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**The Operational Storm Surge Model:
Development, Performance and Maintenance
During 2002**

by

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1. Background

NTSLF at POL develops and maintains tide-surge models used to forecast storm surges on the coasts of England and Wales for DEFRA. The models are run in real-time as part of the forecast suite of models at the Met Office. Results are transmitted to the Environment Agency 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.

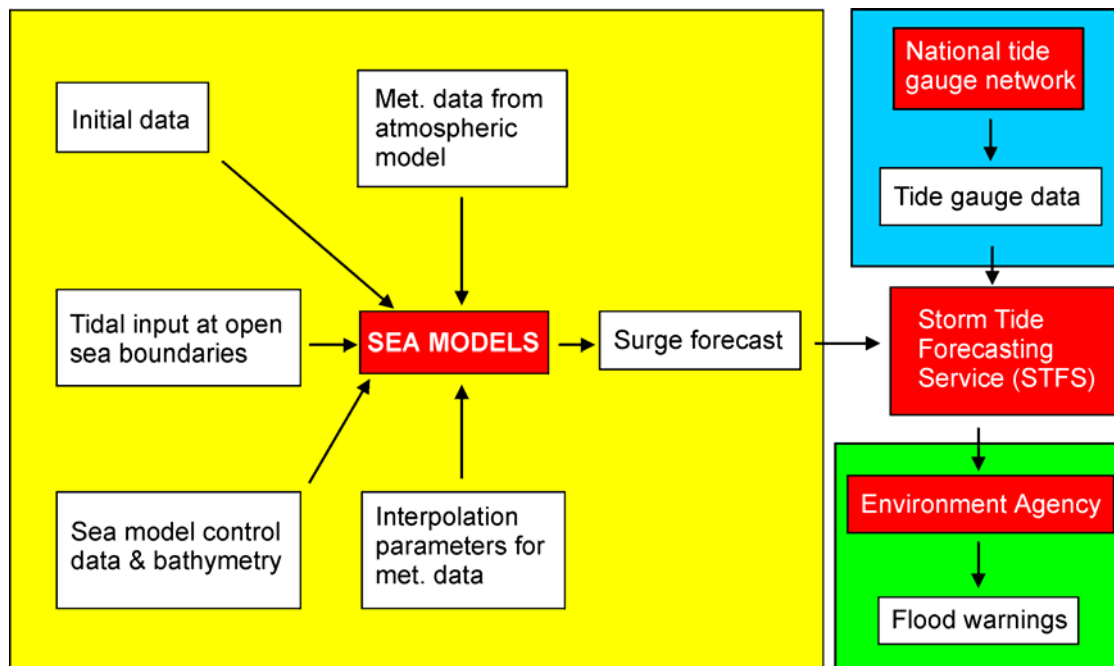


Figure 1: Schematic of the operational surge forecast and warning system.

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. The current models are forced by met data from the Met Office's 12km grid 'mesoscale' weather forecast model (Figure 2).

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.

This report describes the operational surge model system in 2002. It includes developments and changes made to the system, problems encountered, model performance, data archiving issues, and a list of related publications produced during 2002 which are available from the POL library.

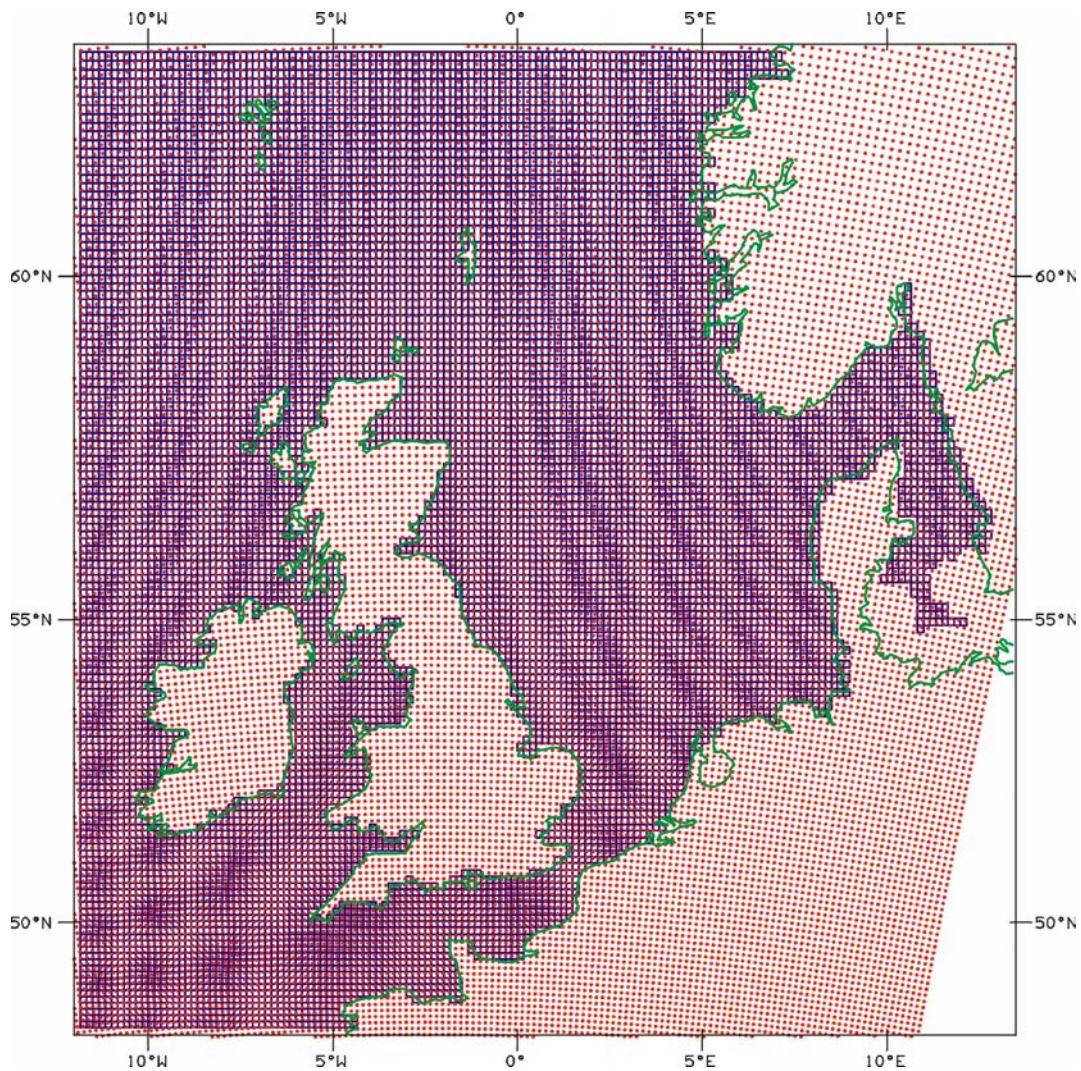


Figure 2: Surge model grid with mesoscale model points superimposed.

2. Operational Changes

2.1. New Dynamics

In 2002 major changes were made to the Met Office's atmospheric models, effectively introducing new models using "New Dynamics" (ND). ND differed in a number of respects from that used previously: calculations were now made on a 'C' grid rather than a 'B' grid, a height based (rather than pressure based) vertical coordinate system was used, and the ordering of grid points was changed. However, the coverage and spatial resolution remained the same.

The Met Office web site (www.metoffice.com) noted that, "*The New Dynamics is more accurate than the current dynamics and has been designed to have better balance with both the physics forcing from the parameterisations and with data assimilation.*"... "*Since the New Dynamics is based upon an unapproximated equation set it can be used to model scales at a very high resolution and will enable the mesoscale model to be run with horizontal grid lengths of much less than 10km as greater computer power becomes available.*"

From late 2001, the Met Office ran a trial version (v5.0) of the Unified Model incorporating ND, which was to replace the current mesoscale atmospheric model dynamics in summer 2002. The change to ND required a revised interface to link to the surge models. This was developed and tests were carried out during December 2001 to ensure that there were no problems with the new interface.

In January 2002 the surge model was incorporated into the operational test suite for ND. In its test mode, the surge model forced by mesoscale ND wind and pressure fields was run just once each day, with the forecast starting at 0000GMT. Each run consisted of 21 hours of "hindcast" followed by a 48 hour forecast. Hourly hindcast and forecast surge elevations for ports around the UK and continental coasts, including the "A Class" tide gauge locations, were archived as time series from each run. Additionally, from the hindcast part of the run, arrays of hourly surge were stored for the entire model grid. Useful archived model data were available from 28th January 2002. Model data were accumulated until the end of March when they were extracted and returned to POL for analysis.

The effect of ND on surge forecast accuracy was investigated in detail using data from the operational trial. Monthly statistics of differences between CS3 hourly surge elevations with standard and ND showed insignificant mean differences ($\pm 0.01\text{m}$) between the two model sets, however RMS differences indicated significant variability (up to 0.10m) through time. Instantaneous deviations were found to be large (up to $\pm 0.50\text{m}$) during surge 'events', i.e. under conditions of strong winds/low pressures, and rapid meteorological development. In relatively quiet periods, the two forcing dynamics produced similar surge forecasts.

Five surge 'events' were looked at in detail. In each case, the ND forecast differed significantly from and in most cases was inferior to the standard. Only one event was better predicted with ND forcing. This was of concern, but there was no clear cause. It was possible that ND produced stronger winds than the original dynamics, thereby enhancing or reducing surge heights depending on the wind direction. Regrettably, no archive of ND met forcing was available so we were unable to examine the forcing data to understand why these differences occurred. A report of the findings was written (Williams and Flather, 2002).

2.2. Bug Fix

In December 2002, a bug in the met processing subroutine (METPROC) of the model code was identified and fixed. The extent to which the bug affected surge accuracy was also looked at. This is discussed further in the next section.

3. Model Performance

3.1. Forecast Errors at Sheerness

Under-forecasting of surges at Sheerness, which is used by EA as the reference port for decisions on Thames Barrier closure, continued to cause difficulties in 2001-2002. Routine comparisons showed significant errors, with model forecast surges on average $\sim 10\text{cm}$ lower than the observations at Sheerness. At some high waters, errors of 30 to 40cm occurred. The problems were investigated and results reported to the DEFRA Storm Tide Forecasting Service Liaison Group (STFSLG) in July 2002.

Several factors suggested that the problem might not be due to the model but that the tide gauge might be responsible. TGI checked and confirmed that blockages were affecting the measured levels and it was decided to refurbish the gauge at the earliest possible opportunity. With suitable tidal conditions, this was done in mid-February 2002. Initial results at Sheerness, Figure 3, suggested that the under-prediction was reduced after the gauge was fixed.

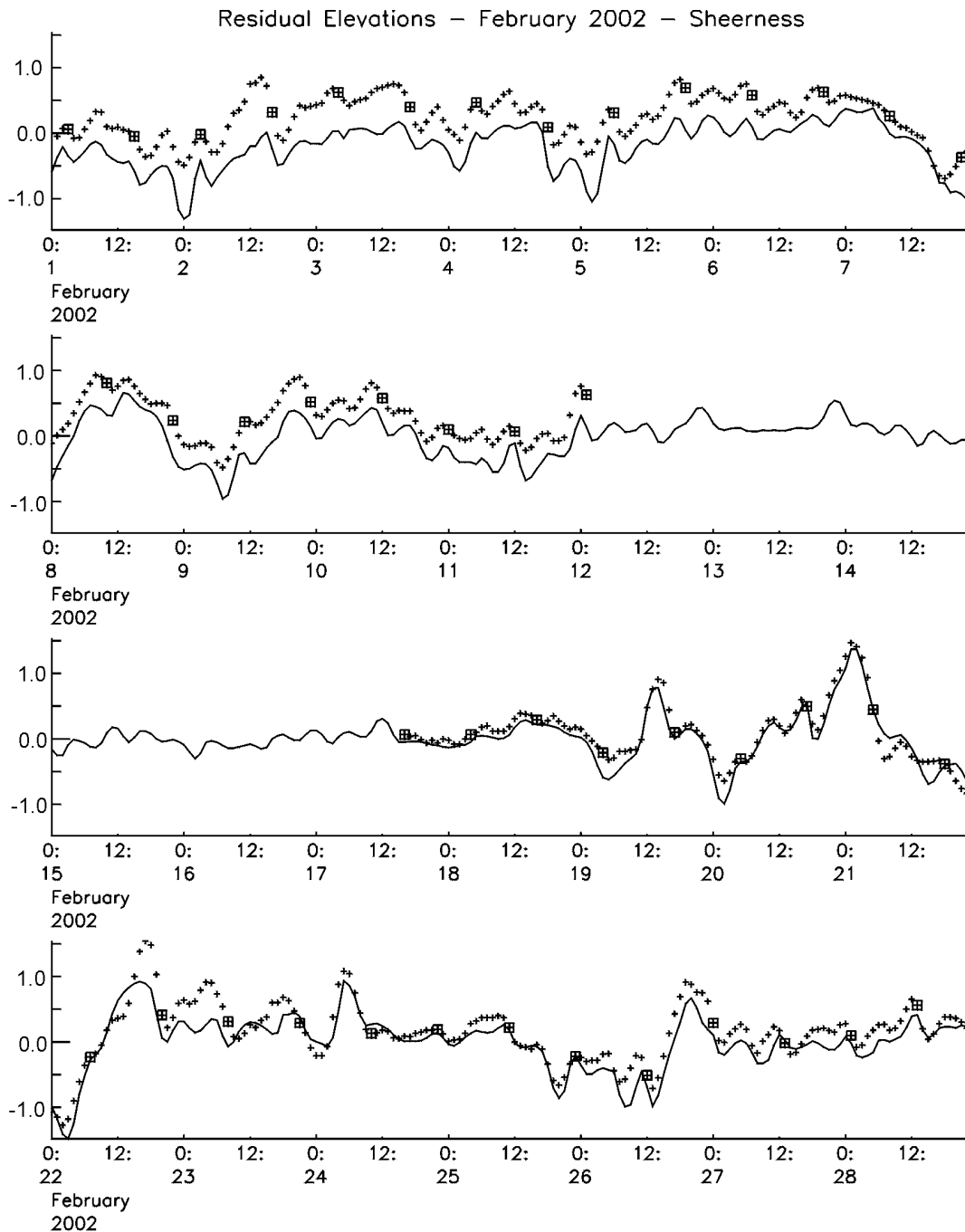


Figure 3: POL routine monthly comparison of observed (+++++) and CS3 forecast surges at Sheerness for February 2002. Squares indicate observed surge at model HW. The gap in observations mid-month is the period when the tide gauge was re-furbished. The reduced offset after the gauge was re-furbished is clear.

Unfortunately, the problems recurred in September 2002. A plot of model v observations for September 2002 is shown in Figure 4 and typifies the problems encountered.

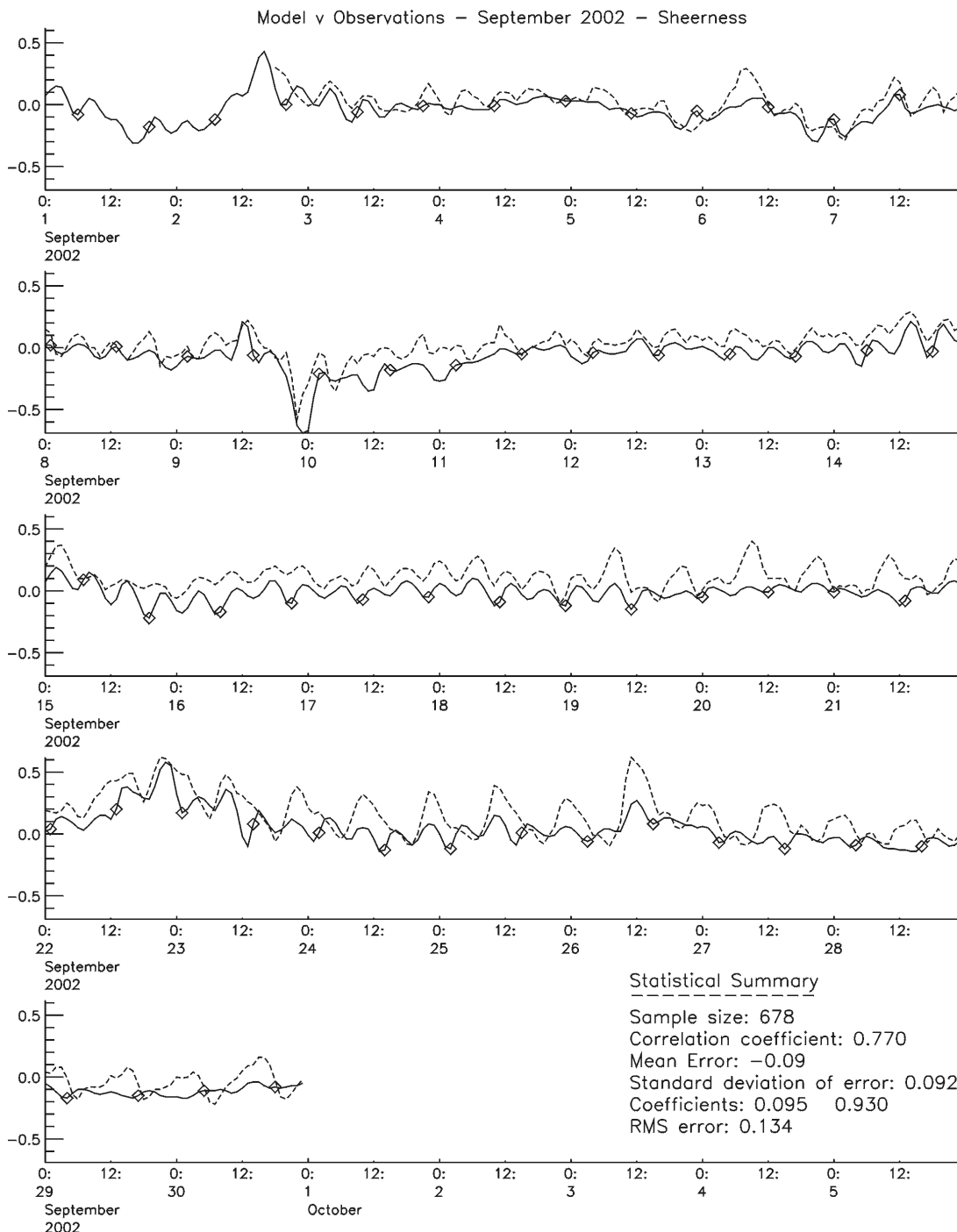


Figure 4: Standard comparison of CS3 residual elevations with observed surges at Sheerness, September 2002. Model results are plotted as a solid line and observed residuals as a dashed line. The symbol ◊ indicates times of model HW.

Figure 4 shows the offset as seen earlier in the year, with the model underestimating observed surges. Large oscillations of about 12 hour period also occur in the observations at certain times. These can have peak-to-peak amplitudes up to 50cm e.g. 19-30 September 2002, and are not reproduced by the model. Six-hourly

oscillations are also seen in the observations e.g. 13-18 September. These have smaller amplitudes (up to ~10cm) are reproduced quite well by the model.

At the end of September we were advised by STFS of further poor results for Sheerness, with CS3 forecasts underestimating surges at high water (HW) by 30-35cm on spring tides during the week of 21-27 September. Winds at this time were from the N to NE and not strong. Surge errors were small but, critically, increased near HW. An initial response was made on the same day, and discussion and e-mail correspondence followed, including useful input from Dave Smith (ex Head of EMARC, the Met Office's "Emergency Monitoring and Response Centre" which incorporates STFS). New investigations started.

In mid-November, EA Thames Barrier (Colin Carron) 'phoned about the problems and provided useful inputs. He reported that EA were carrying out their own investigation and requested observed water levels at Sheerness for 1998-2001. These data were e-mailed to Colin Carron on 22 November and, in return, he provided data from EA's Southend gauge, which we thought would provide a useful comparison.

In the same period, Bob Chadwick (STFS) forwarded correspondence from EA Thames and formally requested that we investigate the problems. Specific cases cited were:

- a) 23rd September 2002, HW at 0130GMT
- b) 2nd November 2002, HW at 2230 and
- c) 6th November 2002, HW at 0100, with forecast residual -0.266m, actual surge +0.18m giving an error of 0.45m.

We examined these events and noted that in all cases, the observed residual at HW was less than 0.6m and that the met situation was fairly quiet. The Sheerness gauge was checked by TGI and found to be functioning correctly. Tidal analyses and predictions were compared and found to be consistent. No analysis used for prediction had included the period from October 2001 when the gauge was faulty (see earlier). Checks on the CS3 model identified an error in the interface to a new version of the atmospheric model introduced on 7 August 2002. This shifted the met forcing by a grid length, about 12km. During storms this affected surge estimates by a few cm, but in quiet periods such as those cited above; the effect was negligible.

A formal letter summarising our findings to date and proposing further aspects for investigation was sent to STFS in December and copied to EA Thames, EA's National Flood Warning Centre (NFWC), DEFRA and the Met Office. Investigation of the problems at Sheerness continued into January with highest priority.

3.2. Immingham Problem

Dave Smith (Met Office) recalled problems on 29 January 2002 at Immingham. This was examined and it was shown that a delay in the peak of the forecast surge arose in the Humber Estuary; very crudely represented on the 12km CS3 grid. Pending possible implementation of finer grid models, an alternative CS3 output point, which better represented the timing of observed surges at Immingham, was suggested.

3.3. Bristol Channel Model Failures

The Bristol Channel forecast run at 1800GMT 10 December 2002 failed. We were advised of the failure by Wendy Hardy (Met Office Operational Core Team Leader) on 11 December and investigated. The cause was a failure in copying model tide data on the CRAY T3E system. This introduced spurious surge values which caused the system to fail. Why the data copying failed is not clear, but the same problem occurred once during 2001.

3.4. 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.

There are 24 statistics tables (Tables 1–12), 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 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, however operational forecasts for these locations are taken from the higher resolution Bristol Channel system of models.

4. Other Operational Issues

4.1. 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 to observed surges derived at tide gauges from observations. This is important for monitoring surge model performance. Data archived for 2002 are summarised in Appendix 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 whole of 2002.
- c) *Model array archive*: the model array archive as described by Smith (1994) has now been superseded by a re-run archive based on the met data archive described above. CS3 is run using the hindcast mesoscale model data and yearly files of model arrays are compiled and stored at POL. The 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. The re-run archive covers 1992-2002 and is available on the POL mass store.

4.2. Meetings

4.2.1. Operational Issues

A meeting with Met Office staff from STFS and operational groups was held at Bidston on 31 January 2002. The agenda included changes at the Met Office (organisational, the relocation to Exeter, plans for a new supercomputer); performance of surge models; notification and logging of problems; activities of the EA/Met Office Coastal Working Group; changes to operational surge models in 2002; long-term plans; New Dynamics; and archive changes at the Met Office affecting the surge forecast system.

4.2.2. Implementing Fine Grid Models

A meeting to discuss possible implementation of fine grid models for the Southern Region of EA was held at DEFRA, London on 21 October 2002, attended by EA Southern Region and NFWC staff, DEFRA and POL. This followed completion by POL of "Fine grid surge model evaluation" (Flather et al., 2001), an R&D project funded by DEFRA (FD1203). Issues and possibilities were discussed, and it was agreed that EA would carry out a feasibility study.

4.3. Scoping Study

A "scoping study" to design an updated operational surge forecast system to better meet the needs of users and take advantage of developments at the Met Office and results of MAFF/DEFRA R&D projects was started. The aim was to establish and

agree a plan to progress from the existing scheme to a unified system with appropriate resolution, physics and procedures, taking advantage of the new Met Office supercomputer to be installed in mid 2003. Initial work was carried out but progress was delayed by the need to give priority to investigating forecast problems at Sheerness.

4.4. Porting Surge Model Codes to the new Met Office Supercomputer

The Met Office decided to buy an NEC SX-6 supercomputer to succeed the CRAY T3E systems in late 2003, providing approximately 6× the processing power of both T3Es combined. A test system was installed at Bracknell in August 2002. Initial help was provided by Met Office staff and we gained access in October 2002. Initial assessments of work required were made and included in the Met Office's project to port operational codes. POL staff attended a "porting" course at Bracknell in early January 2003.

5. Reports Produced

Flather, R.A. 2002. Note on the storm surge and floods on 1 February 2002 in the Irish Sea. *Proudman Oceanographic Laboratory Internal Document No. 146*. 24pp.

Williams, J.A. & Flather, R.A. 2002. Impact of new atmospheric model dynamics on operational surge model performance. *Proudman Oceanographic Laboratory Internal Document No. 145*. 14pp.

Acknowledgements

The authors would like to thank staff at the Met Office for their continuing support which ensures smooth running, and facilitates development of the operational surge model.

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References

Flather, R.A., Williams, J.A., Blackman, D.L. and Carlin, L.A. 2001. Fine grid surge model evaluation. *Proudman Oceanographic Laboratory Internal Document No. 141*. 52pp.

Smith, J.A. 1994. The operational model data archive. *POL Report No. 34*. 34pp.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	743	0.95	0.09	0.06	0.10	0.25	4z 20th
Wick	679	0.92	0.11	0.07	0.13	0.35	9z 29th
Aberdeen	743	0.92	0.04	0.07	0.08	-0.32	19z 28th
North Shields	743	0.93	-0.02	0.07	0.08	-0.46	21z 28th
Whitby	743	0.93	-0.09	0.08	0.12	-0.58	22z 28th
Immingham	743	0.88	0.03	0.12	0.12	-0.86	0z 29th
Cromer	708	0.94	-0.27	0.09	0.29	-0.79	0z 29th
Lowestoft	725	0.95	-0.08	0.08	0.12	-0.44	3z 29th
Felixstowe	743	0.92	-0.13	0.10	0.16	-0.71	19z 26th
Sheerness	743	0.88	-0.29	0.14	0.32	-1.15	20z 26th
Ilfracombe	No Observations Available						
Hinkley Point	743	0.81	-0.14	0.14	0.20	-0.51	14z 31st
Avonmouth	743	0.71	0.01	0.21	0.21	-0.77	0z 26th
Mumbles	743	0.82	-0.12	0.13	0.18	-0.51	18z 1st
Milford Haven	743	0.93	-0.16	0.07	0.18	-0.38	4z 30th
Fishguard	743	0.92	-0.18	0.07	0.20	-0.41	2z 2nd
Barmouth	743	0.93	-0.02	0.10	0.10	0.57	13z 27th
Holyhead	No Observations Available						
Llandudno	No Observations Available						
Liverpool	743	0.95	-0.07	0.10	0.12	-0.38	17z 28th
Heysham	743	0.94	0.04	0.10	0.11	0.43	16z 27th
Workington	743	0.95	0.26	0.10	0.28	0.56	19z 28th
St. Marys	No Observations Available						
Newlyn	743	0.87	-0.06	0.07	0.10	-0.28	0z 2nd
Plymouth	743	0.90	-0.03	0.07	0.08	-0.28	3z 2nd
Weymouth	743	0.91	-0.07	0.07	0.10	-0.34	2z 2nd
Portsmouth	743	0.89	-0.13	0.09	0.16	0.47	16z 26th
Newhaven	739	0.89	-0.07	0.09	0.12	-0.41	5z 27th
Dover	743	0.90	-0.08	0.09	0.13	-0.39	5z 27th
Jersey	743	0.86	-0.17	0.10	0.20	-0.56	17z 1st
Port Erin	52	0.97	0.04	0.07	0.08	0.17	21z 31st
Portpatrick	743	0.96	0.02	0.07	0.07	0.33	12z 28th
Millport	743	0.94	0.08	0.10	0.13	0.49	18z 28th
Islay	683	0.96	-0.03	0.07	0.08	-0.23	18z 27th
Tobermory	640	0.95	0.12	0.10	0.16	0.54	10z 28th
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	743	0.95	0.17	0.08	0.18	0.43	11z 28th
Kinlochbervie	No Observations Available						
Lerwick	611	0.90	0.01	0.06	0.06	0.19	16z 29th
Newport	743	0.70	0.00	0.22	0.22	0.75	17z 26th
Bournemouth	No Observations Available						

Table 1a: Statistics based on hourly data for January 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
	Stornoway	60	0.94	0.09	0.06	0.11	0.20	15z	8th
	Wick	54	0.90	0.07	0.07	0.10	0.23	7z	24th
	Aberdeen	60	0.90	0.01	0.07	0.07	-0.28	13z	28th
	North Shields	60	0.91	-0.06	0.08	0.10	-0.32	15z	28th
	Whitby	60	0.92	-0.13	0.08	0.15	-0.45	15z	28th
	Immingham	60	0.90	0.07	0.09	0.12	0.31	18z	29th
	Cromer	57	0.95	-0.28	0.07	0.29	-0.41	20z	30th
	Lowestoft	59	0.95	-0.08	0.09	0.12	-0.41	19z	26th
	Felixstowe	60	0.93	-0.14	0.09	0.17	-0.40	0z	29th
	Sheerness	60	0.91	-0.31	0.11	0.33	-0.59	0z	29th
	Ilfracombe	No Observations Available							
	Hinkley Point	60	0.87	-0.14	0.11	0.19	-0.35	19z	12th
	Avonmouth	60	0.63	0.10	0.21	0.23	0.64	6z	27th
	Mumbles	60	0.84	-0.11	0.11	0.16	-0.40	20z	1st
	Milford Haven	60	0.92	-0.14	0.07	0.16	-0.31	13z	23th
	Fishguard	60	0.94	-0.18	0.06	0.19	-0.29	14z	23th
	Barmouth	60	0.95	-0.01	0.08	0.08	-0.31	6z	26th
	Holyhead	No Observations Available							
	Llandudno	No Observations Available							
	Liverpool	59	0.94	-0.09	0.10	0.14	-0.26	22z	26th
	Heysham	59	0.95	0.02	0.09	0.09	0.19	15z	19th
	Workington	60	0.94	0.27	0.10	0.28	0.53	16z	20th
	St. Marys	No Observations Available							
	Newlyn	60	0.90	-0.06	0.06	0.09	-0.20	18z	1st
	Plymouth	60	0.92	-0.01	0.07	0.07	-0.23	12z	23th
	Weymouth	60	0.90	-0.05	0.07	0.09	-0.20	13z	23th
	Portsmouth	59	0.87	-0.12	0.10	0.15	-0.29	1z	2nd
	Newhaven	59	0.87	-0.05	0.09	0.10	-0.25	13z	2nd
	Dover	60	0.94	-0.10	0.07	0.13	-0.27	0z	29th
	Jersey	60	0.85	-0.12	0.10	0.16	-0.26	19z	12th
	Port Erin	3	0.97	0.04	0.10	0.09	0.15	13z	31st
	Portpatrick	60	0.96	0.00	0.08	0.08	0.33	12z	28th
	Millport	60	0.94	0.06	0.09	0.11	0.29	17z	20th
	Islay	55	0.96	-0.02	0.07	0.07	0.14	10z	22th
	Tobermory	52	0.92	0.11	0.10	0.15	0.37	10z	20th
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	60	0.95	0.16	0.08	0.17	0.29	19z	28th
	Kinlochbervie	No Observations Available							
	Lerwick	49	0.91	0.01	0.06	0.06	0.12	20z	25th
	Newport	60	0.71	0.10	0.18	0.21	0.64	3z	24th
	Bournemouth	No Observations Available							

Table 1b: Statistics at HW for January 2002.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
Stornoway	671	0.97	0.11	0.06	0.12	0.30	5z	20th
Wick	647	0.97	0.12	0.06	0.14	0.34	12z	20th
Aberdeen	671	0.95	0.05	0.07	0.09	-0.27	4z	2nd
North Shields	671	0.93	-0.05	0.09	0.11	-0.48	5z	2nd
Whitby	671	0.94	-0.10	0.09	0.14	-0.49	5z	2nd
Immingham	671	0.86	0.06	0.15	0.16	-0.53	5z	2nd
Cromer	652	0.92	-0.27	0.13	0.30	-0.74	5z	2nd
Lowestoft	671	0.92	-0.07	0.12	0.14	-0.55	9z	2nd
Felixstowe	671	0.90	-0.10	0.14	0.18	-0.59	12z	2nd
Sheerness	537	0.85	-0.27	0.22	0.35	-0.97	13z	2nd
Ilfracombe	No Observations Available							
Hinkley Point	671	0.78	-0.09	0.20	0.22	-0.80	3z	2nd
Avonmouth	671	0.79	0.06	0.23	0.24	1.46	7z	26th
Mumbles	671	0.86	-0.06	0.15	0.16	-0.64	2z	2nd
Milford Haven	671	0.92	-0.11	0.10	0.15	-0.52	5z	3rd
Fishguard	No Observations Available							
Barmouth	671	0.92	0.00	0.14	0.14	-0.82	4z	26th
Holyhead	No Observations Available							
Llandudno	No Observations Available							
Liverpool	508	0.94	-0.10	0.12	0.16	-0.82	6z	26th
Heysham	600	0.94	0.08	0.13	0.15	0.57	1z	2nd
Workington	671	0.95	0.27	0.11	0.29	0.76	1z	2nd
St. Marys	No Observations Available							
Newlyn	671	0.91	-0.01	0.08	0.08	-0.32	3z	3rd
Plymouth	671	0.87	-0.01	0.09	0.09	-0.42	4z	3rd
Weymouth	671	0.89	-0.03	0.09	0.09	0.31	19z	20th
Portsmouth	671	0.86	-0.10	0.10	0.14	-0.41	19z	4th
Newhaven	671	0.90	-0.05	0.10	0.11	-0.34	20z	26th
Dover	671	0.91	-0.04	0.12	0.13	-0.38	3z	23th
Jersey	671	0.80	-0.09	0.13	0.16	-0.46	19z	3rd
Port Erin	671	0.96	0.11	0.08	0.14	0.38	17z	20th
Portpatrick	671	0.96	0.03	0.09	0.09	0.33	11z	20th
Millport	671	0.95	0.11	0.11	0.15	0.64	12z	20th
Islay	671	0.96	-0.01	0.09	0.09	0.37	10z	20th
Tobermory	641	0.95	0.18	0.09	0.20	0.50	11z	20th
Moray Firth	No Observations Available							
Leith	488	0.85	-0.01	0.12	0.12	-0.48	5z	9th
Ullapool	671	0.97	0.19	0.07	0.20	0.47	13z	20th
Kinlochbervie	No Observations Available							
Lerwick	No Observations Available							
Newport	671	0.65	0.03	0.30	0.30	-1.55	17z	2nd
Bournemouth	No Observations Available							

Table 2a: Statistics based on hourly data for February 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	54	0.98	0.10	0.06	0.11	0.28	11z 20th
	Wick	52	0.96	0.10	0.07	0.12	0.26	17z 21th
	Aberdeen	54	0.95	0.03	0.07	0.08	-0.27	4z 2nd
	North Shields	54	0.92	-0.08	0.09	0.13	-0.44	6z 2nd
	Whitby	54	0.92	-0.14	0.09	0.17	-0.45	7z 2nd
	Immingham	54	0.83	0.05	0.16	0.16	-0.44	9z 2nd
	Cromer	51	0.91	-0.31	0.12	0.34	-0.64	10z 2nd
	Lowestoft	54	0.94	-0.07	0.11	0.13	-0.37	13z 2nd
	Felixstowe	54	0.91	-0.08	0.12	0.15	-0.36	4z 3rd
	Sheerness	44	0.74	-0.27	0.23	0.36	-0.65	19z 5th
	Ilfracombe	No Observations Available						
	Hinkley Point	54	0.81	-0.08	0.17	0.19	0.56	6z 26th
	Avonmouth	54	0.60	0.17	0.28	0.32	1.46	7z 26th
	Mumbles	54	0.86	-0.04	0.14	0.14	-0.35	16z 8th
	Milford Haven	54	0.91	-0.08	0.10	0.13	-0.33	16z 8th
	Fishguard	No Observations Available						
	Barmouth	54	0.93	0.01	0.12	0.12	-0.43	7z 26th
	Holyhead	No Observations Available						
	Llandudno	No Observations Available						
	Liverpool	41	0.94	-0.12	0.11	0.17	-0.33	15z 3rd
	Heysham	49	0.93	0.05	0.13	0.14	0.49	16z 20th
	Workington	54	0.93	0.29	0.14	0.32	0.64	17z 20th
	St. Marys	No Observations Available						
	Newlyn	54	0.88	-0.01	0.09	0.09	0.24	22z 20th
	Plymouth	54	0.84	0.01	0.09	0.09	-0.23	3z 8th
	Weymouth	55	0.85	-0.01	0.09	0.09	0.29	23z 20th
	Portsmouth	54	0.90	-0.06	0.11	0.12	0.34	11z 26th
	Newhaven	54	0.92	-0.02	0.09	0.09	-0.25	9z 8th
	Dover	54	0.91	-0.06	0.12	0.13	-0.33	3z 3rd
	Jersey	54	0.70	0.00	0.15	0.15	-0.37	4z 8th
	Port Erin	54	0.95	0.11	0.09	0.14	0.38	17z 20th
	Portpatrick	54	0.94	0.03	0.10	0.10	0.31	12z 27th
	Millport	54	0.93	0.11	0.12	0.16	0.34	9z 23th
	Islay	54	0.96	-0.01	0.09	0.09	0.33	9z 20th
	Tobermory	52	0.95	0.17	0.10	0.19	0.46	10z 20th
	Moray Firth	No Observations Available						
	Leith	39	0.82	-0.04	0.11	0.11	-0.29	9z 22th
	Ullapool	54	0.97	0.17	0.07	0.18	0.35	11z 20th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	54	0.55	0.22	0.29	0.36	1.50	7z 26th
	Bournemouth	No Observations Available						

Table 2b: Statistics at HW for February 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	743	0.94	0.04	0.06	0.07	-0.22	15z 11th
	Wick	672	0.94	0.01	0.06	0.06	-0.32	15z 11th
	Aberdeen	743	0.95	0.01	0.05	0.05	-0.19	11z 11th
	North Shields	743	0.93	-0.04	0.06	0.08	-0.34	13z 11th
	Whitby	No Observations Available						
	Immingham	743	0.87	0.07	0.10	0.12	0.41	8z 7th
	Cromer	710	0.93	-0.12	0.08	0.15	-0.46	17z 9th
	Lowestoft	743	0.95	-0.05	0.06	0.08	-0.26	2z 11th
	Felixstowe	743	0.93	-0.03	0.08	0.09	0.35	16z 9th
	Sheerness	743	0.91	-0.08	0.10	0.13	-0.41	1z 19th
	Ilfracombe	No Observations Available						
	Hinkley Point	743	0.70	-0.03	0.15	0.15	-0.78	9z 9th
	Avonmouth	743	0.64	0.01	0.22	0.22	-0.99	10z 9th
	Mumbles	743	0.80	0.00	0.10	0.10	-0.56	8z 9th
	Milford Haven	743	0.89	-0.08	0.06	0.10	-0.38	8z 9th
	Fishguard	488	0.92	-0.05	0.06	0.08	-0.24	16z 17th
	Barmouth	743	0.84	-0.04	0.11	0.12	-0.75	8z 9th
	Holyhead	743	0.92	-0.02	0.06	0.07	0.28	15z 9th
	Llandudno	267	0.77	0.08	0.10	0.12	0.51	14z 9th
	Liverpool	743	0.90	-0.07	0.10	0.12	0.65	14z 9th
	Heysham	285	0.84	0.00	0.07	0.07	-0.24	15z 23th
	Workington	743	0.93	0.07	0.08	0.11	0.69	17z 9th
	St. Marys	593	0.93	-0.08	0.05	0.10	-0.27	5z 18th
	Newlyn	No Observations Available						
	Plymouth	743	0.88	0.00	0.07	0.07	-0.29	7z 18th
	Weymouth	743	0.88	-0.05	0.07	0.08	-0.32	7z 14th
	Portsmouth	743	0.86	-0.09	0.08	0.12	-0.47	10z 18th
	Newhaven	743	0.90	-0.03	0.07	0.08	-0.36	10z 18th
	Dover	743	0.91	-0.02	0.08	0.08	0.40	17z 18th
	Jersey	743	0.78	-0.02	0.10	0.10	-0.38	16z 17th
	Port Erin	743	0.94	0.04	0.06	0.07	0.27	5z 11th
	Portpatrick	741	0.93	-0.02	0.07	0.07	0.26	2z 11th
	Millport	No Observations Available						
	Islay	743	0.92	0.00	0.07	0.07	0.36	4z 11th
	Tobermory	743	0.94	0.03	0.07	0.08	0.42	3z 11th
	Moray Firth	743	0.83	0.02	0.09	0.09	-0.54	9z 11th
	Leith	743	0.85	0.02	0.08	0.09	-0.31	0z 12th
	Ullapool	743	0.95	0.08	0.06	0.10	0.28	23z 6th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	743	0.56	0.01	0.24	0.24	-1.24	10z 9th
	Bournemouth	743	0.89	-0.03	0.07	0.07	-0.33	9z 18th

Table 3a: Statistics based on hourly data for March 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	60	0.95	0.04	0.05	0.07	0.19	7z 28th
	Wick	54	0.97	0.01	0.04	0.04	-0.16	10z 11th
	Aberdeen	60	0.93	0.00	0.06	0.06	-0.18	12z 11th
	North Shields	60	0.90	-0.05	0.07	0.09	-0.30	14z 11th
	Whitby	No Observations Available						
	Immingham	60	0.80	0.09	0.11	0.15	-0.29	3z 9th
	Cromer	57	0.90	-0.12	0.09	0.15	-0.37	18z 11th
	Lowestoft	60	0.95	-0.03	0.06	0.07	-0.25	23z 18th
	Felixstowe	60	0.94	-0.06	0.07	0.09	-0.24	3z 19th
	Sheerness	60	0.91	-0.11	0.08	0.14	-0.37	3z 19th
	Ilfracombe	No Observations Available						
	Hinkley Point	60	0.80	-0.03	0.12	0.12	-0.30	5z 10th
	Avonmouth	60	0.82	0.07	0.14	0.16	0.46	1z 23th
	Mumbles	60	0.87	0.01	0.07	0.07	-0.18	18z 12th
	Milford Haven	60	0.93	-0.05	0.05	0.07	-0.17	6z 13th
	Fishguard	40	0.94	-0.02	0.05	0.05	-0.14	10z 18th
	Barmouth	60	0.92	0.00	0.07	0.07	-0.27	19z 10th
	Holyhead	59	0.90	-0.02	0.07	0.07	-0.21	8z 9th
	Llandudno	20	0.76	0.06	0.09	0.11	0.26	17z 6th
	Liverpool	60	0.88	-0.09	0.10	0.13	-0.45	20z 8th
	Heysham	23	0.89	0.01	0.05	0.05	0.10	12z 29th
	Workington	60	0.94	0.08	0.07	0.11	0.31	17z 6th
	St. Marys	47	0.95	-0.08	0.05	0.10	-0.19	7z 17th
	Newlyn	No Observations Available						
	Plymouth	60	0.93	0.01	0.06	0.06	-0.14	6z 14th
	Weymouth	62	0.88	-0.04	0.07	0.08	-0.32	7z 14th
	Portsmouth	60	0.93	-0.09	0.06	0.11	-0.29	0z 14th
	Newhaven	60	0.93	-0.02	0.06	0.07	-0.18	0z 14th
	Dover	60	0.93	-0.01	0.07	0.07	-0.20	2z 19th
	Jersey	60	0.84	0.04	0.09	0.10	-0.23	9z 18th
	Port Erin	59	0.94	0.03	0.06	0.06	0.21	17z 6th
	Portpatrick	60	0.95	-0.03	0.06	0.06	-0.15	0z 13th
	Millport	No Observations Available						
	Islay	62	0.92	0.00	0.07	0.07	0.27	5z 11th
	Tobermory	60	0.95	0.04	0.07	0.07	0.23	5z 11th
	Moray Firth	59	0.73	0.00	0.10	0.10	-0.43	22z 11th
	Leith	60	0.87	0.01	0.07	0.07	0.27	13z 10th
	Ullapool	60	0.95	0.09	0.06	0.10	0.26	6z 11th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	60	0.73	0.07	0.16	0.18	0.53	3z 24th
	Bournemouth	87	0.87	-0.02	0.07	0.07	-0.28	2z 14th

Table 3b: Statistics at HW for March 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
	Stornoway	719	0.92	-0.02	0.05	0.06	-0.17	23z	8th
	Wick	719	0.91	-0.03	0.05	0.06	-0.19	23z	26th
	Aberdeen	719	0.91	-0.03	0.05	0.06	-0.24	22z	26th
	North Shields	719	0.89	-0.05	0.05	0.07	-0.29	1z	27th
	Whitby	454	0.91	-0.05	0.06	0.08	-0.28	22z	26th
	Immingham	719	0.77	0.04	0.09	0.10	0.42	17z	27th
	Cromer	719	0.90	-0.15	0.07	0.17	-0.41	2z	27th
	Lowestoft	719	0.92	-0.07	0.06	0.09	-0.30	15z	29th
	Felixstowe	719	0.89	-0.04	0.07	0.08	-0.32	7z	27th
	Sheerness	719	0.84	-0.08	0.10	0.13	-0.58	12z	29th
	Ilfracombe	No Observations Available							
	Hinkley Point	719	0.72	-0.03	0.14	0.14	-0.50	2z	8th
	Avonmouth	719	0.67	0.00	0.20	0.20	-0.84	3z	29th
	Mumbles	719	0.78	0.00	0.10	0.10	-0.40	3z	8th
	Milford Haven	719	0.83	-0.09	0.07	0.12	-0.36	23z	7th
	Fishguard	702	0.86	-0.10	0.06	0.13	-0.40	0z	8th
	Barmouth	719	0.86	-0.05	0.09	0.10	-0.54	0z	29th
	Holyhead	No Observations Available							
	Llandudno	No Observations Available							
	Liverpool	589	0.78	-0.01	0.11	0.11	0.42	19z	26th
	Heysham	719	0.91	-0.03	0.07	0.08	-0.33	8z	29th
	Workington	719	0.89	0.03	0.08	0.09	0.37	1z	29th
	St. Marys	No Observations Available							
	Newlyn	451	0.89	-0.01	0.04	0.05	-0.28	13z	26th
	Plymouth	719	0.78	0.00	0.07	0.07	-0.30	2z	8th
	Weymouth	719	0.83	-0.05	0.07	0.09	-0.42	0z	8th
	Portsmouth	719	0.84	-0.10	0.07	0.12	-0.44	0z	8th
	Newhaven	719	0.88	-0.03	0.07	0.08	-0.34	22z	7th
	Dover	719	0.85	-0.04	0.08	0.09	-0.30	0z	8th
	Jersey	719	0.76	-0.02	0.10	0.10	-0.38	0z	8th
	Port Erin	719	0.89	0.02	0.06	0.07	-0.26	0z	8th
	Portpatrick	719	0.89	-0.05	0.07	0.09	-0.32	0z	8th
	Millport	514	0.92	0.00	0.06	0.06	0.21	22z	26th
	Islay	719	0.88	-0.04	0.07	0.08	-0.26	0z	8th
	Tobermory	655	0.90	-0.01	0.07	0.07	-0.23	23z	7th
	Moray Firth	No Observations Available							
	Leith	No Observations Available							
	Ullapool	719	0.91	0.01	0.06	0.06	0.20	1z	1st
	Kinlochbervie	No Observations Available							
	Lerwick	No Observations Available							
	Newport	719	0.64	0.00	0.20	0.20	-0.92	3z	29th
	Bournemouth	No Observations Available							

Table 4a: Statistics based on hourly data for April 2002.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	58	0.92	-0.02	0.05	0.06	-0.13	19z 26th
Wick	58	0.92	-0.04	0.05	0.06	-0.19	23z 26th
Aberdeen	58	0.93	-0.03	0.04	0.05	0.12	13z 27th
North Shields	58	0.91	-0.06	0.04	0.08	-0.17	3z 27th
Whitby	36	0.92	-0.06	0.05	0.08	-0.20	5z 29th
Immingham	58	0.80	0.08	0.07	0.10	0.36	18z 27th
Cromer	58	0.89	-0.15	0.06	0.17	-0.32	8z 29th
Lowestoft	57	0.89	-0.06	0.06	0.09	-0.24	20z 26th
Felixstowe	58	0.88	-0.07	0.06	0.10	-0.22	8z 7th
Sheerness	58	0.77	-0.11	0.09	0.14	-0.43	9z 7th
Ilfracombe	No Observations Available						
Hinkley Point	58	0.66	-0.03	0.14	0.14	-0.39	16z 7th
Avonmouth	58	0.69	0.07	0.15	0.16	0.50	1z 21th
Mumbles	58	0.59	0.00	0.12	0.12	-0.37	4z 8th
Milford Haven	58	0.81	-0.06	0.08	0.10	-0.29	4z 8th
Fishguard	57	0.83	-0.08	0.07	0.11	-0.32	5z 8th
Barmouth	58	0.89	-0.02	0.07	0.08	-0.23	6z 8th
Holyhead	No Observations Available						
Llandudno	No Observations Available						
Liverpool	47	0.70	0.00	0.12	0.12	-0.30	21z 7th
Heysham	58	0.88	-0.04	0.07	0.09	-0.24	22z 8th
Workington	58	0.82	0.05	0.10	0.12	0.37	1z 29th
St. Marys	No Observations Available						
Newlyn	37	0.95	0.00	0.03	0.03	0.10	6z 29th
Plymouth	58	0.78	0.01	0.07	0.07	-0.26	3z 8th
Weymouth	59	0.75	-0.04	0.08	0.09	-0.33	4z 8th
Portsmouth	58	0.88	-0.09	0.08	0.12	-0.34	21z 7th
Newhaven	58	0.87	-0.03	0.07	0.08	-0.31	21z 7th
Dover	58	0.86	-0.03	0.07	0.07	-0.21	9z 7th
Jersey	58	0.78	0.04	0.09	0.10	0.24	9z 29th
Port Erin	58	0.85	0.01	0.07	0.07	-0.21	21z 7th
Portpatrick	58	0.85	-0.05	0.08	0.10	-0.29	22z 7th
Millport	42	0.90	-0.01	0.07	0.07	0.15	2z 29th
Islay	62	0.90	-0.03	0.06	0.07	-0.20	4z 8th
Tobermory	53	0.88	0.00	0.07	0.07	-0.20	4z 9th
Moray Firth	No Observations Available						
Leith	No Observations Available						
Ullapool	58	0.92	0.01	0.05	0.05	-0.13	19z 26th
Kinlochbervie	No Observations Available						
Lerwick	No Observations Available						
Newport	58	0.63	0.07	0.17	0.19	0.47	9z 29th
Bournemouth	No Observations Available						

Table 4b: Statistics at HW for April 2002.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	743	0.97	-0.04	0.04	0.06	-0.22	16z 22th
Wick	743	0.96	-0.05	0.04	0.07	-0.23	19z 22th
Aberdeen	743	0.93	-0.05	0.04	0.07	-0.22	1z 23th
North Shields	743	0.86	-0.06	0.05	0.09	-0.23	22z 22th
Whitby	743	0.83	-0.07	0.05	0.09	-0.26	22z 22th
Immingham	743	0.65	0.04	0.09	0.10	-0.28	5z 14th
Cromer	743	0.73	-0.19	0.08	0.21	-0.46	5z 14th
Lowestoft	743	0.78	-0.08	0.07	0.11	-0.34	4z 25th
Felixstowe	743	0.77	-0.06	0.07	0.10	-0.31	23z 14th
Sheerness	No Observations Available						
Ilfracombe	No Observations Available						
Hinkley Point	743	0.68	-0.02	0.13	0.14	0.46	13z 24th
Avonmouth	743	0.61	0.00	0.19	0.19	-0.64	6z 18th
Mumbles	743	0.82	0.01	0.10	0.10	0.34	14z 24th
Milford Haven	743	0.93	-0.08	0.06	0.10	-0.30	15z 13th
Fishguard	743	0.94	-0.10	0.05	0.12	-0.28	20z 20th
Barmouth	743	0.92	-0.04	0.08	0.09	0.43	17z 24th
Holyhead	No Observations Available						
Llandudno	No Observations Available						
Liverpool	515	0.87	0.06	0.07	0.09	0.28	8z 21th
Heysham	699	0.94	-0.04	0.07	0.09	-0.29	0z 21th
Workington	743	0.95	0.03	0.06	0.07	0.22	17z 24th
St. Marys	No Observations Available						
Newlyn	743	0.89	-0.09	0.06	0.11	-0.24	18z 21th
Plymouth	743	0.89	0.00	0.06	0.06	-0.20	19z 21th
Weymouth	743	0.88	-0.03	0.06	0.07	-0.20	21z 21th
Portsmouth	743	0.84	-0.09	0.06	0.11	-0.34	2z 26th
Newhaven	743	0.80	-0.03	0.06	0.07	-0.19	7z 26th
Dover	743	0.69	-0.03	0.08	0.08	-0.26	6z 22th
Jersey	743	0.79	-0.01	0.08	0.08	-0.27	15z 13th
Port Erin	743	0.95	0.02	0.05	0.06	0.18	5z 15th
Portpatrick	743	0.96	-0.05	0.05	0.07	-0.20	1z 21th
Millport	731	0.95	-0.02	0.07	0.07	-0.25	1z 21th
Islay	743	0.96	-0.05	0.06	0.08	-0.25	17z 20th
Tobermory	743	0.96	-0.01	0.05	0.05	0.18	5z 25th
Moray Firth	No Observations Available						
Leith	683	0.79	-0.01	0.07	0.07	0.33	10z 22th
Ullapool	743	0.97	0.00	0.04	0.04	-0.19	16z 22th
Kinlochbervie	No Observations Available						
Lerwick	No Observations Available						
Newport	743	0.60	-0.01	0.19	0.19	-0.65	14z 27th
Bournemouth	No Observations Available						

Table 5a: Statistics based on hourly data for May 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	60	0.97	-0.04	0.04	0.07	-0.22	16z 22th
	Wick	60	0.96	-0.06	0.05	0.08	-0.22	20z 22th
	Aberdeen	60	0.93	-0.05	0.05	0.07	-0.20	22z 22th
	North Shields	60	0.84	-0.08	0.06	0.10	-0.21	0z 23th
	Whitby	60	0.79	-0.08	0.06	0.10	-0.23	17z 14th
	Immingham	60	0.78	0.07	0.07	0.10	0.21	4z 8th
	Cromer	60	0.69	-0.17	0.08	0.20	-0.36	20z 14th
	Lowestoft	59	0.73	-0.07	0.08	0.11	-0.28	6z 22th
	Felixstowe	60	0.85	-0.08	0.05	0.10	-0.20	7z 21th
	Sheerness	No Observations Available						
	Ilfracombe	No Observations Available						
	Hinkley Point	60	0.69	-0.05	0.10	0.12	-0.24	10z 31st
	Avonmouth	60	0.61	0.01	0.13	0.13	0.40	23z 17th
	Mumbles	60	0.71	-0.03	0.09	0.10	-0.22	3z 7th
	Milford Haven	60	0.93	-0.08	0.05	0.10	-0.18	13z 5th
	Fishguard	60	0.94	-0.09	0.05	0.11	-0.18	14z 5th
	Barmouth	59	0.93	-0.05	0.07	0.09	-0.29	17z 22th
	Holyhead	No Observations Available						
	Llandudno	No Observations Available						
	Liverpool	42	0.92	0.03	0.05	0.06	0.13	22z 9th
	Heysham	57	0.94	-0.07	0.06	0.10	-0.25	22z 24th
	Workington	60	0.94	0.01	0.06	0.06	0.16	1z 15th
	St. Marys	No Observations Available						
	Newlyn	60	0.90	-0.10	0.05	0.12	-0.21	12z 21th
	Plymouth	60	0.90	0.00	0.05	0.05	0.11	7z 14th
	Weymouth	60	0.89	-0.02	0.05	0.06	-0.18	14z 21th
	Portsmouth	60	0.86	-0.09	0.06	0.11	-0.24	19z 5th
	Newhaven	60	0.80	-0.05	0.05	0.07	-0.17	19z 21th
	Dover	60	0.77	-0.06	0.06	0.09	-0.23	1z 15th
	Jersey	60	0.76	0.02	0.08	0.08	-0.19	14z 21th
	Port Erin	60	0.95	0.00	0.05	0.05	-0.11	19z 5th
	Portpatrick	60	0.96	-0.06	0.05	0.08	-0.16	16z 17th
	Millport	58	0.95	-0.03	0.06	0.07	-0.17	21z 21th
	Islay	60	0.96	-0.03	0.06	0.07	-0.19	15z 22th
	Tobermory	60	0.96	-0.01	0.05	0.05	0.18	5z 25th
	Moray Firth	No Observations Available						
	Leith	55	0.80	-0.01	0.07	0.07	-0.18	0z 23th
	Ullapool	60	0.97	1.05	0.04	0.04	-0.19	16z 22th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	60	0.58	0.05	0.14	0.15	0.35	0z 19th
	Bournemouth	No Observations Available						

Table 5b: Statistics at HW for May 2002.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	719	0.94	-0.03	0.04	0.06	-0.16	16z 14th
Wick	719	0.93	-0.04	0.04	0.06	-0.18	16z 17th
Aberdeen	719	0.90	-0.03	0.04	0.05	-0.14	12z 15th
North Shields	719	0.88	-0.05	0.04	0.07	-0.18	18z 15th
Whitby	719	0.90	-0.05	0.04	0.07	-0.18	5z 17th
Immingham	719	0.80	0.07	0.07	0.10	0.38	3z 29th
Cromer	719	0.90	-0.16	0.06	0.17	-0.29	16z 10th
Lowestoft	719	0.91	-0.06	0.05	0.08	-0.21	1z 15th
Felixstowe	719	0.86	-0.04	0.06	0.08	-0.24	21z 10th
Sheerness	394	0.86	-0.05	0.08	0.10	-0.32	13z 17th
Ilfracombe	274	0.01	4.82	2.42	5.40	8.81	19z 26th
Hinkley Point	719	0.61	-0.01	0.13	0.13	0.37	15z 29th
Avonmouth	719	0.49	0.02	0.20	0.20	-0.66	4z 13th
Mumbles	719	0.74	0.03	0.10	0.10	0.39	13z 28th
Milford Haven	719	0.90	-0.07	0.05	0.10	-0.24	16z 12th
Fishguard	719	0.93	-0.11	0.04	0.12	-0.22	3z 10th
Barmouth	719	0.89	-0.04	0.07	0.08	-0.39	4z 10th
Holyhead	No Observations Available						
Llandudno	No Observations Available						
Liverpool	719	0.81	0.07	0.07	0.10	0.29	20z 28th
Heysham	466	0.89	-0.03	0.07	0.08	-0.22	23z 18th
Workington	719	0.90	0.03	0.07	0.07	0.23	7z 18th
St. Marys	No Observations Available						
Newlyn	719	0.89	-0.09	0.05	0.11	-0.23	14z 12th
Plymouth	719	0.84	0.01	0.06	0.06	0.18	12z 28th
Weymouth	719	0.85	-0.02	0.05	0.06	-0.21	3z 12th
Portsmouth	719	0.78	-0.07	0.06	0.10	-0.24	21z 11th
Newhaven	No Observations Available						
Dover	719	0.75	-0.01	0.07	0.08	0.22	22z 28th
Jersey	719	0.76	0.00	0.09	0.09	-0.30	3z 12th
Port Erin	719	0.92	0.04	0.05	0.07	0.18	22z 28th
Portpatrick	719	0.92	-0.03	0.05	0.07	-0.18	19z 7th
Millport	514	0.91	-0.01	0.07	0.07	0.20	21z 30th
Islay	719	0.94	-0.04	0.05	0.06	-0.17	20z 7th
Tobermory	719	0.94	-0.02	0.05	0.05	0.16	20z 30th
Moray Firth	No Observations Available						
Leith	719	0.77	0.00	0.07	0.07	0.23	19z 3rd
Ullapool	719	0.95	0.00	0.04	0.04	0.16	15z 10th
Kinlochbervie	No Observations Available						
Lerwick	No Observations Available						
Newport	719	0.53	0.01	0.18	0.18	0.73	16z 28th
Bournemouth	No Observations Available						

Table 6a: Statistics based on hourly data for June 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	58	0.95	-0.04	0.04	0.06	-0.13	12z 17th
	Wick	58	0.92	-0.06	0.04	0.08	-0.18	16z 17th
	Aberdeen	58	0.92	-0.04	0.03	0.05	-0.12	4z 15th
	North Shields	58	0.85	-0.07	0.04	0.09	-0.18	18z 15th
	Whitby	58	0.88	-0.06	0.04	0.08	-0.16	19z 15th
	Immingham	58	0.81	0.09	0.06	0.11	0.26	20z 28th
	Cromer	58	0.91	-0.15	0.05	0.16	-0.25	18z 10th
	Lowestoft	58	0.93	-0.05	0.05	0.07	-0.16	4z 3rd
	Felixstowe	58	0.88	-0.09	0.05	0.11	-0.22	5z 3rd
	Sheerness	32	0.89	-0.11	0.05	0.13	-0.20	0z 24th
	Ilfracombe	22	0.56	8.21	0.37	8.21	8.81	19z 26th
	Hinkley Point	58	0.40	-0.05	0.12	0.13	-0.32	11z 1st
	Avonmouth	58	0.33	0.01	0.15	0.15	0.34	22z 14th
	Mumbles	58	0.73	-0.01	0.07	0.07	-0.19	23z 1st
	Milford Haven	58	0.90	-0.09	0.04	0.10	-0.20	17z 22th
	Fishguard	58	0.92	-0.11	0.04	0.12	-0.20	4z 21th
	Barmouth	57	0.89	-0.05	0.06	0.08	-0.25	8z 10th
	Holyhead	No Observations Available						
	Llandudno	No Observations Available						
	Liverpool	58	0.82	0.03	0.06	0.06	0.19	4z 18th
	Heysham	37	0.87	-0.07	0.06	0.10	-0.20	0z 13th
	Workington	58	0.91	0.00	0.05	0.05	0.13	5z 18th
	St. Marys	No Observations Available						
	Newlyn	58	0.91	-0.10	0.04	0.11	-0.20	17z 11th
	Plymouth	58	0.82	0.00	0.05	0.05	0.13	0z 19th
	Weymouth	58	0.84	-0.02	0.04	0.05	-0.12	10z 1st
	Portsmouth	58	0.82	-0.08	0.05	0.10	-0.18	16z 1st
	Newhaven	No Observations Available						
	Dover	58	0.85	-0.05	0.05	0.07	-0.19	4z 1st
	Jersey	58	0.70	0.01	0.07	0.07	-0.15	17z 22th
	Port Erin	58	0.93	0.02	0.05	0.05	0.13	5z 18th
	Portpatrick	58	0.92	-0.05	0.05	0.07	-0.15	10z 8th
	Millport	41	0.91	-0.02	0.06	0.07	-0.16	17z 1st
	Islay	59	0.94	-0.03	0.05	0.06	-0.14	3z 8th
	Tobermory	58	0.94	-0.02	0.04	0.05	0.13	21z 30th
	Moray Firth	No Observations Available						
	Leith	58	0.78	-0.02	0.06	0.06	-0.15	21z 3rd
	Ullapool	58	0.96	0.00	0.04	0.04	0.11	23z 30th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	58	0.36	0.04	0.16	0.16	0.40	22z 14th
	Bournemouth	No Observations Available						

Table 6b: Statistics at HW for June 2002.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	743	0.92	-0.02	0.04	0.04	-0.14	11z 17th
Wick	743	0.93	-0.02	0.03	0.04	-0.13	16z 16th
Aberdeen	743	0.89	-0.01	0.04	0.04	-0.12	15z 16th
North Shields	29	0.96	-0.02	0.03	0.04	-0.07	9z 1st
Whitby	743	0.84	-0.03	0.04	0.06	-0.17	18z 16th
Immingham	743	0.62	0.08	0.08	0.11	0.30	11z 15th
Cromer	743	0.85	-0.14	0.05	0.15	-0.28	0z 9th
Lowestoft	743	0.87	-0.04	0.04	0.06	-0.18	22z 15th
Felixstowe	743	0.81	-0.02	0.05	0.06	-0.22	20z 9th
Sheerness	464	0.83	-0.04	0.07	0.08	-0.27	20z 8th
Ilfracombe	No Observations Available						
Hinkley Point	743	0.49	-0.01	0.12	0.12	-0.33	19z 26th
Avonmouth	743	0.40	0.03	0.17	0.18	-0.52	4z 12th
Mumbles	743	0.62	0.04	0.08	0.09	0.25	17z 1st
Milford Haven	743	0.81	-0.07	0.05	0.09	-0.19	4z 12th
Fishguard	743	0.86	-0.12	0.04	0.13	-0.22	4z 12th
Barmouth	743	0.87	-0.02	0.05	0.06	-0.20	5z 13th
Holyhead	No Observations Available						
Llandudno	No Observations Available						
Liverpool	743	0.80	0.07	0.07	0.10	0.27	10z 5th
Heysham	743	0.81	-0.01	0.07	0.07	-0.19	9z 12th
Workington	743	0.87	0.05	0.06	0.07	0.23	17z 23th
St. Marys	No Observations Available						
Newlyn	743	0.75	-0.10	0.04	0.11	-0.20	18z 14th
Plymouth	No Observations Available						
Weymouth	743	0.78	-0.03	0.05	0.06	-0.16	18z 17th
Portsmouth	736	0.72	-0.06	0.06	0.09	-0.24	21z 19th
Newhaven	743	0.73	-0.01	0.06	0.06	-0.18	6z 9th
Dover	743	0.71	0.00	0.07	0.07	-0.25	11z 12th
Jersey	743	0.59	-0.04	0.09	0.10	-0.30	18z 26th
Port Erin	743	0.92	0.05	0.04	0.07	0.19	22z 1st
Portpatrick	743	0.90	-0.01	0.04	0.05	-0.14	10z 9th
Millport	424	0.88	0.01	0.05	0.05	0.18	23z 1st
Islay	743	0.94	-0.03	0.04	0.05	-0.15	5z 8th
Tobermory	743	0.93	0.00	0.04	0.04	-0.12	5z 8th
Moray Firth	No Observations Available						
Leith	723	0.72	0.02	0.06	0.07	0.27	14z 31st
Ullapool	743	0.94	0.01	0.04	0.04	0.14	13z 7th
Kinlochbervie	No Observations Available						
Lerwick	No Observations Available						
Newport	743	0.43	0.02	0.16	0.16	0.50	16z 28th
Bournemouth	No Observations Available						

Table 7a: Statistics based on hourly data for July 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	60	0.91	-0.03	0.04	0.05	-0.13	11z 16th
	Wick	60	0.94	-0.03	0.03	0.05	-0.13	16z 16th
	Aberdeen	60	0.92	-0.02	0.03	0.04	-0.09	1z 10th
	North Shields	3	1.00	-0.03	0.02	0.04	-0.05	20z 31st
	Whitby	60	0.87	-0.04	0.04	0.06	-0.15	3z 9th
	Immingham	60	0.87	0.11	0.04	0.12	0.21	4z 8th
	Cromer	60	0.89	-0.14	0.04	0.15	-0.25	17z 8th
	Lowestoft	60	0.89	-0.04	0.04	0.06	-0.14	20z 9th
	Felixstowe	60	0.81	-0.05	0.05	0.07	-0.15	8z 20th
	Sheerness	38	0.86	-0.09	0.06	0.11	-0.19	14z 26th
	Ilfracombe	No Observations Available						
	Hinkley Point	59	0.59	-0.04	0.11	0.12	-0.30	4z 21th
	Avonmouth	59	0.57	0.04	0.14	0.14	0.32	22z 13th
	Mumbles	60	0.67	0.03	0.08	0.08	0.18	15z 5th
	Milford Haven	60	0.85	-0.08	0.04	0.09	-0.17	15z 20th
	Fishguard	59	0.85	-0.11	0.04	0.12	-0.21	15z 19th
	Barmouth	59	0.90	-0.04	0.04	0.06	-0.16	4z 20th
	Holyhead	No Observations Available						
	Llandudno	No Observations Available						
	Liverpool	60	0.90	0.05	0.05	0.07	0.21	17z 2nd
	Heysham	60	0.90	-0.05	0.05	0.07	-0.14	17z 17th
	Workington	60	0.92	0.03	0.04	0.06	0.19	17z 2nd
	St. Marys	No Observations Available						
	Newlyn	60	0.82	-0.10	0.04	0.11	-0.17	16z 22th
	Plymouth	No Observations Available						
	Weymouth	60	0.80	-0.02	0.05	0.05	-0.12	14z 19th
	Portsmouth	60	0.81	-0.08	0.05	0.10	-0.20	13z 26th
	Newhaven	60	0.75	-0.04	0.05	0.07	-0.15	8z 20th
	Dover	60	0.78	-0.02	0.05	0.06	-0.13	22z 8th
	Jersey	60	0.63	-0.02	0.08	0.09	0.17	13z 3rd
	Port Erin	60	0.95	0.04	0.03	0.05	0.15	17z 2nd
	Portpatrick	60	0.93	-0.03	0.04	0.05	-0.13	11z 9th
	Millport	35	0.93	0.00	0.04	0.04	-0.10	21z 19th
	Islay	60	0.91	-0.02	0.04	0.05	-0.13	9z 30th
	Tobermory	60	0.93	0.00	0.04	0.04	-0.11	4z 8th
	Moray Firth	No Observations Available						
	Leith	58	0.83	0.01	0.05	0.05	-0.15	6z 31st
	Ullapool	60	0.94	0.01	0.03	0.03	0.09	7z 24th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	59	0.58	0.07	0.14	0.16	0.32	22z 13th
	Bournemouth	No Observations Available						

Table 7b: Statistics at HW for July 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	743	0.93	-0.01	0.04	0.04	-0.14	11z 15th
	Wick	743	0.94	-0.01	0.03	0.03	-0.12	16z 15th
	Aberdeen	743	0.92	-0.01	0.03	0.03	-0.11	18z 15th
	North Shields	743	0.87	-0.04	0.04	0.06	-0.15	5z 1st
	Whitby	743	0.88	-0.04	0.04	0.06	-0.16	11z 10th
	Immingham	743	0.73	0.08	0.08	0.11	0.29	9z 13th
	Cromer	743	0.89	-0.13	0.05	0.15	-0.27	9z 1st
	Lowestoft	743	0.90	-0.04	0.04	0.06	-0.19	14z 25th
	Felixstowe	743	0.85	0.02	0.06	0.06	0.19	9z 13th
	Sheerness	No Observations Available						
	Ilfracombe	No Observations Available						
	Hinkley Point	743	0.28	-0.01	0.13	0.13	-0.34	5z 23th
	Avonmouth	743	0.29	0.04	0.17	0.17	-0.59	19z 31st
	Mumbles	458	0.41	0.04	0.09	0.10	0.28	20z 11th
	Milford Haven	743	0.78	-0.07	0.05	0.09	-0.21	9z 2nd
	Fishguard	743	0.81	-0.13	0.04	0.14	-0.25	12z 8th
	Barmouth	743	0.77	-0.04	0.06	0.07	-0.32	6z 12th
	Holyhead	743	0.87	0.00	0.04	0.04	-0.13	3z 4th
	Llandudno	677	0.78	0.05	0.06	0.08	0.31	5z 10th
	Liverpool	743	0.69	0.07	0.07	0.10	0.29	4z 13th
	Heysham	743	0.80	-0.02	0.07	0.07	-0.26	20z 30th
	Workington	743	0.84	0.05	0.06	0.08	0.20	2z 12th
	St. Marys	743	0.73	-0.03	0.04	0.05	-0.14	17z 25th
	Newlyn	743	0.79	-0.11	0.04	0.12	-0.24	22z 3rd
	Plymouth	565	0.61	0.01	0.06	0.06	-0.14	4z 26th
	Weymouth	743	0.70	-0.04	0.05	0.07	-0.18	20z 2nd
	Portsmouth	743	0.70	-0.07	0.05	0.09	-0.20	16z 3rd
	Newhaven	743	0.65	-0.01	0.06	0.06	-0.19	14z 3rd
	Dover	743	0.74	-0.01	0.06	0.06	-0.20	16z 3rd
	Jersey	743	0.54	-0.05	0.09	0.10	-0.29	6z 26th
	Port Erin	743	0.87	0.06	0.04	0.07	0.18	21z 9th
	Portpatrick	743	0.89	-0.01	0.04	0.05	-0.15	6z 3rd
	Millport	743	0.85	0.01	0.06	0.06	0.19	14z 18th
	Islay	743	0.89	-0.02	0.05	0.06	-0.15	7z 2nd
	Tobermory	743	0.91	0.01	0.04	0.04	-0.14	10z 15th
	Moray Firth	226	0.80	0.00	0.06	0.06	0.17	18z 30th
	Leith	743	0.75	0.01	0.06	0.06	0.26	4z 13th
	Ullapool	743	0.94	0.04	0.04	0.05	0.14	23z 21th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	743	0.25	0.02	0.17	0.17	-0.56	16z 12th
	Bournemouth	743	0.70	-0.02	0.05	0.06	-0.17	19z 2nd

Table 8a: Statistics based on hourly data for August 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	59	0.90	-0.01	0.04	0.05	-0.13	12z 15th
	Wick	60	0.92	-0.01	0.04	0.04	-0.12	16z 15th
	Aberdeen	60	0.90	-0.01	0.03	0.04	-0.10	2z 25th
	North Shields	60	0.81	-0.05	0.04	0.07	-0.13	20z 15th
	Whitby	60	0.83	-0.04	0.05	0.07	-0.15	21z 15th
	Immingham	60	0.72	0.10	0.07	0.12	0.29	9z 13th
	Cromer	59	0.82	-0.13	0.06	0.15	-0.26	5z 20th
	Lowestoft	60	0.92	-0.04	0.04	0.06	-0.14	10z 25th
	Felixstowe	60	0.81	-0.02	0.05	0.05	-0.12	5z 16th
	Sheerness	No Observations Available						
	Ilfracombe	No Observations Available						
	Hinkley Point	59	0.29	-0.01	0.10	0.10	-0.25	4z 19th
	Avonmouth	59	0.23	0.08	0.13	0.15	0.39	21z 11th
	Mumbles	36	0.56	0.06	0.06	0.09	0.28	21z 11th
	Milford Haven	59	0.78	-0.06	0.05	0.08	-0.15	1z 3rd
	Fishguard	59	0.81	-0.11	0.04	0.12	-0.20	3z 18th
	Barmouth	60	0.74	-0.02	0.06	0.06	-0.18	3z 3rd
	Holyhead	60	0.80	-0.02	0.05	0.05	-0.11	5z 3rd
	Llandudno	53	0.70	0.04	0.06	0.07	0.19	12z 10th
	Liverpool	60	0.65	0.05	0.06	0.08	0.21	12z 9th
	Heysham	60	0.66	-0.06	0.07	0.09	-0.20	5z 2nd
	Workington	60	0.76	0.03	0.06	0.07	0.20	2z 12th
	St. Marys	60	0.65	-0.02	0.04	0.05	-0.10	19z 25th
	Newlyn	60	0.77	-0.12	0.04	0.13	-0.19	22z 1st
	Plymouth	46	0.59	0.01	0.05	0.05	0.11	20z 11th
	Weymouth	60	0.70	-0.02	0.04	0.05	-0.12	12z 2nd
	Portsmouth	60	0.74	-0.08	0.05	0.10	-0.20	23z 21th
	Newhaven	60	0.68	-0.03	0.06	0.06	-0.13	17z 2nd
	Dover	60	0.78	-0.03	0.05	0.07	-0.13	20z 18th
	Jersey	59	0.40	-0.01	0.08	0.08	0.21	21z 11th
	Port Erin	60	0.83	0.04	0.05	0.06	0.15	0z 10th
	Portpatrick	60	0.89	-0.03	0.04	0.05	-0.13	7z 3rd
	Millport	60	0.88	0.01	0.05	0.05	0.10	1z 9th
	Islay	60	0.92	-0.02	0.04	0.05	-0.13	10z 15th
	Tobermory	60	0.88	0.01	0.05	0.05	-0.14	10z 15th
	Moray Firth	18	0.86	0.00	0.05	0.05	0.09	2z 29th
	Leith	60	0.72	0.01	0.06	0.06	0.18	5z 13th
	Ullapool	59	0.93	0.03	0.04	0.05	0.13	8z 10th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	59	0.28	0.09	0.14	0.17	0.44	22z 11th
	Bournemouth	95	0.62	-0.02	0.07	0.07	-0.17	19z 2nd

Table 8b: Statistics at HW for August 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	719	0.87	-0.03	0.05	0.06	-0.14	16z 1st
	Wick	719	0.89	-0.03	0.04	0.05	-0.14	2z 6th
	Aberdeen	719	0.84	-0.02	0.04	0.05	-0.14	8z 10th
	North Shields	719	0.78	-0.04	0.05	0.07	-0.17	17z 10th
	Whitby	719	0.81	-0.04	0.05	0.07	-0.18	1z 26th
	Immingham	719	0.66	0.06	0.08	0.10	0.29	16z 6th
	Cromer	719	0.84	-0.16	0.06	0.17	-0.39	5z 26th
	Lowestoft	719	0.87	-0.06	0.05	0.09	-0.30	17z 9th
	Felixstowe	719	0.81	-0.07	0.07	0.10	-0.32	9z 26th
	Sheerness	678	0.75	-0.09	0.10	0.13	-0.46	11z 26th
	Ilfracombe	513	0.42	-0.10	0.08	0.13	-0.27	4z 25th
	Hinkley Point	719	0.29	-0.04	0.14	0.15	-0.43	20z 1st
	Avonmouth	719	0.32	0.01	0.20	0.20	-0.86	19z 30th
	Mumbles	719	0.47	0.01	0.10	0.10	0.32	15z 1st
	Milford Haven	719	0.68	-0.10	0.06	0.12	-0.25	4z 25th
	Fishguard	719	0.78	-0.15	0.05	0.16	-0.28	12z 17th
	Barmouth	719	0.78	-0.06	0.07	0.10	-0.35	5z 9th
	Holyhead	719	0.85	-0.04	0.04	0.06	-0.16	23z 22th
	Llandudno	719	0.75	0.02	0.06	0.06	0.16	10z 7th
	Liverpool	641	0.66	0.04	0.08	0.09	0.23	19z 27th
	Heysham	719	0.82	-0.05	0.07	0.09	-0.25	2z 7th
	Workington	706	0.62	-0.02	0.10	0.10	-0.33	12z 25th
	St. Marys	688	0.74	-0.09	0.04	0.10	-0.22	16z 22th
	Newlyn	719	0.74	-0.16	0.04	0.17	-0.30	16z 24th
	Plymouth	719	0.58	-0.03	0.07	0.07	-0.24	16z 24th
	Weymouth	719	0.66	-0.08	0.06	0.10	-0.26	14z 24th
	Portsmouth	719	0.66	-0.11	0.06	0.13	-0.31	15z 9th
	Newhaven	719	0.65	-0.05	0.07	0.08	-0.27	12z 26th
	Dover	719	0.69	-0.05	0.08	0.10	-0.33	11z 24th
	Jersey	719	0.53	-0.08	0.10	0.13	-0.34	5z 25th
	Port Erin	719	0.84	0.02	0.04	0.05	0.14	12z 7th
	Portpatrick	719	0.86	-0.04	0.04	0.06	-0.16	2z 24th
	Millport	719	0.84	-0.01	0.05	0.06	0.17	14z 5th
	Islay	719	0.88	-0.05	0.04	0.07	-0.16	11z 25th
	Tobermory	719	0.86	-0.01	0.05	0.05	0.15	15z 7th
	Moray Firth	719	0.70	-0.01	0.07	0.07	0.25	20z 6th
	Leith	719	0.65	0.02	0.07	0.07	0.25	12z 5th
	Ullapool	719	0.87	0.02	0.05	0.05	0.16	16z 7th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	719	0.26	0.00	0.20	0.20	-0.75	3z 9th
	Bournemouth	719	0.66	-0.06	0.06	0.09	-0.23	19z 14th

Table 9a: Statistics based on hourly data for September 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	57	0.89	-0.03	0.04	0.05	-0.12	19z 20th
	Wick	58	0.85	-0.03	0.05	0.06	-0.12	1z 26th
	Aberdeen	58	0.79	-0.02	0.05	0.06	-0.12	15z 10th
	North Shields	58	0.78	-0.05	0.05	0.07	-0.17	17z 10th
	Whitby	58	0.78	-0.04	0.05	0.07	-0.15	18z 10th
	Immingham	58	0.72	0.10	0.07	0.12	0.26	17z 6th
	Cromer	57	0.83	-0.16	0.06	0.17	-0.29	21z 10th
	Lowestoft	58	0.85	-0.05	0.06	0.08	-0.18	9z 21th
	Felixstowe	58	0.82	-0.10	0.07	0.12	-0.24	12z 22th
	Sheerness	55	0.67	-0.12	0.09	0.15	-0.34	13z 22th
	Ilfracombe	41	0.39	-0.10	0.06	0.12	-0.23	19z 22th
	Hinkley Point	57	0.38	-0.04	0.13	0.13	-0.33	4z 17th
	Avonmouth	57	0.27	0.05	0.16	0.17	0.46	12z 30th
	Mumbles	57	0.70	0.00	0.07	0.07	0.20	12z 30th
	Milford Haven	57	0.70	-0.08	0.05	0.10	-0.21	19z 22th
	Fishguard	58	0.76	-0.12	0.05	0.13	-0.21	13z 14th
	Barmouth	58	0.79	-0.03	0.06	0.07	-0.16	21z 8th
	Holyhead	58	0.81	-0.05	0.05	0.07	-0.16	23z 22th
	Llandudno	58	0.69	0.02	0.06	0.06	0.15	11z 7th
	Liverpool	52	0.63	0.03	0.07	0.08	0.17	11z 7th
	Heysham	58	0.75	-0.08	0.07	0.11	-0.24	1z 26th
	Workington	57	0.60	-0.02	0.09	0.09	-0.23	14z 25th
	St. Marys	55	0.70	-0.07	0.05	0.09	-0.17	18z 22th
	Newlyn	58	0.73	-0.15	0.04	0.16	-0.25	17z 21th
	Plymouth	58	0.64	-0.02	0.06	0.06	-0.17	18z 22th
	Weymouth	58	0.55	-0.06	0.07	0.09	-0.23	14z 16th
	Portsmouth	58	0.69	-0.13	0.07	0.15	-0.25	1z 24th
	Newhaven	58	0.68	-0.05	0.07	0.09	-0.19	9z 17th
	Dover	58	0.83	-0.05	0.06	0.08	-0.17	15z 27th
	Jersey	57	0.58	-0.03	0.09	0.09	-0.24	16z 17th
	Port Erin	58	0.82	0.01	0.05	0.05	0.12	11z 7th
	Portpatrick	58	0.84	-0.05	0.05	0.07	-0.16	2z 24th
	Millport	58	0.84	-0.02	0.05	0.06	-0.13	2z 24th
	Islay	63	0.91	-0.04	0.03	0.05	-0.14	23z 15th
	Tobermory	58	0.88	-0.01	0.04	0.04	0.12	18z 7th
	Moray Firth	58	0.68	0.00	0.07	0.07	0.19	23z 7th
	Leith	58	0.57	0.02	0.07	0.07	0.19	13z 5th
	Ullapool	57	0.88	0.02	0.05	0.05	0.14	12z 30th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	58	0.25	0.06	0.16	0.17	0.42	13z 30th
	Bournemouth	89	0.53	-0.05	0.07	0.09	-0.23	19z 14th

Table 9b: Statistics at HW for September 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	743	0.90	0.02	0.04	0.05	0.17	13z 23th
	Wick	743	0.88	0.02	0.05	0.06	0.21	0z 29th
	Aberdeen	743	0.91	0.02	0.06	0.06	-0.28	21z 22th
	North Shields	743	0.93	-0.01	0.06	0.06	-0.31	16z 23th
	Whitby	743	0.94	0.00	0.06	0.06	0.29	5z 29th
	Immingham	29	0.90	0.09	0.07	0.11	0.23	6z 18th
	Cromer	722	0.93	-0.12	0.09	0.15	-0.67	15z 27th
	Lowestoft	682	0.93	-0.05	0.08	0.10	-0.55	16z 27th
	Felixstowe	743	0.91	-0.04	0.10	0.11	-0.46	0z 26th
	Sheerness	743	0.89	-0.07	0.13	0.15	-0.74	14z 27th
	Ilfracombe	713	0.77	-0.03	0.12	0.12	0.73	8z 27th
	Hinkley Point	743	0.72	0.02	0.17	0.17	0.96	9z 27th
	Avonmouth	739	0.66	0.07	0.25	0.26	-1.11	6z 27th
	Mumbles	743	0.78	0.07	0.12	0.14	0.84	8z 27th
	Milford Haven	743	0.84	-0.05	0.09	0.11	-0.41	4z 27th
	Fishguard	743	0.85	-0.06	0.09	0.11	-0.35	10z 15th
	Barmouth	743	0.86	0.00	0.12	0.12	-0.91	7z 27th
	Holyhead	No Observations Available						
	Llandudno	No Observations Available						
	Liverpool	743	0.90	0.10	0.10	0.14	-0.78	10z 27th
	Heysham	743	0.89	0.02	0.10	0.10	0.66	13z 27th
	Workington	622	0.87	-0.10	0.09	0.14	-0.50	21z 24th
	St. Marys	No Observations Available						
	Newlyn	743	0.83	-0.10	0.08	0.14	-0.41	2z 20th
	Plymouth	743	0.79	0.02	0.09	0.10	0.42	23z 25th
	Weymouth	743	0.77	-0.01	0.10	0.10	0.45	16z 27th
	Portsmouth	15	0.69	0.02	0.14	0.14	0.48	16z 27th
	Newhaven	743	0.82	0.01	0.10	0.10	0.58	14z 27th
	Dover	743	0.86	0.00	0.10	0.10	-0.52	22z 25th
	Jersey	574	0.75	-0.01	0.13	0.13	0.71	9z 27th
	Port Erin	743	0.90	0.07	0.07	0.10	0.36	15z 27th
	Portpatrick	743	0.89	0.02	0.07	0.07	0.34	17z 27th
	Millport	743	0.85	0.04	0.09	0.09	0.51	17z 27th
	Islay	743	0.90	0.01	0.06	0.06	0.32	18z 27th
	Tobermory	538	0.81	0.03	0.04	0.06	0.23	7z 22th
	Moray Firth	No Observations Available						
	Leith	743	0.81	0.05	0.09	0.10	0.49	3z 29th
	Ullapool	743	0.89	0.09	0.05	0.10	0.23	20z 27th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	743	0.62	0.05	0.24	0.25	-1.34	5z 27th
	Bournemouth	No Observations Available						

Table 10a: Statistics based on hourly data for October 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	59	0.88	0.03	0.05	0.05	0.15	20z 23th
	Wick	60	0.90	0.02	0.05	0.05	0.14	12z 22th
	Aberdeen	61	0.93	0.02	0.05	0.06	0.12	0z 29th
	North Shields	60	0.90	-0.02	0.08	0.08	-0.31	16z 23th
	Whitby	59	0.91	0.00	0.07	0.07	-0.21	17z 23th
	Immingham	2	1.00	0.14	0.02	0.14	0.15	3z 3rd
	Cromer	52	0.91	-0.14	0.08	0.16	-0.39	21z 25th
	Lowestoft	55	0.93	-0.05	0.09	0.10	-0.26	23z 25th
	Felixstowe	60	0.91	-0.04	0.09	0.10	-0.41	15z 27th
	Sheerness	60	0.85	-0.10	0.12	0.15	-0.41	3z 26th
	Ilfracombe	59	0.79	0.03	0.10	0.11	0.48	9z 27th
	Hinkley Point	59	0.67	0.07	0.17	0.18	0.86	10z 27th
	Avonmouth	59	0.74	0.16	0.18	0.24	0.89	10z 27th
	Mumbles	59	0.81	0.07	0.10	0.13	0.40	21z 25th
	Milford Haven	59	0.86	0.00	0.08	0.08	0.25	21z 25th
	Fishguard	60	0.80	-0.02	0.09	0.09	0.29	11z 27th
	Barmouth	60	0.89	0.03	0.09	0.09	-0.26	10z 25th
	Holyhead	No Observations Available						
	Llandudno	No Observations Available						
	Liverpool	60	0.89	0.11	0.09	0.14	0.43	14z 27th
	Heysham	60	0.85	0.01	0.11	0.11	0.40	15z 27th
	Workington	50	0.87	-0.08	0.08	0.12	-0.34	8z 15th
	St. Marys	No Observations Available						
	Newlyn	59	0.86	-0.09	0.08	0.12	-0.33	0z 15th
	Plymouth	59	0.83	0.04	0.09	0.09	0.29	9z 27th
	Weymouth	60	0.78	0.01	0.09	0.09	0.39	9z 27th
	Portsmouth	2	1.00	0.07	0.05	0.07	0.10	14z 25th
	Newhaven	60	0.78	0.02	0.11	0.11	0.53	15z 27th
	Dover	60	0.86	-0.01	0.09	0.09	0.33	15z 27th
	Jersey	46	0.67	0.05	0.15	0.16	0.67	10z 27th
	Port Erin	60	0.87	0.07	0.08	0.11	0.36	15z 27th
	Portpatrick	60	0.86	0.01	0.08	0.08	0.33	16z 27th
	Millport	61	0.84	0.04	0.08	0.09	0.34	16z 27th
	Islay	64	0.92	0.01	0.06	0.06	0.14	8z 28th
	Tobermory	43	0.77	0.03	0.05	0.06	0.21	6z 22th
	Moray Firth	No Observations Available						
	Leith	60	0.85	0.06	0.09	0.11	0.28	0z 17th
	Ullapool	59	0.90	0.09	0.04	0.10	0.20	20z 23th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	60	0.47	0.16	0.23	0.28	0.94	22z 25th
	Bournemouth	No Observations Available						

Table 10b: Statistics at HW for October 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
	Stornoway	719	0.93	0.05	0.05	0.07	-0.19	5z	4th
	Wick	719	0.78	0.03	0.08	0.09	-0.41	3z	3rd
	Aberdeen	719	0.89	0.02	0.06	0.06	-0.19	13z	6th
	North Shields	719	0.92	-0.02	0.06	0.07	-0.32	16z	6th
	Whitby	719	0.92	-0.01	0.06	0.07	-0.31	16z	6th
	Immingham	719	0.86	0.07	0.10	0.13	0.34	7z	8th
	Cromer	719	0.94	-0.15	0.08	0.17	-0.51	17z	6th
	Lowestoft	719	0.94	-0.06	0.07	0.10	-0.37	16z	6th
	Felixstowe	672	0.91	-0.05	0.09	0.10	-0.40	20z	6th
	Sheerness	713	0.88	-0.10	0.11	0.15	-0.49	21z	3rd
	Ilfracombe	719	0.81	-0.04	0.10	0.11	-0.32	18z	24th
	Hinkley Point	719	0.61	0.01	0.17	0.17	-0.53	2z	21th
	Avonmouth	719	0.51	0.07	0.24	0.25	-0.70	6z	26th
	Mumbles	719	0.77	0.04	0.12	0.12	0.42	1z	10th
	Milford Haven	719	0.89	-0.07	0.09	0.12	-0.42	10z	30th
	Fishguard	719	0.89	-0.07	0.08	0.11	-0.31	6z	24th
	Barmouth	719	0.83	0.01	0.10	0.10	-0.35	7z	27th
	Holyhead	557	0.91	0.05	0.07	0.08	0.29	19z	7th
	Llandudno	No Observations Available							
	Liverpool	719	0.80	0.13	0.09	0.16	0.40	21z	3rd
	Heysham	719	0.84	0.03	0.09	0.09	0.37	23z	3rd
	Workington	719	0.89	-0.07	0.08	0.11	-0.32	13z	27th
	St. Marys	439	0.89	-0.06	0.06	0.09	-0.22	23z	30th
	Newlyn	715	0.90	-0.09	0.07	0.12	-0.26	3z	5th
	Plymouth	633	0.88	0.01	0.08	0.08	0.25	9z	22th
	Weymouth	719	0.83	-0.01	0.08	0.08	-0.39	4z	14th
	Portsmouth	714	0.82	-0.07	0.08	0.11	-0.41	3z	14th
	Newhaven	719	0.80	-0.01	0.09	0.09	-0.41	4z	14th
	Dover	719	0.85	-0.02	0.09	0.09	-0.35	10z	23th
	Jersey	719	0.72	-0.03	0.12	0.13	-0.51	2z	14th
	Port Erin	719	0.91	0.08	0.07	0.11	0.38	20z	3rd
	Portpatrick	719	0.90	0.03	0.08	0.08	0.38	21z	3rd
	Millport	719	0.87	0.04	0.09	0.10	0.42	21z	3rd
	Islay	719	0.90	0.03	0.08	0.09	0.33	19z	3rd
	Tobermory	No Observations Available							
	Moray Firth	708	0.76	0.05	0.09	0.10	0.35	0z	3rd
	Leith	No Observations Available							
	Ullapool	719	0.94	0.14	0.06	0.15	0.34	20z	11th
	Kinlochbervie	No Observations Available							
	Lerwick	No Observations Available							
	Newport	719	0.54	0.04	0.22	0.23	-0.92	16z	23th
	Bournemouth	No Observations Available							

Table 11a: Statistics based on hourly data for November 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	& DATE
	Stornoway	58	0.94	0.06	0.05	0.08	0.15	23z 10th
	Wick	58	0.82	0.03	0.07	0.07	0.19	9z 15th
	Aberdeen	58	0.90	0.02	0.06	0.06	-0.17	14z 6th
	North Shields	57	0.88	-0.05	0.08	0.10	-0.32	16z 6th
	Whitby	57	0.90	-0.04	0.07	0.08	-0.29	17z 6th
	Immingham	58	0.88	0.07	0.11	0.12	0.28	4z 3rd
	Cromer	58	0.92	-0.15	0.09	0.18	-0.38	18z 3rd
	Lowestoft	58	0.94	-0.08	0.08	0.11	-0.31	22z 6th
	Felixstowe	45	0.94	-0.08	0.07	0.10	-0.28	0z 6th
	Sheerness	58	0.88	-0.17	0.10	0.20	-0.41	1z 6th
	Ilfracombe	58	0.80	0.00	0.08	0.08	0.20	7z 22th
	Hinkley Point	58	0.55	0.04	0.13	0.14	0.33	8z 22th
	Avonmouth	58	0.42	0.13	0.18	0.22	0.52	1z 28th
	Mumbles	58	0.80	0.03	0.10	0.10	0.23	20z 7th
	Milford Haven	58	0.88	-0.05	0.08	0.09	-0.21	19z 5th
	Fishguard	58	0.88	-0.04	0.07	0.08	0.20	18z 3rd
	Barmouth	58	0.79	0.03	0.09	0.10	0.30	19z 3rd
	Holyhead	45	0.92	0.04	0.07	0.07	0.22	0z 8th
	Llandudno	No Observations Available						
	Liverpool	58	0.84	0.11	0.07	0.13	0.37	22z 3rd
	Heysham	58	0.83	0.01	0.08	0.07	0.31	22z 3rd
	Workington	58	0.87	-0.06	0.08	0.10	0.21	23z 3rd
	St. Marys	35	0.89	-0.06	0.06	0.08	-0.15	7z 24th
	Newlyn	58	0.91	-0.09	0.07	0.11	-0.23	17z 5th
	Plymouth	51	0.92	0.02	0.07	0.07	0.21	19z 7th
	Weymouth	58	0.86	0.00	0.07	0.07	-0.27	2z 14th
	Portsmouth	57	0.87	-0.04	0.07	0.08	-0.22	8z 14th
	Newhaven	58	0.88	0.00	0.07	0.07	-0.15	8z 14th
	Dover	58	0.94	-0.05	0.07	0.09	-0.25	1z 7th
	Jersey	58	0.72	0.02	0.11	0.11	-0.42	3z 14th
	Port Erin	58	0.90	0.07	0.07	0.10	0.36	22z 3rd
	Portpatrick	58	0.91	0.02	0.07	0.07	0.25	23z 3rd
	Millport	58	0.91	0.02	0.07	0.08	0.22	23z 3rd
	Islay	58	0.90	0.04	0.07	0.09	0.24	9z 10th
	Tobermory	No Observations Available						
	Moray Firth	58	0.73	0.03	0.10	0.10	0.26	10z 3rd
	Leith	No Observations Available						
	Ullapool	58	0.93	0.15	0.06	0.16	0.26	23z 10th
	Kinlochbervie	No Observations Available						
	Lerwick	No Observations Available						
	Newport	58	0.45	0.16	0.17	0.23	0.53	9z 22th
	Bournemouth	No Observations Available						

Table 11b: Statistics at HW for November 2002.

PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE
Stornoway	743	0.96	0.03	0.05	0.06	0.28	20z 2nd
Wick	700	0.95	0.02	0.06	0.07	-0.28	20z 24th
Aberdeen	No Observations Available						
North Shields	743	0.94	-0.05	0.07	0.08	-0.30	6z 25th
Whitby	743	0.94	-0.04	0.07	0.08	-0.28	7z 25th
Immingham	743	0.84	0.02	0.10	0.10	-0.37	12z 2nd
Cromer	714	0.93	-0.18	0.08	0.21	-0.50	13z 2nd
Lowestoft	743	0.93	-0.09	0.07	0.12	-0.31	12z 27th
Felixstowe	743	0.91	-0.10	0.09	0.14	-0.37	12z 25th
Sheerness	743	0.85	-0.14	0.12	0.18	-0.57	13z 24th
Ilfracombe	699	0.83	-0.09	0.12	0.15	-0.45	3z 24th
Hinkley Point	743	0.71	-0.02	0.19	0.19	-0.74	4z 24th
Avonmouth	743	0.69	0.06	0.25	0.26	-0.96	7z 26th
Mumbles	743	0.81	0.01	0.13	0.13	0.46	2z 2nd
Milford Haven	743	0.87	-0.11	0.10	0.15	-0.39	12z 18th
Fishguard	743	0.88	-0.11	0.09	0.15	-0.39	13z 18th
Barmouth	743	0.90	0.02	0.10	0.10	0.43	14z 2nd
Holyhead	740	0.91	0.03	0.09	0.09	0.35	20z 2nd
Llandudno	No Observations Available						
Liverpool	No Observations Available						
Heysham	743	0.92	0.05	0.10	0.12	0.49	23z 2nd
Workington	743	0.92	-0.05	0.10	0.12	-0.36	8z 19th
St. Marys	739	0.88	-0.07	0.09	0.12	-0.29	11z 18th
Newlyn	743	0.86	-0.11	0.09	0.14	-0.33	23z 18th
Plymouth	743	0.81	-0.02	0.10	0.10	-0.37	2z 26th
Weymouth	743	0.83	-0.06	0.10	0.12	-0.37	8z 26th
Portsmouth	743	0.83	-0.09	0.10	0.14	-0.60	10z 26th
Newhaven	743	0.85	-0.05	0.10	0.11	0.36	8z 2nd
Dover	743	0.88	-0.06	0.10	0.12	-0.35	9z 18th
Jersey	743	0.76	-0.07	0.13	0.15	-0.49	4z 26th
Port Erin	743	0.93	0.06	0.08	0.10	0.36	20z 2nd
Portpatrick	743	0.93	0.01	0.08	0.09	0.39	8z 2nd
Millport	743	0.92	0.03	0.10	0.10	0.53	9z 2nd
Islay	743	0.93	0.01	0.09	0.09	0.43	17z 2nd
Tobermory	625	0.94	0.02	0.07	0.08	0.32	21z 2nd
Moray Firth	743	0.83	0.01	0.10	0.10	0.42	6z 3rd
Leith	743	0.85	0.02	0.08	0.09	0.34	21z 2nd
Ullapool	743	0.96	0.13	0.06	0.14	0.38	19z 2nd
Kinlochbervie	No Observations Available						
Lerwick	No Observations Available						
Newport	743	0.69	0.05	0.23	0.23	-1.11	5z 24th
Bournemouth	743	0.85	-0.06	0.09	0.12	-0.44	9z 26th

Table 12a: Statistics based on hourly data for December 2002.

	PORT	SIZE	CORR	MEAN	S.D.	RMSE	MAX ERR	DATE	
	Stornoway	60	0.96	0.04	0.05	0.06	0.18	6z	3rd
	Wick	57	0.94	0.02	0.08	0.08	-0.17	9z	2nd
	Aberdeen	No Observations Available							
	North Shields	59	0.92	-0.07	0.08	0.11	-0.29	7z	25th
	Whitby	60	0.91	-0.06	0.08	0.10	-0.28	7z	25th
	Immingham	60	0.91	0.01	0.09	0.09	0.19	20z	23th
	Cromer	52	0.92	-0.21	0.08	0.23	-0.37	17z	2nd
	Lowestoft	60	0.93	-0.10	0.08	0.13	-0.29	16z	27th
	Felixstowe	60	0.93	-0.18	0.07	0.19	-0.30	20z	14th
	Sheerness	60	0.90	-0.22	0.09	0.24	-0.40	18z	27th
	Ilfracombe	58	0.88	-0.07	0.08	0.11	-0.29	3z	1st
	Hinkley Point	60	0.79	-0.04	0.13	0.14	0.38	10z	24th
	Avonmouth	60	0.77	0.07	0.16	0.17	0.47	10z	24th
	Mumbles	60	0.86	0.00	0.09	0.09	0.31	17z	2nd
	Milford Haven	60	0.90	-0.11	0.08	0.13	-0.27	15z	14th
	Fishguard	60	0.90	-0.08	0.08	0.12	-0.24	19z	18th
	Barmouth	60	0.91	0.03	0.09	0.10	0.26	12z	10th
	Holyhead	60	0.91	0.01	0.09	0.09	0.30	21z	2nd
	Llandudno	No Observations Available							
	Liverpool	No Observations Available							
	Heysham	60	0.92	0.01	0.10	0.10	0.42	22z	2nd
	Workington	60	0.91	-0.08	0.10	0.13	0.32	22z	2nd
	St. Marys	59	0.87	-0.08	0.08	0.12	-0.27	16z	18th
	Newlyn	60	0.87	-0.10	0.08	0.14	-0.27	16z	18th
	Plymouth	60	0.88	-0.02	0.07	0.08	0.20	16z	2nd
	Weymouth	60	0.83	-0.06	0.09	0.11	-0.23	18z	18th
	Portsmouth	60	0.85	-0.09	0.10	0.13	-0.32	4z	26th
	Newhaven	60	0.89	-0.07	0.08	0.11	-0.25	22z	31st
	Dover	60	0.93	-0.10	0.07	0.12	-0.26	0z	5th
	Jersey	60	0.81	-0.04	0.10	0.11	-0.33	4z	1st
	Port Erin	60	0.93	0.04	0.08	0.09	0.30	10z	2nd
	Portpatrick	60	0.93	0.00	0.08	0.08	0.27	10z	2nd
	Millport	60	0.94	0.01	0.08	0.08	0.22	23z	2nd
	Islay	62	0.94	0.02	0.08	0.08	0.36	16z	2nd
	Tobermory	50	0.94	0.02	0.07	0.07	0.31	16z	2nd
	Moray Firth	62	0.79	-0.01	0.11	0.11	-0.29	2z	25th
	Leith	59	0.85	0.00	0.09	0.09	-0.19	8z	27th
	Ullapool	60	0.95	0.13	0.06	0.15	0.31	6z	3rd
	Kinlochbervie	No Observations Available							
	Lerwick	No Observations Available							
	Newport	60	0.75	0.09	0.16	0.18	0.58	11z	24th
	Bournemouth	85	0.86	-0.06	0.09	0.11	-0.29	1z	19th

Table 12b: Statistics at HW for December 2002.

<u>FILENAME</u>	<u>START DATE OF HINDCAST IN RUN</u>	<u>CONTENTS</u>
FILE05.CS302	12Z 21/12/01-00Z 29/01/02	155 h' & f'casts
FILE06.CS302	12Z 29/01/02-00Z 22/02/02	96 h' & f'casts
FILE07.CS302	06Z 22/02/02-00Z 21/03/02	108 h' & f'casts
FILE08.CS302	06Z 21/03/02-00Z 18/04/02	112 h' & f'casts
FILE09.CS302	06Z 18/04/02-00Z 10/05/02	88 h' & f'casts
FILE10.CS302	06Z 10/05/02-18Z 05/06/02	107 h' & f'casts
FILE11.CS302	06Z 06/06/02-18Z 25/07/02	203 h' & f'casts
FILE12.CS302	06Z 26/07/02-18Z 20/08/02	99 h' & f'casts
FILE01.CS303	06Z 20/08/02-18Z 26/09/02	151 h' & f'casts
FILE02.CS303	06Z 27/09/02-06Z 29/10/02	128 h' & f'casts
FILE03.CS303 ^a	12Z 29/10/02-00Z 28/11/02	119 h' & f'casts
FILE04.CS303 ^b	06Z 28/11/02-00Z 23/12/02	100 h' & f'casts
FILE05.CS303 ^c	06Z 23/12/02-00Z 21/01/03	116 h' & f'casts

Appendix A: Port data archive files for 2002.

^a 12Z 6/11 occurs 3* in CS3 with 6h, 12h & 18h h'casts. Gap in BCM,SRM and levels between 6Z 6/11 & 6Z 7/11.

^b 12Z 10/11 occurs 3* in CS3 with 6h, 12h & 18h h'casts. Gaps in BCM, SRM and levels.

^c 12Z 29/12/2002 hindcast has duff data (tidal) in 0h and 1h.