

The Operational Storm Surge Model:
Maintenance, Performance and
Development

April 2005 March 2006

by

Jane A. Williams & Kevin J. Horsburgh

June 2006



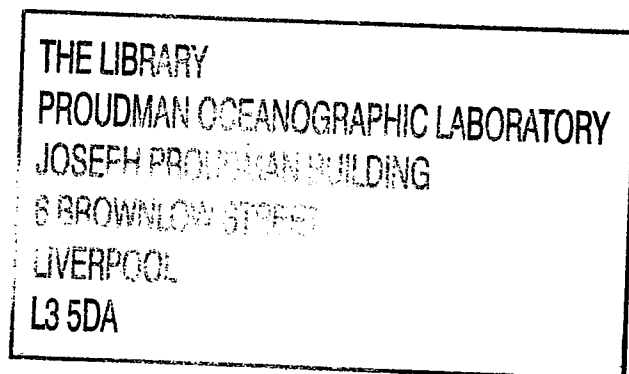
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1. Introduction

This report describes work undertaken on the operational surge forecasting models during the period April 2005 to March 2006. It covers maintenance of the models run at the Met Office, a review and summary of the model performance, including work on problems with runs and issues affecting forecast accuracy, and development of the models and systems. This work is funded by the Environment Agency (EA).

An overview of the surge forecast system is given in Section 2. Section 3 describes operational changes made during the year including the introduction of a new atmospheric model at the Met Office. Section 4 discusses model performance issues during the year, in particular 25th August when east coast surges were under-predicted. Other operational issues and outputs are covered in Section 5.

Appendix A describes the data archives, routine statistical analyses carried out and gives tables with monthly error statistics for all hourly values and for surges at approximately tidal high water.

Appendix B contains a summary of the investigation into the 25 August event, a copy of which was sent to STFS.

2. Background

The National Tidal and Sea Level Facility (NTSLF) at POL develops and maintains tide-surge models used to forecast storm surges on the coasts of England and Wales for the Environment Agency (EA). The models are run in real-time as part of the forecast suite of models at the Met Office. Results are transmitted to the EA and used, together with data from the National Tide Gauge Network for coastal flood warning in England and Wales. Figure 1 shows a schematic of the system.

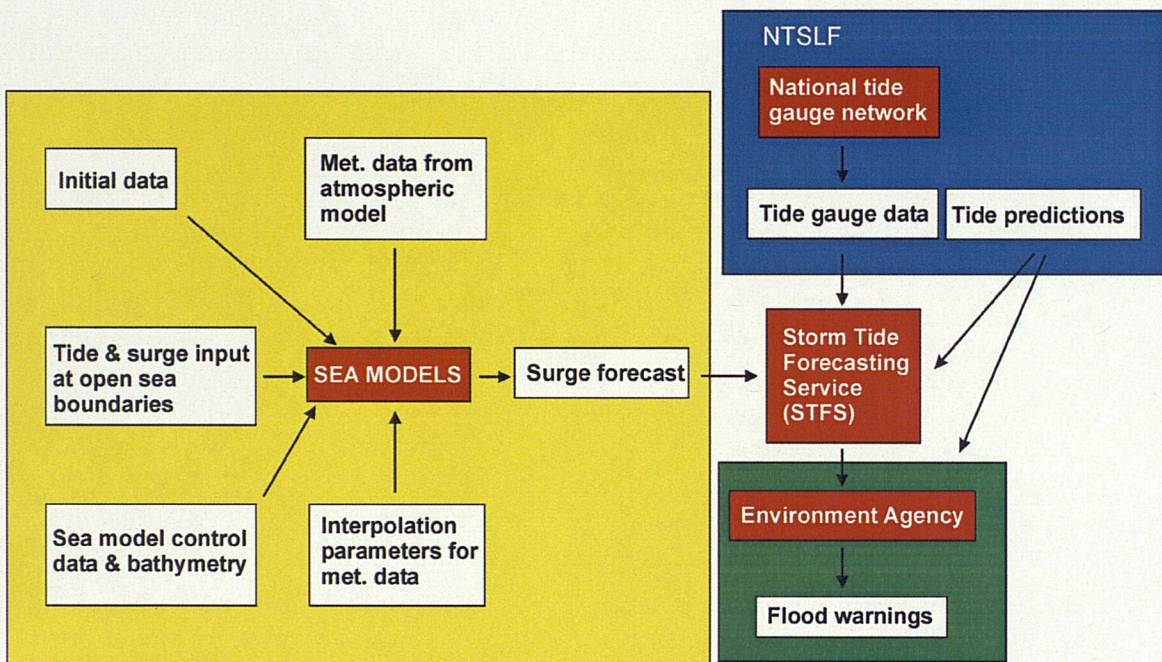


Figure 1: Schematic of the operational surge forecast and warning system.

First operational surge forecasts were run in 1978 using coarse (~35km) grid surge and (~100km) atmospheric models. The present system comprises a 12km shelf model (CS3, shown in Figure 2) with refinements to 1km and a 1-D river model to provide useful predictions in the complex regime of the Bristol Channel and Severn Estuary (Figure 3). The current models are forced by 10m winds and atmospheric pressure from the Met Office's 12km grid 'mesoscale' weather forecast model (Figure 2).

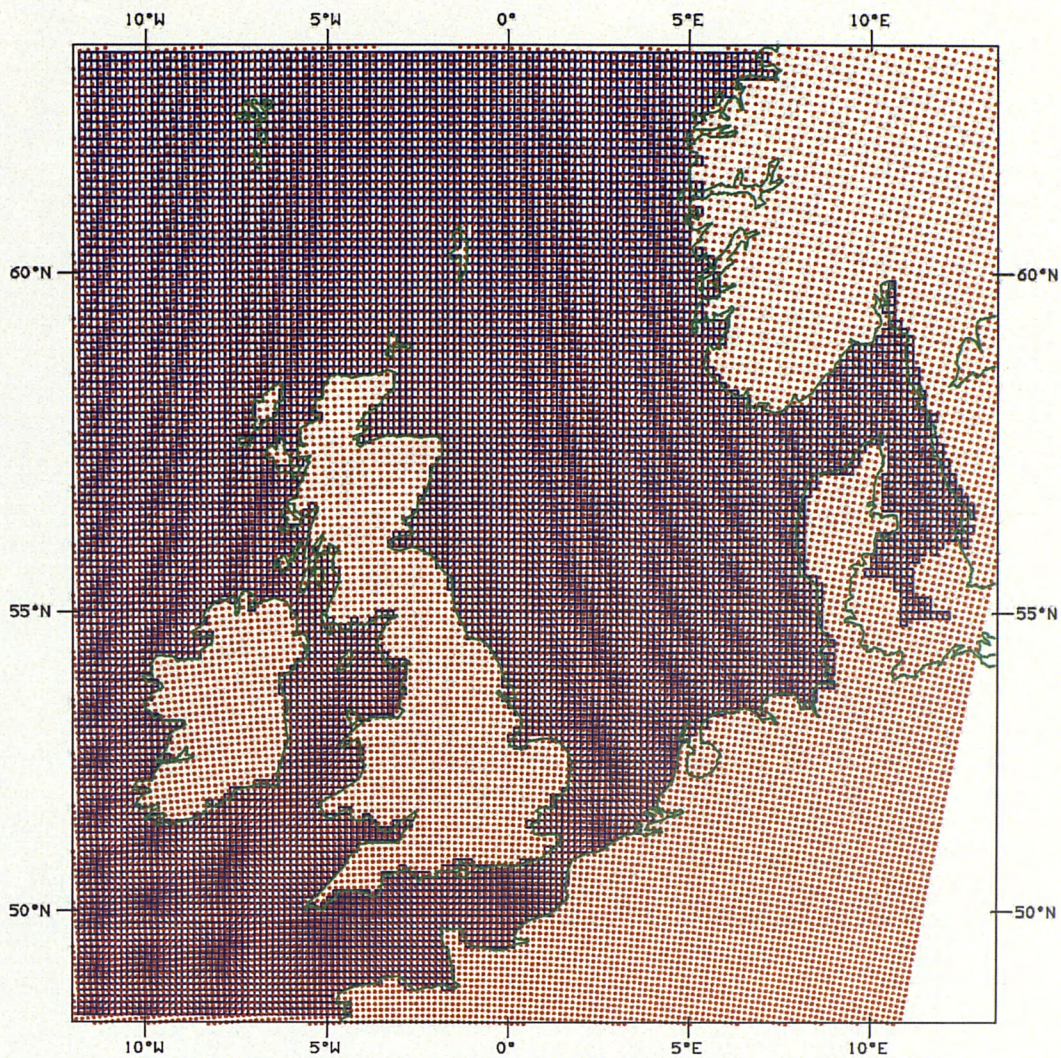


Figure 2: Surge model grid with mesoscale model points superimposed.

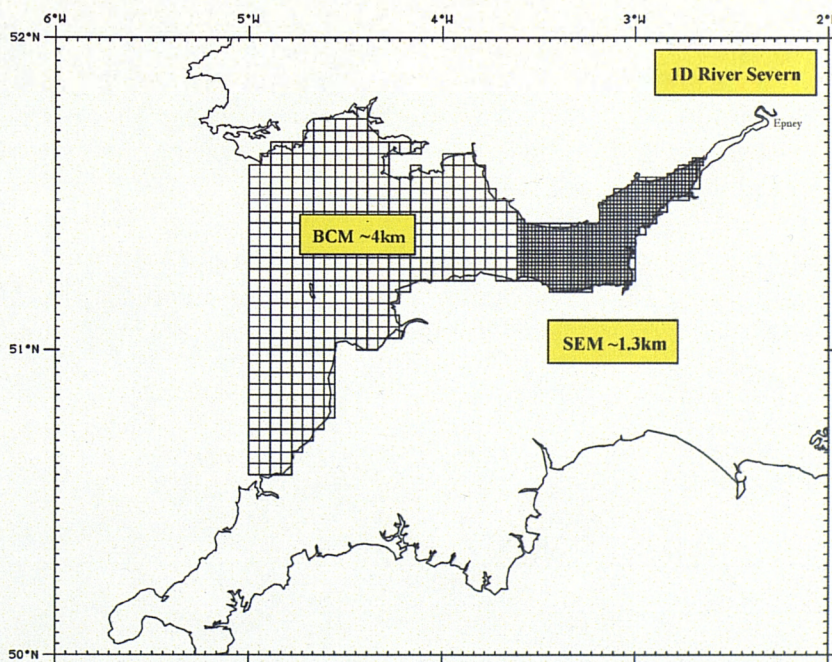


Figure 3: The Bristol Channel, Severn Estuary and River models.

After successful pre-operational trials, the POL south coast model (SCM) became operational from the midday forecast on 07/12/04. It has a resolution of ~1.2km with longitudinal open boundaries extending south from Newhaven and Weymouth, coinciding with locations of tide gauges on the national network. The SCM grid is shown in Figure 4.

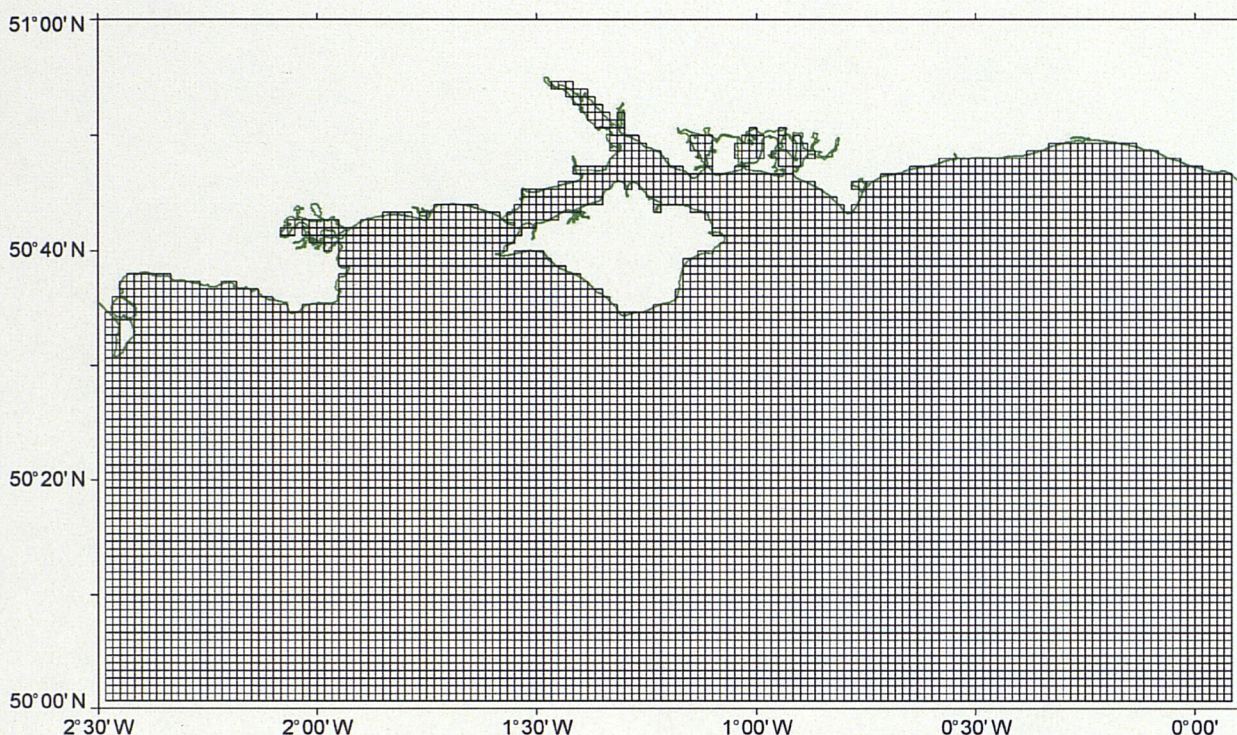


Figure 4: POL South coast model (SCM) resolution ~1.2km.

Surge models run four times per day producing forecasts up to 2 days ahead. The model surge is combined with tides predicted at tide gauge sites to give the best estimate of total water level. The Bristol Channel models have also been tuned to provide accurate water level forecasts, eliminating some problems in combining tide and surge in this highly non-linear area.

Model performance is routinely monitored at POL by comparing forecast results with observations every month. Typical RMS errors are about 10cm. Significant forecast errors are investigated and causes diagnosed so that the system can be progressively improved.

3. Operational Changes

a. Introduction of a New Atmospheric Model

In mid-April 2005, the Met Office informed us of the introduction of a new atmospheric forecast model called the North Atlantic Extended model (NAE). This model will initially have the same resolution as the current mesoscale model (~12km) but with a much extended domain (see Figure 5); the resulting number of grid points increasing approximately 10 fold. Initially, the new model will run in parallel with the mesoscale

model before replacing it. A new interface to all models in the surge suite (plus the Thames Barrier model) was required as high priority.

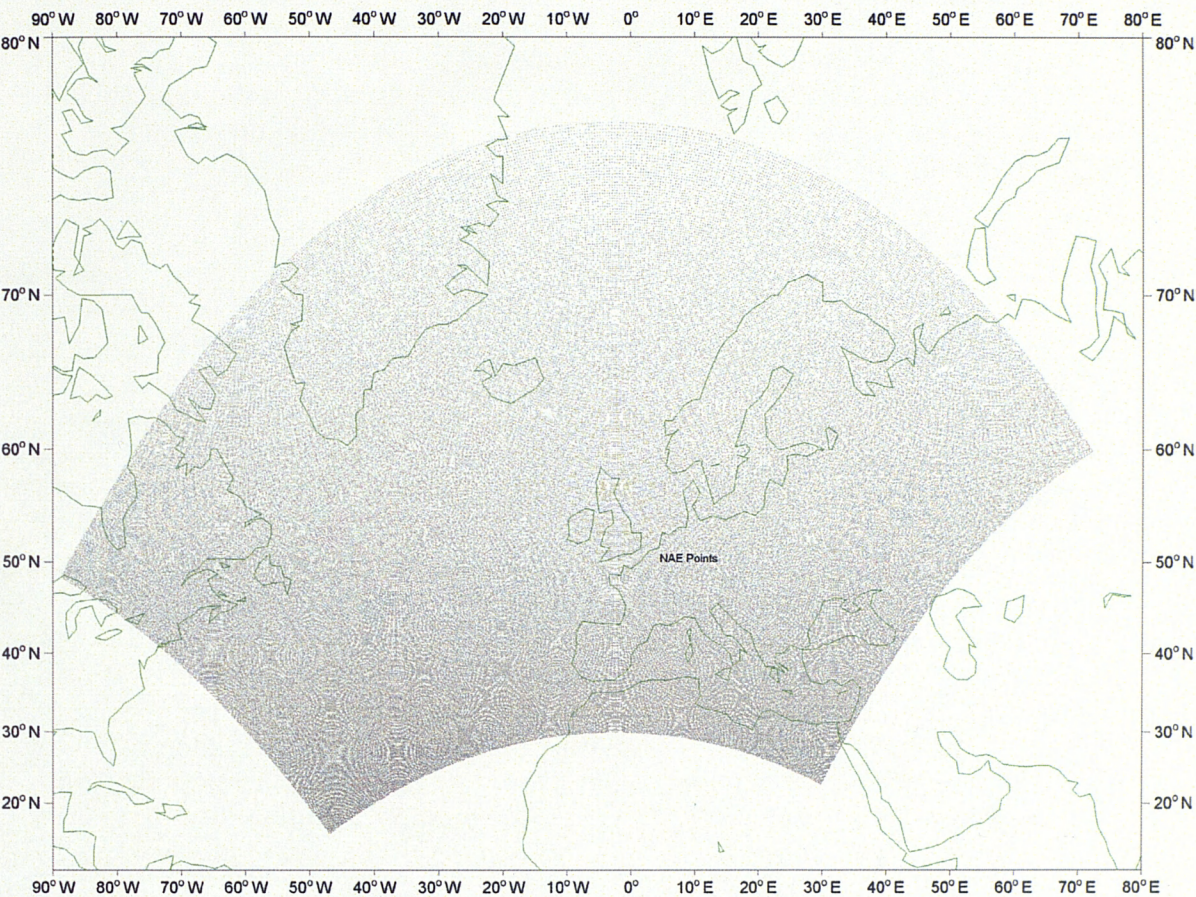


Figure 5: NAE atmospheric model points.

b. 15-minute model outputs

The requirement for higher frequency model output (15-minute instead of hourly) had already been identified (Flather and Williams, 2004) and requested by the EA. Output at 15-minute intervals would provide better temporal resolution and comparison with tide gauge output, which is available at 15-minute intervals, would be possible. However, implementation of this had been delayed due to the announcement of the new NAE model. Since termination of the mesoscale is imminent, it was decided to only implement the 15-minute output in the NAE surge model suite. After the models had successfully been set up for NAE, they were then modified to produce 15-minute outputs. This involved significant changes to the input and output of all the model codes. New versions of all model and ancillary codes were created and extensive tests performed. The 15-minute NAE models were incorporated into the parallel suite at the Met Office in October 2005.

c. Changes to assimilation files

Due to the introduction of the NAE and the “4D Var” data assimilation scheme at the Met Office, computational restrictions forced a change from eight to four mesoscale

assimilation runs. The surge model script and the program 'settas' were modified to accommodate this change at the end of March 2006.

d. Error in SCM output

During the testing phase of the new NAE interface to the surge models, an error was found in the output of SCM. Further investigation showed an error in the operational script used at the Met Office. Met Office staff were informed and a correction was put into effect from the 6z run 05/07/05.

e. Integration of the Thames model code into the National Flood Forecasting System

In 1989 POL supplied the Thames Barrier with a stand-alone regional model referred to as TWAM (Thames Water Model). The model covers the southern part of the North Sea and the eastern portion of the English Channel (Flather, 1989; 1993). The input of external surge at the model's open boundaries may be corrected using tide gauge data from North Shields and Newhaven. During 2005/2006 POL were requested to migrate the TWAM code to a Windows platform so that the model could be executed by the Environment Agency's new National Flood Forecasting System (NFFS). The NFFS system requires that all input and output files are in XML format, and that system diagnostics are performed. This involved the development of a substantial amount of new code to return the model input files (from the NEC operational suite) into the native format. The new version of TWAM is now complete and is under test at the Thames Barrier. The existing system will continue to run in parallel at the Thames Barrier and hence will require updates (see a) until it is discontinued. *(This work was funded under a separate contract but is reported here since it clearly represents a major alteration to the operational system and carries implications for future support).*

4. Model Performance

During the period covered by this report, there were two surge events that were under-predicted by the model. They are described below.

Forecast Errors on the East Coast: August 24 2005

On 24th August 2005, a Low of central pressure 969hPa tracked off the northwest coast of Scotland generating south-westerly winds which caused flooding in the Western Isles and produced an external surge which propagated down the east coast. The surge model forecast the surge on the northwest coast of Scotland; however the propagating east coast surge was under predicted at HW during the afternoon of 24th by up to 20cm at east coast locations. This event was investigated and a summary was sent to Stewart Wortley on 25th October 2005 (see Appendix B).

Forecast errors at Sheerness: 16 December 2005

A Tidal Services Feedback Form was received following an under-prediction at Sheerness of 29 cm. Forecast errors were also reported at Sheerness. Analysis of the Port Table outputs and tide gauge data confirmed that the external surge was incorrect as far north as Leith. The Met Office investigated the performance of the

atmospheric model (NMC Problem 366) and reported significant differences in wind speed and direction around Scotland at the time of the forecast. It was concluded that errors in the wind and pressure fields of the UK mesoscale model were responsible for the subsequent errors in the marine model.

5. Operational and Other Issues

a. Meetings

Kevin Horsburgh attended the following meetings:

- 17 May 2005: Contracts Discussions with EA, Swindon.
- 31 May 2005: STFS subgroup meeting, London.
- 2 June 2005: IPR meeting, Birmingham with Clare Marsden.
- 5-7 July 2005: Defra conference, York with David Blackman from POL.
- 2 August 2005: STFS subgroup meeting, London.
- 30-31 Aug 2005: Meeting at Met Office, Exeter relating to security issues: with Jane Williams from POL.
- 11 October 2005: STFS subgroup meeting, London.
- 13 October 2005: EA visited POL to meet for discussions and to see work of POL. Initial discussions also attended by Andrew Willmott, Les Bradley and Jane Williams from POL, with other POL staff involved in presentations and demonstrations in the afternoon.
- 17 January 2006: STFS subgroup meeting, London.
- 13 March 2006: STFS steering group meeting, London.

b. New Dial-In Arrangements

Due to a revision of security procedures at the Met Office, POL staff who dial-in to their computer systems were required to undergo security clearance before further access to systems were allowed. Following this and a visit to the Met Office in August 2005, POL users have been given a dedicated lap top computer for dial-in access to Met Office systems. In addition, a new secure dial-in procedure is now used for connection.

c. Reports Produced

Williams J.A. & K.J. Horsburgh, 2005. The Operational Storm Surge Model: Maintenance, Performance and Development April 2004 – March 2005. *Proudman Oceanographic Laboratory, Internal Document, No 173*, 38 p.

Acknowledgements

The authors would like to thank Stewart Wortley, STFS staff and EA staff for bringing problems to our attention and for providing useful information and discussion. Thanks also to staff at the Met Office for their continuing support which ensures smooth running of the system and facilitates development of the operational surge model.

This work was funded by EA under the Tide Gauge Maintenance Contract at POL.

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Flather, R.A. 1989. The development of a new model for Thames Barrier operations. *Proudman Oceanographic Laboratory Internal Document No. 6*. (Unpublished Document)

Flather, R.A., 1993. An updated forecast model for Thames Barrier operations. *Proudman Oceanographic Laboratory Internal Document No. 46*. 15pp + Figs & Tables.

Flather, R.A. & J.A. Williams, 2004. Future Development of Operational Storm Surge and Sea Level Prediction. *Proudman Oceanographic Laboratory, Internal Document, No. 165*, 70 pp.

Appendix A: Data Archives and Statistics

1. Data Archives

Routine archiving of operational model and related outputs is undertaken to ensure data are always available for surge modelling work as well as other applications.

There are three archives:

- a) *Port data archive*: this comprises model hindcast and forecast data for a selection of 42 locations (including “A class” gauge locations) around the UK and NW European coasts. There are 4 sets of hindcast and forecast data for each day corresponding to each operational model run. Usually this comprises 6 hour hindcast and 48 hour forecast although this can change if there have been operational system failures at the Met Office. This archive is updated after each operational run. Once a month forecasts are extracted, returned to POL and time series plots and statistics are produced comparing model forecast with observed surges derived at tide gauges from observations. This is important for monitoring surge model performance. (Monthly time series plots are now available on the POL web-site to external users under the NTSLF pages: see Chapter 5 [e].) Data archived for April 2005 - March 2006 are summarised in Table 13. There are similar archives for the BCM, SRM and SCM models. (The SCM archive was started in December 2004^a.)
- b) *Met data archive*: fields of mesoscale met data comprising hindcast 10m wind components and mean sea level pressure (MSLP) are extracted from the Met Office’s archive and transferred to POL via ftp. Such data are essential for surge model development and investigating problems such as poor forecasts or model failure. Data are reformatted, checked for consistency, sorted and stored in monthly files. Data have been archived at hourly intervals in monthly files for the period April 2005 to March 2006.

A test archive for the new NAE model was set up at the Met Office in October 2005. This is a tape archive in the same format as the mesoscale archive. Due to the size of the NAE domain, it is necessary to extract a subset of this archive for transmission back to POL. (The entire domain comprises ~350000 points for each parameter.) A job has been set up based on a subset of approximately 150000 points. This will cover the largest surge model used at POL, the North East Atlantic model (NEA), which has a domain large enough to cover any future extensions to CS3. This will form the basis of a replacement atmospheric model archive at POL when it becomes operational.
- c) *Model array archive*: CS3 is re-run using the hindcast mesoscale model data described above and arrays are archived at POL. This “re-run” archive is periodically updated when new met archive data have been returned to POL. The re-run archive comprises hourly z, u and v components of tide + surge and surge only for the entire model grid and covers the period 1992-March 2006. *From January 2006, the re-run archive has been run on a Linux workstation and*

^a Due to operational error, good data start from 06z 05/07/05

hence the binary data arrays are in a different format. The data are available on the POL mass store and available to external users through POL Applications Team.

2. Statistical Analysis

As previously mentioned, archived port data are transferred back to POL at regular intervals in order to assess the model's performance by comparison with observations. In addition to time series plots, simple statistics are calculated based on the difference between hourly model and observations (model residual – observed residual). From this, mean, standard deviation, correlation coefficient, RMS error, maximum error and the time at which that occurred, are calculated. Additionally, these parameters are calculated for the hour closest to model high water for each month, as these are the most important for flood forecasting.

3. Tables of Monthly Statistics

There are 24 statistics tables (Tables 1a–12b), two for each month. The first (“a”) gives a summary of the hourly comparisons for the entire month, and the second (“b”) contains the same statistics but at the hour closest to HW. All values are given in metres. The following abbreviations are used in the column headings:

- PORT: The location of the comparison
- SIZE: Sample size (i.e. where there exists both a model and observed value)
- CORR: Correlation coefficient
- MEAN: The arithmetic mean of the series
- S.D.: The standard deviation of the mean
- RMSE: The root mean square (RMS) error
- MAX ERR: The maximum difference between model and observation occurring in the series
- DATE: The hour and day of the month at which the maximum difference occurs

Note that the tables contain statistics for the Bristol Channel ports from CS3, however operational forecasts for these locations are taken from the higher resolution Bristol Channel system of models.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	719	0.94	-0.03	0.05	0.06	-0.17	12z 28th
Wick	719	0.93	-0.01	0.05	0.05	-0.20	3z 29th
Aberdeen	719	0.91	-0.03	0.05	0.06	-0.19	5z 29th
North Shields	719	0.89	-0.08	0.06	0.10	-0.27	17z 29th
Whitby	719	0.90	-0.15	0.07	0.17	-0.45	9z 8th
Immingham	719	0.84	-0.04	0.10	0.11	-0.44	14z 6th
Cromer	719	0.91	0.00	0.08	0.08	-0.28	15z 6th
Lowestoft	719	0.93	-0.05	0.07	0.09	-0.31	16z 6th
Felixstowe	719	0.88	0.01	0.09	0.09	0.28	16z 19th
Sheerness	719	0.84	0.00	0.11	0.11	-0.47	20z 6th
Ilfracombe	716	0.74	-0.07	0.09	0.12	-0.29	21z 2nd
Hinkley Point	651	0.53	-0.03	0.15	0.16	-0.46	5z 18th
Avonmouth	719	0.41	-0.09	0.26	0.27	-0.84	20z 2nd
Mumbles	719	0.69	0.02	0.10	0.11	0.37	22z 19th
Milford Haven	719	0.86	-0.05	0.07	0.09	-0.23	21z 2nd
Fishguard	719	0.90	-0.13	0.05	0.15	-0.26	1z 22nd
Barmouth	719	0.87	-0.04	0.07	0.09	-0.47	15z 8th
Holyhead	270	0.84	-0.09	0.05	0.10	-0.23	22z 23rd
Llandudno	719	0.78	0.00	0.11	0.11	0.38	1z 8th
Liverpool	719	0.80	-0.15	0.09	0.18	-0.40	2z 2nd
Heysham	719	0.86	-0.16	0.09	0.19	-0.49	4z 6th
Workington	719	0.91	0.08	0.08	0.12	0.40	3z 9th
St. Marys	719	0.88	-0.02	0.05	0.06	-0.16	15z 21st
Newlyn	719	0.87	-0.06	0.05	0.09	-0.22	21z 2nd
Plymouth	719	0.78	-0.01	0.07	0.07	0.20	8z 19th
Weymouth	719	0.80	-0.03	0.06	0.07	-0.23	5z 2nd
Portsmouth	719	0.78	-0.04	0.06	0.07	-0.22	1z 7th
Newhaven	719	0.74	-0.02	0.07	0.08	-0.26	2z 2nd
Dover	719	0.81	-0.03	0.09	0.09	-0.38	22z 8th
Jersey	719	0.58	-0.06	0.12	0.14	-0.36	17z 24th
Port Erin	719	0.92	0.15	0.06	0.16	0.32	2z 9th
Portpatrick	555	0.93	-0.04	0.06	0.08	-0.22	11z 28th
Millport	561	0.93	0.00	0.07	0.07	-0.20	12z 28th
Islay	719	0.94	-0.05	0.06	0.09	-0.30	12z 28th
Tobermory	719	0.94	-0.03	0.05	0.06	-0.17	16z 22nd
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	719	0.96	0.01	0.05	0.05	0.16	21z 9th
Kinlochbervie	719	0.95	0.01	0.05	0.05	0.18	22z 10th
Lerwick	719	0.93	-0.01	0.04	0.04	-0.13	12z 29th
Newport	418	0.38	-0.10	0.22	0.24	-0.73	18z 17th
Bournemouth	719	0.78	-0.02	0.06	0.07	0.21	6z 19th

Table 1a: Statistics based on hourly data for April 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	58	0.93	-0.03	0.05	0.06	-0.15	19z 24th
	Wick	58	0.91	-0.02	0.06	0.06	-0.19	2z 29th
	Aberdeen	58	0.88	-0.04	0.05	0.07	-0.18	4z 29th
	North Shields	58	0.85	-0.11	0.06	0.13	-0.25	19z 29th
	Whitby	58	0.86	-0.18	0.07	0.20	-0.34	19z 29th
	Immingham	58	0.82	-0.07	0.09	0.12	-0.29	16z 6th
	Cromer	58	0.87	-0.01	0.09	0.09	-0.24	17z 6th
	Lowestoft	58	0.91	-0.04	0.08	0.09	-0.23	19z 6th
	Felixstowe	58	0.90	-0.06	0.07	0.09	-0.22	15z 29th
	Sheerness	58	0.81	-0.07	0.08	0.11	-0.36	8z 18th
	Ilfracombe	58	0.68	-0.06	0.10	0.12	-0.23	16z 20th
	Hinkley Point	52	0.39	-0.05	0.17	0.18	-0.35	16z 19th
	Avonmouth	57	0.46	-0.12	0.19	0.23	-0.55	16z 19th
	Mumbles	58	0.67	-0.01	0.11	0.11	0.23	19z 8th
	Milford Haven	58	0.86	-0.05	0.07	0.09	-0.17	17z 21st
	Fishguard	57	0.90	-0.12	0.05	0.14	-0.23	19z 23rd
	Barmouth	57	0.90	-0.06	0.07	0.09	-0.22	19z 6th
	Holyhead	22	0.84	-0.13	0.05	0.14	-0.23	22z 23rd
	Llandudno	58	0.73	-0.04	0.12	0.12	0.31	3z 16th
	Liverpool	58	0.77	-0.20	0.09	0.23	-0.35	23z 23rd
	Heysham	58	0.80	-0.21	0.10	0.23	-0.37	4z 2nd
	Workington	58	0.86	0.05	0.09	0.10	0.22	0z 9th
	St. Marys	58	0.85	-0.03	0.06	0.07	-0.16	4z 22nd
	Newlyn	58	0.85	-0.07	0.06	0.10	-0.19	15z 21st
	Plymouth	58	0.81	-0.02	0.08	0.08	-0.17	17z 23rd
	Weymouth	58	0.85	-0.03	0.06	0.06	-0.17	5z 22nd
	Portsmouth	58	0.77	-0.05	0.07	0.08	-0.17	4z 2nd
	Newhaven	58	0.69	-0.05	0.08	0.10	-0.19	12z 24th
	Dover	58	0.83	-0.06	0.08	0.10	-0.23	12z 24th
	Jersey	58	0.66	-0.02	0.12	0.12	-0.23	19z 24th
	Port Erin	58	0.90	0.12	0.07	0.14	0.30	23z 8th
	Portpatrick	45	0.90	-0.06	0.07	0.10	-0.22	0z 24th
	Millport	45	0.90	-0.01	0.08	0.08	-0.18	1z 24th
	Islay	64	0.95	-0.03	0.06	0.07	-0.16	8z 28th
	Tobermory	58	0.93	-0.02	0.06	0.07	0.16	20z 28th
	Moray Firth	No Observations Available						
	Leith	No Observations Available						
	Ullapool	57	0.95	0.01	0.05	0.05	0.13	21z 11th
	Kinlochbervie	57	0.94	0.02	0.06	0.06	0.13	19z 7th
	Lerwick	58	0.93	-0.01	0.04	0.04	-0.09	13z 27th
	Newport	33	0.18	-0.15	0.18	0.24	-0.46	17z 19th
	Bournemouth	86	0.78	-0.01	0.06	0.06	-0.17	6z 2nd

Table 1b: Statistics at HW for April 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
	Stornoway	682	0.96	-0.05	0.03	0.07	-0.16	16z 18th
	Wick	743	0.95	-0.03	0.03	0.05	-0.17	13z 26th
	Aberdeen	743	0.92	-0.04	0.04	0.06	-0.15	1z 21st
	North Shields	743	0.91	-0.08	0.04	0.09	-0.22	1z 20th
	Whitby	743	0.91	-0.16	0.04	0.17	-0.33	18z 26th
	Immingham	743	0.80	-0.04	0.08	0.09	-0.32	15z 26th
	Cromer	743	0.88	-0.01	0.07	0.07	-0.28	18z 26th
	Lowestoft	743	0.93	-0.05	0.05	0.08	-0.22	22z 28th
	Felixstowe	743	0.86	0.00	0.07	0.07	0.23	23z 4th
	Sheerness	743	0.83	0.00	0.10	0.10	-0.38	1z 29th
	Ilfracombe	743	0.79	-0.06	0.07	0.09	-0.25	15z 19th
	Hinkley Point	No Observations Available						
	Avonmouth	743	0.41	-0.05	0.24	0.25	-0.65	17z 23rd
	Mumbles	743	0.74	0.03	0.08	0.09	0.30	12z 26th
	Milford Haven	743	0.87	-0.05	0.05	0.08	-0.19	15z 11th
	Fishguard	743	0.90	-0.13	0.04	0.14	-0.26	16z 13th
	Barmouth	743	0.88	-0.04	0.07	0.08	-0.25	17z 19th
	Holyhead	743	0.93	-0.06	0.04	0.07	-0.17	3z 1st
	Llandudno	743	0.88	-0.02	0.06	0.07	-0.18	14z 29th
	Liverpool	743	0.84	-0.17	0.08	0.19	-0.39	13z 29th
	Heysham	No Observations Available						
	Workington	743	0.92	0.06	0.06	0.09	0.35	17z 28th
	St. Marys	743	0.88	-0.03	0.04	0.05	-0.14	14z 20th
	Newlyn	743	0.88	-0.06	0.04	0.07	-0.18	8z 1st
	Plymouth	723	0.78	-0.01	0.05	0.06	-0.16	7z 1st
	Weymouth	743	0.78	-0.03	0.05	0.06	-0.19	16z 13th
	Portsmouth	743	0.78	-0.03	0.06	0.07	-0.21	9z 12th
	Newhaven	743	0.79	-0.01	0.06	0.06	-0.18	0z 27th
	Dover	743	0.81	-0.04	0.07	0.08	-0.31	2z 1st
	Jersey	743	0.60	-0.05	0.09	0.10	-0.28	4z 25th
	Port Erin	743	0.92	0.15	0.05	0.15	0.28	16z 4th
	Portpatrick	743	0.96	-0.06	0.04	0.07	-0.18	4z 1st
	Millport	743	0.94	-0.01	0.05	0.06	-0.18	2z 31st
	Islay	724	0.96	-0.07	0.04	0.08	-0.18	0z 20th
	Tobermory	743	0.96	-0.04	0.04	0.06	-0.14	2z 1st
	Moray Firth	No Observations Available						
	Leith	No Observations Available						
	Ullapool	743	0.95	-0.02	0.04	0.04	-0.14	16z 18th
	Kinlochbervie	743	0.96	-0.01	0.04	0.04	-0.13	16z 18th
	Lerwick	743	0.95	-0.03	0.03	0.05	-0.12	20z 1st
	Newport	743	0.57	-0.08	0.16	0.18	-0.50	19z 1st
	Bournemouth	743	0.81	-0.01	0.05	0.06	-0.20	15z 11th

Table 2a: Statistics based on hourly data for May 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	&	DATE
	Stornoway	54	0.95	-0.05	0.04	0.07	-0.16	16z	18th
	Wick	60	0.95	-0.05	0.04	0.07	-0.17	13z	26th
	Aberdeen	60	0.93	-0.05	0.04	0.07	-0.14	15z	26th
	North Shields	60	0.87	-0.10	0.05	0.11	-0.22	1z	20th
	Whitby	60	0.84	-0.18	0.06	0.20	-0.32	17z	26th
	Immingham	59	0.76	-0.05	0.09	0.10	-0.21	21z	28th
	Cromer	59	0.84	-0.02	0.08	0.08	-0.16	5z	22nd
	Lowestoft	60	0.92	-0.05	0.06	0.08	-0.18	5z	2nd
	Felixstowe	60	0.90	-0.06	0.06	0.09	-0.17	0z	25th
	Sheerness	60	0.79	-0.07	0.07	0.10	-0.24	13z	25th
	Ilfracombe	59	0.80	-0.04	0.07	0.08	-0.25	15z	19th
	Hinkley Point	No Observations Available							
	Avonmouth	59	0.73	-0.06	0.12	0.14	-0.37	16z	19th
	Mumbles	59	0.76	0.01	0.08	0.08	0.23	10z	28th
	Milford Haven	59	0.88	-0.04	0.05	0.07	-0.17	15z	19th
	Fishguard	59	0.90	-0.11	0.04	0.12	-0.20	5z	20th
	Barmouth	60	0.87	-0.06	0.07	0.10	-0.25	17z	19th
	Holyhead	60	0.96	-0.07	0.04	0.08	-0.17	3z	1st
	Llandudno	60	0.90	-0.05	0.06	0.08	-0.17	20z	19th
	Liverpool	60	0.93	-0.21	0.06	0.22	-0.33	20z	19th
	Heysham	No Observations Available							
	Workington	60	0.92	0.03	0.06	0.07	0.23	15z	28th
	St. Marys	59	0.88	-0.04	0.04	0.06	-0.14	15z	20th
	Newlyn	59	0.91	-0.06	0.04	0.08	-0.16	7z	27th
	Plymouth	58	0.89	0.00	0.05	0.05	-0.12	2z	19th
	Weymouth	59	0.78	-0.02	0.05	0.06	-0.17	14z	18th
	Portsmouth	60	0.85	-0.05	0.06	0.07	-0.18	4z	1st
	Newhaven	60	0.84	-0.04	0.06	0.07	-0.17	1z	27th
	Dover	60	0.85	-0.04	0.06	0.08	-0.17	21z	20th
	Jersey	59	0.79	-0.01	0.07	0.07	-0.18	16z	19th
	Port Erin	60	0.96	0.12	0.04	0.12	0.21	22z	6th
	Portpatrick	60	0.96	-0.07	0.04	0.09	-0.16	21z	19th
	Millport	60	0.96	-0.02	0.04	0.05	-0.14	1z	25th
	Islay	61	0.96	-0.05	0.04	0.07	-0.13	6z	16th
	Tobermory	59	0.95	-0.03	0.04	0.05	0.13	21z	28th
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	59	0.96	-0.01	0.04	0.04	-0.14	16z	18th
	Kinlochbervie	59	0.96	-0.01	0.04	0.04	-0.13	16z	18th
	Lerwick	60	0.96	-0.03	0.03	0.05	-0.09	20z	19th
	Newport	59	0.62	-0.06	0.13	0.14	-0.38	17z	19th
	Bournemouth	87	0.73	-0.02	0.06	0.07	-0.19	18z	15th

Table 2b: Statistics at HW for May 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	719	0.95	-0.07	0.04	0.09	-0.17	1z 22nd
Wick	719	0.92	-0.06	0.04	0.07	-0.20	17z 15th
Aberdeen	719	0.90	-0.07	0.04	0.09	-0.19	20z 15th
North Shields	719	0.87	-0.10	0.04	0.11	-0.26	21z 15th
Whitby	719	0.87	-0.18	0.04	0.19	-0.35	22z 15th
Immingham	719	0.74	-0.06	0.07	0.10	-0.29	15z 23rd
Cromer	719	0.86	-0.04	0.05	0.07	-0.28	16z 22nd
Lowestoft	719	0.88	-0.07	0.05	0.09	-0.23	5z 16th
Felixstowe	719	0.83	-0.02	0.06	0.07	-0.25	6z 16th
Sheerness	719	0.81	-0.02	0.07	0.08	-0.29	7z 16th
Ilfracombe	719	0.77	-0.10	0.07	0.12	-0.29	3z 22nd
Hinkley Point	471	0.47	-0.04	0.13	0.14	-0.41	19z 28th
Avonmouth	719	0.32	-0.08	0.23	0.25	-0.72	3z 22nd
Mumbles	719	0.72	-0.00	0.09	0.09	0.27	12z 24th
Milford Haven	542	0.65	-0.13	0.08	0.15	-0.30	7z 28th
Fishguard	719	0.88	-0.16	0.05	0.17	-0.29	5z 28th
Barmouth	No Observations Available						
Holyhead	719	0.91	-0.08	0.04	0.10	-0.20	20z 18th
Llandudno	719	0.87	-0.06	0.06	0.09	-0.21	13z 26th
Liverpool	719	0.83	-0.21	0.07	0.23	-0.41	7z 22nd
Heysham	No Observations Available						
Workington	719	0.90	0.03	0.06	0.07	0.22	22z 1st
St. Marys	483	0.90	-0.10	0.04	0.11	-0.23	8z 28th
Newlyn	716	0.85	-0.10	0.04	0.11	-0.24	9z 28th
Plymouth	719	0.80	-0.04	0.06	0.07	-0.22	6z 28th
Weymouth	719	0.82	-0.06	0.05	0.09	-0.24	4z 27th
Portsmouth	719	0.80	-0.06	0.06	0.09	-0.27	23z 27th
Newhaven	719	0.80	-0.05	0.06	0.08	-0.24	22z 22nd
Dover	719	0.77	-0.06	0.07	0.09	-0.32	1z 27th
Jersey	710	0.66	-0.10	0.09	0.13	-0.36	4z 23rd
Port Erin	719	0.91	0.13	0.05	0.14	0.26	19z 1st
Portpatrick	719	0.92	-0.07	0.04	0.09	-0.19	3z 29th
Millport	719	0.90	-0.04	0.06	0.07	-0.25	2z 29th
Islay	719	0.93	-0.10	0.04	0.11	-0.23	3z 29th
Tobermory	719	0.93	-0.08	0.04	0.09	-0.19	1z 22nd
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	711	0.94	-0.04	0.04	0.06	-0.15	19z 14th
Kinlochbervie	710	0.94	-0.05	0.04	0.07	-0.17	20z 14th
Lerwick	683	0.90	-0.06	0.03	0.07	-0.18	21z 15th
Newport	717	0.48	-0.11	0.17	0.20	-0.73	20z 29th
Bournemouth	719	0.81	-0.06	0.06	0.08	-0.24	17z 26th

Table 3a: Statistics based on hourly data for June 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	58	0.94	-0.07	0.04	0.09	-0.15	15z 17th
	Wick	58	0.90	-0.06	0.04	0.08	-0.20	17z 15th
	Aberdeen	58	0.88	-0.07	0.04	0.09	-0.19	20z 15th
	North Shields	58	0.83	-0.10	0.05	0.11	-0.24	22z 15th
	Whitby	57	0.81	-0.19	0.05	0.20	-0.35	22z 15th
	Immingham	58	0.80	-0.05	0.07	0.09	-0.25	0z 16th
	Cromer	58	0.86	-0.03	0.05	0.06	-0.19	1z 16th
	Lowestoft	58	0.85	-0.07	0.05	0.09	-0.23	5z 16th
	Felixstowe	58	0.80	-0.09	0.06	0.11	-0.25	6z 16th
	Sheerness	58	0.74	-0.07	0.07	0.10	-0.29	7z 16th
	Ilfracombe	58	0.74	-0.07	0.07	0.10	-0.21	3z 18th
	Hinkley Point	41	0.40	-0.02	0.11	0.11	0.22	15z 1st
	Avonmouth	58	0.59	-0.07	0.11	0.13	-0.26	10z 11th
	Mumbles	58	0.68	-0.00	0.08	0.07	0.23	17z 4th
	Milford Haven	44	0.59	-0.12	0.08	0.14	-0.23	1z 16th
	Fishguard	58	0.91	-0.14	0.04	0.15	-0.22	1z 15th
	Barmouth	No Observations Available						
	Holyhead	58	0.88	-0.09	0.05	0.11	-0.18	3z 28th
	Llandudno	58	0.84	-0.08	0.06	0.10	-0.19	7z 18th
	Liverpool	58	0.84	-0.23	0.07	0.24	-0.35	7z 18th
	Heysham	No Observations Available						
	Workington	58	0.89	0.01	0.06	0.06	0.15	22z 3rd
	St. Marys	39	0.86	-0.10	0.04	0.11	-0.18	20z 26th
	Newlyn	57	0.81	-0.09	0.05	0.11	-0.19	23z 15th
	Plymouth	57	0.77	-0.04	0.06	0.07	-0.16	14z 18th
	Weymouth	58	0.88	-0.05	0.04	0.07	-0.14	15z 18th
	Portsmouth	58	0.75	-0.06	0.07	0.09	-0.21	3z 27th
	Newhaven	58	0.81	-0.06	0.06	0.09	-0.19	20z 18th
	Dover	58	0.80	-0.06	0.06	0.09	-0.20	0z 23rd
	Jersey	58	0.77	-0.05	0.06	0.08	-0.20	16z 18th
	Port Erin	58	0.90	0.11	0.05	0.12	0.26	20z 1st
	Portpatrick	58	0.92	-0.09	0.05	0.10	-0.18	21z 17th
	Millport	58	0.88	-0.05	0.06	0.08	-0.20	21z 17th
	Islay	58	0.94	-0.08	0.04	0.10	-0.20	0z 17th
	Tobermory	58	0.93	-0.07	0.04	0.09	-0.17	2z 18th
	Moray Firth	No Observations Available						
	Leith	No Observations Available						
	Ullapool	57	0.93	-0.03	0.04	0.06	-0.12	15z 17th
	Kinlochbervie	57	0.93	-0.04	0.05	0.06	-0.12	16z 17th
	Lerwick	55	0.91	-0.06	0.03	0.07	-0.17	17z 15th
	Newport	58	0.64	-0.07	0.11	0.14	-0.28	10z 11th
	Bournemouth	81	0.80	-0.06	0.06	0.09	-0.24	17z 26th

Table 3b: Statistics at HW for June 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
	Stornoway	743	0.96	-0.06	0.04	0.07	-0.21	2z	3rd
	Wick	743	0.95	-0.04	0.04	0.06	-0.20	9z	3rd
	Aberdeen	743	0.92	-0.05	0.04	0.07	-0.19	12z	3rd
	North Shields	743	0.92	-0.09	0.04	0.10	-0.26	5z	5th
	Whitby	743	0.92	-0.18	0.04	0.19	-0.35	18z	6th
	Immingham	743	0.85	-0.06	0.07	0.09	-0.30	6z	5th
	Cromer	743	0.88	-0.02	0.06	0.07	-0.22	1z	4th
	Lowestoft	743	0.92	-0.06	0.05	0.08	-0.22	23z	3rd
	Felixstowe	743	0.87	-0.01	0.07	0.07	-0.23	22z	3rd
	Sheerness	743	0.86	-0.02	0.07	0.08	-0.21	22z	25th
	Ilfracombe	743	0.74	-0.09	0.07	0.12	-0.31	18z	28th
	Hinkley Point	739	0.53	-0.04	0.12	0.13	-0.45	19z	28th
	Avonmouth	743	0.28	-0.08	0.25	0.27	-0.86	20z	28th
	Mumbles	743	0.65	0.01	0.10	0.10	-0.29	19z	28th
	Milford Haven	743	0.86	-0.14	0.05	0.16	-0.31	17z	26th
	Fishguard	743	0.89	-0.15	0.04	0.16	-0.29	6z	28th
	Barmouth	614	0.79	-0.06	0.06	0.09	-0.31	5z	24th
	Holyhead	375	0.95	-0.07	0.04	0.08	-0.20	5z	3rd
	Llandudno	743	0.79	-0.04	0.07	0.08	-0.20	4z	3rd
	Liverpool	No Observations Available							
	Heysham	416	0.66	-0.07	0.07	0.10	-0.27	8z	19th
	Workington	743	0.88	0.06	0.06	0.08	0.25	17z	24th
	St. Marys	No Observations Available							
	Newlyn	743	0.90	-0.09	0.04	0.10	-0.20	19z	2nd
	Plymouth	743	0.82	-0.04	0.06	0.07	-0.21	1z	21st
	Weymouth	743	0.84	-0.06	0.05	0.09	-0.22	18z	26th
	Portsmouth	743	0.82	-0.05	0.06	0.08	-0.22	13z	5th
	Newhaven	743	0.79	-0.04	0.06	0.08	-0.23	12z	31st
	Dover	743	0.82	-0.05	0.07	0.09	-0.28	21z	21st
	Jersey	743	0.63	-0.09	0.10	0.13	-0.35	7z	28th
	Port Erin	743	0.89	0.14	0.05	0.15	0.28	15z	19th
	Portpatrick	743	0.92	-0.05	0.04	0.07	-0.23	3z	3rd
	Millport	743	0.90	-0.02	0.06	0.06	-0.23	2z	3rd
	Islay	743	0.94	-0.08	0.04	0.10	-0.28	2z	3rd
	Tobermory	743	0.94	-0.05	0.04	0.07	-0.23	2z	3rd
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	743	0.95	-0.03	0.04	0.05	-0.19	3z	3rd
	Kinlochbervie	743	0.96	-0.04	0.04	0.06	-0.20	3z	3rd
	Lerwick	743	0.92	-0.04	0.03	0.06	-0.17	13z	3rd
	Newport	743	0.42	-0.11	0.18	0.21	-0.71	19z	28th
	Bournemouth	743	0.81	-0.06	0.06	0.09	-0.23	19z	16th

Table 4a: Statistics based on hourly data for July 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR & DATE			
Stornoway	60	0.97	-0.05	0.03	0.06	-0.15	18z	3rd	
Wick	60	0.95	-0.05	0.04	0.07	-0.20	9z	3rd	
Aberdeen	60	0.92	-0.06	0.04	0.07	-0.18	11z	3rd	
North Shields	59	0.93	-0.10	0.04	0.11	-0.22	3z	6th	
Whitby	59	0.93	-0.18	0.05	0.19	-0.32	14z	3rd	
Immingham	60	0.85	-0.05	0.06	0.09	-0.23	5z	5th	
Cromer	60	0.89	-0.01	0.06	0.06	-0.20	6z	5th	
Lowestoft	60	0.93	-0.05	0.05	0.07	-0.19	19z	3rd	
Felixstowe	60	0.89	-0.06	0.05	0.09	-0.23	22z	3rd	
Sheerness	60	0.86	-0.07	0.06	0.09	-0.19	23z	3rd	
Ilfracombe	60	0.75	-0.06	0.05	0.09	-0.18	11z	14th	
Hinkley Point	60	0.56	-0.03	0.09	0.10	-0.24	20z	8th	
Avonmouth	60	0.38	-0.07	0.14	0.15	0.39	15z	30th	
Mumbles	60	0.62	0.03	0.07	0.07	0.22	14z	30th	
Milford Haven	60	0.90	-0.13	0.04	0.14	-0.21	12z	15th	
Fishguard	60	0.91	-0.13	0.03	0.14	-0.23	5z	3rd	
Barmouth	49	0.89	-0.06	0.04	0.07	-0.17	14z	15th	
Holyhead	31	0.96	-0.06	0.03	0.07	-0.13	7z	2nd	
Llandudno	60	0.84	-0.05	0.06	0.08	-0.16	19z	17th	
Liverpool	No Observations Available								
Heysham	34	0.82	-0.10	0.06	0.12	-0.21	17z	14th	
Workington	60	0.93	0.04	0.04	0.06	0.15	20z	30th	
St. Marys	No Observations Available								
Newlyn	59	0.94	-0.09	0.03	0.10	-0.16	15z	3rd	
Plymouth	60	0.84	-0.04	0.05	0.07	-0.13	16z	3rd	
Weymouth	60	0.85	-0.04	0.04	0.07	-0.16	15z	31st	
Portsmouth	60	0.89	-0.06	0.05	0.08	-0.17	11z	5th	
Newhaven	60	0.88	-0.04	0.04	0.06	-0.16	11z	5th	
Dover	60	0.90	-0.04	0.05	0.07	-0.23	22z	3rd	
Jersey	60	0.57	-0.02	0.08	0.08	-0.17	12z	14th	
Port Erin	60	0.94	0.13	0.04	0.14	0.22	14z	25th	
Portpatrick	60	0.94	-0.07	0.04	0.08	-0.16	21z	17th	
Millport	60	0.89	-0.03	0.06	0.07	-0.16	19z	15th	
Islay	60	0.94	-0.07	0.05	0.09	-0.27	3z	3rd	
Tobermory	60	0.95	-0.04	0.05	0.07	-0.21	3z	3rd	
Moray Firth	No Observations Available								
Leith	No Observations Available								
Ullapool	60	0.96	-0.02	0.04	0.05	-0.13	14z	16th	
Kinlochbervie	60	0.97	-0.03	0.04	0.05	-0.14	5z	3rd	
Lerwick	60	0.93	-0.04	0.03	0.06	-0.14	21z	3rd	
Newport	60	0.38	-0.05	0.13	0.14	-0.32	13z	15th	
Bournemouth	92	0.84	-0.06	0.06	0.09	-0.20	21z	17th	

Table 4b: Statistics at HW for July 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
	Stornoway	737	0.94	-0.02	0.04	0.05	0.15	19z	24th
	Wick	730	0.96	-0.01	0.03	0.04	-0.14	9z	24th
	Aberdeen	737	0.95	-0.03	0.04	0.05	-0.19	21z	24th
	North Shields	737	0.94	-0.07	0.04	0.09	-0.24	19z	24th
	Whitby	737	0.94	-0.15	0.04	0.16	-0.34	19z	24th
	Immingham	737	0.87	-0.05	0.08	0.10	-0.39	17z	24th
	Cromer	737	0.94	0.00	0.06	0.06	-0.31	17z	24th
	Lowestoft	737	0.94	-0.05	0.05	0.07	-0.30	0z	25th
	Felixstowe	737	0.89	0.00	0.07	0.07	-0.37	1z	25th
	Sheerness	737	0.85	-0.02	0.09	0.10	-0.45	1z	25th
	Ilfracombe	737	0.58	-0.08	0.08	0.11	-0.27	11z	15th
	Hinkley Point	737	0.37	-0.03	0.14	0.14	-0.40	19z	28th
	Avonmouth	737	0.17	-0.07	0.27	0.28	-0.75	20z	27th
	Mumbles	737	0.53	0.03	0.10	0.11	0.31	0z	26th
	Milford Haven	737	0.77	-0.13	0.05	0.14	-0.27	18z	26th
	Fishguard	737	0.81	-0.13	0.05	0.14	-0.27	16z	8th
	Barmouth	737	0.75	-0.06	0.08	0.10	-0.53	5z	22nd
	Holyhead	737	0.88	-0.05	0.04	0.07	-0.17	11z	26th
	Llandudno	737	0.82	-0.03	0.06	0.07	-0.22	11z	26th
	Liverpool	449	0.79	-0.15	0.09	0.18	-0.39	11z	26th
	Heysham	737	0.84	-0.04	0.07	0.09	0.25	7z	21st
	Workington	737	0.87	0.07	0.07	0.10	0.41	17z	24th
	St. Marys	483	0.80	-0.07	0.04	0.08	-0.17	17z	26th
	Newlyn	704	0.75	-0.09	0.04	0.10	-0.21	17z	8th
	Plymouth	737	0.57	-0.04	0.07	0.08	-0.20	16z	8th
	Weymouth	737	0.67	-0.06	0.06	0.08	-0.22	20z	15th
	Portsmouth	737	0.74	-0.05	0.06	0.08	-0.19	8z	25th
	Newhaven	737	0.70	-0.04	0.07	0.08	-0.23	17z	15th
	Dover	737	0.81	-0.05	0.08	0.09	-0.34	16z	15th
	Jersey	737	0.38	-0.08	0.12	0.15	-0.39	7z	26th
	Port Erin	737	0.87	0.16	0.05	0.17	0.31	17z	24th
	Portpatrick	737	0.90	-0.03	0.05	0.06	-0.14	14z	31st
	Millport	737	0.88	0.01	0.06	0.06	0.20	21z	24th
	Islay	727	0.91	-0.06	0.05	0.08	-0.18	12z	8th
	Tobermory	597	0.92	-0.03	0.04	0.06	-0.15	1z	5th
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	737	0.95	0.00	0.04	0.04	0.15	20z	24th
	Kinlochbervie	737	0.95	-0.02	0.04	0.05	0.20	19z	24th
	Lerwick	737	0.96	-0.02	0.03	0.03	-0.09	3z	15th
	Newport	737	0.26	-0.09	0.20	0.23	-0.96	3z	22nd
	Bournemouth	737	0.68	-0.05	0.06	0.08	-0.27	19z	15th

Table 5a: Statistics based on hourly data for August 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	60	0.94	-0.01	0.04	0.04	0.13	22z 24th
Wick	59	0.94	-0.02	0.04	0.05	-0.12	14z 9th
Aberdeen	58	0.95	-0.04	0.03	0.05	-0.16	17z 24th
North Shields	59	0.93	-0.09	0.04	0.10	-0.19	18z 24th
Whitby	60	0.92	-0.17	0.04	0.17	-0.34	19z 24th
Immingham	60	0.91	-0.05	0.06	0.08	-0.23	21z 24th
Cromer	60	0.93	0.00	0.05	0.05	-0.21	22z 24th
Lowestoft	60	0.96	-0.04	0.04	0.06	-0.20	1z 25th
Felixstowe	59	0.93	-0.07	0.05	0.09	-0.29	3z 25th
Sheerness	59	0.89	-0.09	0.07	0.12	-0.24	22z 30th
Ilfracombe	60	0.54	-0.05	0.08	0.10	-0.21	16z 30th
Hinkley Point	60	0.32	-0.03	0.13	0.13	-0.29	17z 30th
Avonmouth	60	0.24	-0.09	0.17	0.19	-0.43	11z 12th
Mumbles	60	0.46	0.04	0.09	0.10	0.29	23z 25th
Milford Haven	60	0.77	-0.11	0.05	0.12	-0.22	16z 30th
Fishguard	60	0.79	-0.10	0.04	0.11	-0.19	17z 30th
Barmouth	60	0.74	-0.04	0.05	0.07	-0.15	18z 30th
Holyhead	59	0.81	-0.05	0.05	0.07	-0.15	18z 15th
Llandudno	59	0.74	-0.03	0.06	0.07	0.15	3z 26th
Liverpool	36	0.76	-0.16	0.07	0.17	-0.34	7z 16th
Heysham	59	0.78	-0.07	0.06	0.10	-0.21	14z 9th
Workington	59	0.84	0.05	0.06	0.08	0.20	4z 26th
St. Marys	39	0.82	-0.05	0.04	0.07	-0.16	15z 30th
Newlyn	57	0.72	-0.09	0.04	0.10	-0.21	15z 30th
Plymouth	60	0.60	-0.05	0.06	0.08	-0.20	15z 30th
Weymouth	61	0.64	-0.05	0.06	0.08	-0.18	3z 30th
Portsmouth	59	0.70	-0.06	0.05	0.09	-0.18	3z 25th
Newhaven	59	0.69	-0.04	0.07	0.08	-0.17	9z 30th
Dover	59	0.87	-0.05	0.06	0.08	-0.26	3z 25th
Jersey	60	0.33	-0.01	0.10	0.10	-0.22	16z 30th
Port Erin	59	0.83	0.15	0.05	0.16	0.28	15z 24th
Portpatrick	59	0.91	-0.05	0.04	0.07	-0.12	22z 30th
Millport	59	0.91	-0.01	0.05	0.05	0.15	5z 26th
Islay	61	0.91	-0.05	0.05	0.07	-0.15	2z 1st
Tobermory	49	0.89	-0.01	0.05	0.05	0.13	21z 24th
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	60	0.96	0.01	0.04	0.04	-0.08	12z 13th
Kinlochbervie	60	0.96	0.00	0.04	0.04	0.11	23z 24th
Lerwick	59	0.96	-0.01	0.03	0.03	-0.08	6z 15th
Newport	60	0.25	-0.06	0.18	0.19	-0.47	4z 30th
Bournemouth	91	0.64	-0.04	0.06	0.07	-0.24	20z 15th

Table 5b: Statistics at HW for August 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	&	DATE
	Stornoway	530	0.93	-0.01	0.04	0.04	-0.14	18z	9th
	Wick	719	0.96	0.00	0.04	0.04	-0.16	22z	19th
	Aberdeen	719	0.94	-0.02	0.04	0.05	-0.19	21z	19th
	North Shields	564	0.95	-0.06	0.05	0.08	-0.24	0z	20th
	Whitby	719	0.95	-0.13	0.05	0.15	-0.31	4z	20th
	Immingham	719	0.90	-0.02	0.08	0.08	-0.36	3z	20th
	Cromer	719	0.95	0.00	0.07	0.07	-0.29	5z	20th
	Lowestoft	719	0.96	-0.05	0.06	0.08	-0.25	7z	20th
	Felixstowe	719	0.93	-0.02	0.07	0.07	-0.28	8z	20th
	Sheerness	719	0.90	-0.04	0.09	0.10	-0.37	8z	18th
	Ilfracombe	719	0.67	-0.06	0.09	0.11	-0.28	5z	7th
	Hinkley Point	719	0.46	-0.01	0.16	0.17	-0.53	5z	28th
	Avonmouth	719	0.38	-0.07	0.24	0.25	-0.74	7z	26th
	Mumbles	719	0.63	0.04	0.11	0.12	0.41	0z	29th
	Milford Haven	719	0.83	-0.12	0.06	0.14	-0.27	4z	7th
	Fishguard	719	0.85	-0.12	0.05	0.13	-0.25	2z	3rd
	Barmouth	719	0.85	-0.04	0.08	0.09	-0.49	3z	18th
	Holyhead	717	0.91	-0.02	0.05	0.06	0.17	4z	29th
	Llandudno	719	0.86	-0.01	0.08	0.08	0.28	5z	29th
	Liverpool	No Observations Available							
	Heysham	719	0.88	-0.02	0.08	0.09	-0.39	0z	14th
	Workington	719	0.91	0.09	0.08	0.11	0.43	19z	26th
	St. Marys	719	0.84	-0.06	0.04	0.07	-0.16	4z	7th
	Newlyn	719	0.83	-0.08	0.05	0.10	-0.22	19z	12th
	Plymouth	719	0.66	-0.02	0.07	0.08	-0.20	16z	7th
	Weymouth	719	0.68	-0.05	0.06	0.08	-0.21	8z	10th
	Portsmouth	719	0.74	-0.04	0.06	0.08	-0.26	9z	27th
	Newhaven	719	0.76	-0.02	0.07	0.08	-0.28	9z	28th
	Dover	719	0.85	-0.04	0.08	0.09	-0.33	9z	20th
	Jersey	719	0.44	-0.06	0.12	0.14	-0.43	6z	7th
	Port Erin	719	0.92	0.17	0.05	0.18	0.35	17z	27th
	Portpatrick	719	0.93	-0.03	0.06	0.07	-0.19	12z	29th
	Millport	719	0.91	0.02	0.07	0.07	0.31	17z	28th
	Islay	719	0.94	-0.04	0.05	0.07	-0.20	17z	24th
	Tobermory	719	0.96	-0.01	0.05	0.05	-0.20	17z	24th
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	719	0.97	0.02	0.04	0.05	0.19	15z	26th
	Kinlochbervie	719	0.97	0.00	0.04	0.04	-0.14	18z	9th
	Lerwick	719	0.96	0.00	0.03	0.03	-0.14	22z	19th
	Newport	719	0.39	-0.09	0.23	0.24	-0.90	2z	19th
	Bournemouth	719	0.72	-0.03	0.06	0.07	-0.21	17z	12th

Table 6a: Statistics based on hourly data for September 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	43	0.91	0.00	0.04	0.04	0.13	17z 28th
Wick	58	0.95	-0.02	0.04	0.05	-0.13	0z 20th
Aberdeen	57	0.94	-0.03	0.04	0.06	-0.15	2z 20th
North Shields	45	0.94	-0.08	0.05	0.10	-0.22	4z 20th
Whitby	58	0.94	-0.15	0.05	0.17	-0.28	5z 20th
Immingham	58	0.92	-0.02	0.08	0.08	-0.22	2z 28th
Cromer	58	0.95	-0.01	0.06	0.06	0.14	18z 16th
Lowestoft	58	0.96	-0.04	0.05	0.07	-0.17	10z 20th
Felixstowe	58	0.95	-0.06	0.05	0.09	-0.17	21z 14th
Sheerness	58	0.94	-0.09	0.07	0.11	-0.28	21z 14th
Ilfracombe	58	0.79	-0.04	0.07	0.09	-0.19	18z 3rd
Hinkley Point	58	0.54	-0.02	0.14	0.14	-0.43	4z 28th
Avonmouth	58	0.49	-0.12	0.19	0.23	-0.60	4z 28th
Mumbles	58	0.71	0.02	0.10	0.10	0.28	0z 26th
Milford Haven	58	0.91	-0.10	0.05	0.12	-0.18	19z 5th
Fishguard	58	0.94	-0.08	0.04	0.09	-0.18	17z 28th
Barmouth	58	0.91	-0.02	0.06	0.07	-0.18	4z 14th
Holyhead	57	0.91	-0.04	0.05	0.07	-0.13	12z 6th
Llandudno	58	0.88	-0.02	0.07	0.07	-0.16	12z 6th
Liverpool	No Observations Available						
Heysham	58	0.92	-0.07	0.06	0.10	-0.20	13z 6th
Workington	58	0.90	0.06	0.07	0.10	0.43	18z 26th
St. Marys	58	0.86	-0.05	0.04	0.07	-0.13	17z 2nd
Newlyn	58	0.87	-0.08	0.04	0.10	-0.17	17z 2nd
Plymouth	58	0.78	-0.03	0.06	0.07	-0.14	17z 2nd
Weymouth	59	0.81	-0.04	0.05	0.06	-0.14	3z 28th
Portsmouth	58	0.78	-0.05	0.06	0.09	-0.24	9z 28th
Newhaven	58	0.82	-0.03	0.07	0.08	-0.26	8z 28th
Dover	58	0.90	-0.05	0.07	0.08	-0.23	8z 28th
Jersey	58	0.59	-0.01	0.08	0.08	-0.21	4z 28th
Port Erin	58	0.92	0.15	0.05	0.16	0.29	18z 26th
Portpatrick	58	0.93	-0.04	0.05	0.07	-0.15	1z 5th
Millport	58	0.92	-0.01	0.06	0.07	-0.17	21z 28th
Islay	61	0.93	-0.02	0.05	0.06	0.13	7z 27th
Tobermory	58	0.96	8.03	0.04	0.04	0.11	21z 23rd
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	58	0.96	0.03	0.05	0.06	0.15	10z 23rd
Kinlochbervie	58	0.97	0.01	0.04	0.04	0.10	14z 26th
Lerwick	58	0.96	0.00	0.03	0.03	-0.10	0z 20th
Newport	58	0.50	-0.07	0.19	0.20	-0.61	4z 28th
Bournemouth	90	0.69	-0.01	0.06	0.06	-0.17	17z 24th

Table 6b: Statistics at HW for September 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	351	0.98	-0.00	0.04	0.04	-0.15	4z 31st
Wick	637	0.97	0.01	0.05	0.05	-0.18	4z 31st
Aberdeen	743	0.96	-0.01	0.05	0.05	-0.19	20z 30th
North Shields	743	0.93	-0.06	0.07	0.09	-0.29	23z 30th
Whitby	743	0.93	-0.12	0.07	0.14	-0.37	23z 30th
Immingham	743	0.85	-0.03	0.09	0.10	-0.36	3z 28th
Cromer	743	0.91	-0.03	0.08	0.09	-0.36	2z 31st
Lowestoft	743	0.91	-0.08	0.08	0.12	-0.36	10z 28th
Felixstowe	582	0.85	-0.05	0.09	0.11	-0.38	23z 30th
Sheerness	743	0.83	-0.07	0.11	0.13	-0.49	10z 28th
Ilfracombe	743	0.89	-0.05	0.08	0.10	-0.30	15z 27th
Hinkley Point	743	0.76	0.01	0.14	0.14	-0.45	17z 27th
Avonmouth	743	0.64	-0.04	0.22	0.22	-0.68	14z 28th
Mumbles	743	0.86	0.06	0.10	0.12	0.40	23z 21st
Milford Haven	743	0.95	-0.10	0.06	0.13	-0.35	11z 28th
Fishguard	743	0.96	-0.09	0.05	0.11	-0.25	11z 28th
Barmouth	743	0.93	-0.00	0.09	0.09	-0.37	13z 28th
Holyhead	743	0.96	-0.00	0.05	0.05	-0.18	9z 30th
Llandudno	743	0.92	0.02	0.08	0.09	0.32	0z 2nd
Liverpool	No Observations Available						
Heysham	743	0.93	0.00	0.08	0.08	-0.29	0z 30th
Workington	743	0.95	0.12	0.08	0.14	0.37	0z 31st
St. Marys	743	0.94	-0.05	0.06	0.07	-0.25	14z 29th
Newlyn	743	0.93	-0.06	0.06	0.09	-0.28	15z 27th
Plymouth	743	0.87	-0.00	0.08	0.08	-0.28	14z 27th
Weymouth	743	0.87	-0.03	0.07	0.08	-0.26	2z 27th
Portsmouth	743	0.83	-0.03	0.08	0.09	-0.31	10z 28th
Newhaven	743	0.83	-0.01	0.08	0.09	-0.35	8z 28th
Dover	743	0.82	-0.05	0.09	0.11	-0.42	8z 28th
Jersey	743	0.72	-0.04	0.12	0.12	-0.40	15z 29th
Port Erin	743	0.97	0.20	0.06	0.21	0.36	9z 10th
Portpatrick	743	0.97	0.02	0.06	0.06	-0.19	11z 30th
Millport	743	0.96	0.05	0.07	0.08	0.26	9z 10th
Islay	No Observations Available						
Tobermory	No Observations Available						
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	743	0.97	0.06	0.05	0.08	0.23	9z 26th
Kinlochbervie	743	0.98	0.03	0.04	0.05	0.19	5z 10th
Lerwick	743	0.96	0.01	0.04	0.04	-0.14	17z 30th
Newport	743	0.68	-0.06	0.20	0.21	-0.61	5z 22nd
Bournemouth	743	0.86	-0.01	0.07	0.07	-0.24	11z 28th

Table 7a: Statistics based on hourly data for October 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	28	0.99	0.01	0.04	0.04	-0.08	6z 30th
	Wick	53	0.97	-0.00	0.05	0.05	-0.13	22z 31st
	Aberdeen	59	0.98	-0.02	0.04	0.05	-0.14	12z 31st
	North Shields	60	0.94	-0.09	0.06	0.11	-0.24	0z 28th
	Whitby	60	0.94	-0.16	0.06	0.17	-0.31	2z 31st
	Immingham	60	0.84	-0.06	0.09	0.11	-0.32	2z 28th
	Cromer	60	0.91	-0.04	0.07	0.09	-0.25	17z 30th
	Lowestoft	60	0.91	-0.08	0.07	0.11	-0.30	20z 30th
	Felixstowe	46	0.85	-0.12	0.09	0.15	-0.38	23z 30th
	Sheerness	59	0.79	-0.13	0.12	0.18	-0.45	22z 28th
	Ilfracombe	60	0.87	-0.04	0.09	0.10	-0.30	15z 27th
	Hinkley Point	60	0.75	-0.00	0.13	0.13	-0.36	4z 28th
	Avonmouth	60	0.63	-0.10	0.18	0.21	-0.59	4z 28th
	Mumbles	60	0.85	0.02	0.11	0.11	-0.26	4z 28th
	Milford Haven	60	0.94	-0.10	0.07	0.12	-0.33	15z 27th
	Fishguard	60	0.95	-0.07	0.06	0.09	-0.23	6z 31st
	Barmouth	60	0.94	-0.00	0.08	0.08	-0.21	17z 28th
	Holyhead	60	0.95	-0.02	0.06	0.06	-0.18	9z 30th
	Llandudno	60	0.92	-0.00	0.08	0.08	0.24	22z 1st
	Liverpool	No Observations Available						
	Heysham	60	0.93	-0.04	0.09	0.09	-0.26	9z 28th
	Workington	60	0.95	0.09	0.07	0.12	0.25	14z 21st
	St. Marys	60	0.91	-0.05	0.06	0.09	-0.22	2z 28th
	Newlyn	60	0.92	-0.07	0.07	0.10	-0.25	13z 27th
	Plymouth	60	0.87	-0.01	0.08	0.08	-0.28	14z 27th
	Weymouth	61	0.84	-0.02	0.08	0.08	-0.26	2z 27th
	Portsmouth	60	0.84	-0.03	0.08	0.09	-0.27	9z 28th
	Newhaven	60	0.76	-0.04	0.09	0.10	-0.33	9z 28th
	Dover	60	0.84	-0.07	0.09	0.12	-0.33	9z 28th
	Jersey	60	0.69	-0.01	0.11	0.11	0.29	9z 21st
	Port Erin	60	0.97	0.17	0.05	0.18	0.28	11z 1st
	Portpatrick	60	0.97	-0.00	0.05	0.05	-0.19	11z 30th
	Millport	59	0.95	0.02	0.07	0.07	-0.19	11z 30th
	Islay	No Observations Available						
	Tobermory	No Observations Available						
	Moray Firth	No Observations Available						
	Leith	No Observations Available						
	Ullapool	60	0.97	0.07	0.05	0.08	0.20	0z 25th
	Kinlochbervie	60	0.98	0.03	0.04	0.05	0.12	23z 23rd
	Lerwick	60	0.97	0.01	0.04	0.04	-0.13	22z 31st
	Newport	60	0.66	-0.05	0.18	0.19	-0.55	16z 27th
	Bournemouth	88	0.81	-0.01	0.08	0.08	-0.24	11z 28th

Table 7b: Statistics at HW for October 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX	ERR	& DATE
	Stornoway	719	0.97	0.04	0.07	0.08	0.22	8z	26th
	Wick	719	0.96	0.04	0.08	0.09	-0.28	14z	8th
	Aberdeen	719	0.95	0.01	0.09	0.09	-0.28	16z	8th
	North Shields	719	0.91	-0.06	0.10	0.12	-0.39	18z	8th
	Whitby	719	0.93	-0.14	0.09	0.17	-0.46	19z	8th
	Immingham	719	0.85	-0.02	0.13	0.14	-0.70	22z	8th
	Cromer	719	0.92	-0.04	0.12	0.13	-0.48	16z	3rd
	Lowestoft	719	0.92	-0.08	0.10	0.13	-0.52	20z	24th
	Felixstowe	719	0.90	-0.07	0.12	0.14	-0.45	22z	3rd
	Sheerness	719	0.88	-0.05	0.14	0.15	-0.68	23z	3rd
	Ilfracombe	719	0.84	-0.03	0.12	0.12	0.34	19z	25th
	Hinkley Point	719	0.76	0.03	0.17	0.17	0.61	8z	26th
	Avonmouth	719	0.67	-0.00	0.28	0.28	1.04	9z	26th
	Mumbles	719	0.85	0.07	0.13	0.15	0.47	20z	25th
	Milford Haven	719	0.89	-0.09	0.10	0.14	-0.36	5z	6th
	Fishguard	719	0.92	-0.08	0.08	0.12	-0.33	2z	2nd
	Barmouth	719	0.92	0.03	0.11	0.11	0.37	19z	25th
	Holyhead	696	0.94	0.01	0.09	0.09	0.32	16z	25th
	Llandudno	719	0.85	0.09	0.15	0.18	0.74	15z	25th
	Liverpool	349	0.71	-0.04	0.12	0.13	0.42	14z	25th
	Heysham	719	0.92	0.02	0.12	0.13	0.49	16z	25th
	Workington	719	0.94	0.16	0.12	0.20	0.70	16z	25th
	St. Marys	598	0.85	-0.02	0.08	0.08	0.29	21z	25th
	Newlyn	719	0.84	-0.04	0.09	0.10	0.30	21z	25th
	Plymouth	719	0.83	-0.00	0.10	0.10	0.30	19z	25th
	Weymouth	716	0.85	-0.01	0.09	0.09	-0.33	23z	1st
	Portsmouth	719	0.81	-0.01	0.11	0.11	-0.48	1z	2nd
	Newhaven	719	0.83	-0.01	0.10	0.10	0.41	3z	26th
	Dover	719	0.86	-0.05	0.12	0.13	-0.41	12z	7th
	Jersey	719	0.72	-0.02	0.14	0.14	-0.43	16z	2nd
	Port Erin	719	0.94	0.22	0.09	0.23	0.57	17z	25th
	Portpatrick	719	0.96	0.04	0.09	0.10	0.37	17z	25th
	Millport	719	0.95	0.06	0.11	0.12	0.47	19z	25th
	Islay	546	0.94	0.06	0.08	0.10	0.33	18z	25th
	Tobermory	679	0.97	0.04	0.07	0.08	0.32	23z	11th
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	719	0.97	0.09	0.07	0.12	0.30	9z	25th
	Kinlochbervie	719	0.98	0.07	0.07	0.11	0.30	11z	25th
	Lerwick	719	0.96	0.04	0.08	0.09	0.23	20z	25th
	Newport	719	0.72	-0.03	0.23	0.24	-0.89	17z	6th
	Bournemouth	719	0.85	-0.00	0.09	0.09	-0.40	0z	2nd

Table 8a: Statistics based on hourly data for November 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	58	0.98	0.05	0.07	0.09	0.21	3z 25th
Wick	58	0.95	0.01	0.10	0.10	0.27	7z 25th
Aberdeen	57	0.94	-0.01	0.10	0.10	0.26	9z 25th
North Shields	58	0.89	-0.10	0.11	0.15	-0.37	19z 8th
Whitby	58	0.89	-0.17	0.11	0.21	-0.44	20z 8th
Immingham	58	0.76	-0.06	0.16	0.17	-0.70	22z 8th
Cromer	58	0.88	-0.05	0.12	0.13	-0.36	23z 8th
Lowestoft	58	0.89	-0.08	0.12	0.14	-0.45	1z 9th
Felixstowe	58	0.92	-0.13	0.09	0.17	-0.39	19z 10th
Sheerness	57	0.84	-0.13	0.11	0.18	-0.40	1z 4th
Ilfracombe	58	0.88	-0.04	0.08	0.09	-0.24	3z 27th
Hinkley Point	58	0.84	-0.01	0.11	0.11	-0.36	4z 27th
Avonmouth	58	0.83	-0.09	0.15	0.17	-0.59	4z 27th
Mumbles	58	0.87	0.03	0.09	0.10	0.20	5z 14th
Milford Haven	58	0.91	-0.10	0.07	0.13	-0.26	20z 5th
Fishguard	58	0.93	-0.07	0.06	0.09	-0.20	19z 1st
Barmouth	58	0.94	-0.00	0.10	0.10	0.23	15z 25th
Holyhead	56	0.93	-0.01	0.10	0.10	0.25	18z 25th
Llandudno	58	0.84	0.04	0.15	0.16	0.63	18z 25th
Liverpool	29	0.81	-0.12	0.10	0.16	-0.25	22z 30th
Heysham	58	0.95	-0.03	0.09	0.09	0.22	19z 25th
Workington	58	0.94	0.11	0.10	0.14	0.38	19z 25th
St. Marys	48	0.86	-0.03	0.08	0.09	-0.20	17z 1st
Newlyn	58	0.86	-0.06	0.08	0.10	-0.25	16z 1st
Plymouth	58	0.86	-0.00	0.09	0.09	0.22	12z 25th
Weymouth	58	0.92	-0.01	0.06	0.06	-0.19	2z 11th
Portsmouth	58	0.89	-0.02	0.09	0.09	-0.29	23z 1st
Newhaven	58	0.91	-0.05	0.07	0.09	-0.29	23z 1st
Dover	58	0.87	-0.09	0.11	0.14	-0.32	1z 4th
Jersey	58	0.86	0.02	0.09	0.09	0.22	12z 9th
Port Erin	58	0.95	0.18	0.10	0.20	0.47	19z 25th
Portpatrick	58	0.95	0.01	0.09	0.09	0.31	19z 25th
Millport	57	0.93	0.03	0.11	0.11	0.46	20z 25th
Islay	46	0.95	0.07	0.09	0.12	0.31	18z 24th
Tobermory	55	0.97	0.05	0.08	0.09	0.29	12z 25th
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	58	0.97	0.10	0.08	0.13	0.25	7z 17th
Kinlochbervie	58	0.97	0.09	0.09	0.12	0.25	5z 12th
Lerwick	58	0.97	0.04	0.07	0.08	0.20	18z 25th
Newport	58	0.77	-0.05	0.15	0.16	-0.54	4z 27th
Bournemouth	81	0.86	0.00	0.09	0.09	0.30	5z 26th

Table 8b: Statistics at HW for November 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	737	0.95	0.10	0.05	0.11	0.26	23z	19th
Wick	737	0.92	0.10	0.05	0.12	0.27	17z	19th
Aberdeen	737	0.90	0.06	0.06	0.08	0.28	19z	17th
North Shields	737	0.91	0.01	0.06	0.07	0.20	15z	17th
Whitby	737	0.94	-0.08	0.08	0.11	-0.45	9z	16th
Immingham	737	0.89	0.03	0.10	0.10	0.59	16z	17th
Cromer	737	0.96	0.03	0.08	0.09	0.50	16z	17th
Lowestoft	737	0.97	-0.00	0.07	0.07	-0.30	18z	16th
Felixstowe	737	0.94	-0.00	0.10	0.09	-0.31	12z	16th
Sheerness	737	0.91	-0.01	0.12	0.12	-0.51	11z	3rd
Ilfracombe	737	0.89	-0.01	0.09	0.09	-0.26	2z	2nd
Hinkley Point	737	0.80	0.05	0.14	0.15	-0.51	2z	2nd
Avonmouth	737	0.67	0.02	0.23	0.23	-0.71	3z	2nd
Mumbles	737	0.87	0.10	0.10	0.14	0.42	10z	3rd
Milford Haven	737	0.94	-0.05	0.07	0.09	-0.24	2z	2nd
Fishguard	737	0.94	-0.05	0.06	0.09	-0.21	3z	2nd
Barmouth	737	0.92	0.08	0.08	0.11	0.29	15z	8th
Holyhead	504	0.94	0.05	0.07	0.08	0.20	18z	16th
Llandudno	737	0.83	0.11	0.11	0.15	0.50	15z	16th
Liverpool	737	0.87	-0.04	0.10	0.10	-0.30	7z	27th
Heysham	737	0.90	0.08	0.09	0.12	0.33	21z	18th
Workington	737	0.91	0.21	0.09	0.23	0.45	19z	3rd
St. Marys	737	0.93	0.01	0.06	0.06	0.20	22z	2nd
Newlyn	737	0.94	-0.02	0.06	0.06	0.19	10z	3rd
Plymouth	No Observations Available							
Weymouth	737	0.91	0.01	0.08	0.08	-0.35	15z	2nd
Portsmouth	737	0.89	0.03	0.09	0.09	-0.46	17z	2nd
Newhaven	737	0.90	0.03	0.08	0.08	0.25	4z	3rd
Dover	737	0.88	0.00	0.11	0.11	0.36	4z	3rd
Jersey	737	0.84	-0.00	0.13	0.13	-0.42	15z	2nd
Port Erin	737	0.94	0.04	0.06	0.08	0.22	21z	16th
Portpatrick	No Observations Available							
Millport	737	0.92	0.12	0.08	0.15	0.43	9z	21st
Islay	737	0.94	0.08	0.07	0.10	0.27	18z	16th
Tobermory	737	0.94	0.09	0.06	0.11	0.29	6z	21st
Moray Firth	No Observations Available							
Leith	No Observations Available							
Ullapool	650	0.94	0.16	0.06	0.17	0.35	16z	18th
Kinlochbervie	737	0.94	0.15	0.06	0.16	0.34	5z	19th
Lerwick	737	0.92	0.10	0.04	0.11	0.31	16z	17th
Newport	737	0.74	-0.00	0.19	0.19	-0.59	3z	2nd
Bournemouth	737	0.90	0.02	0.08	0.08	-0.46	16z	2nd

Table 9a: Statistics based on hourly data for December 2005.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	59	0.94	0.10	0.06	0.12	0.21	9z 20th
Wick	59	0.93	0.08	0.05	0.09	0.20	12z 17th
Aberdeen	59	0.91	0.04	0.05	0.07	0.17	14z 17th
North Shields	60	0.88	-0.02	0.07	0.07	-0.16	0z 12th
Whitby	59	0.91	-0.11	0.07	0.13	-0.29	5z 17th
Immingham	59	0.88	0.01	0.10	0.10	0.25	19z 17th
Cromer	59	0.96	0.02	0.08	0.08	0.24	20z 17th
Lowestoft	59	0.97	-0.02	0.07	0.07	0.18	22z 17th
Felixstowe	59	0.97	-0.09	0.07	0.12	-0.31	12z 16th
Sheerness	59	0.96	-0.12	0.08	0.15	-0.43	13z 16th
Ilfracombe	59	0.89	-0.00	0.08	0.08	0.20	19z 31st
Hinkley Point	59	0.83	0.02	0.11	0.11	0.27	19z 30th
Avonmouth	59	0.82	-0.03	0.12	0.13	-0.27	22z 20th
Mumbles	59	0.93	0.08	0.07	0.11	0.26	12z 8th
Milford Haven	59	0.94	-0.05	0.06	0.09	-0.19	3z 27th
Fishguard	59	0.93	-0.04	0.06	0.07	-0.16	15z 26th
Barmouth	59	0.94	0.06	0.07	0.09	0.20	7z 14th
Holyhead	41	0.93	0.03	0.07	0.08	0.15	23z 16th
Llandudno	60	0.86	0.06	0.09	0.11	0.36	0z 17th
Liverpool	59	0.93	-0.12	0.06	0.14	-0.29	8z 27th
Heysham	59	0.90	0.01	0.08	0.08	0.22	12z 31st
Workington	59	0.92	0.17	0.07	0.18	0.34	12z 31st
St. Marys	59	0.93	-0.00	0.06	0.06	0.16	6z 3rd
Newlyn	59	0.94	-0.02	0.06	0.06	-0.17	1z 27th
Plymouth	No Observations Available						
Weymouth	59	0.91	0.03	0.07	0.08	0.25	7z 3rd
Portsmouth	59	0.93	0.01	0.07	0.07	0.18	0z 3rd
Newhaven	59	0.91	-0.00	0.07	0.07	0.20	23z 30th
Dover	59	0.94	-0.04	0.07	0.09	-0.20	12z 16th
Jersey	59	0.91	0.07	0.09	0.11	0.31	8z 3rd
Port Erin	59	0.95	0.01	0.06	0.06	0.16	0z 17th
Portpatrick	No Observations Available						
Millport	59	0.93	0.10	0.07	0.12	0.30	1z 17th
Islay	59	0.94	0.10	0.06	0.12	0.27	18z 16th
Tobermory	59	0.94	0.10	0.06	0.12	0.21	18z 31st
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	52	0.93	0.17	0.06	0.19	0.28	20z 17th
Kinlochbervie	59	0.94	0.16	0.06	0.17	0.30	10z 19th
Lerwick	60	0.93	0.10	0.04	0.10	0.19	14z 21st
Newport	59	0.76	-0.04	0.15	0.15	0.32	13z 8th
Bournemouth	84	0.86	0.02	0.08	0.09	0.22	0z 20th

Table 9b: Statistics at HW for December 2005.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	743	0.97	0.10	0.05	0.11	0.31	16z 12th
	Wick	672	0.96	0.10	0.05	0.11	0.30	19z 12th
	Aberdeen	743	0.95	0.06	0.06	0.08	0.31	20z 12th
	North Shields	743	0.93	-0.01	0.07	0.07	-0.29	16z 11th
	Whitby	743	0.94	-0.09	0.07	0.11	-0.36	16z 11th
	Immingham	463	0.82	0.00	0.09	0.09	-0.28	19z 24th
	Cromer	743	0.94	0.02	0.08	0.09	-0.32	19z 11th
	Lowestoft	743	0.96	-0.02	0.06	0.07	-0.23	21z 11th
	Felixstowe	743	0.93	0.00	0.08	0.08	-0.33	23z 11th
	Sheerness	743	0.91	-0.03	0.10	0.11	-0.36	22z 11th
	Ilfracombe	732	0.79	-0.02	0.08	0.09	-0.25	10z 25th
	Hinkley Point	743	0.67	0.03	0.13	0.14	-0.37	10z 25th
	Avonmouth	743	0.51	-0.00	0.22	0.22	-0.72	11z 25th
	Mumbles	743	0.76	0.09	0.10	0.13	0.39	14z 1st
	Milford Haven	743	0.89	-0.07	0.06	0.09	-0.23	10z 26th
	Fishguard	743	0.91	-0.07	0.05	0.09	-0.20	16z 30th
	Barmouth	743	0.89	0.05	0.09	0.10	-0.43	17z 31st
	Holyhead	743	0.94	0.03	0.05	0.06	0.23	18z 1st
	Llandudno	743	0.89	0.09	0.08	0.12	0.40	17z 1st
	Liverpool	743	0.90	-0.05	0.09	0.10	-0.33	4z 20th
	Heysham	743	0.92	0.07	0.08	0.11	0.35	8z 2nd
	Workington	743	0.93	0.22	0.08	0.23	0.48	18z 10th
	St. Marys	743	0.83	0.00	0.04	0.04	0.16	11z 1st
	Newlyn	743	0.85	-0.04	0.05	0.06	-0.16	8z 25th
	Plymouth	No Observations Available						
	Weymouth	743	0.85	-0.00	0.06	0.06	0.26	9z 1st
	Portsmouth	743	0.85	0.01	0.07	0.07	0.22	5z 2nd
	Newhaven	743	0.88	0.01	0.07	0.07	-0.20	5z 25th
	Dover	743	0.91	-0.01	0.08	0.08	-0.28	11z 31st
	Jersey	743	0.68	-0.01	0.11	0.12	-0.38	17z 15th
	Port Erin	743	0.95	0.04	0.06	0.07	0.24	17z 1st
	Portpatrick	No Observations Available						
	Millport	743	0.94	0.12	0.07	0.14	0.33	10z 1st
	Islay	743	0.96	0.06	0.06	0.08	0.28	8z 1st
	Tobermory	697	0.95	0.09	0.06	0.11	0.29	17z 12th
	Moray Firth	No Observations Available						
	Leith	No Observations Available						
	Ullapool	743	0.96	0.17	0.06	0.18	0.37	15z 1st
	Kinlochbervie	743	0.97	0.16	0.06	0.17	0.38	1z 11th
	Lerwick	743	0.97	0.08	0.04	0.09	0.18	23z 3rd
	Newport	743	0.60	-0.01	0.18	0.18	-0.68	15z 31st
	Bournemouth	743	0.85	0.01	0.06	0.07	0.22	9z 1st

Table 10a: Statistics based on hourly data for January 2006.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	60	0.98	0.10	0.04	0.11	0.20	20z 1st
Wick	53	0.97	0.09	0.04	0.10	0.16	10z 12th
Aberdeen	60	0.95	0.04	0.05	0.07	0.18	12z 12th
North Shields	60	0.96	-0.03	0.06	0.07	-0.21	7z 20th
Whitby	60	0.96	-0.11	0.06	0.13	-0.33	14z 11th
Immingham	37	0.86	0.03	0.07	0.08	0.20	11z 6th
Cromer	60	0.95	0.00	0.07	0.07	-0.28	17z 11th
Lowestoft	60	0.97	-0.03	0.06	0.06	-0.18	13z 20th
Felixstowe	59	0.94	-0.07	0.07	0.10	-0.26	15z 20th
Sheerness	60	0.92	-0.09	0.09	0.13	-0.29	23z 11th
Ilfracombe	59	0.86	0.00	0.08	0.08	-0.15	19z 15th
Hinkley Point	60	0.86	0.01	0.12	0.12	0.28	1z 8th
Avonmouth	60	0.84	-0.00	0.17	0.16	0.43	2z 8th
Mumbles	60	0.85	0.09	0.09	0.13	0.24	16z 10th
Milford Haven	60	0.91	-0.05	0.05	0.08	-0.16	20z 17th
Fishguard	60	0.94	-0.05	0.05	0.07	-0.14	0z 22nd
Barmouth	60	0.94	0.06	0.06	0.08	0.19	4z 9th
Holyhead	59	0.93	0.02	0.06	0.06	0.15	11z 1st
Llandudno	59	0.92	0.06	0.06	0.09	0.28	12z 1st
Liverpool	59	0.93	-0.11	0.06	0.13	-0.23	14z 4th
Heysham	59	0.96	0.02	0.06	0.06	0.18	9z 10th
Workington	59	0.95	0.18	0.07	0.20	0.37	10z 11th
St. Marys	60	0.86	-0.00	0.04	0.04	0.12	6z 1st
Newlyn	60	0.87	-0.03	0.05	0.06	-0.12	6z 15th
Plymouth	No Observations Available						
Weymouth	60	0.86	0.01	0.06	0.06	0.17	7z 1st
Portsmouth	59	0.91	0.00	0.07	0.07	0.16	12z 1st
Newhaven	59	0.92	0.00	0.07	0.07	-0.14	22z 11th
Dover	59	0.94	-0.03	0.07	0.07	-0.22	14z 17th
Jersey	60	0.76	0.05	0.10	0.11	0.33	8z 1st
Port Erin	59	0.94	0.02	0.06	0.06	0.18	12z 1st
Portpatrick	No Observations Available						
Millport	60	0.95	0.10	0.07	0.12	0.27	0z 13th
Islay	61	0.97	0.07	0.05	0.09	0.21	19z 1st
Tobermory	56	0.96	0.10	0.06	0.11	0.29	17z 12th
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	60	0.96	0.18	0.06	0.19	0.32	8z 1st
Kinlochbervie	60	0.96	0.17	0.06	0.17	0.32	18z 11th
Lerwick	59	0.97	0.09	0.04	0.10	0.17	1z 3rd
Newport	60	0.83	-0.03	0.16	0.16	-0.33	6z 12th
Bournemouth	91	0.82	0.00	0.07	0.07	0.17	10z 1st

Table 10b: Statistics at HW for January 2006.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	671	0.98	0.05	0.05	0.07	0.18	3z 14th
	Wick	488	0.98	0.06	0.04	0.08	0.19	17z 28th
	Aberdeen	516	0.96	0.02	0.05	0.06	0.21	18z 8th
	North Shields	517	0.94	-0.05	0.06	0.08	-0.21	6z 24th
	Whitby	502	0.94	-0.12	0.07	0.14	-0.43	5z 9th
	Immingham	596	0.87	-0.04	0.10	0.11	-0.39	5z 9th
	Cromer	671	0.96	0.01	0.07	0.07	-0.26	5z 9th
	Lowestoft	520	0.97	-0.04	0.06	0.08	-0.24	6z 28th
	Felixstowe	671	0.94	-0.00	0.08	0.08	-0.27	23z 10th
	Sheerness	661	0.91	-0.05	0.11	0.12	-0.35	19z 26th
	Ilfracombe	519	0.87	-0.05	0.09	0.10	-0.28	9z 23rd
	Hinkley Point	671	0.73	-0.00	0.15	0.15	-0.50	8z 23rd
	Avonmouth	528	0.59	-0.05	0.24	0.25	-0.88	20z 22nd
	Mumbles	472	0.86	0.07	0.11	0.13	0.39	17z 16th
	Milford Haven	446	0.93	-0.09	0.07	0.12	-0.28	7z 19th
	Fishguard	528	0.94	-0.10	0.06	0.12	-0.27	7z 19th
	Barmouth	671	0.91	0.01	0.09	0.09	-0.44	16z 28th
	Holyhead	671	0.96	-0.01	0.06	0.06	-0.20	6z 25th
	Llandudno	521	0.94	0.08	0.08	0.12	0.35	14z 28th
	Liverpool	667	0.92	-0.09	0.09	0.12	-0.29	4z 23rd
	Heysham	671	0.88	0.01	0.11	0.11	-0.35	7z 26th
	Workington	671	0.95	0.17	0.08	0.19	0.42	15z 28th
	St. Marys	671	0.93	-0.02	0.05	0.06	-0.17	6z 19th
	Newlyn	658	0.91	-0.06	0.06	0.09	-0.20	9z 25th
	Plymouth	296	0.89	0.01	0.08	0.08	-0.22	19z 22nd
	Weymouth	522	0.90	-0.02	0.08	0.08	-0.27	18z 22nd
	Portsmouth	572	0.90	-0.01	0.08	0.08	-0.29	5z 26th
	Newhaven	625	0.91	-0.01	0.08	0.08	-0.22	13z 19th
	Dover	671	0.91	-0.03	0.09	0.10	-0.37	3z 23rd
	Jersey	671	0.81	-0.03	0.12	0.13	-0.39	7z 19th
	Port Erin	671	0.95	-0.00	0.06	0.06	-0.16	8z 25th
	Portpatrick	No Observations Available						
	Millport	671	0.95	0.08	0.07	0.11	0.33	18z 15th
	Islay	671	0.96	0.01	0.06	0.06	0.19	8z 17th
	Tobermory	671	0.97	0.04	0.06	0.08	0.24	2z 15th
	Moray Firth	No Observations Available						
	Leith	No Observations Available						
	Ullapool	671	0.97	0.11	0.05	0.12	0.26	17z 1st
	Kinlochbervie	643	0.98	0.10	0.05	0.11	0.24	17z 15th
	Lerwick	671	0.98	0.05	0.03	0.06	0.19	18z 28th
	Newport	671	0.65	-0.05	0.21	0.22	-0.75	16z 1st
	Bournemouth	528	0.90	-0.01	0.07	0.08	-0.27	4z 21st

Table 11a: Statistics based on hourly data for February 2006.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	54	0.98	0.07	0.05	0.08	0.18	20z 13th
Wick	39	0.99	0.05	0.04	0.06	0.13	21z 24th
Aberdeen	41	0.97	0.01	0.04	0.04	0.12	11z 9th
North Shields	41	0.95	-0.06	0.05	0.08	-0.16	17z 15th
Whitby	41	0.94	-0.14	0.07	0.16	-0.35	2z 9th
Immingham	48	0.90	-0.03	0.09	0.09	-0.21	3z 9th
Cromer	54	0.96	0.01	0.07	0.07	0.17	14z 23rd
Lowestoft	42	0.98	-0.04	0.06	0.07	-0.23	7z 9th
Felixstowe	54	0.94	-0.07	0.07	0.10	-0.27	23z 10th
Sheerness	53	0.93	-0.11	0.08	0.14	-0.27	13z 12th
Ilfracombe	40	0.90	-0.02	0.09	0.10	-0.20	21z 18th
Hinkley Point	54	0.82	0.00	0.15	0.15	-0.36	6z 10th
Avonmouth	42	0.78	-0.03	0.21	0.21	-0.48	6z 10th
Mumbles	38	0.90	0.05	0.10	0.11	0.27	3z 24th
Milford Haven	36	0.93	-0.07	0.07	0.10	-0.19	23z 21st
Fishguard	42	0.96	-0.08	0.05	0.10	-0.19	1z 22nd
Barmouth	54	0.95	0.04	0.06	0.07	0.17	12z 20th
Holyhead	54	0.94	-0.00	0.06	0.06	-0.15	14z 19th
Llandudno	42	0.94	0.07	0.08	0.11	0.27	11z 28th
Liverpool	54	0.96	-0.12	0.06	0.14	-0.25	10z 10th
Heysham	54	0.91	-0.01	0.10	0.10	-0.31	11z 27th
Workington	54	0.96	0.17	0.07	0.18	0.36	20z 7th
St. Marys	54	0.94	-0.01	0.05	0.05	-0.14	8z 19th
Newlyn	53	0.92	-0.04	0.06	0.07	-0.16	8z 19th
Plymouth	24	0.92	0.00	0.07	0.07	0.15	8z 17th
Weymouth	43	0.91	-0.02	0.07	0.08	-0.18	16z 9th
Portsmouth	46	0.92	-0.02	0.08	0.08	0.19	14z 17th
Newhaven	50	0.91	-0.00	0.08	0.08	-0.17	23z 10th
Dover	54	0.93	-0.02	0.08	0.08	-0.20	23z 10th
Jersey	54	0.84	0.06	0.12	0.13	0.31	21z 16th
Port Erin	54	0.95	-0.01	0.06	0.06	-0.15	9z 25th
Portpatrick	No Observations Available						
Millport	54	0.95	0.06	0.08	0.10	0.25	22z 24th
Islay	55	0.96	0.03	0.06	0.07	0.19	8z 17th
Tobermory	54	0.98	0.06	0.06	0.08	0.20	8z 17th
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	54	0.98	0.12	0.05	0.13	0.22	20z 13th
Kinlochbervie	52	0.98	0.12	0.05	0.13	0.22	20z 28th
Lerwick	54	0.98	0.05	0.03	0.06	0.10	21z 24th
Newport	54	0.75	-0.02	0.21	0.21	-0.54	6z 10th
Bournemouth	67	0.84	-0.00	0.09	0.09	0.25	23z 16th

Table 11b: Statistics at HW for February 2006.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
	Stornoway	743	0.94	0.04	0.06	0.07	0.19	16z 1st
	Wick	743	0.92	0.05	0.06	0.08	0.19	11z 11th
	Aberdeen	478	0.94	0.01	0.05	0.05	0.17	4z 7th
	North Shields	585	0.95	-0.02	0.07	0.07	-0.20	13z 31st
	Whitby	519	0.94	-0.12	0.05	0.13	-0.25	15z 28th
	Immingham	562	0.80	-0.02	0.09	0.09	-0.27	3z 5th
	Cromer	611	0.95	0.03	0.07	0.08	0.25	0z 14th
	Lowestoft	680	0.95	-0.02	0.07	0.08	-0.23	17z 28th
	Felixstowe	No Observations Available						
	Sheerness	677	0.88	-0.02	0.11	0.11	-0.39	20z 28th
	Ilfracombe	573	0.87	-0.04	0.09	0.10	0.31	10z 10th
	Hinkley Point	721	0.76	-0.01	0.16	0.16	0.66	12z 10th
	Avonmouth	534	0.78	-0.08	0.21	0.23	-1.00	20z 23rd
	Mumbles	706	0.87	0.05	0.10	0.11	0.49	11z 10th
	Milford Haven	562	0.94	-0.12	0.06	0.14	-0.28	1z 30th
	Fishguard	562	0.93	-0.12	0.07	0.14	-0.29	16z 18th
	Barmouth	611	0.93	-0.02	0.09	0.09	-0.33	16z 30th
	Holyhead	563	0.94	-0.01	0.07	0.07	0.23	14z 10th
	Llandudno	634	0.94	0.03	0.08	0.09	0.34	3z 1st
	Liverpool	360	0.92	-0.09	0.09	0.13	-0.31	6z 30th
	Heysham	526	0.93	0.14	0.10	0.17	0.43	5z 5th
	Workington	743	0.86	-0.03	0.07	0.07	-0.17	13z 30th
	St. Marys	519	0.89	-0.06	0.06	0.09	-0.21	20z 23rd
	Newlyn	360	0.89	-0.03	0.07	0.07	-0.18	3z 12th
	Plymouth	296	0.77	-0.01	0.08	0.08	-0.27	18z 23rd
	Weymouth	369	0.89	-0.03	0.08	0.08	-0.20	21z 18th
	Portsmouth	714	0.89	-0.00	0.08	0.08	-0.27	3z 24th
	Newhaven	No Observations Available						
	Dover	743	0.75	-0.04	0.13	0.14	-0.35	19z 23rd
	Jersey	743	0.93	-0.02	0.07	0.08	0.19	17z 10th
	Port Erin	No Observations Available						
	Portpatrick	743	0.93	0.06	0.09	0.10	0.36	11z 10th
	Millport	743	0.93	-0.02	0.08	0.08	0.27	10z 10th
	Islay	637	0.93	0.04	0.07	0.08	0.25	9z 10th
	Tobermory	No Observations Available						
	Moray Firth	No Observations Available						
	Leith	565	0.93	0.09	0.07	0.11	0.28	0z 5th
	Ullapool	729	0.93	0.07	0.07	0.10	0.26	1z 5th
	Kinlochbervie	743	0.94	0.04	0.04	0.06	0.17	7z 1st
	Lerwick	704	0.66	-0.09	0.24	0.26	-1.13	15z 31st
	Newport	681	0.89	-0.00	0.08	0.08	-0.24	5z 23rd

Table 12a: Statistics based on hourly data for March 2006.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE	
	Stornoway	60	0.94	0.04	0.06	0.07	0.18	11z	6th
	Wick	59	0.94	0.04	0.05	0.07	0.19	10z	11th
	Aberdeen	38	0.95	0.01	0.05	0.05	0.12	6z	7th
	North Shields	45	0.97	-0.00	0.06	0.06	0.17	15z	13th
	Whitby	41	0.94	-0.12	0.05	0.14	-0.25	15z	28th
	Immingham	46	0.81	-0.02	0.08	0.08	-0.21	7z	30th
	Cromer	49	0.94	0.02	0.07	0.07	0.20	18z	13th
	Lowestoft	55	0.95	-0.01	0.07	0.07	-0.18	22z	30th
	Felixstowe	No Observations Available							
	Sheerness	55	0.88	-0.04	0.09	0.10	-0.24	10z	10th
	Ilfracombe	45	0.84	0.00	0.09	0.09	0.20	9z	3rd
	Hinkley Point	58	0.73	0.00	0.14	0.14	0.33	1z	8th
	Avonmouth	43	0.76	-0.10	0.18	0.20	-0.44	6z	11th
	Mumbles	57	0.81	0.06	0.11	0.13	0.27	9z	3rd
	Milford Haven	45	0.95	-0.10	0.06	0.12	-0.26	5z	27th
	Fishguard	46	0.95	-0.09	0.06	0.11	-0.20	22z	18th
	Barmouth	49	0.91	-0.02	0.10	0.11	-0.28	8z	30th
	Holyhead	43	0.92	-0.02	0.08	0.08	-0.19	16z	23rd
	Llandudno	50	0.94	0.03	0.07	0.08	0.16	15z	5th
	Liverpool	29	0.94	-0.09	0.07	0.12	-0.26	12z	31st
	Heysham	42	0.93	0.15	0.09	0.18	0.36	10z	10th
	Workington	60	0.82	-0.03	0.07	0.08	-0.15	19z	18th
	St. Marys	42	0.87	-0.05	0.07	0.09	-0.15	5z	13th
	Newlyn	30	0.85	-0.02	0.07	0.07	0.16	23z	7th
	Plymouth	25	0.75	0.01	0.07	0.07	0.16	0z	8th
	Weymouth	28	0.95	-0.03	0.06	0.07	-0.15	0z	30th
	Portsmouth	57	0.90	-0.00	0.08	0.08	0.17	7z	9th
	Newhaven	No Observations Available							
	Dover	60	0.74	0.04	0.12	0.12	0.30	13z	8th
	Jersey	59	0.92	-0.03	0.08	0.09	-0.18	2z	19th
	Port Erin	No Observations Available							
	Portpatrick	60	0.91	0.05	0.09	0.11	0.33	10z	10th
	Millport	66	0.95	-0.00	0.07	0.07	0.16	15z	10th
	Islay	51	0.94	0.06	0.07	0.09	0.21	10z	6th
	Tobermory	No Observations Available							
	Moray Firth	No Observations Available							
	Leith	46	0.91	0.09	0.07	0.12	0.24	0z	7th
	Ullapool	59	0.92	0.07	0.07	0.10	0.22	21z	1st
	Kinlochbervie	59	0.96	0.05	0.04	0.06	0.14	3z	6th
	Lerwick	57	0.58	-0.06	0.22	0.23	-0.59	18z	10th
	Newport	81	0.88	0.00	0.08	0.08	0.21	10z	10th

Table 12b: Statistics at HW for March 2006.

<u>FILENAME</u>	<u>START & END TIME OF RUN</u>	<u>CONTENTS</u>
FILE08.CS305	06Z 08/03/05-00Z 05/04/05	112 h' & f'casts
FILE09.CS305	06Z 05/04/05-18Z 09/05/05	139 h' & f'casts
FILE10.CS305	06Z 10/05/05-00Z 03/06/05	97 h' & f'casts
FILE11.CS305	06Z 03/06/05-00Z 12/07/05	156 h' & f'casts
FILE12.CS305	06Z 12/07/05-18Z 22/08/05	167 h' & f'casts
FILE01.CS306	06Z 23/08/05-00Z 09/09/05	68 h' & f'casts
FILE02.CS306	06Z 09/09/05-06Z 20/10/05	165 h' & f'casts ⁺
FILE03.CS306	12Z 20/10/05-00Z 08/11/05	75 h' & f'casts
FILE04.CS306	06Z 08/11/05-00Z 05/12/05	108 h' & f'casts
FILE05.CS306	12Z 05/12/05-00Z 27/01/06	211 h' & f'casts
FILE06.CS306	06Z 27/01/06-00Z 22/03/06	216 h' & f'casts
FILE07.CS306	06Z 22/03/06-18Z 24/04/06	135 h' & f'casts

* Removed 504 lines of record from 18/10. HC not run. Rerun was successful.

Table 13: Port data archive files for 2005-06. NB. The start and end times and dates are of the first data output from the run. (Normally this is the start of the hindcast.)

Appendix B:

Notes on the surge event of 24th August 2005

Background

On 24th August 2005, a Low of central pressure 969hPa tracked off the northwest coast of Scotland generating south-westerly winds which caused flooding in the Western Isles and produced an external surge which propagated down the east coast. The surge model forecast the surge on the northwest coast of Scotland; however the propagating east coast surge was under predicted at HW during the afternoon of 24th by up to 20cm at east coast locations. Figure 1 shows the position of the low pressure area at 0z on 24th August and its subsequent location at 0z 25th August.

The POL workstation version of the operational model, CS3, was run for the period 22-26 Aug 2005 using mesoscale winds and pressure data extracted from the archive at the Met Office. The results from this run were comparable with those produced routinely from the operational version of this model at the Met Office.

Model Runs

Table 1 gives a summary of surges at HW on 24th/25th August comparing observed surges with output from various model runs. The extent to which the surges were under predicted by CS3 is shown in this table.

In Run 1 the winds were enhanced by 10% over the entire model domain for the 5-day period. This was to give an indication of whether an error in the mesoscale wind speed would account for the difference between model and observed surges. Figure 2 shows the resulting time series plot with observations and the standard run. The standard CS3 run is shown as a solid line, the observations are crosses and Run 1 of CS3 is shown as a dashed line. HW times are indicated by diamonds. It can be seen in Figure 2 that enhancing the winds increases both the negative surge on the morning of 24th Aug due to the enhanced offshore wind and the E coast propagating surge is enhanced at HW from Stornoway to Aberdeen. However the effect is minimal from North Shields and further south, where the enhancement is only apparent in the hours after HW.

ECNS (shown in Figure 3) was then set up to run for this period. ECNS has the same resolution as CS3 but with an open boundary across the North Sea extending eastward from Aberdeen. The run was set up for the same period as above and data from the A-class tide gauge at Aberdeen was extracted for this period to be assimilated into the model's northern boundary. This would effectively correct any errors in the external surge propagating at the boundary. The results from the run of ECNS can be seen as the dashed line in Figure 4. Figure 4 shows the effect of boundary correction. The surges are closer to those observed giving improvements to the surge at HW on 24th, however the improvement is less marked at locations further south, becoming minimal south of Lowestoft.

Summary

East coast surge under prediction on 24/25 August 2005 has been briefly investigated. CS3 had under predicted surges at HW by ~20cm.

A global adjustment of the mesoscale model winds gave an indication of the sensitivity of the model to the wind speed. The trough and peak of the surge were overestimated but the values at HW were only enhanced by a few centimetres.

A second model run was done using ECNS with observed surges assimilated at Aberdeen. This would correct any external errors propagating into the model domain. Results were generally improved at the more northern locations; errors reduced from ~20cm to ~10cm at HW (down to Lowestoft). There is only minimal improvement further south. This indicates that the source of the error at these southern locations is likely to be generated within the domain of the model i.e. probably a local wind effect.

It can be seen in Figure 1 that there is a warm front which becomes occluded passing over the southern half of the UK associated with this low. It is possible that if this feature was not well defined or timed within the mesoscale model then a shift in wind speed or direction could have affected the surge produced by the model.

Unfortunately observed winds were unavailable to investigate this with further model experiments. It would be interesting to see the outcome of an investigation into the mesoscale model performance for this event, and possibly re-run the model with appropriately adjusted wind fields to see if the surge would be improved.

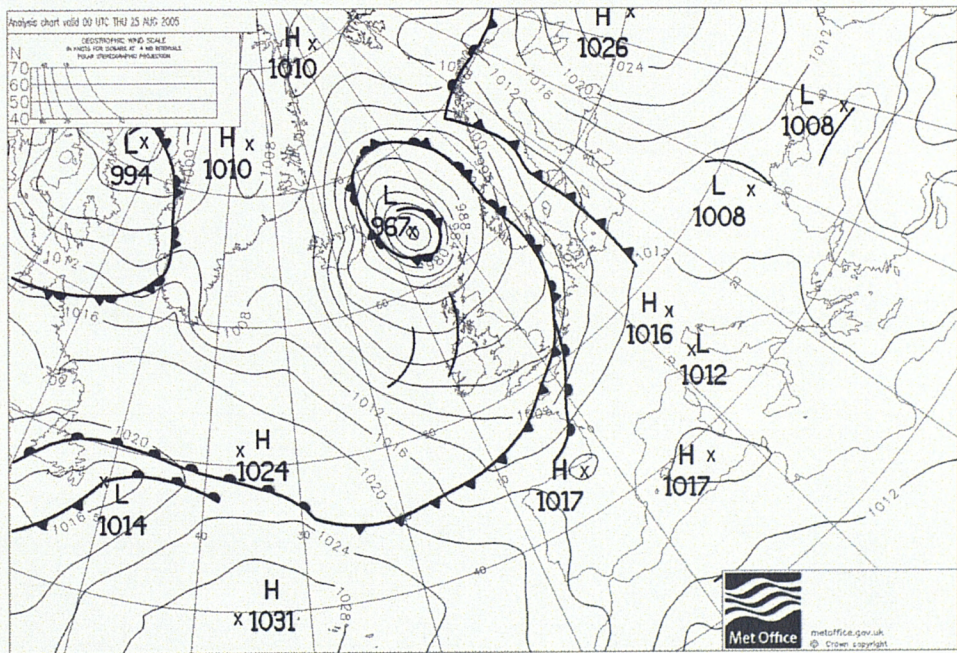
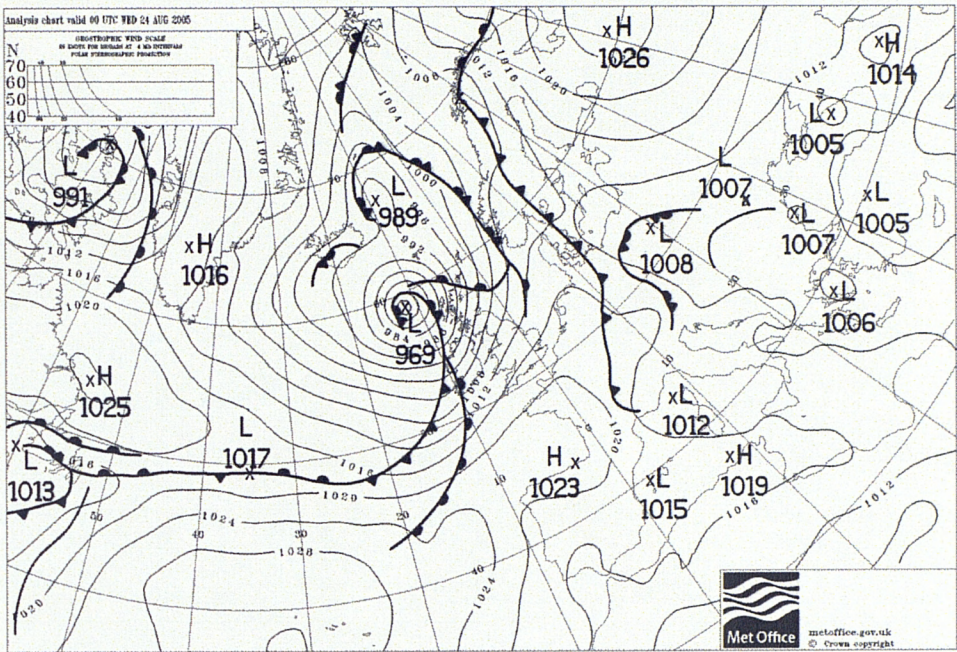


Figure 1: MSLP charts showing the passage of the Low on 24th and 25th Aug.

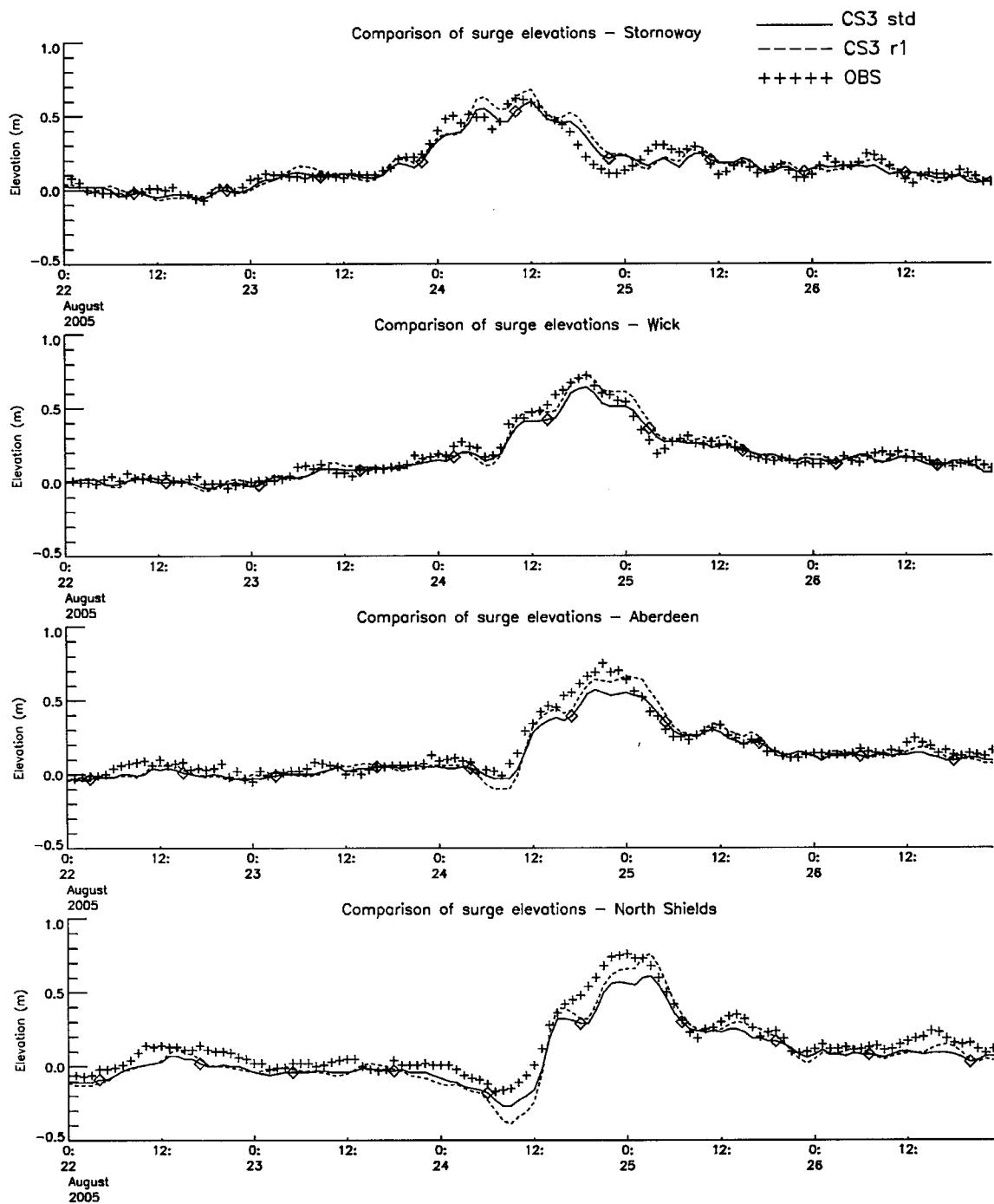


Figure 2: Standard CS3 model output v Run 1 (enhanced winds) v observations.

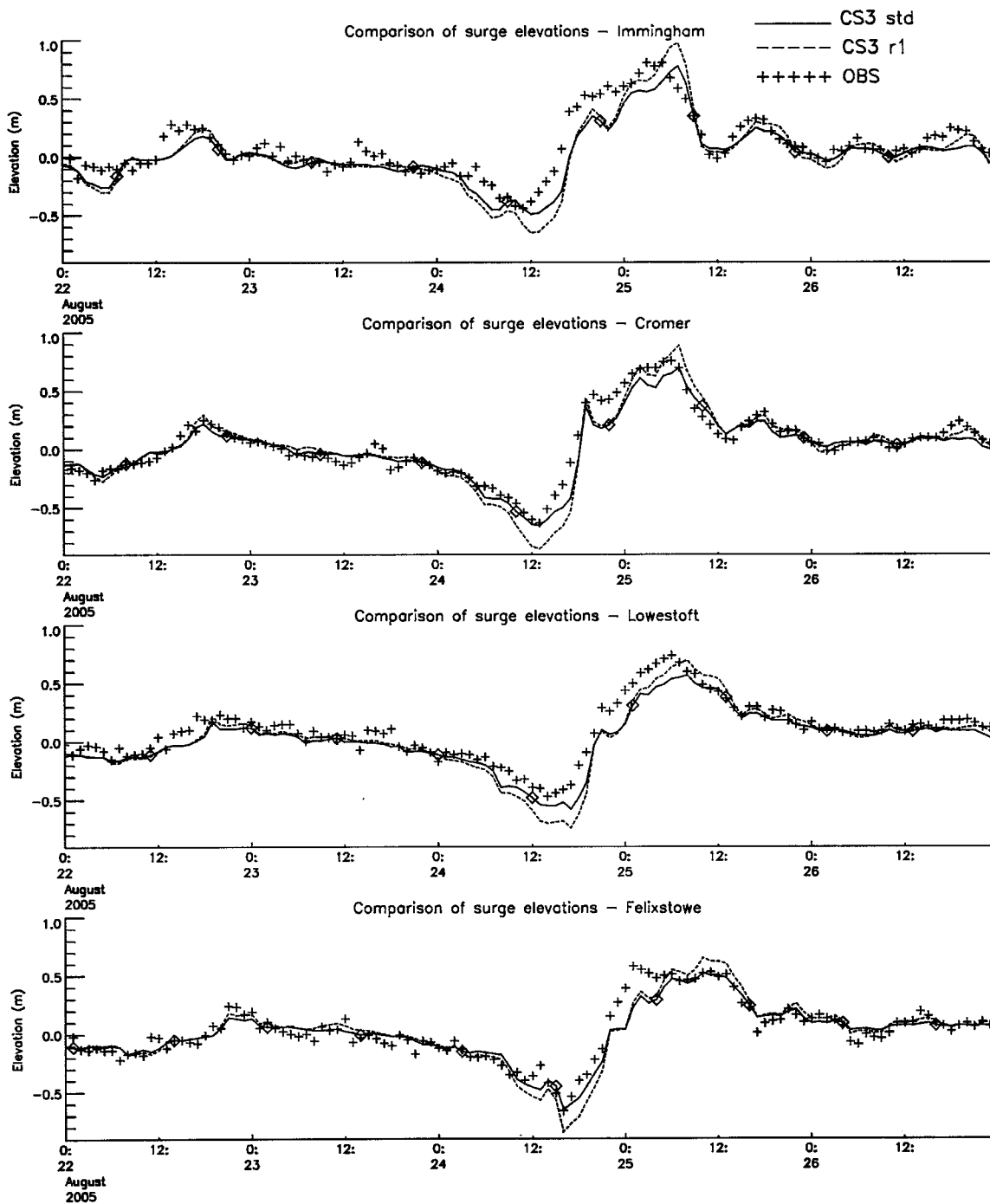


Figure 2: Continued.

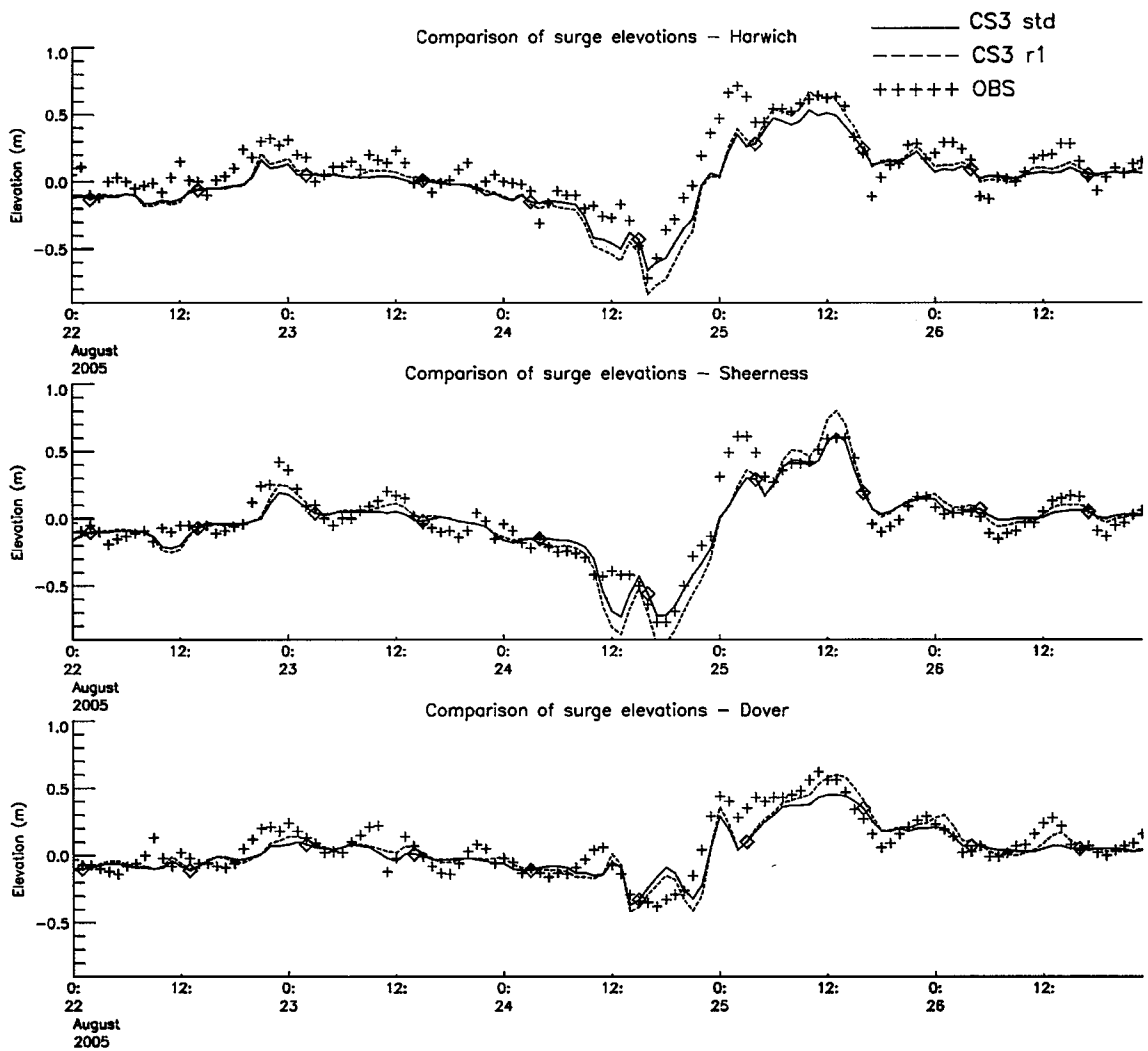


Figure 2: Continued.

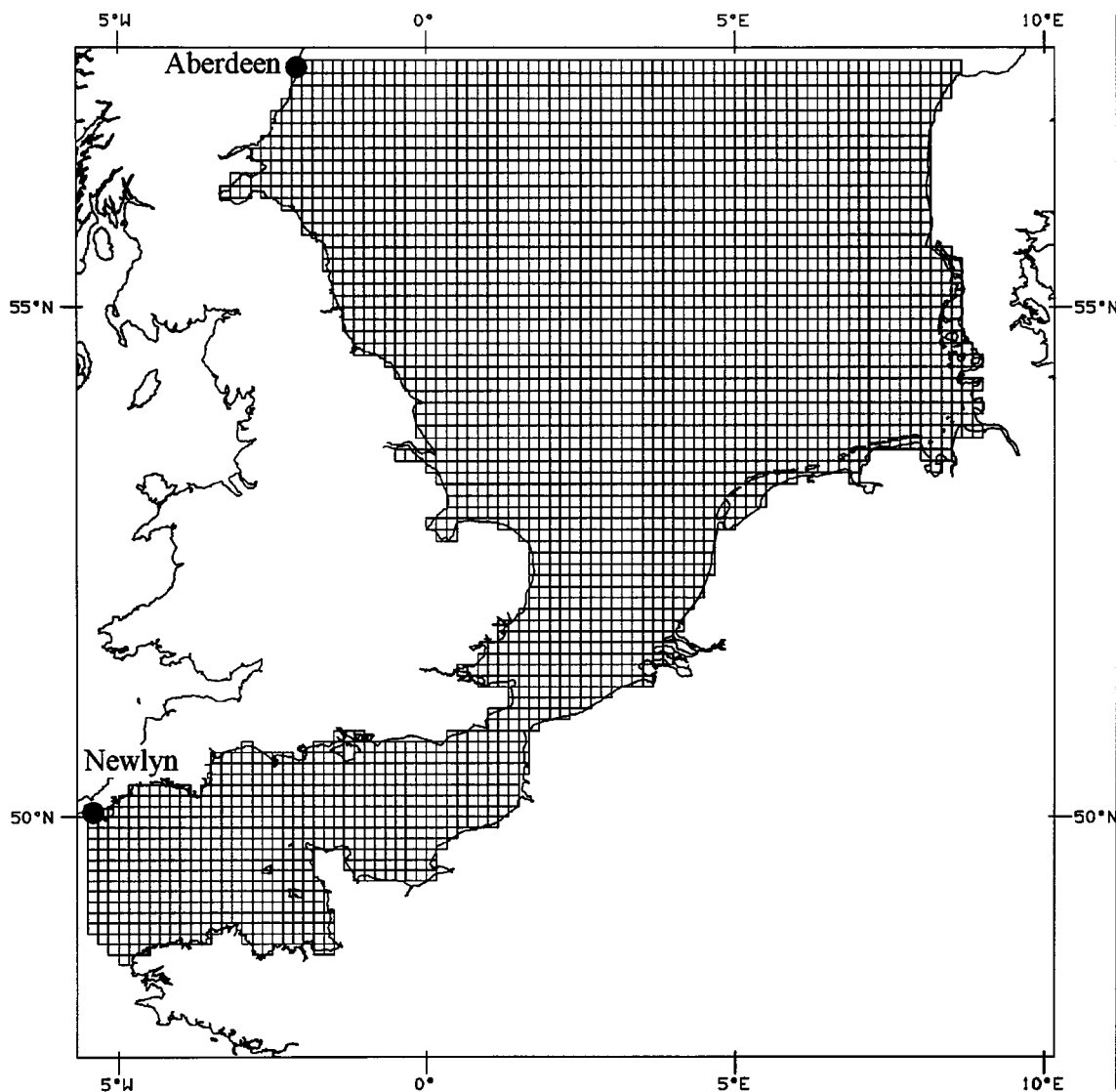


Figure 3: 12km ECNS model grid with northern boundary at Aberdeen.

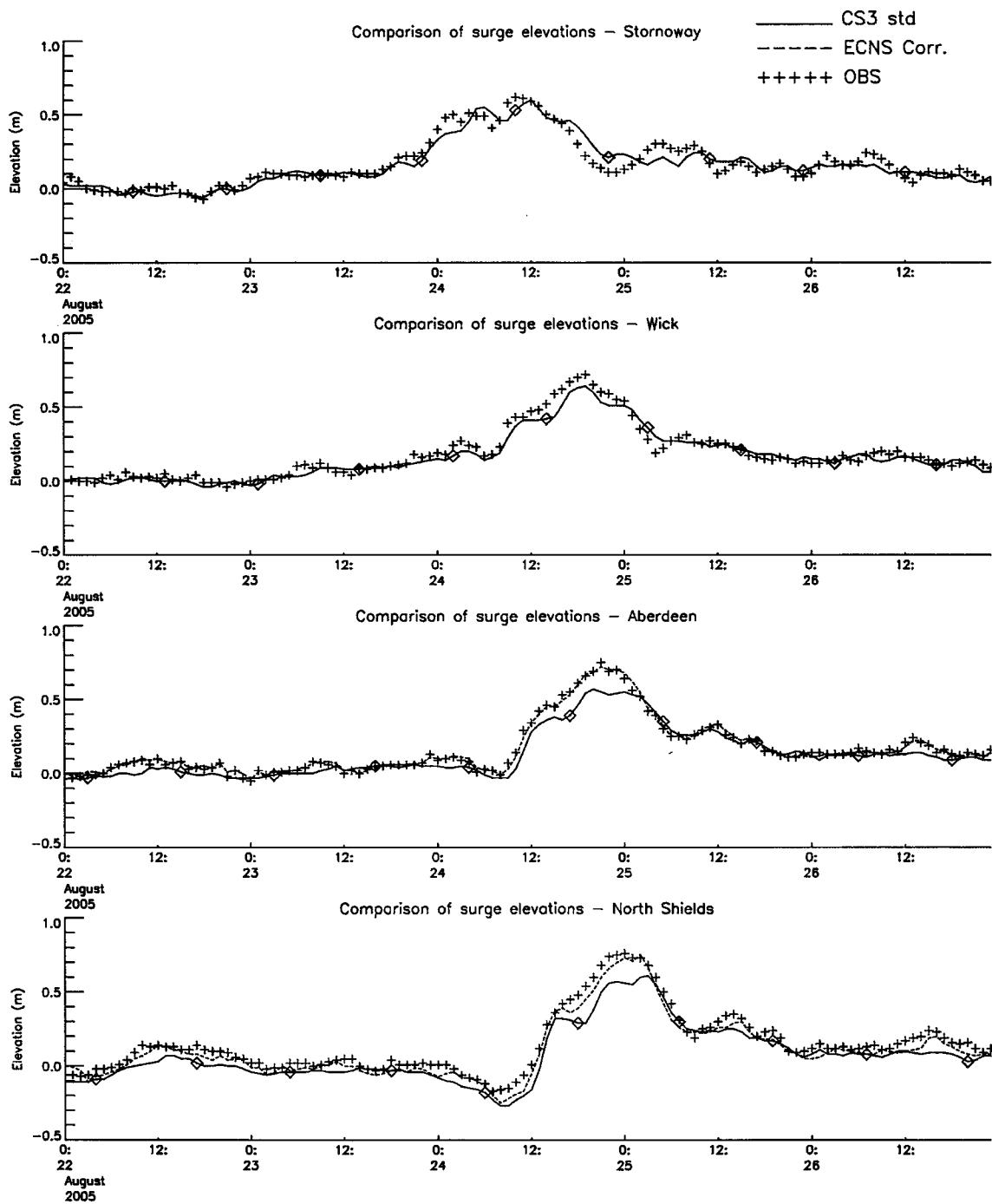


Figure 4: Standard CS3 model output v ECNS (with assimilation) v observations.

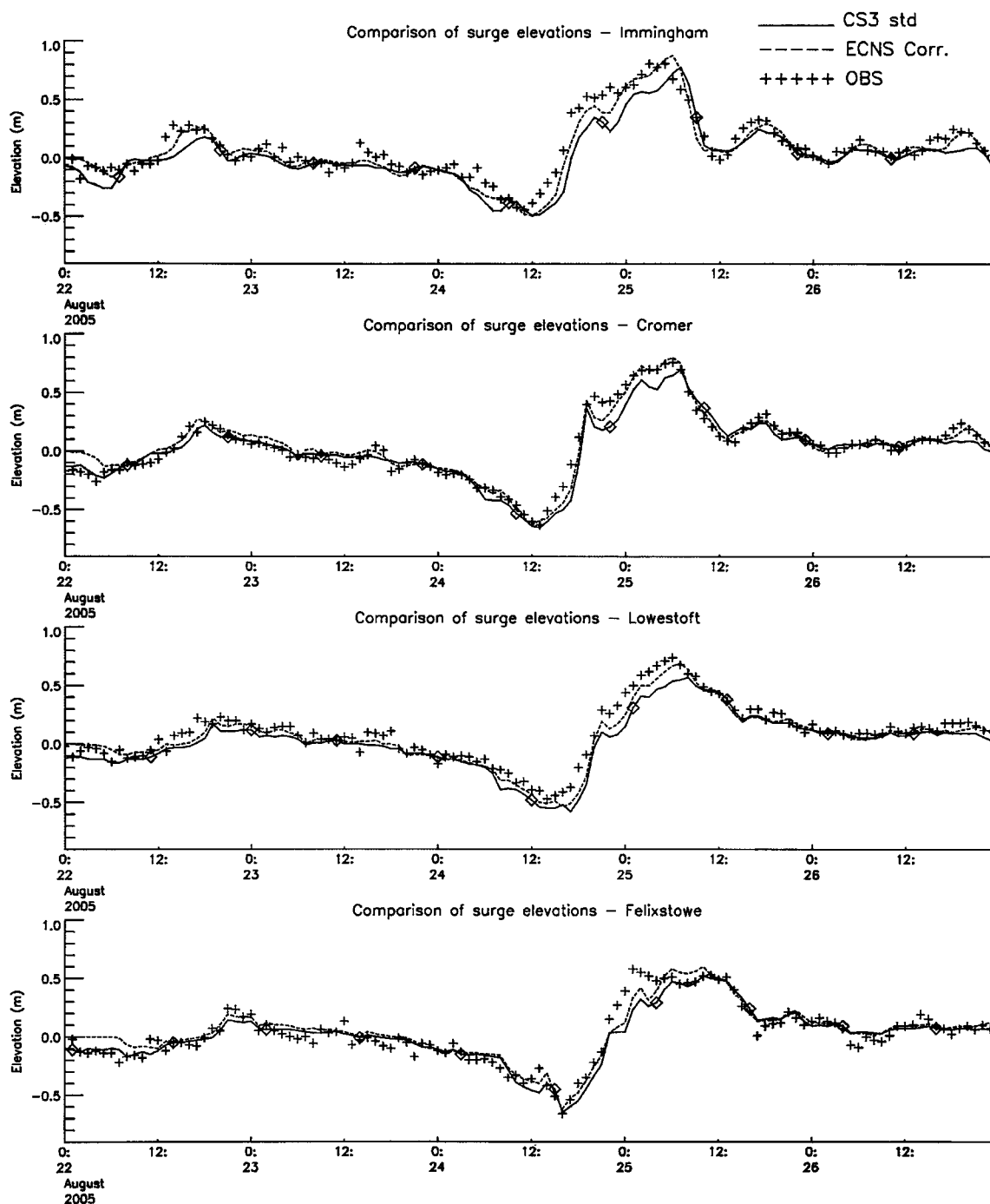


Figure 4: Continued.

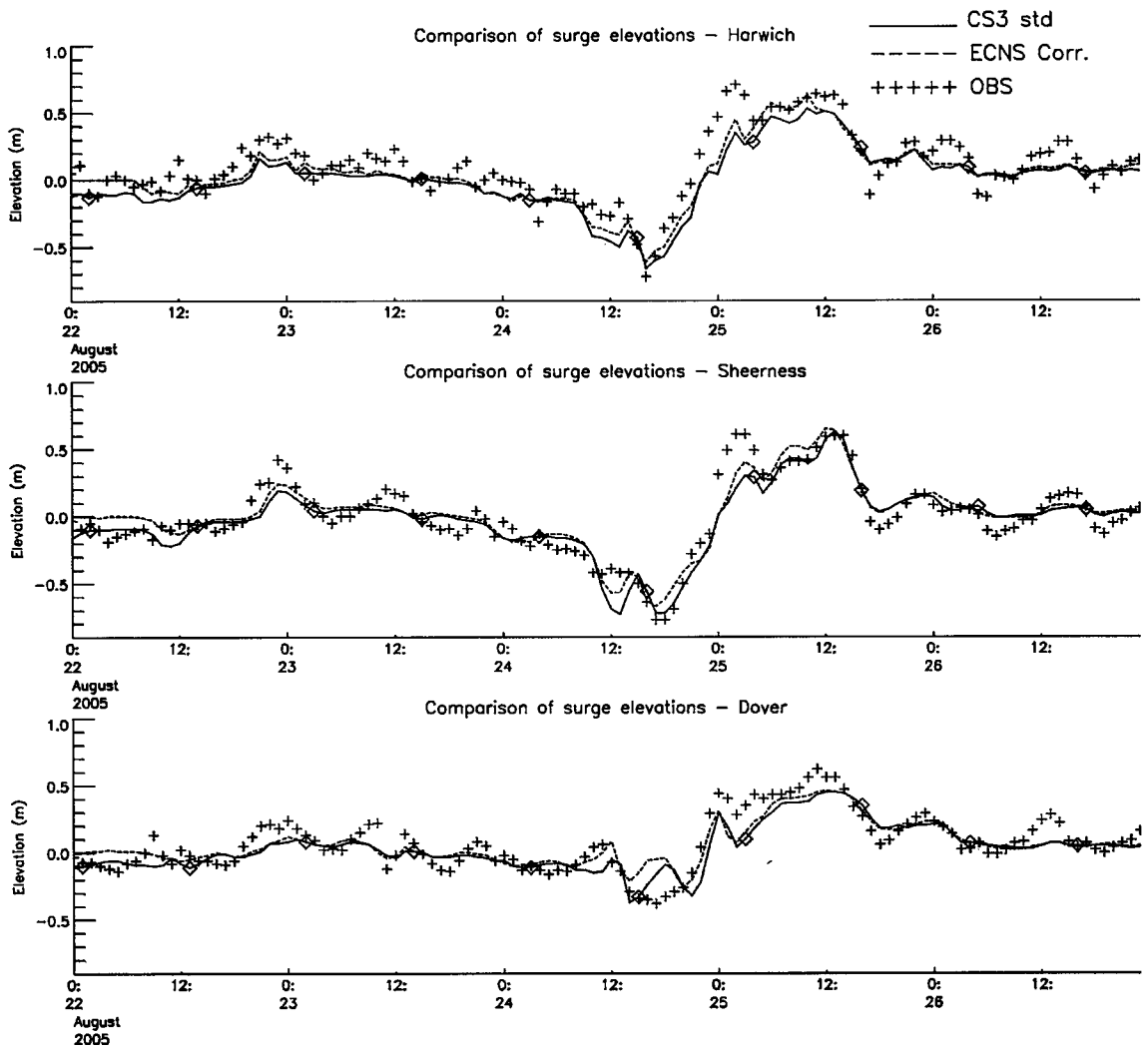


Figure 4: Continued.

Port	HW time	Observed	CS3 Std	CS3 Run 1	ECNS
Stornoway	11z (24th)	0.61	0.53	0.63	-
Wick	14z	0.52	0.42	0.47	-
Aberdeen	17z	0.55	0.39	0.43	0.53
N Shields	18z	0.48	0.29	0.32	0.45
Immingham	21z	0.54	0.31	0.35	0.39
Cromer	22z	0.43	0.21	0.23	0.33
Lowestoft	01z (25th)	0.50	0.31	0.35	0.40
Felixstowe	04z	0.48	0.29	0.32	0.31
Harwich	04z	0.44	0.28	0.29	0.30
Sheerness	04z	0.49	0.29	0.32	0.36
Dover	03z	0.35	0.10	0.10	0.15

Table 1: Observed and Model Surges (in m) at HW on 24/25th August 2005.
N.B. HW time is the hour closest to actual HW as defined in the model.