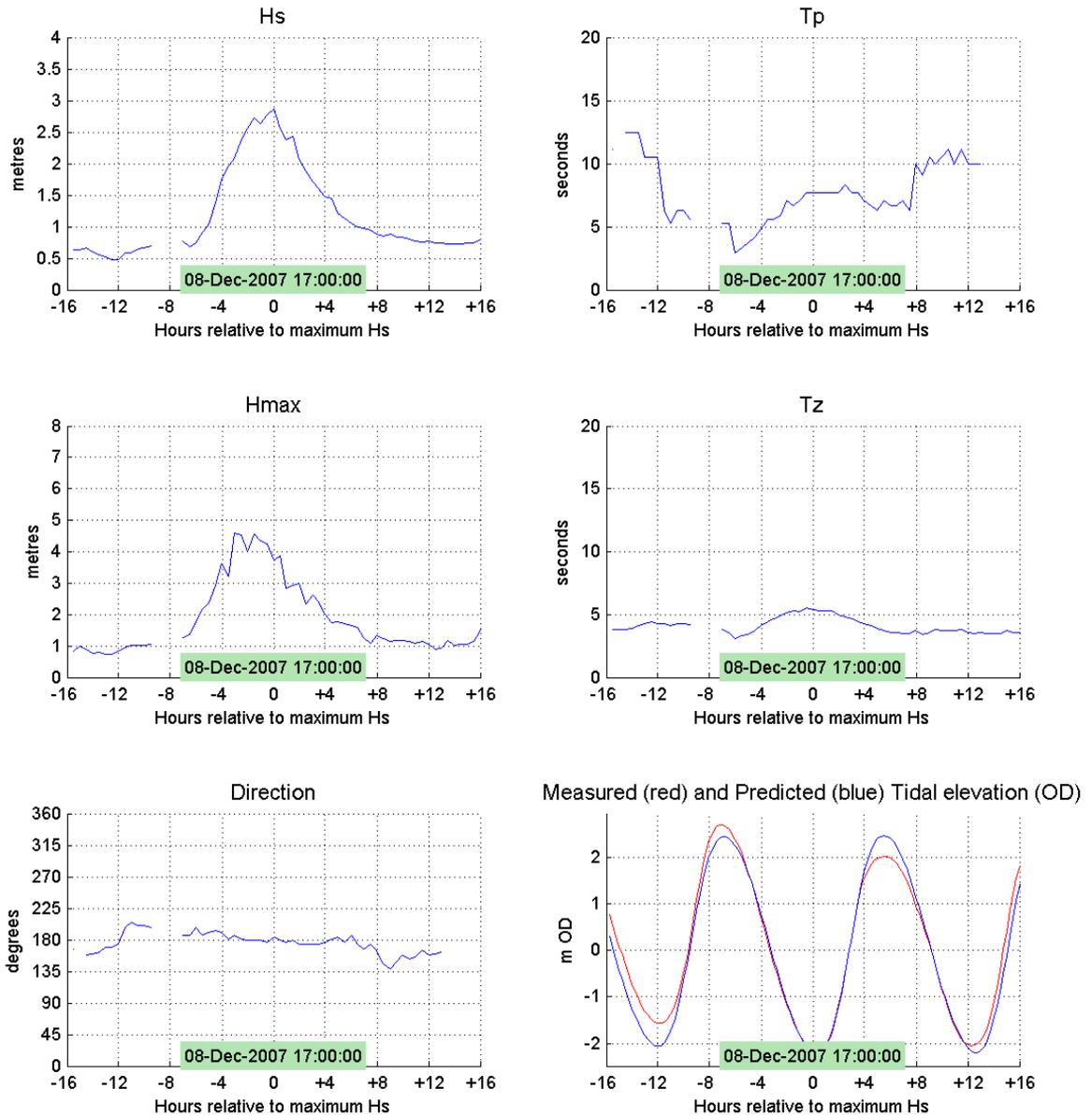


Figure F7 Third highest event of reporting period

The swell train which preceded this short-lived (~8 hour) storm was generated by a deep low (~968 hPa) southeast of Greenland which tracked southeastwards, deepening slightly, to a position just of Northern Ireland by midnight 09 December.

Folkestone - Storms during Jul 2007 to Jun 2008

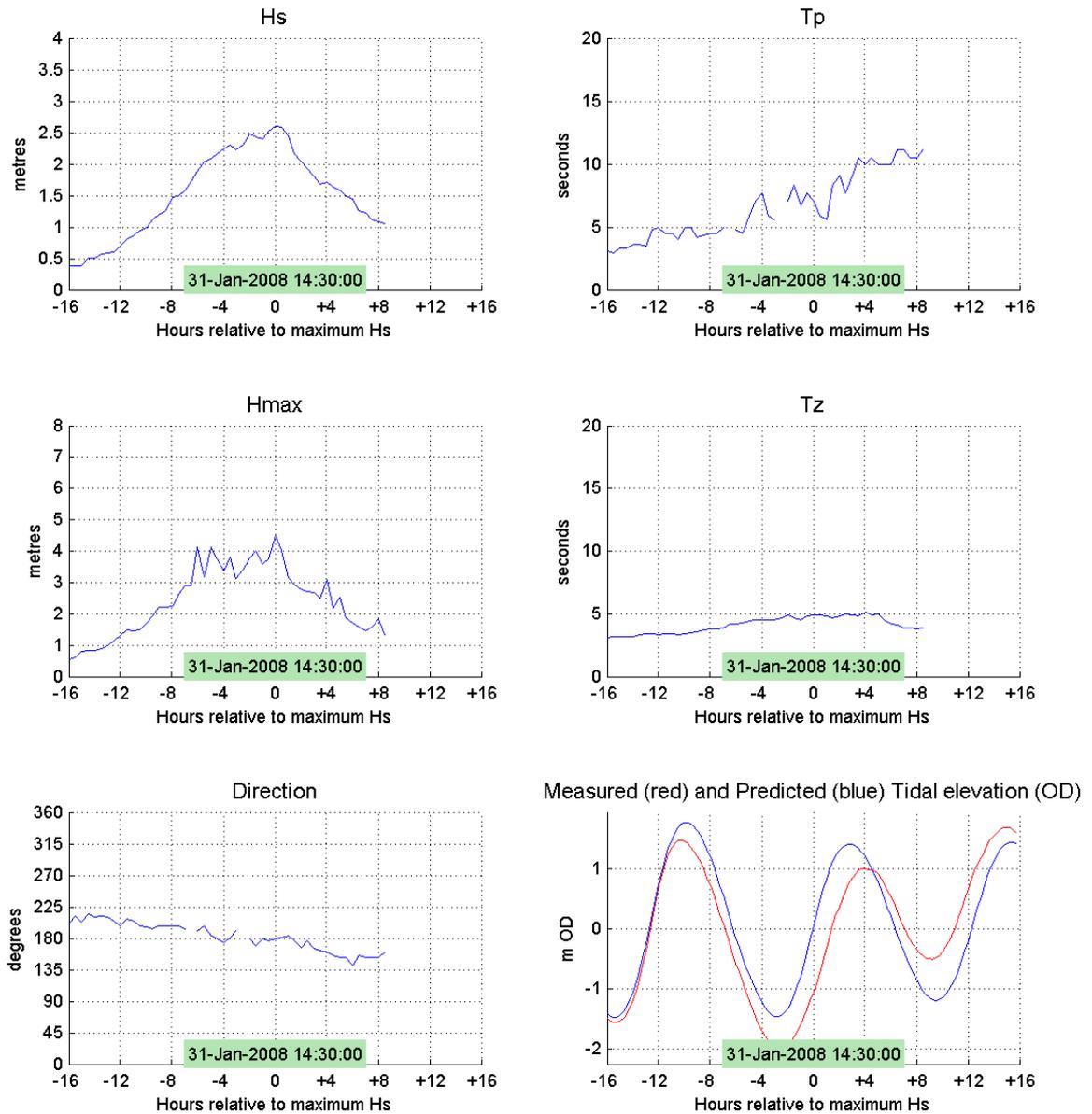
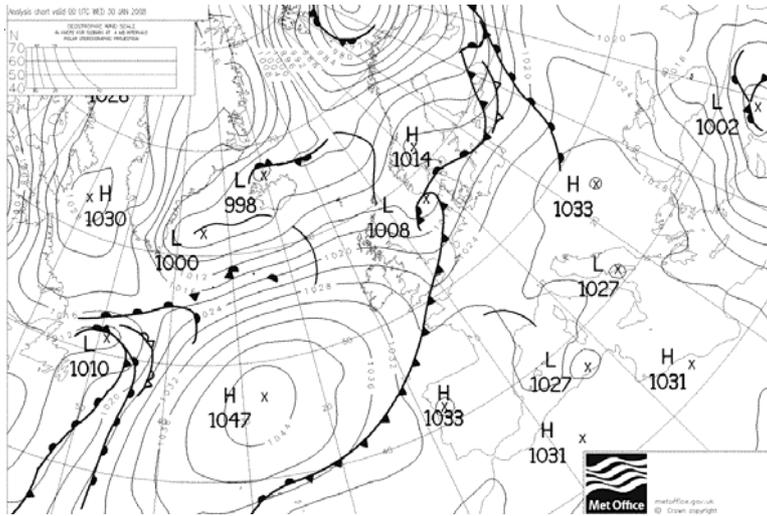
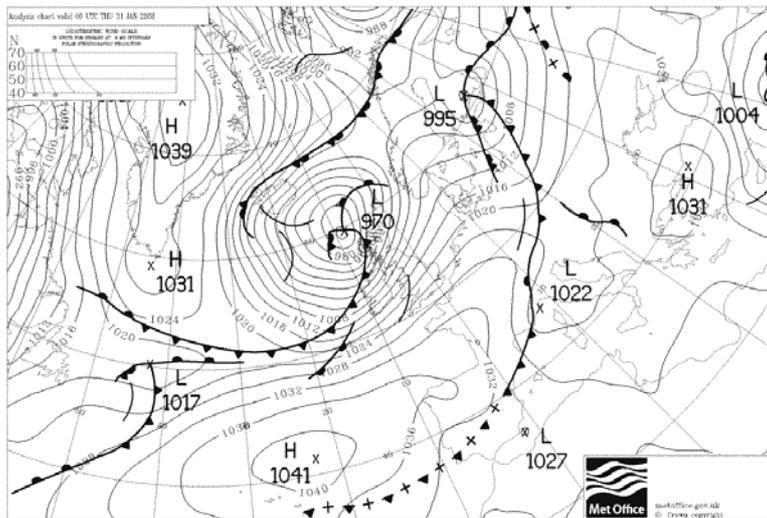


Figure F8 Fourth highest event of reporting period

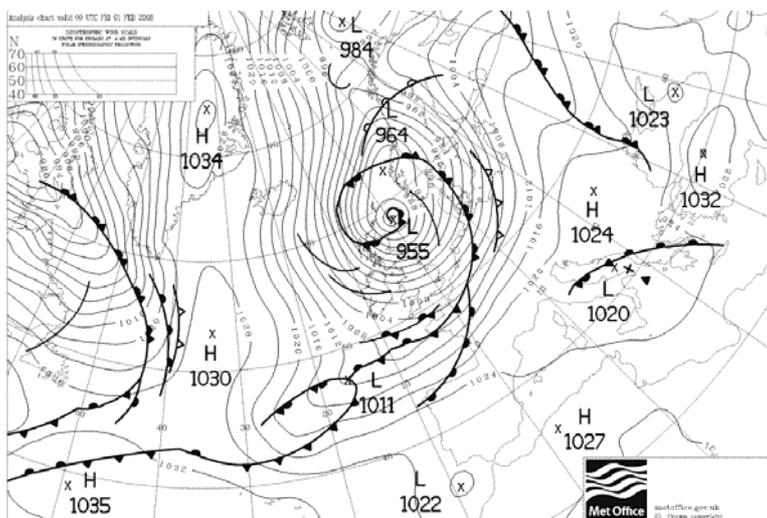
The unusual feature of this storm was the lengthy (~16 hour) negative tidal surge associated with it, followed by a period of positive surging. Peak wave period built steadily through the storm, which developed rapidly and transited slowly across northern Scotland into the North Sea, deepening to 955 hPa by midnight 01 February.



00:00Z, 30 January 2008



00:00Z, 31 January 2008



00:00Z, 01 February 2008

Figure F9 Surface pressure charts

Folkestone - Storms during Jul 2007 to Jun 2008

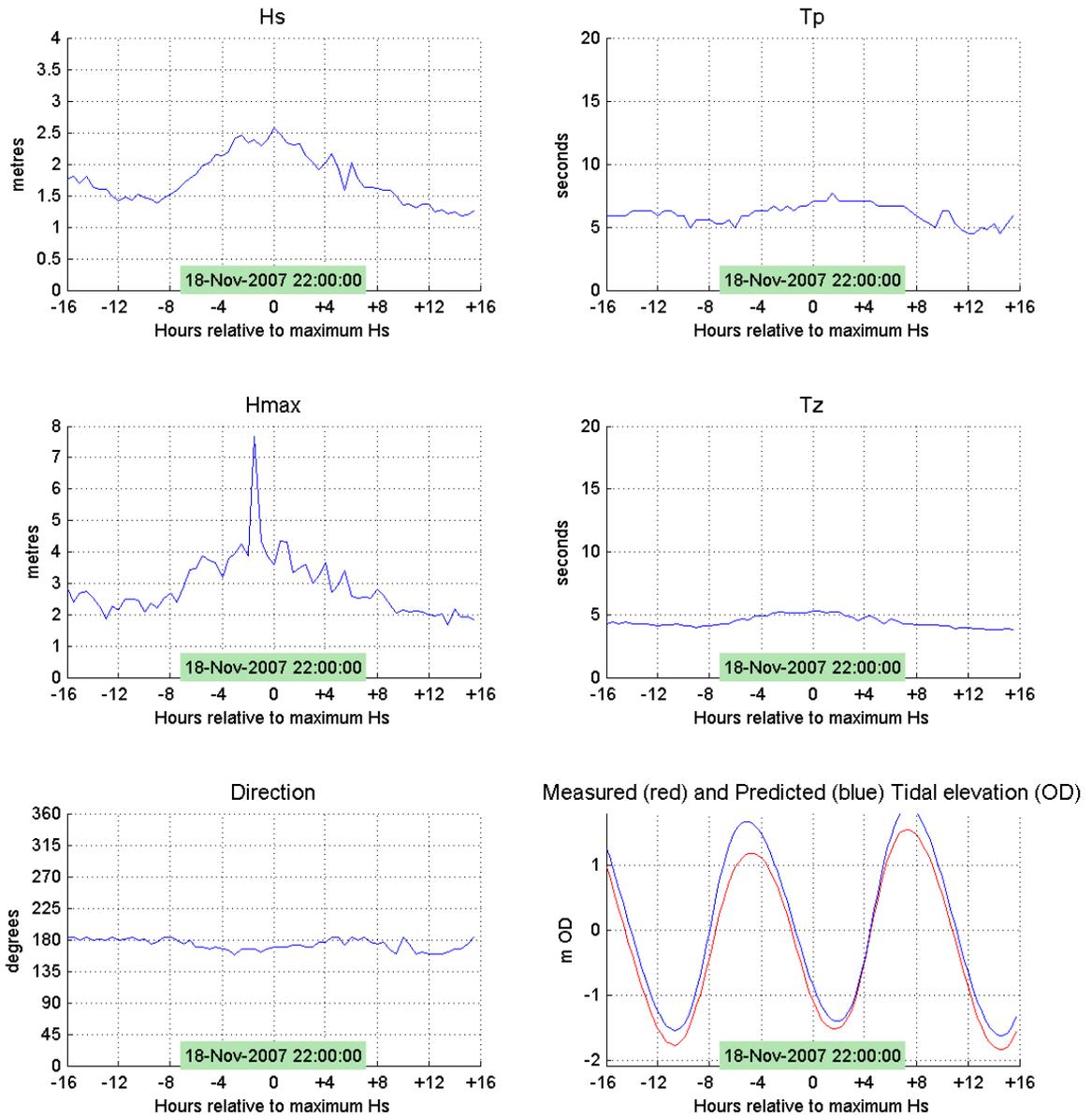


Figure F10 Fifth highest event of reporting period

Once again, only negative tidal surges were associated with this minor storm. Direction of wave approach was South by East and the waves were locally-generated, with no evidence of swell waves. The peak in Hmax is likely to be a spike in the data.