

Report on the Quality of Marine Surface Observations

Report Number 38

July to December 2007

REPORT ON THE QUALITY OF MARINE SURFACE OBSERVATIONS:

JULY TO DECEMBER 2007

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For further information on or copies of this report, please contact:

Manager of Observation Monitoring,
Discovery 2,
The Met Office,
Fitzroy Road,
Exeter,
Devon,
EX1 3PB
United Kingdom.

E-mail: adrian.semple@metoffice.gov.uk

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1. INTRODUCTION

In 1985, the Commission for Basic Systems (CBS) agreed that there was a need for GDPS / Global NWP centres to monitor the quality of observations available on the GTS and to exchange monthly lists of stations providing seemingly erroneous data. In 1988 three lead centres were nominated which would have a co-ordinating role of producing, at six-monthly intervals, consolidated lists of suspect stations for given data types together with information on the nature of the error. The Met Office was allocated the role as lead centre for marine surface observations which encompass observations from ships, drifting buoys, moored buoys and other fixed marine platforms. This is the thirty-eighth of its reports and covers the period July to December 2007. For each observing platform identified as suspect, values are supplied for the number of observations received at the Met Office, the number of these observations with gross errors, the observations' mean differences from the background values used by the numerical data assimilation system and the standard deviations of these differences.

Following the CBS recommendations, by the end of the 1980s there were four centres active in the monthly exchange of monitoring information; The Met Office, ECMWF, RSMC Tokyo and NCEP. Since then, a number of other centres have also begun to exchange this information and these reports have included data provided by Météo-France as of report number 23. Initially, the only monitoring information exchanged on marine surface observations related to pressure, and the first two WMO reports addressed that parameter alone. Since then, these reports have contained monitoring statistics for wind observations, now being exchanged between centres on a consistent monthly basis. In addition, the report contains monitoring results for sea-surface temperature (SST). Due to changes in the observation processing system and database structure, there was no monitoring of SST data at the Met Office from May 1998 to September 2000. The SST information presented in reports 20 to 23 was therefore compiled, with permission, from the monthly NCEP monitoring data and so is not directly comparable with that presented in other reports. SST monitoring was reinstated at the Met Office from October 2000.

2. MONITORING METHODS

Errors in observations may arise from a number of sources: the instrument may be malfunctioning, figures may be mistaken while being transferred manually, or there may be corruption of data during transmission. Errors can also arise in the pressure report if the adjustment to sea level is made incorrectly or not at all, and a poorly sited anemometer can result in errors in the observations of wind. For SST observations, the depth at which the observation is made can be crucial. 'Surface' observations from buoys are usually made at a depth of around 0.5m, whereas ships may take a measurement between a depth of 10m and the surface, depending on the method used. At present, there is no indication given within the report of the observation's depth, so it is not possible to determine the significance of this factor. (By contrast, satellites measure the temperature of the ocean's 'skin' which is generally slightly cooler than the temperature immediately beneath, by several tenths of a °C, as a result of evaporative cooling and other surface processes.)

Some errors can be detected by applying checks on the code format and the internal consistency of the report (for example: are the position and pressure consistent with a report 6 hours earlier?). Checks on spatial consistency are possible if there are other nearby observations. However, such quality checks are unable to identify errors on all occasions and it is recognised that the numerical data assimilation systems in use today can provide global reference values applicable in observation monitoring. The short-term forecast from the previous numerical analysis, commonly known as the first-guess or background field, provides perhaps the most useful information on observation quality, as it represents an accurate and spatially consistent estimate of the observed value which is independent of the observation itself. Observation-minus-background (hereafter referred to as O-B) differences are at the core of all monitoring work by GDPS centres. Unlike wind and pressure, SST monitoring at the Met Office used to be performed against the analysis field, this being judged a sufficiently good approximation due to the slowly varying nature of SST, relative to parameters measured above the surface. As of October 2000, background values have been used but with the slowly varying nature of SST used to assume persistence, such that the background is in fact the previous analysis. (These analyses are performed daily at the Met Office from an assimilation of both surface and satellite observations.) Thus the SST monitoring at the Met Office is no longer limited by a dependence upon the observations themselves.

Taking all marine surface observations together, the values of O-B have distinct characteristics. The vast majority of the observations show quite small departures from background and the distribution of O-B is nearly Gaussian, with little or no bias. The errors in the background field probably contribute most to the values of O-B for these observations. There is often, however, a smaller group of observations departing much more from the background, for which observation error is the only reasonable explanation for the large values of O-B. Studies of the distribution and variation of O-B at different points around the globe enable reasonably accurate estimation of background error, and this provides the basis for the monitoring methods described here. Those marine observing platforms for which, in a sufficiently large sample, the observed values differ from the background by an amount significantly in excess of the estimate of background error, may be labelled as suspect with a high degree of confidence. The limits used here to identify suspect observing platforms have been set sufficiently stringent to preclude much likelihood of the background, rather than the observations, being in error.

Each monitoring centre produces a monthly list of the identifiers of marine observing platforms considered suspect according to the departure from the model background values. All observations, both synoptic and asynoptic, are assimilated. At the Met Office (as of May 2000) and ECMWF, the background fields are interpolated to the observation time whereas Météo-France, Tokyo and Washington, use the background value valid at the nearest main synoptic hour.

Given that the number of observations made during the month is at least 20, then the condition used by all centres for obtaining platforms for the suspect lists is that at least one of the following criteria are satisfied:

Pressure

1. the | mean of O-B | ≥ 4.0 hPa
2. the standard deviation of O-B ≥ 6.0 hPa
3. the percentage of gross errors ≥ 25

Wind

1. the | mean of O-B | $\geq 5.0\text{ms}^{-1}$ (Speed)
 $\geq 30^\circ$ (Direction)
2. the standard deviation of O-B $\geq 80^\circ$ (Direction)
3. the percentage of gross errors ≥ 25

Gross errors are defined as observations that depart from the background by more than 15hPa (Pressure) or 25ms^{-1} (Vector Wind). The mean and standard deviation of the samples are evaluated excluding gross errors and in this way occasional 'wild' values resulting from, for example, corruption during transmission, do not influence the sample characteristics. Direction statistics are also calculated excluding values in light winds, where either the observed or background speeds are less than 5ms^{-1} .

Relatively little information is exchanged between centres on a regular monthly basis for SST.

The monthly results for pressure from all five monitoring centres show considerable agreement, both on the observing platforms listed as suspect and the values of the mean and rms difference from each centre's background. Differences between the monthly suspect lists are usually due to the different numbers of observations available at each centre. The cut-off varies between 6 and 24 hours. There are also some unexplained variations in the data receipt between the centres, which may be due to problems in the GTS or in the local procedures for handling the data. Monitoring results for wind speed also show reasonable agreement on the mean and standard deviation from each centre's background; there is less agreement as to which platforms are listed, reflecting the greater uncertainty when monitoring wind speed.

This report draws together all the monthly monitoring results exchanged on marine surface data and identifies a list of observing platforms that have provided observations of poor quality over the 6-month period. In drawing up this list, there have been a number of guiding principles:

1. As with the monthly lists, accuracy is assessed relative to background values.
2. Observing platforms are listed only where there is a very high degree of confidence that the observations rather than the background values are in error.
3. At least 40 reports are required over the period in which the observations are considered suspect.
4. The perceived accuracy over the last part of the six-month period is of greatest importance; observing platforms are not listed if there has been recent improvement and their reports are at present without major error.
5. Given that the number of observations made during the period is greater than or equal to 40, then the condition for listing a platform as suspect in this report is that at least one of the following criteria are satisfied:

Pressure

1. the | mean of O-B | ≥ 3.5 hPa
2. the standard deviation of O-B ≥ 5.0 hPa
3. the percentage of gross errors ≥ 25

Wind

1. the | mean of O-B | $\geq 5.0\text{ms}^{-1}$ (Speed)
 $\geq 30^\circ$ (Direction)
2. the standard deviation of O-B $\geq 6.0\text{ms}^{-1}$ (Speed)
 $\geq 60^\circ$ (Direction)
3. the percentage of gross errors ≥ 25

SST

1. the | mean of O-B | ≥ 3.0 °C
2. the standard deviation of O-B ≥ 5.0 °C
3. the percentage of gross errors ≥ 25

All observations having gross errors are excluded from the calculation of the mean and standard deviation of O-B. The same gross error limits apply in these reports as in the monthly lists. The Met Office now sets a limit of 10°C for SST but this was previously 5°C and NCEP use 15°C. Also, criteria previously used in these reports were based on O-A statistics. Data presented here is, then, not directly comparable with that in earlier reports.

The limits on the bias and standard deviation O-B are more stringent than those for the monthly lists because the sample sizes are larger. If there has been a recent change in quality, they are only applied at the end of the period. Identifiers can be listed in this report without appearing on any of the monthly lists. This is can be due to a representative sample only being obtained over several months or deterioration occurring at the end of the period for platforms reporting very frequently. The 6-month list is longer than most of the monthly lists because many ships cease reporting for variable periods of time, in many cases while they are in port or out of service. Only over a relatively long period, probably more than 6 months, is a representative sample obtained from all those ships providing observations.

3. MONITORING RESULTS

The monitoring results presented in this report relate only to data exchanged over the GTS. Observations from marine platforms are transmitted in one of two formats: the SHIP code, used for most observations from ships, moored buoys and other fixed platforms, and the BUOY code, used mostly for observations from drifting buoys. In this report, the term "ship observations" refers to those received in the SHIP code and the "drifting buoy observations" to those received in BUOY code. The SHIP code indicates whether the observation was made manually or by an automatic system and accordingly the sub-divisions "manual ship" and "automatic ship" will be defined.

3.1 Pressure

In the six-month period, July to December 2007, 3836377 observations of pressure were monitored at Exeter from 2686 manual ships, 786 drifting buoys, and 457 automatic ships. The number of reports received from individual ships varies greatly as Table 1 demonstrates; apparently, a large percentage only report once. The reason for this is unclear but it may be a result of errors in the part of the message giving the ship identifier. A comparison with the corresponding table in report number 37 shows a slight decrease (~1%) in the number of manual ships reporting pressure whereas there has been a slight increase in the number of automatic ships reporting (~3%). There has also been a considerable increase of 19.6% in the number of drifting buoys reporting pressure. Since most marine observations are located in the northern hemisphere, there is inevitably some seasonal variation in the number of vessels reporting, especially in the case of buoys, since new or replacement buoys are generally deployed in better weather conditions. Considering the general trends over previous reports this confirms the move towards fewer manual ships reporting pressure observations, compensated by an increase in automated platforms.

Table 2 shows the number of observations of pressure that have been received over the GTS at the Met Office and processed, over past 6-month periods. Due to changes in data storage methods in May 1991, report number 5 covered the period January to May 1991 only, thence figures for January to June 1991 have been scaled-up in order to make a fair comparison with other 6-month periods; this may not be entirely accurate. Further changes in November 1993 for drifting buoys and automatic ships for pressure and winds, may have allowed duplication of a few identifiers in totals for the period June to December 1993, as reclassification from one observation type to another occurred. The observation distribution shown in Table 2 will also have been affected in the long term with a slight shift towards drifting buoys; no duplication of observations occurred however. (SST observations were not affected by the November 1993 change.) The period January to June 1998 is also based on only 5 months data (February-June), but the numbers of observations received have been scaled up, as in the 1991 case.

Figure 1 shows the information presented in Table 2 more clearly. It can be seen that the total number of observations remained fairly steady with only minor fluctuations until report number 11 (January-June 1994). Since that time however, there has been a steady increase in the total, with the number of observations of pressure nearly doubling between reports 11 and 16 (July-December 1996), a period of just 2.5 years. This increase was due to the larger number of reports from each drifting buoy, as reliability has improved; many drifting buoys now make several thousand observations of pressure during a 6-month period. The number of reports from drifting buoys now exceeds those for manual ships by around 498%, with a little over 59% of all marine pressure observations now being made by drifting buoys. The sudden increase seen in the number of automatic ships in report number 19 (January-June 1998) was due to observation processing changes at the Met Office, whereby all reports from 'automatic ships'

are processed, rather than only one report per 6-hour assimilation period, as previously. Since then there has been a steady increasing trend in the total number of pressure reports.

A histogram of O-B differences for all ship pressure reports in the period July to December 2007 is shown in Figure 2a, together with the Gaussian distribution with the same mean and standard deviation. Although almost all values fall within the range +5 to -5 hPa, a small number of much larger values, presumably resulting from erroneous observations, contribute to the large standard deviation of the population. The distribution for all those observations which fail the automatic quality-control checks is broad (Figure 2b). The remaining 93.9% of the observations, that pass the quality checks, show a distribution of O-B which is very close to Gaussian (Figure 2c) with mean 0.0 hPa and standard deviation 1.3 hPa. The principal contribution to the standard deviation is assumed to be from background errors.

A global estimate of the background error, such as that provided above, can conceal large spatial variations. Background values will be more accurate in data-rich areas (e.g.: in the North Sea or Mediterranean) or where the meteorological variability is low (e.g.: the tropics). The geographical distributions of the mean and standard deviation of the values of O-B from all ship observations which pass the quality-control checks, have been calculated for 10-degree latitude-longitude boxes and are plotted in Figures 3 and 4. In most areas, the magnitude of the mean is less than 1.0 hPa, the exceptions being generally where the sample size is small. The standard deviation is generally around 1.5 hPa. The number of ship pressure reports accepted by the model quality control in each 10-degree box is shown in Figure 5.

Table 3 contains a list of those ships and drifting buoys considered to have produced suspect observations of pressure in the period July to December 2007. Values over the six-month period are given for the number of observations of pressure available for Met Office global model runs, the number of observations differing from the model background value by more than 15 hPa (gross errors), and the mean and standard deviation of the model O-B. The number of times the identifier has appeared on the monthly suspect lists from the five monitoring centres is also given. In order to give a detailed picture of the frequency of reporting and any changes in the observation accuracy, 6-month time-series of O-B differences are given at the end of the report for each of the identifiers listed.

An interesting characteristic of the errors identified here, which soon becomes obvious on inspection of the time-series charts at the end of this report, is that most can be attributed to a bias in the observed pressure. In many cases, the bias is constant over the whole monitoring period; although some values depart greatly from the sample mean, presumably due to some gross error in the observation, these are generally isolated instances. In only a few cases are there regular large random departures from background. Those observing platforms listed in Table 3 which appeared in report number 37 (January to June 2007) have been indicated with an asterisk. A comparison of the statistics given here with those in the report number 36 (July to December 2006), clearly indicates that the bias in the pressure observations from a few ships has hardly changed for more than a year.

Statistics for those marine observing platforms listed in report number 37 and which do not appear in Table 3b, are given in Table 4 along with comments on the quality of their pressure observations. Time-series charts of the pressure observations from these platforms are not given. Less than 40 reports were received in the 6-month period for some of the ships on this list. Approximately 65% of them, however, do show some improvement in the quality of their observations.

3.2 Wind

Monitoring observations of wind is more problematical than pressure. On most observing platforms, wind is measured using anemometers; the reported speed depends upon the averaging period and instrument height above sea level, which varies a great deal between platforms. Since large structures distort wind flow, the anemometer position relative to the wind bearing and platform structure does affect the measurement. (These factors do not apply to those ship observations where wind speed is based on visual estimates of the sea state e.g. the UK VOF fleet.)

In these monitoring results, the background winds are valid at a height of 10 metres above mean sea level; slightly lower than the average height of ship anemometers. Where anemometer height is much different from 10 metres, a significant O-B speed bias may be evident. Examples of this are, observations from oil rigs or tankers with anemometer heights of 50m or more (although the speeds reported by some rigs are now adjusted on board to be nominal 10m values) and buoys, where the anemometer can be as low as 2m.

In the period July to December 2007, 1637708 wind observations were available for monitoring at Exeter, from 2730 manual ships, 65 drifting buoys, and 502 automatic ships. (More detail is given in Table 1.) The number of reported manual ship identifiers has decreased only slightly (~0.8%) since report number 37 (January to June 2007) as the long-term downward trend in manual ships reaches a plateau. The number of drifting buoys reporting wind observations has increased by 24 platforms to the current number of 65 and there has been an increase in the number of automatic ships of 3.7%. As stated for pressure observations, the large increase in the number of monitored wind observations, seen in report number nineteen, was largely due to the inclusion of all 'automatic ship' data, not just one report in each six hour period.

Histograms of O-B differences for ship observations of wind speed are presented in Figures 2d, 2e and 2f and of wind direction in Figures 2g, 2h and 2i. As with observations of pressure, those wind observations that fail the quality-control checks differ most from background, some by as much as 50 ms^{-1} , and they make a large contribution to the variance of O-B. The distributions of O-B wind speed and direction for the remaining 93% of the observations are nearly Gaussian. There is a speed bias of 1.1 ms^{-1} relative to background, with a direction bias of just -1.4° .

Figures 6 and 7 show the geographical distributions over the six-month period of the mean and standard deviation of O-B for ship observations of wind speed that pass the quality-control checks. The numbers of wind reports used to generate these statistics are presented in Figure 8. The standard deviation of O-B wind speed is typically 2.5 to 4 ms^{-1} in middle latitudes and 2 to 3 ms^{-1} in the tropics. The bias is generally around $+1 \text{ ms}^{-1}$, but exceeds $+2 \text{ ms}^{-1}$ in a few places. Similar distributions of the mean and standard deviation of O-B wind direction are shown in Figures 9 and 10. Only reports where both the observed and background wind speeds are greater than 5 ms^{-1} were used to obtain these values. The magnitude of the bias is less than 10 degrees in most places. The standard deviation is generally between 20 and 30 degrees globally but in some data-sparse areas, it is as large as 40 or 50 degrees. The numbers of reports of wind direction used to generate these statistics are presented in Figure 11.

Figures 6-11 provide reference values against which to compare the O-B characteristics for different marine observing platforms. Table 5 contains a list of those ships and drifting buoys considered to have produced suspect observations of wind speed in the period July to December 2007, and in Table 7 a similar list is provided for wind direction. Values are given for the number of observations of wind received at the Met Office, the number of observations having a vector difference from background of more than 25 ms^{-1} (gross errors), and the mean and standard deviation of O-B. Time-series of O-B are given at the end of the report for each listed identifier. In the majority of the cases of suspect speed observations, a constant bias is clearly

evident. Errors in observations of direction are more random in nature. Tables 6 and 8 contain statistics for platforms reporting in ship code which are not included in Tables 5 and 7 but that were listed in the previous report, for wind speed and direction respectively. Time-series plots for these identifiers are not included in this report.

3.3 *Sea-surface temperature*

In the six-month period July to December 2007, a total of 6219555 observations of SST were monitored at the Met Office, from 2413 manual ships, 1697 drifting buoys and 353 automatic ships. Of the total, 447710 were from manual ships, 4639853 from drifting buoys and 1131992 from automatic ships. (More detail is given in Table 1.) For the same reasons as stated for pressure observations, it appears that many identifiers report only once during the six-month period. The long-term decrease in the number of manual ships reporting SST appears to have reached a plateau and has decreased by only 1.4% since report number 37 (January to June 2007). The number of drifting buoys has also decreased slightly (~1%) whereas the number of automatic ships reporting is steadily rising with an increase of 1.4%. Despite there being fewer drifting buoys reporting than ships, they contribute a substantial percentage of the total number of SST observations received. This is due to the frequency of buoy observations; hourly in many cases, with ships tending to report only at the main synoptic hours.

Histograms of O-B differences for all ship SST reports are shown in Figures 2j, 2k and 2l. As with observations of pressure and wind, those SST observations that fail the quality-control checks differ most from background and make a large contribution to the variance of O-B. The distribution of O-B SST for the remaining 86% of the observations is nearly Gaussian. There is a bias of 0.1°C relative to background.

Figures 12 and 13 show the geographical distributions over the three-month period of the mean and standard deviation of O-B for ship observations that pass the quality control checks. The numbers of reports used to generate these statistics are presented in Figure 14. The bias is generally around 0.5°C and the standard deviation 1 to 2°C. Particular exceptions to this tend to show up where the number of observations is relatively low.

Table 9 contains a list of the ships and drifting buoys considered to have produced suspect observations over the 6-month period. The comments given in each case provide an indication of the main reason for the station to be listed as suspect; time-series charts have also been plotted for SST and are included at the end of the report. The majority of the identifiers appearing on the list do so because of bias. Table 10 gives details of the performance over the latest 6-month period of ships which were considered suspect in the previous period but which do not appear in Table 9.

4. SUMMARY

123 marine observing platforms are listed as producing suspect observations of pressure over the period July to December 2007, 128 as producing suspect wind observations and 68 as producing suspect SST observations. The first report issued by RSMC Bracknell, for the period January to June 1989, listed 150 marine platforms producing suspect observations of pressure. With the selection criteria remaining unchanged, an initial reduction in the number of platforms listed as suspect was followed by a series of reports listing numbers of suspects fluctuating around ~80. Between June 1996 and July 1997 (reports 15 and 18) there was an increase in the number of pressure suspects reported and the figure now fluctuates around ~130. When considered alongside the fluctuations in numbers of reporting platforms we see that the fraction producing spurious observations is increasing. Over the same period, there has been an increase in the numbers of wind observing platforms listed as suspect, although this appears not to be a worrying trend.

The most common characteristic in the case of identifiers listed as producing suspect pressure observations is bias in the reported pressure, sometimes remaining constant for many months. In the case of wind suspects, the most common reasons for listing a platform are a bias in the reported wind speed or large standard deviations or biases in wind direction. For sea-surface temperature observations, bias is again the most common cause of error.

The selection criteria have been set sufficiently stringent to ensure that the platforms listed are only those for which there is a high degree of confidence in their reports having errors. There are many others, not listed here, for which there must be considerable doubt over the quality of the observations. A wider range of monitoring results is available from the Met Office on request.

TABLE 1: FREQUENCY DISTRIBUTION OF THE NUMBER OF REPORTS OF PRESSURE, WIND AND SEA SURFACE TEMPERATURE FROM INDIVIDUAL IDENTIFIERS AVAILABLE FOR MONITORING AT EXETER, JULY TO DECEMBER 2007.

Number of reports	Number of manual ships reporting			Number of drifting buoys reporting			Number of automatic ships reporting		
	Press.	Wind	SST*	Press.	Wind	SST*	Press.	Wind	SST*
1	261	273	267	7	7	6	18	19	2
2-10	284	292	312	4	7	18	16	16	7
11-20	166	165	165	8	4	10	2	3	2
21-40	232	239	221	5	5	18	6	7	4
41-100	586	595	516	14	2	25	20	23	3
101-200	637	647	476	23	3	44	18	20	1
201-500	389	389	319	73	6	134	27	37	14
501-1000	62	61	46	65	6	153	29	38	16
1001-1500	31	33	29	67	4	150	41	52	29
1500+	38	36	62	520	21	1139	280	287	275
Total	2686	2730	2413	786	65	1697	457	502	353
(Report 37)	(2710)	(2753)	(2447)	(657)	(41)	(1716)	(444)	(484)	(348)

* numbers are for automatic (fixed) buoys only

TABLE 2: NUMBER OF OBSERVATIONS OF PRESSURE RECEIVED AT EXETER ON THE GTS FOR EACH OF THE SIX-MONTH PERIODS COVERED BY THE WMO REPORTS ON THE QUALITY OF MARINE OBSERVATIONS.

Period	WMO report number	Number of Observations			
		Manual ships	Drifting buoys	Automatic ships	Total
Jan - Jun 1989	1	424087	174971	40082	639140
Jul - Dec 1989	2	421315	151972	58016	631303
Jan - Jun 1990	3	424335	177927	63847	666109
Jul - Dec 1990	4	412430	205488	71146	689064
Jan - Jun 1991	5	364760	177069	64401	606230
Jul - Dec 1991	6	348710	148604	68456	565770
Jan - Jun 1992	7	332443	216872	73893	623208
Jul - Dec 1992	8	336958	247873	80862	665693
Jan - Jun 1993	9	340293	288208	77317	705818
Jul - Dec 1993	10	348082	316261	88650	752993
Jan - Jun 1994	11	334134	279963	111928	726025
Jul - Dec 1994	12	383760	305618	142468	831846
Jan - Jun 1995	13	369781	407111	124537	901429
Jul - Dec 1995	14	394016	528938	138653	1061607
Jan - Jun 1996	15	430162	566035	122909	1119106
Jul - Dec 1996	16	477928	621869	133221	1233018
Jan - Jun 1997	17	446530	623835	122178	1192543
Jul - Dec 1997	18	453399	684292	140227	1277918
Jan - Jun 1998	19	426622	700743	423217	1550582
Jul - Dec 1998	20	443548	700239	497313	1641100
Jan - Jun 1999	21	432506	697983	466311	1596800
Jul - Dec 1999	22	448996	771624	500070	1720690
Jan - Jun 2000	23	443023	772510	455799	1671332
Jul - Dec 2000	24	477828	829588	512338	1819754
Jan - Jun 2001	25	458345	784686	465887	1708918
Jul - Dec 2001	26	473887	914744	554002	1942633
Jan - Jun 2002	27	443876	1111699	517200	2072775
Jul - Dec 2002	28	544433	952313	595959	2092705
Jan - Jun 2003	29	432672	994877	506185	1933734
Jul - Dec 2003	30	473591	1128039	605241	2206871
Jan - Jun 2004	31	435824	1092461	596495	2124780
Jul - Dec 2004	32	434160	1113527	724014	2271701
Jan - Jun 2005	33	471113	1221528	717207	2409848
Jul - Dec 2005	34	472565	1523938	837397	2833900
Jan - Jun 2006	35	456847	1758276	792765	3007888
Jul - Dec 2006	36	447474	1833376	975555	3256405
Jan - Jun 2007	37	410076	1947986	998474	3356536
Jul - Dec 2007	38	454512	2265115	1116750	3836377

TABLE 3: LIST OF MARINE OBSERVING PLATFORMS REPORTING SUSPECT PRESSURE OBSERVATIONS OVER THE PERIOD JULY TO DECEMBER 2007.

- Column 1 Call sign or identifier.
 Column 2 Number of pressure observations available for monitoring over the 6-month period, excluding duplicates, but including any observations with gross errors.
 Column 3 Number of pressure observations differing by more than 15 hPa from background (gross error).
 Column 4 Standard deviation of observation-minus-background differences excluding cases of gross error.
 Column 5 Mean of observation-minus-background differences (bias) excluding cases of gross error.
 Columns 6-10 Number of times observing platform has appeared on suspect lists. B=Exeter, E=ECMWF, F=MétéoFrance, T=Tokyo, W=Washington.
 Column 11 Comments on quality of pressure observations.
- Notes: 1. Units are hPa.
 2. Observing platforms marked with an asterisk were listed in the previous report January to June 2007)

Table 3a: Platforms reporting in BUOY code

i): Platforms non-operational at the end of the reporting period

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
17658	2707	1076	6.7	-0.9	3	3	3	3	3	SD
17662	1309	7	3.4	3.6	1	1	1	1	1	Bias
17667	1863	636	4.4	-3.4	2	2	2	3	2	GE
21543	600	0	1.1	8.1	2	2	2	2	2	Bias
21548	1209	0	1.7	5.5	3	3	3	3	3	Bias
21940	132	42	1.6	0.4	1	1	1	1	1	Bias ad GE
21963	645	5	2.6	7.2	2	2	2	2	2	Bias
23591	52	3	4.2	7.5	1	1	1	0	1	Bias
23600	803	0	0.5	5.0	2	2	2	2	2	Bias
23912	521	0	1.0	-4.4	2	1	2	1	2	Bias
23931	3063	0	0.7	-3.6	2	4	3	6	6	Bias
31509	1098	0	0.6	-3.7	1	1	0	1	0	Bias
33600	3283	0	0.7	-3.7	1	0	0	1	0	Bias
33654	544	25	5.2	0.0	0	0	0	0	0	SD
42549	151	0	2.2	-4.1	1	1	0	0	1	Bias
42550	78	1	1.9	-3.8	1	1	0	0	1	Bias
48528	5019	1360	3.0	-0.7	2	2	2	3	2	Bias and GE
48530	508	62	3.1	-1.6	0	0	0	0	0	SD
48628	3096	2354	6.8	6.2	3	3	3	2	3	Bias and GE
54546	348	326	1.7	-13.0	1	1	1	1	1	Bias ad GE

Continued →

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
56532	245	77	6.5	3.8	1	1	1	1	1	Bias and GE
63527	245	15	1.8	-13.8	1	1	0	0	1	Bias
71547	281	1	3.4	-5.0	6	0	5	0	0	Bias
71647	145	69	6.8	0.8	1	1	1	1	1	GE

ii): Platforms operational at the end of the reporting period

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
16937	223	93	4.9	4.0	1	1	1	1	1	Bias and GE
23598	813	0	0.5	-4.1	1	2	2	2	2	Bias
23602	710	0	0.5	8.3	2	2	2	2	2	Bias
33652	3594	0	0.7	-3.5	0	0	0	0	0	Bias

Table 3b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
9MBW7	81	2	2.9	-4.5	1	1	0	0	2	Bias
9VDD2 *	310	0	1.7	4.7	6	0	6	4	6	Bias
A8CB7 *	171	1	1.5	-3.3	0	0	0	0	0	Bias
A8GQ8 *	107	0	1.6	3.7	0	1	0	0	3	Bias
A8IU6	67	0	1.3	3.9	1	1	1	1	2	Bias
A8JI3	99	0	2.0	3.7	2	2	2	0	2	Bias
A8KD9 *	71	0	0.6	-6.5	1	1	1	1	1	Bias
A8LO9	92	1	1.1	-4.8	2	1	2	1	2	Bias
A8MY4	88	0	1.9	-3.6	1	0	1	1	1	Bias
AUBC	128	0	1.8	4.6	2	1	1	1	1	Bias
AUBD	82	0	1.6	8.6	2	1	2	1	2	Bias
AUFI *	110	1	2.0	4.2	2	0	2	1	2	Bias
C6CL6 *	225	1	1.2	3.8	2	0	0	0	2	Bias
C6FM8 *	114	0	1.4	5.1	2	1	2	2	2	Bias
C6FP2 *	119	0	1.0	4.8	2	1	2	1	4	Bias
C6FP5	42	0	1.1	7.9	1	0	1	1	1	Bias
C6FU7 *	267	0	1.3	5.5	5	0	5	4	5	Bias
C6JZ7	54	0	1.7	5.4	1	0	0	0	1	Bias
C6PZ3 *	219	0	2.3	2.5	1	0	0	0	0	Bias
C6SE8	91	0	2.7	-4.0	0	0	0	0	0	Bias
C6SJ5 *	64	5	3.4	-9.5	1	0	0	0	1	Bias
C6TL7	91	0	2.1	4.7	0	0	0	1	1	Bias
C6TX6	371	1	1.2	-5.4	6	0	5	5	6	Bias
C6UC3	228	0	1.3	4.7	5	0	4	2	6	Bias
C6UZ6	117	0	1.3	-4.4	2	1	3	1	3	Bias

Continued →

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments	
C6VG7	168	1	1.0	-7.8	5	0	4	1	5	Bias	
C6VG8	260	2	1.5	-6.8	3	1	3	2	3	Bias	
CFN4292	51	1	3.7	5.2	0	0	0	0	0	Bias	
DARU	69	0	1.3	4.0	0	1	0	0	0	Bias	
DBUT	40	0	2.4	3.7	0	0	0	0	0	Bias	
DDRE2	*	137	0	1.2	-5.6	3	0	3	0	3	Bias
DDSK	*	133	0	2.0	4.1	2	1	3	0	4	Bias
DDZN2		206	1	1.1	5.2	5	3	5	4	5	Bias
DEAZ	*	118	0	1.0	5.2	2	2	2	2	3	Bias
DEDM	*	40	0	0.6	5.1	0	0	0	0	0	Bias
DGSE		143	0	1.3	3.7	1	0	1	1	1	Bias
DPSD		120	0	1.3	3.6	0	0	0	0	0	Bias
ELTY4	*	57	0	0.6	-5.9	0	0	0	0	0	Bias
ELVZ7		69	0	0.9	3.6	0	0	0	0	0	Bias
HPYE	*	47	0	0.8	-3.2	0	0	0	0	0	Bias
HRRF		585	0	0.7	-3.7	2	0	0	3	0	Bias
J8PE3	*	115	0	1.5	6.5	3	1	3	0	3	Bias
J8PR3	*	49	2	1.5	12.2	1	1	1	0	2	Bias
KMJL	*	60	0	1.0	-3.7	1	0	0	1	0	Bias
KS000		76	29	0.7	0.0	1	1	1	1	1	GE
KS049	*	987	0	0.9	-4.2	4	0	6	6	2	Bias
MLFV3		58	0	1.7	-4.2	1	0	1	0	1	Bias
ONEH		60	0	1.1	-4.4	0	0	0	0	0	Bias
OWTW2		73	0	1.6	3.9	0	0	0	0	0	Bias
P3NB5		59	0	5.6	0.0	0	0	0	0	0	SD
PBGH		610	2	2.2	-4.0	3	0	2	2	1	Bias
S6JP		63	0	3.4	3.8	0	0	0	0	0	Bias
SYAQ		106	0	2.1	5.5	1	0	1	0	4	Bias
TESTCA7	*	1045	814	0.5	-11.1	5	5	0	0	0	Bias and GE
TESTFR		92	92	---	---	1	0	0	0	0	GE
UANA		73	24	7.8	0.2	1	1	1	1	1	GE
UCJL	*	78	0	2.6	-5.4	3	3	2	0	2	Bias
UCKB	*	90	2	3.8	-3.9	1	1	1	1	1	Bias
UCTS		369	12	5.7	-0.3	2	2	1	1	2	SD
UCUO	*	88	13	5.7	4.4	1	1	1	1	1	Bias and SD
UDYG		112	83	1.4	-3.7	2	2	2	1	2	GE
UEXF	*	68	1	1.2	-5.0	0	0	0	0	0	Bias
UFJN	*	318	0	1.3	-4.2	3	0	2	2	2	Bias
UGJA		105	22	6.6	3.0	2	2	2	0	2	GE
UGOU	*	80	4	1.8	-4.5	1	1	1	0	1	Bias

Continued →

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
UGTP	42	0	1.9	3.9	0	0	0	0	1	Bias
UHWM	81	1	2.1	-4.0	2	2	2	0	2	Bias
UIAH *	124	17	3.9	-1.2	0	0	0	0	1	SD
UICO *	179	3	5.4	-0.5	1	1	1	1	1	SD
UIFL *	168	1	1.9	6.4	5	4	5	0	5	Bias
UITR *	288	3	3.5	1.4	0	0	1	0	1	Bias
V2AW5 *	108	11	2.6	12.2	2	3	2	1	4	Bias
V2OB8 *	137	0	0.9	4.9	4	1	4	3	4	Bias
V7BW6	70	0	1.6	-3.9	0	0	0	0	0	Bias
V7BW7	116	0	1.6	6.0	3	0	3	0	3	Bias
V7BW8 *	75	0	1.0	5.0	2	0	2	0	3	Bias
V7DI8 *	250	0	1.4	5.3	4	0	4	2	4	Bias
V7HD3	117	0	1.9	-5.1	1	1	1	0	1	Bias
VRBN8	67	0	2.2	4.2	0	0	0	0	0	Bias
VRCQ2	69	9	3.7	4.1	1	1	0	0	1	Bias
VRVZ2	110	0	1.9	3.4	0	0	0	0	0	Bias
VRYX3	63	0	2.5	4.8	1	0	1	0	3	Bias
VRZT8	67	17	3.9	5.2	1	1	1	1	4	Bias and GE
VTXK *	125	0	3.1	2.5	0	0	0	0	0	Bias
VVML	86	1	6.5	5.4	2	2	1	1	2	Bias
WADZ	249	0	1.2	-3.9	2	0	1	1	0	Bias
WAM7635	191	3	3.9	0.8	1	1	1	0	1	Bias
WCX7445	2673	44	3.1	-4.5	5	0	3	3	2	Bias and GE
WDD6039	191	0	2.0	-3.6	1	1	1	0	1	Bias
WDD7117	83	0	1.5	6.6	2	0	2	0	2	Bias
WDD7294	59	0	0.9	5.3	2	0	1	1	3	Bias
WNBE *	313	0	0.9	-4.3	5	0	5	1	3	Bias
WRTF *	183	0	1.7	-2.8	1	0	1	0	1	Bias
ZCDJ5	58	0	0.7	-4.5	0	0	0	0	0	Bias
ZCDV2	76	0	1.5	3.2	0	0	0	0	0	Bias

TABLE 4: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 3 BUT LISTED AS SUSPECT OVER THE PERIOD JANUARY TO JUNE 2007.

Column 1 Call sign or identifier.
 Column 2 Number of pressure observations available for monitoring over the 6-month period, excluding duplicates, but including any observations with gross errors.
 Column 3 Number of pressure observations differing by more than 15 hPa from background (gross error).
 Column 4 Standard deviation of observation-minus-background differences excluding cases of gross error.
 Column 5 Mean of observation-minus-background differences (bias) excluding cases of gross error.
 Column 6 Comments on quality of pressure observations.

Notes: 1. Units are hPa

Identifier	N Obs.	NGE	SD	Bias	Comments
17912	0	---	---	---	No reports
21914	0	---	---	---	No reports
23982	0	---	---	---	No reports
25522	0	---	---	---	No reports
31918	0	---	---	---	No reports
3FOB5	209	0	2.5	2.4	Bias reduced
41037	693	0	1.0	-1.0	Bias reduced
48624	0	---	---	---	No reports
52595	0	---	---	---	No reports
54933	0	---	---	---	No reports
62137	105	0	1.9	1.1	Bias reduced
74544	0	---	---	---	No reports
9MCX2	109	0	3.3	3.5	Bias reduced
9VKY3	65	0	1.4	-1.5	Bias reduced
A8AC4	80	0	0.9	-0.6	Bias reduced
A8DE3	136	0	2.3	-1.2	Bias reduced
A8HG2	219	0	1.3	-0.3	Bias reduced
A8HJ4	22	0	1.1	4.9	Less than 40 reports
A8IU7	10	0	0.5	4.0	Less than 40 reports
A8JY5	88	0	2.1	-0.5	Bias reduced
A8LL4	56	0	2.0	1.0	Bias reduced
AUCT	69	1	7.2	2.3	Bias reduced
C6FV3	215	0	1.5	2.3	Bias reduced
C6FZ6	175	0	1.5	0.6	Bias reduced
C6SE7	34	0	1.3	-8.3	Less than 40 reports

Continued →

Identifier	N Obs.	NGE	SD	Bias	Comments
C6UA5	148	0	1.4	0.3	Bias reduced
DHSI	372	1	1.5	2.8	Bias reduced
DLCG	37	0	0.7	4.3	Less than 40 reports
DNEN	110	0	0.8	-0.1	Bias reduced
ELYT5	175	1	2.7	2.7	Bias reduced
OWWS2	53	0	2.4	3.2	Bias reduced
OZOK2	99	0	0.8	-0.1	Bias reduced
P3NL5	110	0	3.9	2.1	Bias reduced
PBJF	266	0	1.1	1.3	Bias reduced
S6JQ	43	3	3.9	-0.5	Bias reduced
UANF	13	0	2.4	7.0	Less than 40 reports
UCUD	163	0	1.3	-1.2	SD reduced
UCUQ	275	0	2.6	1.2	SD reduced
UDYN	24	0	2.1	1.9	Less than 40 reports
UEYO	142	3	2.4	-2.6	Bias reduced
UFJJ	294	8	2.4	-1.8	GE reduced
UFZQ	113	3	3.5	-0.7	SD reduced
UIAG	2	0	0.7	0.0	Less than 40 reports
UITP	24	1	2.2	10.4	Less than 40 reports
V2OB9	96	0	1.2	3.2	Bias reduced
V2OH7	49	0	1.8	0.0	SD reduced
V7BX3	191	0	1.1	-2.1	Bias reduced
VRZK8	130	0	3.1	-1.9	Bias reduced
WDB9986	55	1	5.1	7.7	Bias reduced
XXJW	3	0	0.2	5.0	Less than 40 reports
ZCAX3	99	0	2.3	-0.2	Bias reduced

TABLE 5: LIST OF MARINE OBSERVING PLATFORMS REPORTING SUSPECT WIND SPEED OBSERVATIONS OVER THE PERIOD JULY TO DECEMBER 2007.

- Column 1 Call sign or identifier.
 Column 2 Number of wind speed observations available for monitoring over the 6-month period, excluding duplicates, but including any observations with gross errors.
 Column 3 Number of wind observations with vector difference from background of more than 25ms^{-1} (gross error).
 Column 4 Standard deviation of observation-minus-background differences excluding cases of gross error.
 Column 5 Mean of observation-minus-background differences (bias) excluding cases of gross error.
 Column 6-10 Number of times observing platform has appeared on suspect lists. B=Exeter, E=ECMWF, F=MétéoFrance, T=Tokyo, W=Washington.
 Column 11 Comments on quality of wind speed observations.
- Notes: 1. Units are ms^{-1}
 2. Observing platforms marked with an asterisk were listed in the previous report (January to June 2007)

Table 5a: Platforms reporting in BUOY code

i): Platforms non-operational at the end of the reporting period

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
41917	707	1	3.4	8.1	2	2	2	1	2	Bias
44706	2416	5	3.3	5.1	2	2	1	0	1	Bias

ii): Platforms operational at the end of the reporting period

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
42556	2227	214	6.7	4.8	2	2	2	0	2	Bias and SD

Table 5b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
23493	1123	0	2.3	-4.9	4	4	2	3	4	Bias
42361	655	60	4.2	7.9	1	1	1	1	1	Bias and GE
46054	* 3218	0	2.7	3.4	0	0	0	1	0	Bias
46081	* 3391	0	2.9	2.3	0	0	0	0	0	Bias
46088	8478	0	3.1	3.3	1	0	0	0	0	Bias
9MCN8	* 65	0	5.1	7.7	2	2	2	0	2	Bias
9MEU4	156	4	6.9	4.0	0	1	0	0	0	Bias and SD
9VKY3	65	0	2.9	4.9	0	0	0	0	0	Bias
9VPY3	52	0	2.4	6.7	1	1	1	1	1	Bias
A8AL6	83	1	5.1	6.0	2	0	1	1	0	Bias
A8AY3	168	0	3.7	7.9	4	4	4	2	4	Bias
BATEU06	279	27	6.7	5.5	1	1	1	1	1	Bias and SD
BATFR43	139	46	3.4	9.5	1	1	1	1	1	Bias and GE
D9VPY3D	126	1	3.6	7.4	4	4	4	4	4	Bias
DBUY	108	0	4.7	5.3	2	2	2	0	2	Bias
DEFI	140	0	6.2	2.8	0	0	0	0	0	SD
DIGF	43	0	3.9	5.3	0	0	0	0	0	Bias
ELQB8	966	0	3.0	4.4	3	0	1	0	0	Bias
GRFP	52	1	5.2	5.0	1	0	1	0	1	Bias
KS002	* 91	11	5.6	8.6	3	1	2	0	3	Bias and SD
LIPI	260	74	2.1	-0.7	1	0	0	0	0	GE
OWFU2	* 205	4	5.8	6.7	1	2	2	0	2	Bias
P3JA9	259	0	5.1	5.4	2	2	2	3	2	SD
SCKM	* 150	1	3.8	4.9	2	1	1	1	1	Bias
UACU	* 193	0	3.6	4.5	2	2	2	0	2	Bias
V7DT6	70	2	5.5	5.2	0	0	0	0	0	Bias
VEP717	* 1282	0	4.3	4.9	3	2	1	2	3	Bias
VRVB6	62	0	4.7	5.4	0	0	0	0	0	Bias
WBM5091	* 633	0	3.1	3.2	0	0	0	2	0	Bias
WBN5978	* 440	0	3.9	3.5	0	0	0	0	0	Bias
WDC7836	137	0	4.5	5.4	1	0	3	1	3	Bias
WQZ9670	* 153	1	3.8	4.3	1	0	1	0	1	Bias
WYL5445	59	0	3.9	5.2	1	0	0	0	1	Bias
ZM2101	68	0	4.6	4.7	0	0	0	0	0	Bias

TABLE 6: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 5 BUT LISTED AS SUSPECT OVER THE PERIOD JANUARY TO JUNE 2007.

- Column 1 Call sign or identifier.
 Column 2 Number of wind speed observations available for monitoring over the 6-month period, excluding duplicates, but including any observations with gross errors.
 Column 3 Number of wind observations with vector difference from background of more than 25ms^{-1} (gross error).
 Column 4 Standard deviation of observation-minus-background differences excluding cases of gross error.
 Column 5 Mean of observation-minus-background differences (bias) excluding cases of gross error.
 Column 6 Comments on quality of wind speed observations.

Notes: 1. Units are ms^{-1}

Identifier	N Obs.	NGE	SD	Bias	Comments
23100	0	---	---	---	No reports
42023	3477	0	1.4	-0.3	Bias reduced
42362	9550	0	3.2	0.7	Bias reduced
44251	2811	0	1.7	-0.9	Bias reduced
46131	4184	0	2.9	3.2	Bias reduced
46146	4074	0	2.5	3.6	Bias reduced
62108	0	---	---	---	No reports
9MET6	11	0	6.4	8.1	Less than 40 reports
9MTS	94	1	2.3	1.1	Bias reduced
A8CF9	38	2	4.5	9.1	Less than 40 reports
A8IN7	108	0	2.2	-0.1	Bias reduced
BATFR20	1906	9	3.8	3.4	Bias reduced
CFN3031	1247	0	3.3	0.4	SD reduced
DDDI2	167	0	3.4	0.6	Bias reduced
DQVH	334	0	3.0	1.3	
HP6038	276	0	2.8	4.6	Bias reduced
IBPW	4	2	3.5	0.8	Less than 40 reports
SGBA	87	0	2.7	2.0	Bias reduced
UGJA	107	2	3.5	1.8	Bias, SD and GE reduced
UIAG	2	0	0.4	-0.8	Less than 40 reports
UIAH	125	0	4.3	0.6	Bias reduced
VRUZ9	163	2	2.8	3.0	SD reduced
VRYO3	14	0	6.0	8.0	Less than 40 reports
VTXK	125	1	2.7	1.6	Bias reduced

TABLE 7: LIST OF MARINE OBSERVING PLATFORMS PRODUCING SUSPECT WIND DIRECTION OBSERVATIONS OVER THE PERIOD JULY TO DECEMBER 2007 .

Column 1	Call sign or identifier.
Column 2	Number of wind direction observations available for monitoring over the 6-month period, excluding duplicates, but including any observations with gross errors.
Column 3	Number of wind observations with vector difference from background of more than 25ms ⁻¹ (gross error).
Column 4	Standard deviation of observation-minus-background differences excluding cases of gross error.
Column 5	Mean of observation-minus-background differences (bias) excluding cases of gross error.
Column 6-10	Number of times observing platform has appeared on suspect lists. B=Exeter, E=ECMWF, F=MétéoFrance, T=Tokyo, W=Washington.
Column 11	Comments on quality of wind direction observations.

- Notes:*
1. Units are degrees (°).
 2. Observing platforms marked § had a significant speed bias at some time within the period and the statistics and their plots refer to direction reports associated with background wind speeds greater than 5 ms⁻¹. If no significant speed bias was present, the statistics and plots refer to direction reports with an observed speed greater than 5 ms⁻¹.
 3. Observing platforms marked with an asterisk were listed in the previous report (January to June 2007)

Table 7a: Platforms reporting in BUOY code

*i): Platforms **non-operational** at the end of the reporting period*

Identifier	N Obs.	NGE	SD	Bias	B E F T W	Comments
23927	496	3	82.5	69.0	1 1 1 1 1	Bias and SD
23928 §	294	3	72.0	31.4	1 1 2 1 2	Bias and SD

*ii): Platforms **operational** at the end of the reporting period*

Identifier	N Obs.	NGE	SD	Bias	B E F T W	Comments
23925	575	1	45.7	42.9	1 1 1 1 2	Bias
31978	1671	184	115.8	-106.4	3 4 5 2 5	SD

Table 7b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments	
23097	*	1200	0	70.3	21.4	2	3	4	3	4	SD
23172	*	1211	0	130.8	27.9	4	6	6	6	6	SD
3FUX6	§	97	2	74.2	-5.7	0	1	1	0	1	SD
3FYB3	§	81	0	78.3	-10.1	1	0	1	0	2	SD
45144	*	1869	0	40.9	45.4	2	0	1	1	2	Bias
45145	*	1005	0	63.4	-19.4	1	1	1	1	2	SD
46022		4141	0	46.8	40.3	0	0	0	0	3	Bias
46081	*	3296	0	44.7	-35.9	1	1	4	5	5	Bias
46091	*	2760	0	43.4	-31.2	0	0	1	0	5	Bias
5WDC	*	56	0	59.7	-14.9	0	0	0	0	0	SD
9MBW7		78	2	61.1	1.6	0	0	0	0	1	SD
9VBX		95	0	65.3	-6.4	0	0	0	0	2	SD
9VDD3		81	0	64.0	0.0	0	0	0	0	1	SD
9VVK		137	1	64.9	-18.7	0	1	1	0	1	SD
A8CC9		183	5	83.4	3.8	2	2	2	2	2	SD
A8CH8		101	0	68.2	-17.4	0	0	0	0	0	SD
A8CP8		78	0	61.7	5.5	0	0	1	0	1	SD
A8ER9		169	0	65.3	-1.4	0	0	0	0	1	SD
A8HN8	§	67	2	63.5	-14.4	0	0	0	0	0	SD
AUCU		64	2	81.5	9.6	1	1	1	0	1	SD
BATFR4:	§	139	43	35.6	-47.8	1	1	1	1	1	Bias
C6FU9		104	1	71.2	-10.1	0	0	0	0	1	SD
CGBY		1154	7	115.0	12.6	4	2	4	0	6	SD
CGDP		1447	5	109.5	-19.5	2	3	5	3	6	SD
CPXC1	§	700	0	78.7	15.8	0	0	1	0	3	SD
DBUY	§	108	0	68.0	17.4	0	1	1	0	2	SD
DCRN2	*	177	0	44.8	6.5	0	0	0	0	0	SD
DFCX2		74	0	61.7	-3.5	0	0	0	0	0	SD
DGDO		151	0	76.3	0.2	0	0	0	0	1	SD
ELTS6	*	97	0	60.8	-17.2	0	0	0	0	1	SD
ELWC5	*	65	1	101.0	2.2	0	0	0	0	1	SD
ELYT5	*	172	1	52.9	-16.0	0	0	0	0	2	SD
GQVJ		74	0	64.3	-20.8	0	0	0	0	1	SD
H3GR		479	0	69.7	-3.3	0	0	0	0	0	SD
HPNV		238	1	77.0	2.0	1	1	1	1	3	SD
HZGH		105	0	65.6	-5.1	0	0	0	0	1	SD
J8NW	*	123	0	64.4	-27.1	0	0	0	0	0	SD
J8NY		214	0	62.1	-32.9	0	0	0	0	3	Bias and SD
J8PD		88	0	66.8	-10.1	0	0	0	0	0	SD
J8PE3		115	0	56.4	-45.1	0	0	0	0	0	Bias

Continued →

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
KLHZ	115	0	44.9	43.7	0	0	0	0	1	Bias
KS002	*\$ 91	10	89.3	58.5	0	1	2	0	3	Bias and SD
KS028	176	0	34.3	32.1	1	1	1	1	0	Bias
LAEP4	60	0	66.3	12.3	0	0	0	0	0	SD
LIPI	256	74	107.4	62.6	1	1	1	1	1	Bias and SD
MINUK03	* 3949	18	83.6	-40.5	6	6	6	2	6	Bias and SD
ONAU	99	0	60.3	9.5	0	0	0	0	1	SD
OYZC	156	1	67.6	35.9	0	0	0	0	1	Bias and SD
PCBU	* 236	0	51.5	-28.5	0	0	0	0	1	SD
PCCL	88	0	72.6	-11.4	0	0	0	0	0	SD
PCFW	147	0	60.1	-21.5	0	0	0	0	1	SD
PCHF	89	0	62.9	3.2	0	0	0	0	2	SD
PCIH	265	1	62.7	-10.3	0	0	1	1	1	SD
PDTP	* 94	0	91.9	23.5	0	0	0	0	2	SD
S6JR	* 89	0	59.2	-3.1	0	0	0	0	0	SD
TBWFR01	* 245	0	73.5	27.4	1	1	1	0	2	SD
UCJX	96	0	66.4	2.9	0	0	1	0	3	SD
UCKB	86	0	60.4	-3.7	0	0	0	0	0	SD
UCKD	119	0	65.5	-5.0	0	0	0	0	2	SD
UCUC	144	0	54.3	55.6	1	1	1	1	2	Bias
UCUE	130	1	47.6	30.6	0	0	0	0	1	Bias
UCUO	* 88	0	127.6	-13.7	1	1	1	1	1	SD
UDYG	114	0	76.1	70.2	0	0	0	0	2	Bias and SD
UGJA	103	2	76.0	20.2	0	1	1	0	2	SD
UGTV	82	0	74.2	-0.9	0	0	0	0	0	SD
UIAH	125	0	82.5	-7.9	0	0	0	0	2	SD
V2AD6	* 178	0	57.7	-28.8	0	0	0	0	2	SD
V2AW5	106	1	78.3	-2.6	1	1	1	0	4	SD
V2CE8	84	0	78.1	42.5	0	1	1	0	3	Bias and SD
V2FN	* 148	0	39.2	-74.2	0	0	0	0	0	Bias
V2IR	91	0	103.4	10.0	1	1	2	1	1	SD
V2OH2	* 97	0	57.2	-11.5	0	0	0	0	1	SD
V2OO4	\$ 57	0	60.3	-30.9	0	0	0	0	1	Bias and SD
VRX3	63	0	64.3	4.7	0	0	0	0	1	SD
VRZN9	176	0	65.9	10.3	1	0	1	0	1	SD
VRZT8	\$ 132	1	63.8	-2.9	1	2	0	1	0	SD
VTXG	178	0	76.9	7.1	0	2	3	1	5	SD
VVFH	102	1	62.6	-12.3	0	0	0	0	2	SD
WBM5091	\$ 593	0	63.2	2.3	0	0	0	0	0	SD
WBP3396	*\$ 144	0	61.7	7.7	0	0	0	0	2	SD

Continued →

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
WBVY *	176	0	52.5	-14.7	0	0	0	0	3	SD
WCX7445 *	3114	13	70.6	-4.6	2	2	2	1	2	SD
WCY2920 *	165	0	56.1	-9.0	0	0	0	0	3	SD
WCZ6534 *	56	0	54.2	-1.5	0	0	0	0	3	SD
WDA3359	97	1	56.8	-35.3	0	0	0	0	3	Bias
WDB7918	61	0	60.7	6.6	0	0	0	0	0	SD
WDC9368	199	0	61.8	6.1	0	0	0	0	2	SD
WUR7250 *	70	0	72.5	30.9	0	0	0	0	1	Bias and SD
WXY2934	60	0	60.3	6.6	0	0	0	0	1	SD
WYT8432	184	0	60.7	3.9	0	0	0	0	0	SD
ZCBD4 *	93	0	62.0	-11.8	0	0	0	0	1	SD
ZCDM8	126	0	48.3	30.4	0	0	0	0	1	Bias
ZCDV9	117	0	62.4	-3.5	0	1	0	0	1	SD

TABLE 8: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 7 BUT LISTED AS SUSPECT OVER THE PERIOD JANUARY TO JUNE 2007.

Column 1	Call sign or identifier.
Column 2	Number of wind direction observations available for monitoring over the 6-month period, excluding duplicates, but including any observations with gross errors.
Column 3	Number of wind observations with vector difference from background of more than 25ms ⁻¹ (gross error).
Column 4	Standard deviation of observation-minus-background differences excluding cases of gross error.
Column 5	Mean of observation-minus-background differences (bias) excluding cases of gross error.
Column 6	Comments on quality of wind direction observations.

Notes: 1. Units are degrees (°)

Identifier	N Obs.	NGE	SD	Bias	Comments
23101	986	0	28.5	-6.6	SD reduced
23173	0	---	---	---	No reports
44053	0	---	---	---	No reports
46205	2744	0	31.7	1.8	SD reduced
46233	0	---	---	---	No reports
52621	0	---	---	---	No reports
63055	1178	0	30.0	14.2	SD reduced
A3BN5	149	0	51.5	-12.2	SD reduced
A8CF9	38	1	48.6	4.4	Less than 40 reports
A8CK7	63	0	40.5	-19.3	SD reduced
A8JY5	88	0	49.7	-6.0	SD reduced
AGRF	96	0	41.0	32.8	Bias reduced
C6FM6	374	4	50.6	-10.6	Bias reduced
C6FZ6	175	0	45.6	-6.2	SD reduced
C6KU8	37	0	52.7	3.4	Less than 40 reports
C6SS3	196	0	47.7	-2.0	SD reduced
DCUJ2	206	1	50.0	5.7	SD reduced
ELTY2	193	0	41.5	-9.4	SD reduced
H9YR	25	0	20.6	78.2	Less than 40 reports
IBPW	4	2	101.2	19.1	Less than 40 reports
IBVL	5	0	1.6	9.8	Less than 40 reports
J7AV7	192	0	45.0	7.4	SD reduced
MFLQ4	86	0	42.0	0.4	SD reduced
OVZV2	145	0	53.2	-15.7	SD reduced
UCAE	116	0	62.8	-5.3	SD reduced

Continued →

Identifier	N Obs.	NGE	SD	Bias	Comments
UCUQ	275	0	50.4	0.1	SD and Bias reduced
UDUR	90	0	51.2	2.8	SD reduced
UERK	121	0	47.4	16.8	SD reduced
V7BX4	193	0	37.1	4.4	SD reduced
V7EE5	120	0	51.3	-19.7	Bias and SD reduced
VRYO9	4	0	0.0	-97.0	Less than 40 reports

TABLE 9: LIST OF MARINE OBSERVING PLATFORMS REPORTING SUSPECT SEA SURFACE TEMPERATURE OBSERVATIONS OVER THE PERIOD JULY TO DECEMBER 2007.

Column 1	Call sign or identifier.
Column 2	Number of sea-surface temperature observations available for monitoring over the six-month period, excluding duplicates, but including any observations with gross errors.
Column 3	Number of sea surface temperature observations differing by more than 10 °C from background (gross error).
Column 4	Standard deviation of observation-minus-background differences excluding cases of gross error.
Column 5	Mean of observation-minus-background differences excluding cases of gross error.
Columns 6-10	Number of times observing platform has appeared on suspect lists. B=Exeter, E=ECMWF, F=MétéoFrance, T=Tokyo, W=Washington.
Column 11	Comments on quality of sea surface temperature observations.

- Notes:*
1. Units are °C
 2. Observing platforms marked with an asterisk were listed in the previous report (January to June 2007)

Table 9a: Platforms reporting in BUOY code

i): Platforms non-operational at the end of the reporting period

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
13530	61	5	3.0	3.8	1	-	0	-	1	Bias
17659	139	7	4.2	-4.1	1	-	1	-	0	Bias
21520	2328	626	4.6	-2.0	5	-	3	-	2	Bias and GE
21926	1826	4	1.4	1.5	0	-	0	-	0	SD
32543	130	23	3.1	-3.3	1	-	1	-	1	Bias
41554	40	26	0.5	0.0	1	-	1	-	1	GE
43520	168	80	3.8	-4.8	2	-	2	-	2	GE
48611	213	213	---	---	1	-	1	-	1	GE
48665	150	150	---	---	1	-	1	-	1	GE
56517	1107	0	1.8	3.3	1	-	0	-	1	Bias
61857	136	0	2.4	-3.1	1	-	0	-	0	Bias
61881	353	51	4.6	2.0	2	-	0	-	0	GE
61888	176	174	2.3	-0.9	1	-	1	-	1	GE
61889	797	411	4.8	-3.9	2	-	2	-	2	GE
61892	571	567	4.7	-3.9	1	-	1	-	1	Bias and GE
61894	1664	704	2.1	-7.9	3	-	3	-	3	Bias and GE
63527	340	28	4.2	-3.9	1	-	0	-	0	Bias
71688	47	47	---	---	1	-	1	-	1	GE

ii): Platforms operational at the end of the reporting period

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
31978	1295	82	3.3	-3.8	4	-	0	-	1	Bias
44510	4381	0	2.0	-1.3	0	-	0	-	0	Bias

Table9b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
3FBE8	42	3	2.4	-3.7	0	-	0	-	0	Bias
3FIF8	43	27	1.9	-1.1	0	-	0	-	0	GE
44140	* 4108	0	2.0	-1.0	0	-	0	-	2	Bias
45139	* 2095	13	1.7	-1.2	0	-	0	-	1	Bias
45141	287	287	---	---	1	-	1	-	1	GE
45144	* 1971	1649	1.3	7.8	3	-	0	-	3	Bias and GE
45145	* 944	801	0.8	7.8	3	-	0	-	2	Bias and GE
45150	1390	936	0.3	9.5	3	-	1	-	2	Bias and GE
46029	* 1777	0	1.0	-4.1	3	-	1	-	1	Bias
9MCR4	195	2	2.2	-3.9	4	-	4	-	1	Bias
9VDD2	232	12	3.4	-3.4	4	-	4	-	1	Bias
9VDN3	73	0	1.7	3.4	1	-	1	-	1	Bias
9VEN5	72	0	2.5	-3.9	1	-	1	-	2	Bias
A8CF3	44	0	2.7	-3.7	0	-	0	-	0	Bias
A8IV4	140	1	2.3	-3.0	1	-	2	-	0	Bias
A8MW2	233	5	2.6	-6.2	5	-	5	-	5	Bias
AVOUK00	380	65	2.5	5.8	3	-	2	-	3	Bias
C6UG4	* 171	1	2.1	-3.2	2	-	3	-	2	Bias
CGDP	* 447	0	1.5	3.7	4	-	3	-	2	Bias
DAJL	* 407	0	0.8	3.4	6	-	4	-	0	Bias
DARY	* 192	0	1.1	3.2	3	-	1	-	0	Bias
DHQS	73	1	1.1	-3.6	1	-	1	-	0	Bias
DHSI	* 331	2	1.6	-4.9	6	-	6	-	6	Bias
DIBZ	* 171	0	0.9	-4.4	3	-	3	-	2	Bias
DINA	156	6	3.9	0.5	2	-	1	-	1	SD
KS002	* 95	91	0.1	-9.9	3	-	2	-	3	Bias and GE
KS011	42	20	1.9	-5.6	1	-	1	-	1	Bias and GE
KS057	3681	3527	1.1	0.9	5	-	0	-	6	GE
KS064	62	2	2.0	4.0	1	-	2	-	1	Bias
KS066	48	10	1.5	-8.1	1	-	1	-	1	Bias

Continued →

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
LADR4 *	75	0	1.2	3.7	2	-	2	-	0	Bias
LAOO5	164	43	1.9	-1.4	2	-	2	-	2	GE
NRCB	220	0	3.1	-1.1	0	-	0	-	0	Bias
P3BA7	85	0	1.8	-4.9	1	-	1	-	1	Bias
P3NF5	76	0	2.4	-3.9	1	-	1	-	0	Bias
TEST	115	115	---	---	2	-	0	-	0	GE
TOUR	579	0	1.2	1.4	0	-	0	-	0	Bias
UASP	108	0	1.1	-4.5	3	-	2	-	0	Bias
UCJX	93	0	1.4	-3.0	1	-	1	-	0	Bias
UDOD	57	1	2.4	-3.2	0	-	0	-	0	Bias
VGDT	40	6	2.2	-5.4	0	-	0	-	0	Bias
VOCJ *	730	0	1.7	3.5	2	-	1	-	3	Bias
VSQL9	101	37	2.1	-0.5	2	-	2	-	2	GE
WCY2306 *	81	1	1.8	-0.9	0	-	0	-	0	Bias
WDB9135	99	2	1.8	-4.3	2	-	1	-	0	Bias
WE4805	158	8	2.0	-3.2	2	-	4	-	1	Bias
WSRH *	169	0	1.2	-4.3	5	-	5	-	4	Bias
ZCDH7	172	0	1.0	3.2	3	-	2	-	0	Bias

TABLE 10: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 9 BUT LISTED AS SUSPECT OVER THE PERIOD JANUARY TO JUNE 2007.

- Column 1 Call sign or identifier
 Column 2 Number of sea-surface temperature observations available for monitoring over the 6-month period, including any observations with gross errors.
 Column 3 Number of sea surface temperature observations differing by more than 10 °C from the background (gross error).
 Column 4 Standard deviation of observation-minus-background differences excluding cases of gross error.
 Column 5 Mean of observation-minus-background differences excluding cases of gross error.
 Column 6 Comments on quality of sea surface temperature observations.

Notes: 1. Units are °C

Identifier	N Obs.	NGE	SD	Bias	Comments
17511	0	---	---	---	No reports
17560	0	---	---	---	No reports
22102	3001	1	1.6	-0.9	Bias reduced
22531	0	---	---	---	No reports
31513	0	---	---	---	No reports
32548	0	---	---	---	No reports
41025	4322	0	1.6	0.3	Bias reduced
41112	8592	0	0.6	0.0	Bias reduced
41613	0	---	---	---	No reports
41902	0	---	---	---	No reports
42007	4322	0	0.8	0.1	Bias reduced
42046	0	---	---	---	No reports
43508	0	---	---	---	No reports
43517	0	---	---	---	No reports
44004	4258	0	0.8	-0.1	Bias reduced
44014	4330	0	1.2	-0.5	Bias reduced
44044	12522	0	1.4	1.6	Bias reduced
44054	1922	0	0.7	-0.2	Bias reduced
44055	3331	0	1.2	0.7	Bias reduced
44137	4205	0	1.0	-0.5	Bias reduced
44141	4289	0	1.3	-0.5	Bias reduced
44834	0	---	---	---	No reports
44842	0	---	---	---	No reports
45005	1149	0	1.0	0.0	Bias reduced
45008	2182	0	1.0	0.5	Bias reduced

Continued →

Identifier	N Obs.	NGE	SD	Bias	Comments
45154	1253	0	1.0	0.8	Bias and GE reduced
46063	1	0	0.0	-6.9	Less than 40 reports
54916	0	---	---	---	No reports
61689	0	---	---	---	No reports
61700	0	---	---	---	No reports
61883	0	---	---	---	No reports
61885	0	---	---	---	No reports
61886	0	---	---	---	No reports
61890	0	---	---	---	No reports
61891	0	---	---	---	No reports
61893	0	---	---	---	No reports
61895	0	---	---	---	No reports
61896	0	---	---	---	No reports
64616	0	---	---	---	No reports
64617	0	---	---	---	No reports
71573	0	---	---	---	No reports
A8GU5	12	0	1.1	-1.3	Less than 40 reports
C6RN3	830	0	0.9	1.6	Bias reduced
CG8049	171	2	1.6	0.4	Bias reduced
DCCM2	165	0	2.1	-1.6	Bias reduced
DIGW	92	0	1.3	-3.2	Bias reduced
ELYE8	34	0	1.5	2.3	Less than 40 reports
KNBD	244	4	1.7	-0.3	SD reduced
KS049	1	1	---	---	Less than 40 reports
P3ZY6	71	0	3.0	-0.8	Bias reduced
PHHQ	15	0	0.6	5.4	Less than 40 reports
S6HU4	49	0	1.4	-0.7	Bias reduced
SGBA	87	0	1.0	2.8	Bias reduced
SHJC	260	0	1.6	0.4	Bias and SD reduced
SIWB	97	0	0.8	1.1	Bias reduced
V7DP7	228	1	2.2	-3.0	Bias reduced
V7HS2	6	0	1.2	-1.8	Less than 40 reports
V7LF2	205	2	2.3	3.3	Bias reduced
VRBH6	18	0	2.0	-3.7	Less than 40 reports
WAAH	173	0	1.3	2.6	Bias reduced
WMLH	26	0	2.0	2.5	Less than 40 reports
WZE4928	455	5	2.6	-1.2	SD reduced
WZJD	92	0	2.2	-2.1	Bias reduced

Figure 1: Number of observations of pressure received at Exeter on the GTS for each of the six-month periods covered by the WMO reports on the quality of marine surface observations

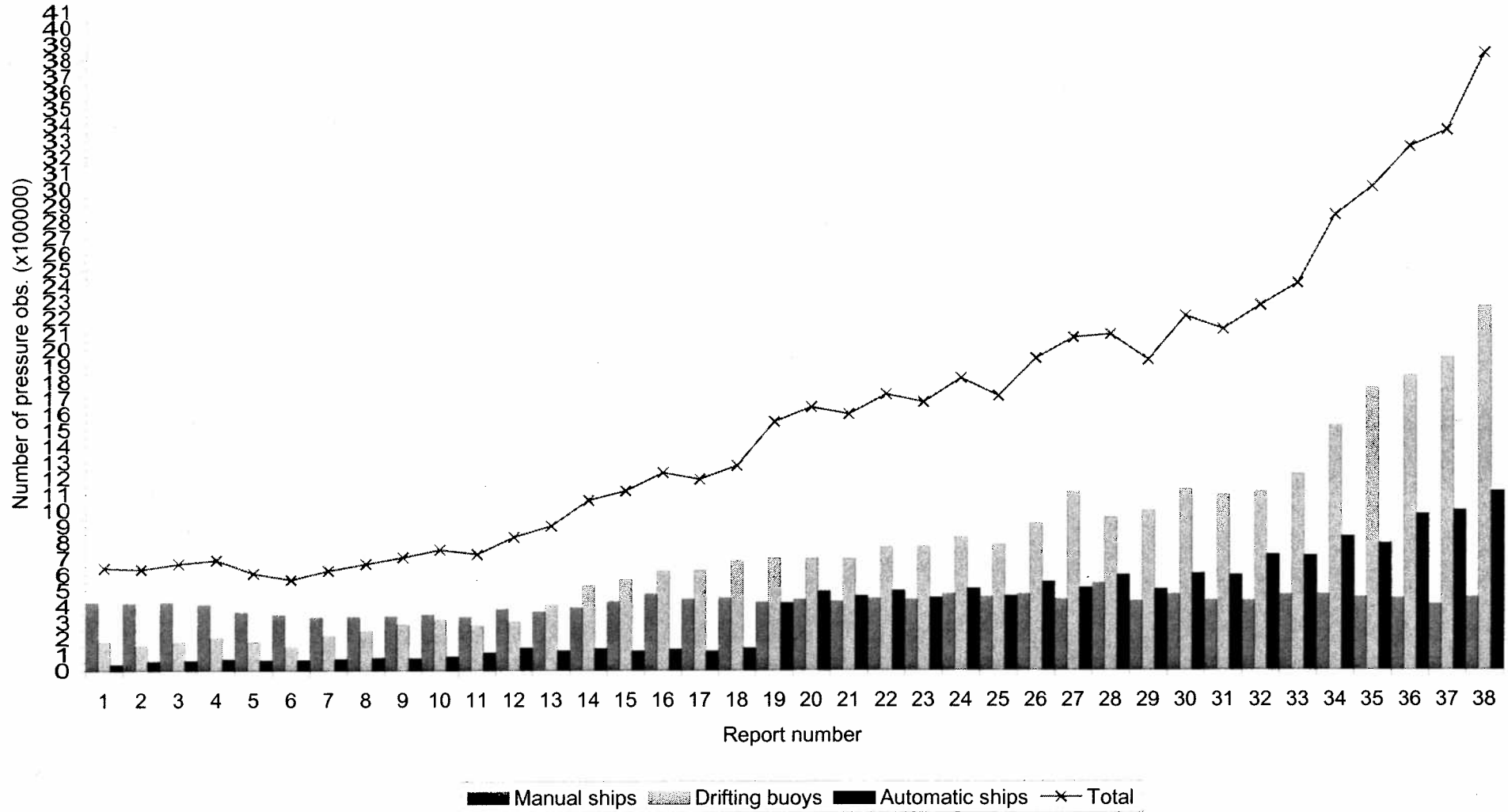
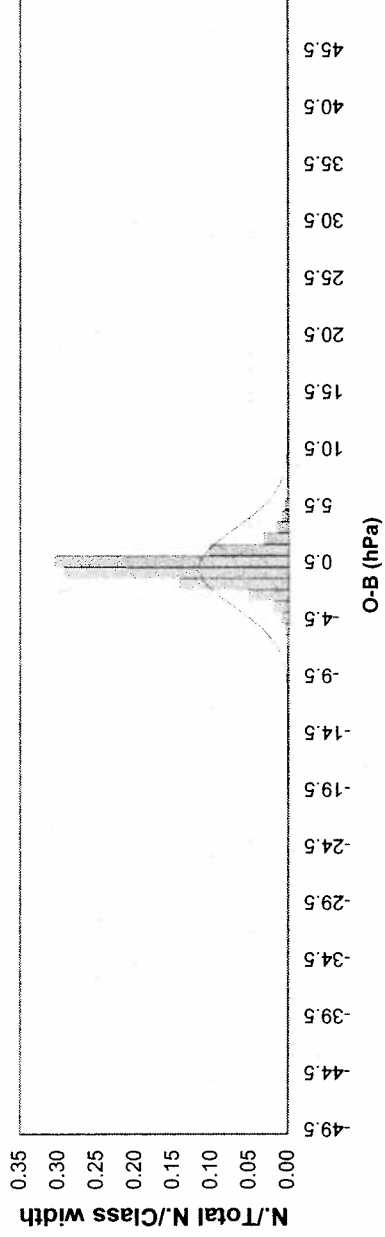
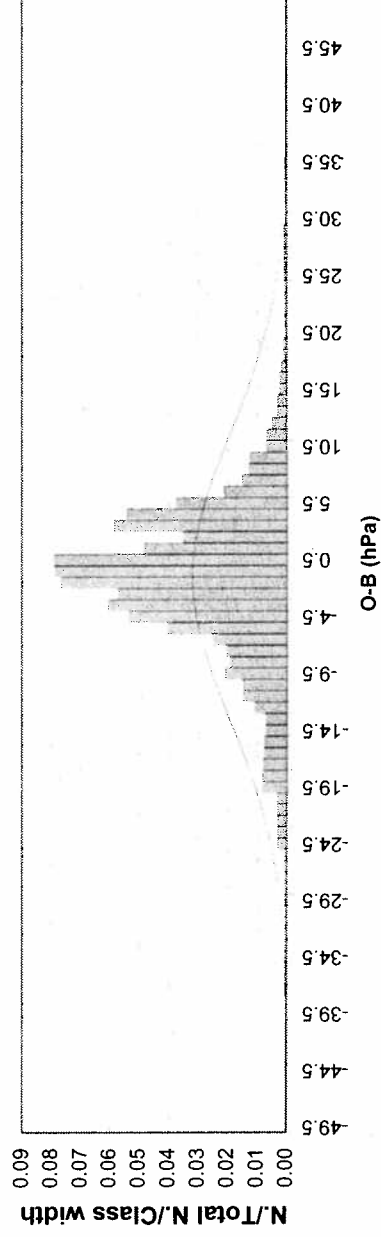


Figure 2a: Distribution of ship O-B pressure (hPa)
Period of data: JUL-DEC 2007 Data used: All observations



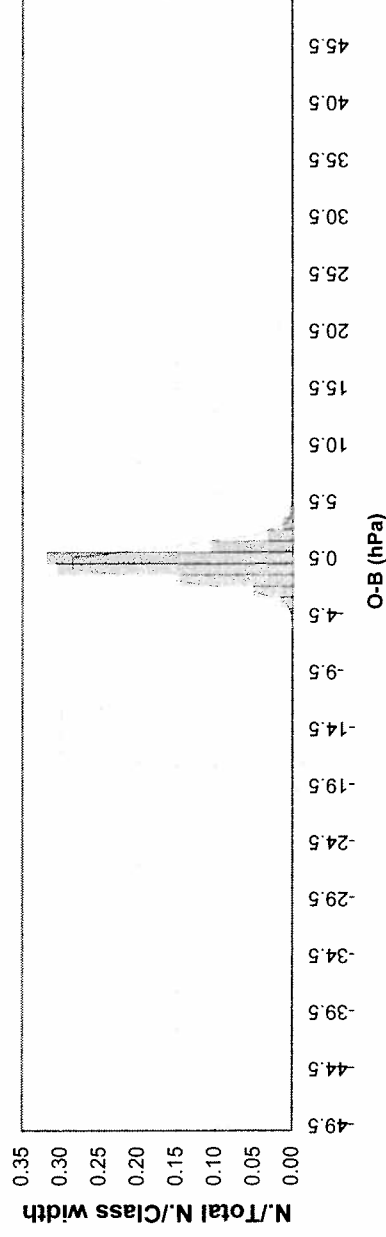
Mean O-B = -0.1 SD O-B = 3.4

Figure 2b: Distribution of ship O-B pressure (hPa)
Period of data: JUL-DEC 2007 Data used: Flagged observations



Mean O-B = -1.0 SD O-B = 12.5

Figure 2c: Distribution of ship O-B pressure (hPa)
Period of data: JUL-DEC 2007 Data used: Unflagged observations



Mean O-B = 0.0 SD O-B = 1.3

Figure 2d: Distribution of ship O-B wind speed (ms⁻¹)
 Period of data: JUL-DEC 2007 Data used: All observations

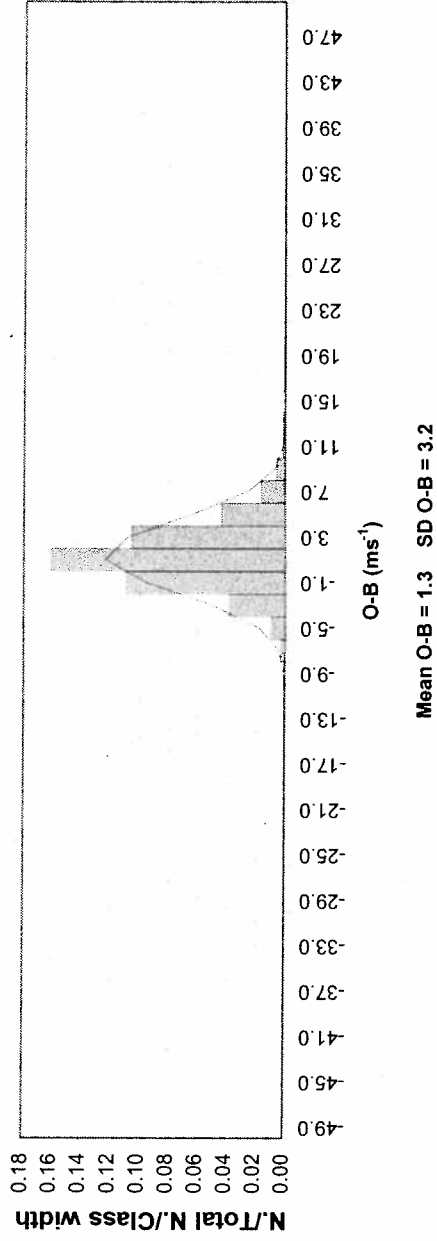


Figure 2e: Distribution of ship O-B wind speed (ms⁻¹)
 Period of data: JUL-DEC 2007 Data used: Flagged observations

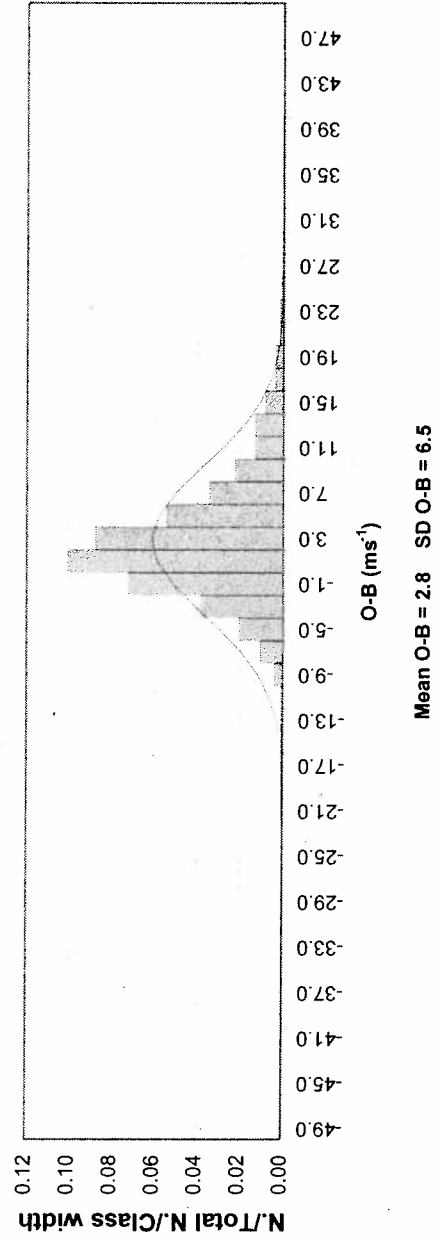


Figure 2f: Distribution of ship O-B wind speed (ms⁻¹)
 Period of data: JUL-DEC 2007 Data used: Unflagged observations

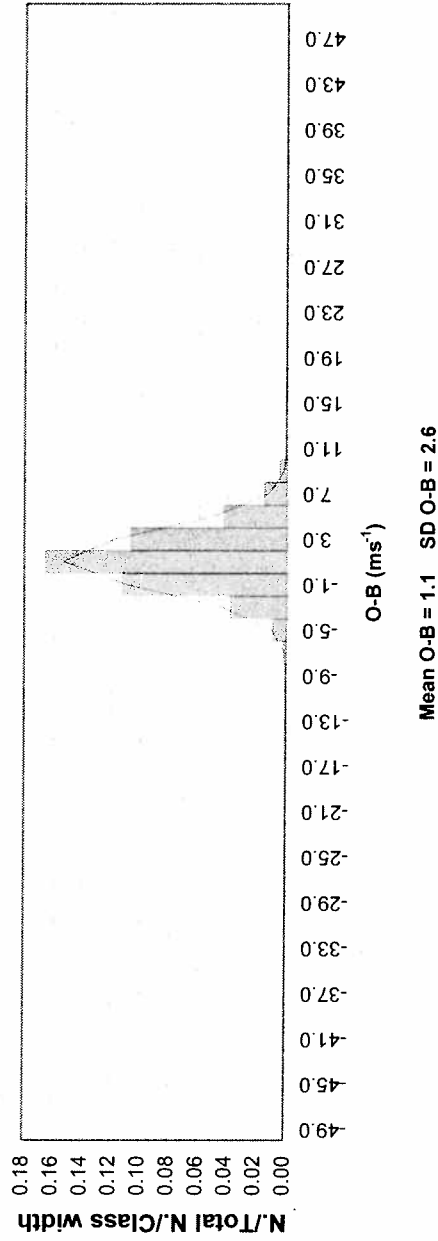


Figure 2g: Distribution of ship O-B wind direction (degrees)
 Period of data: JUL-DEC 2007 Data used: All observations

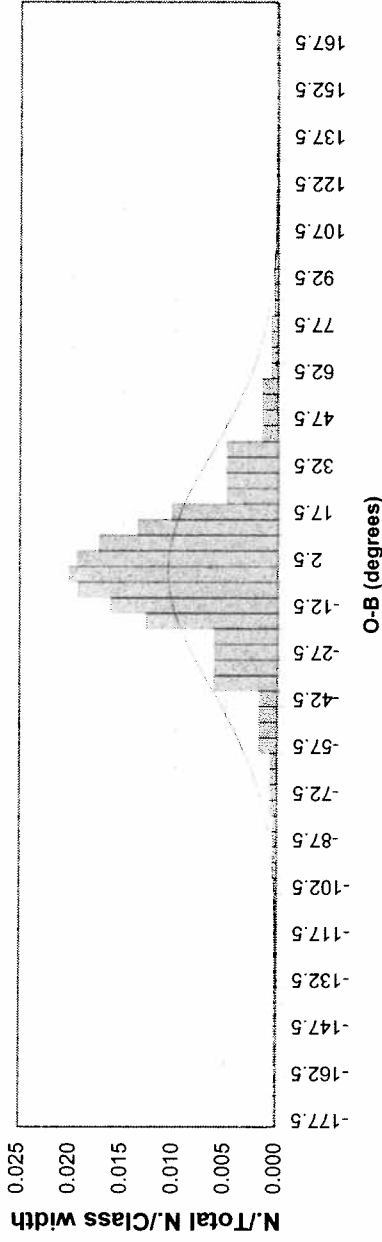


Figure 2h: Distribution of ship O-B wind direction (degrees)
 Period of data: JUL-DEC 2007 Data used: Flagged observations

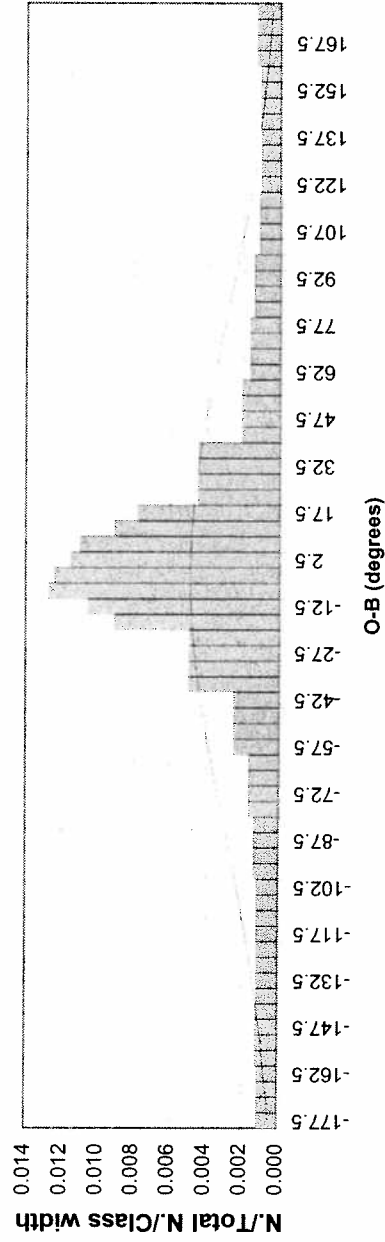


Figure 2i: Distribution of ship O-B wind direction (degrees)
 Period of data: JUL-DEC 2007 Data used: Unflagged observations

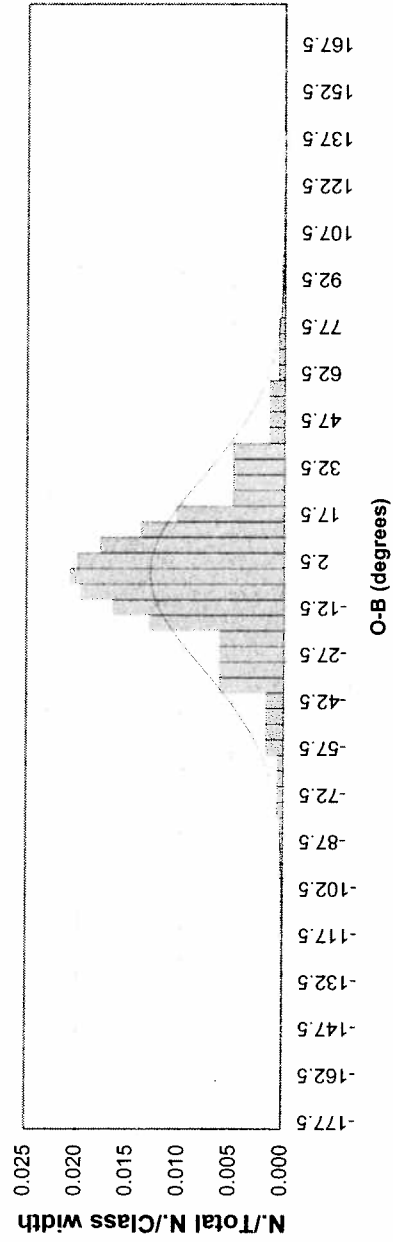


Figure 2j: Distribution of ship O-B SST (°C)
 Period of data: JUL-DEC 2007 Data used: All observations

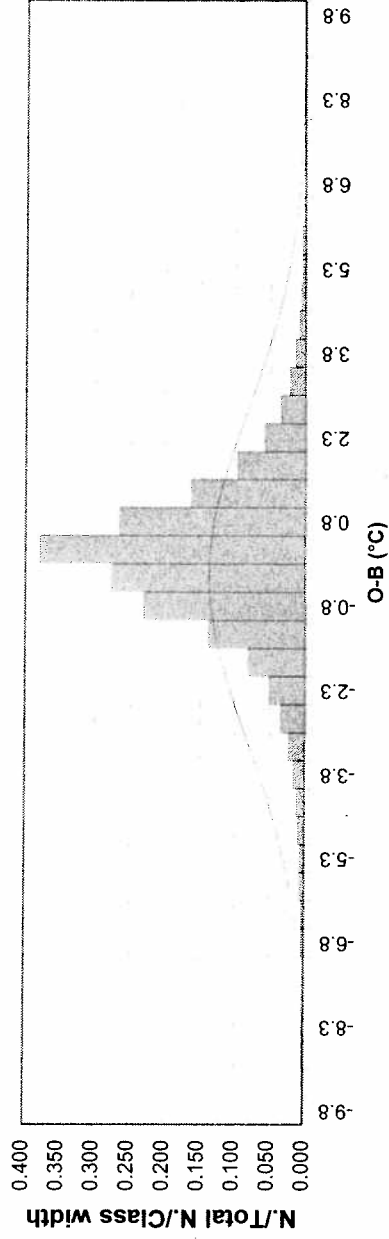


Figure 2k: Distribution of ship O-B SST (°C)
 Period of data: JUL-DEC 2007 Data used: Flagged observations

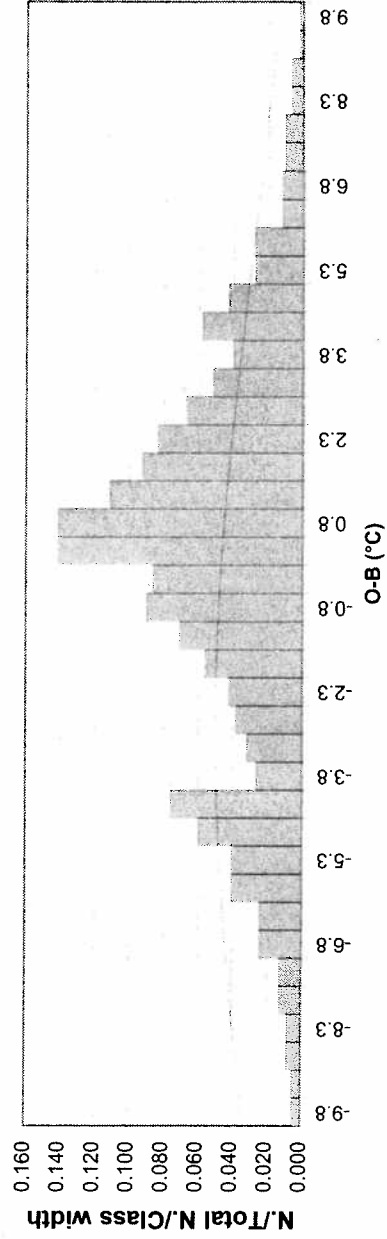


Figure 2l: Distribution of ship O-B SST (°C)
 Period of data: JUL-DEC 2007 Data used: Unflagged observations

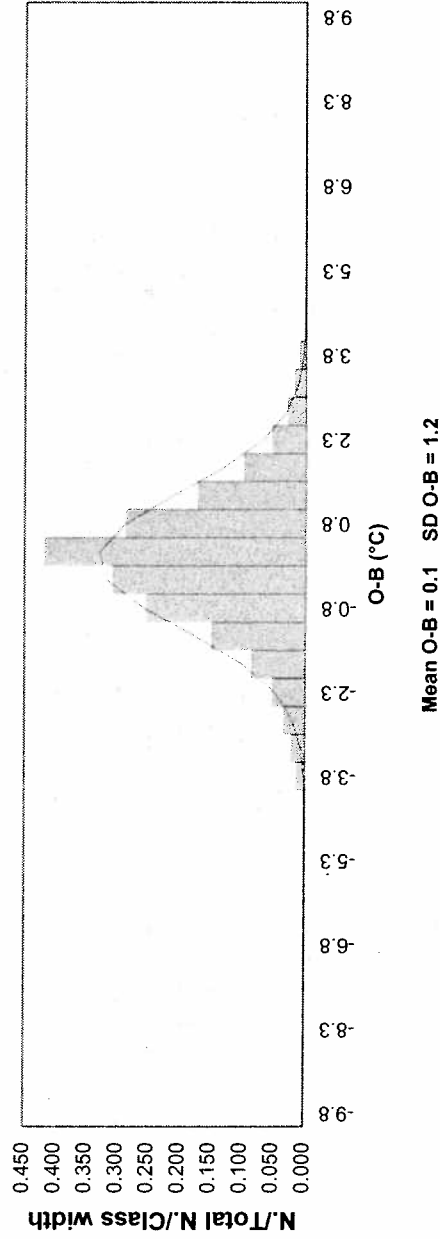


Figure 3: Bias of Ship O-B Pressure (hPa). Date:- July - December 2007
Only observations passing quality control used in statistics
Contours drawn to 10 degree boxes, if the number of observations is greater than 10
Shaded areas have a bias of magnitude greater than 1.0 hPa

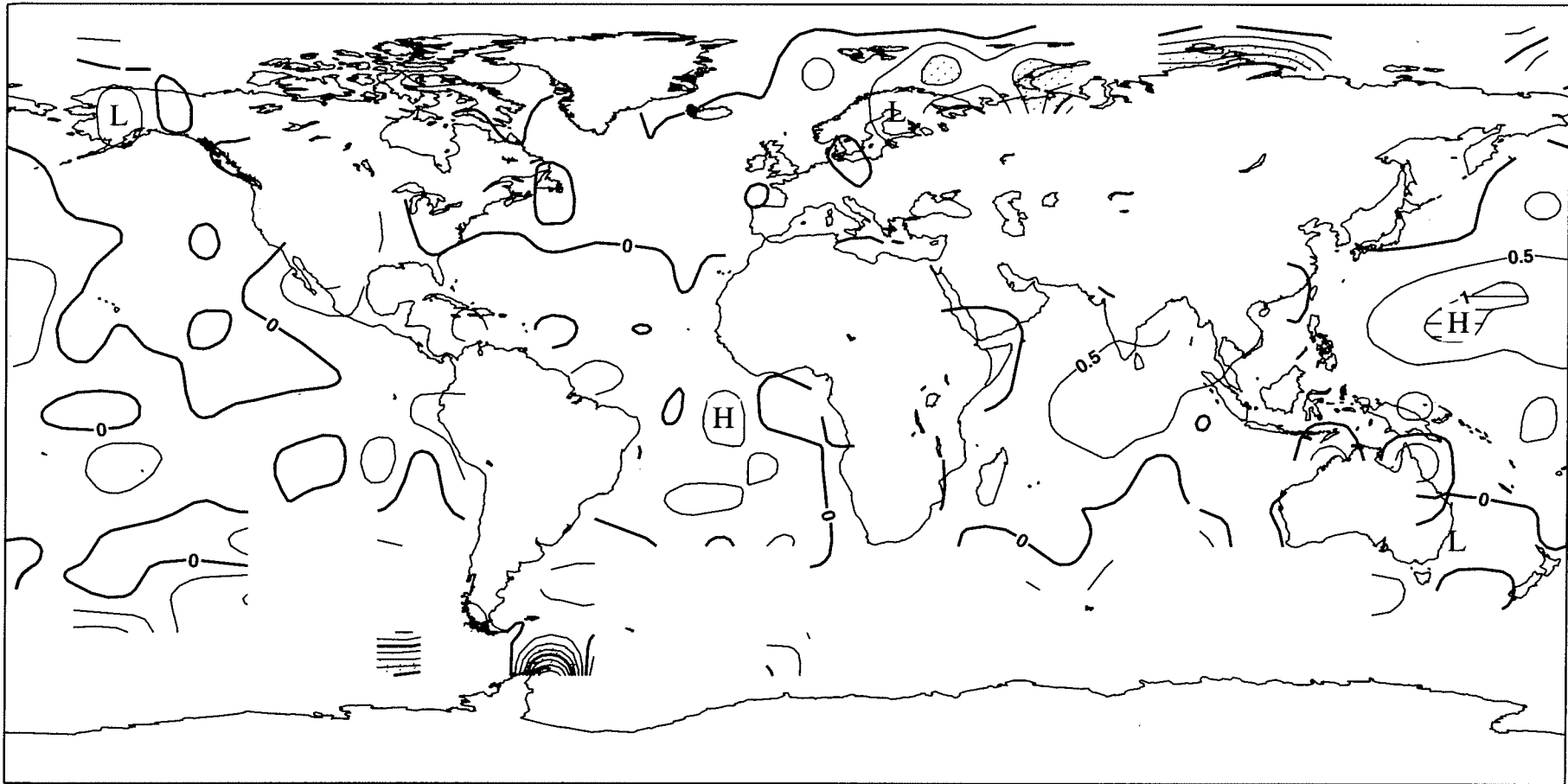


Figure 4: Standard Deviation of Ship O-B Pressure (hPa). Date:- July - December 2007
Only Observations passing quality control used in statistics
Contours drawn to 10 degree boxes, if the number of observations is greater than 10
Shaded areas have a standard deviation of greater than 2.0 hPa

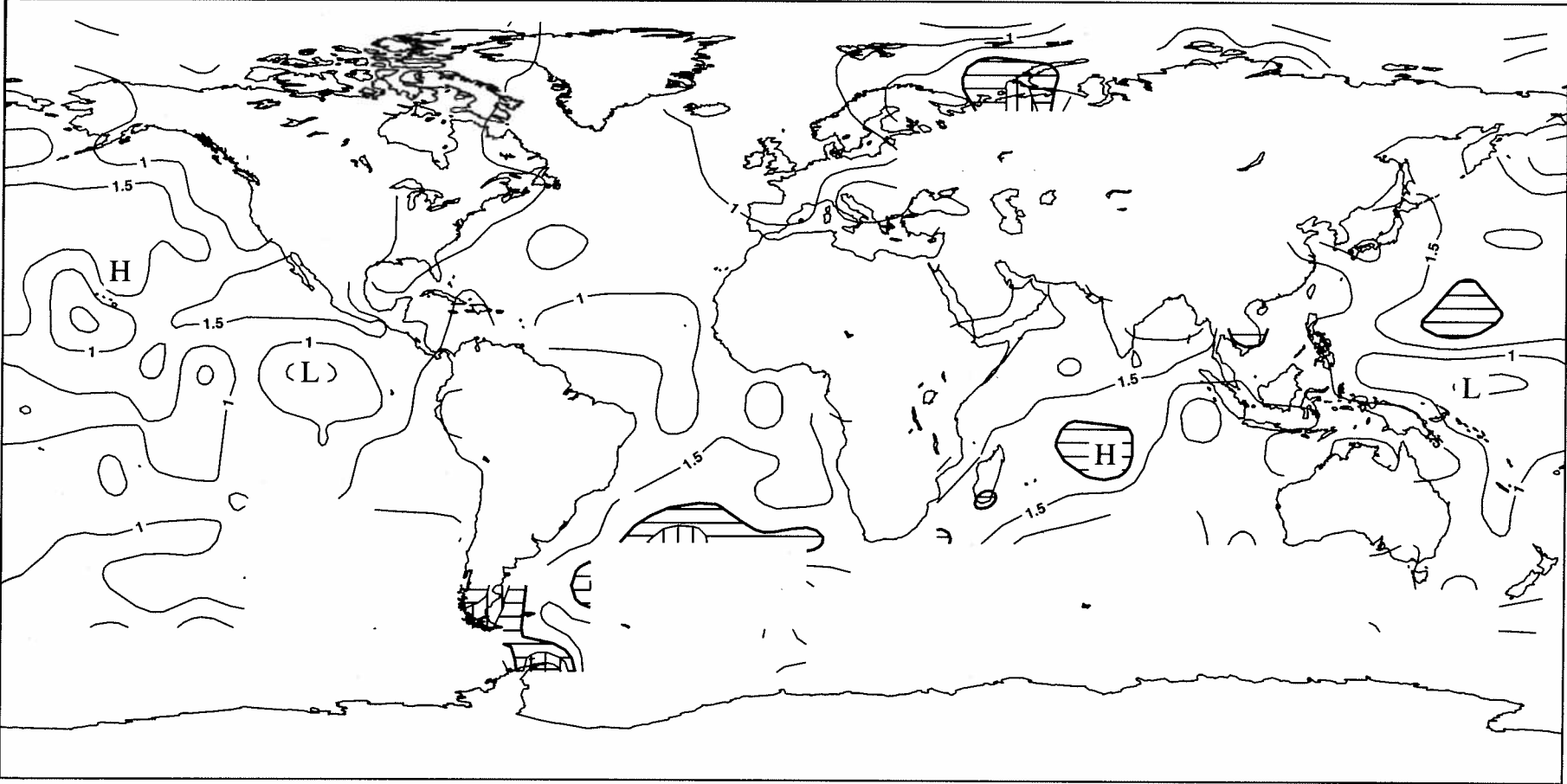


Figure 6: Bias of Ship O-B Wind Speed (ms-1). Date:- July - December 2007

Only observations passing quality control used in statistics

Contours drawn to 10 degree boxes, if the number of observations is greater than 10

Shaded areas have a bias of magnitude greater than 2.0 ms-1

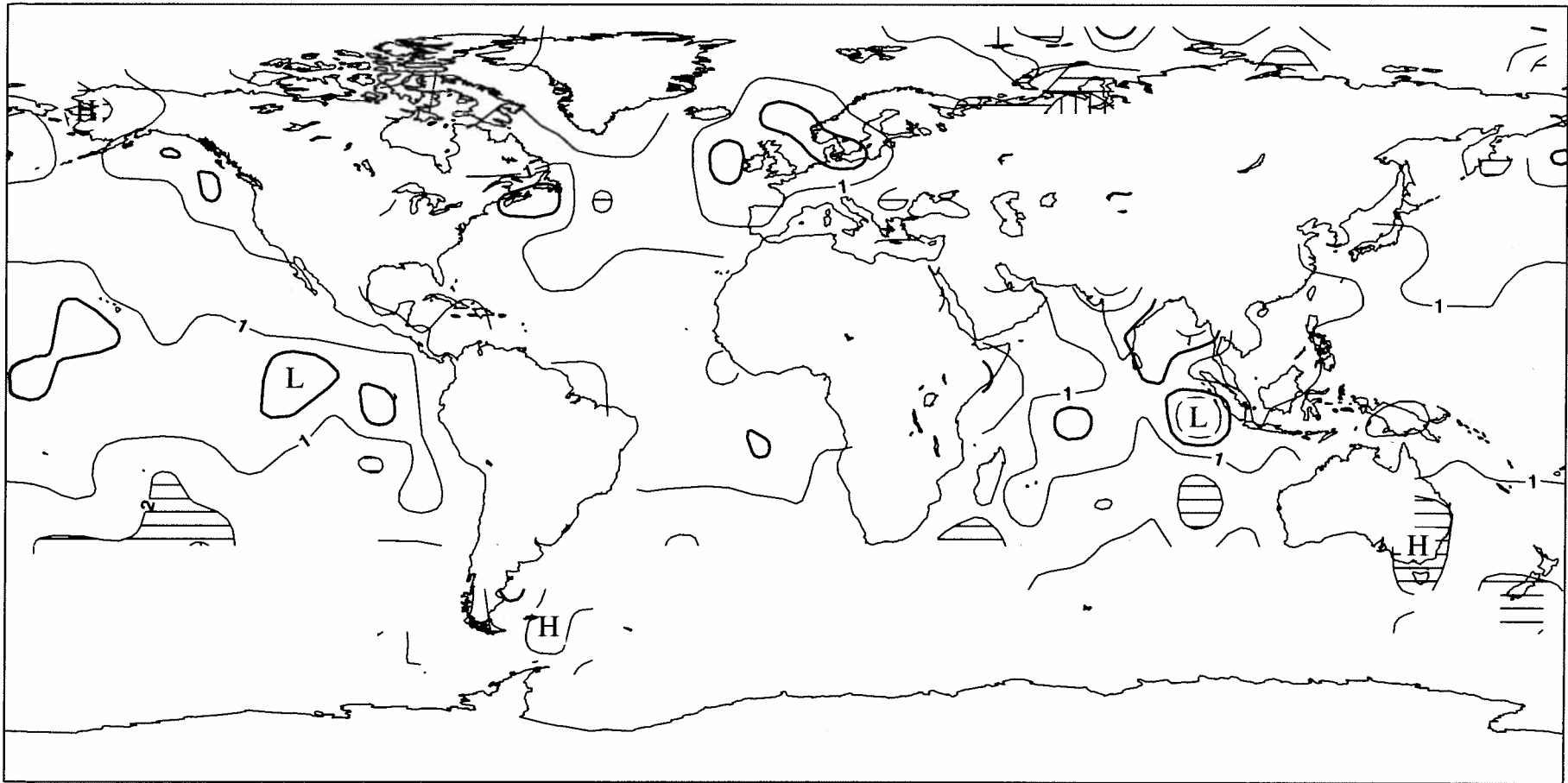


Figure 7: Standard Deviation of Ship O-B Wind Speed (ms-1). Date:- July - December 2007
Only Observations passing quality control used in statistics
Contours drawn to 10 degree boxes, if the number of observations is greater than 10
Shaded areas have a standard deviation of greater than 4.0 ms-1

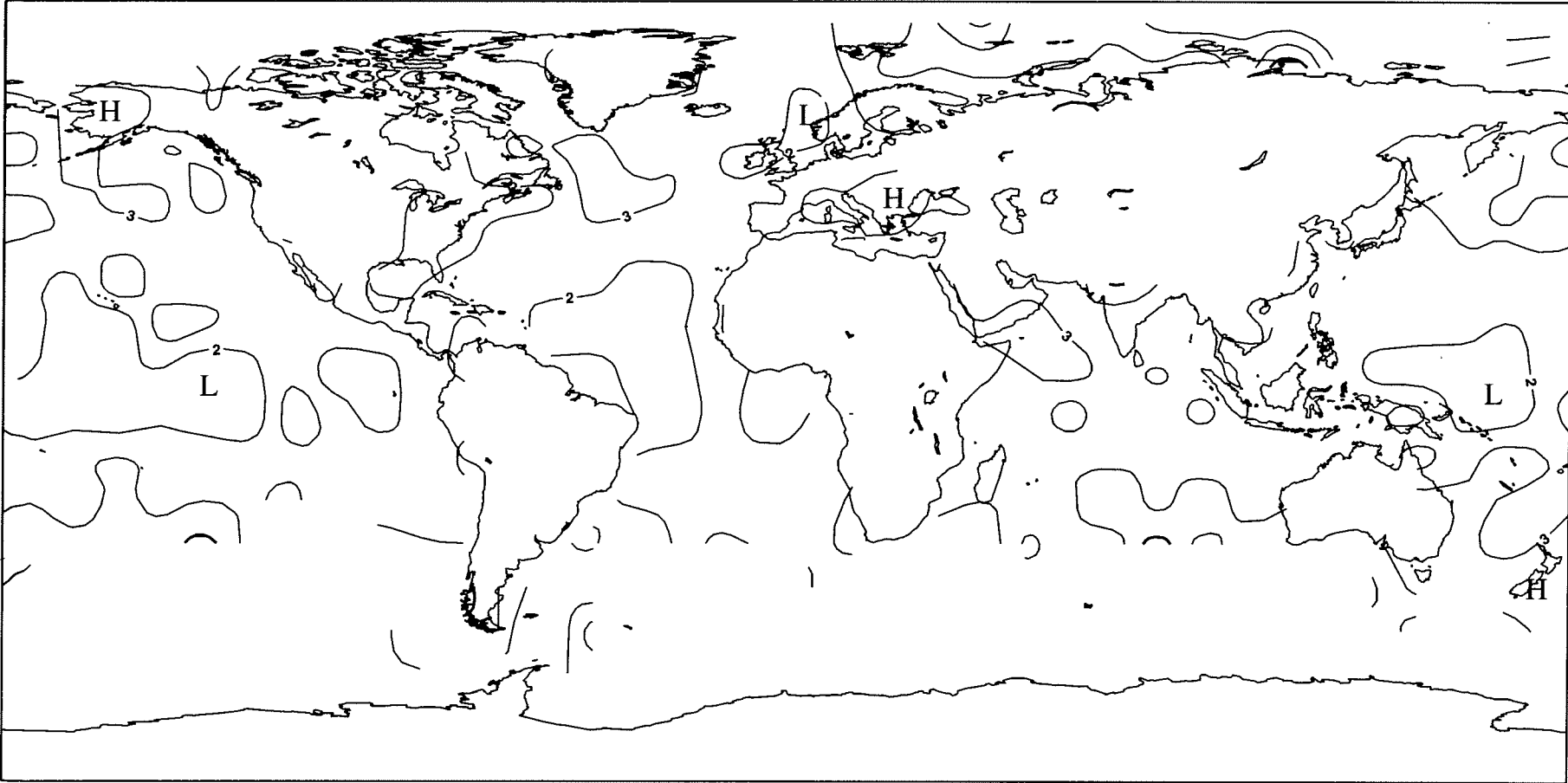


Figure 9: Bias of Ship O-B Wind Direction (degrees). Date:- July - December 2007
Only observations passing quality control used in statistics
Contours drawn to 10 degree boxes, if the number of observations is greater than 10
Shaded areas have a bias of magnitude greater than 10 degrees

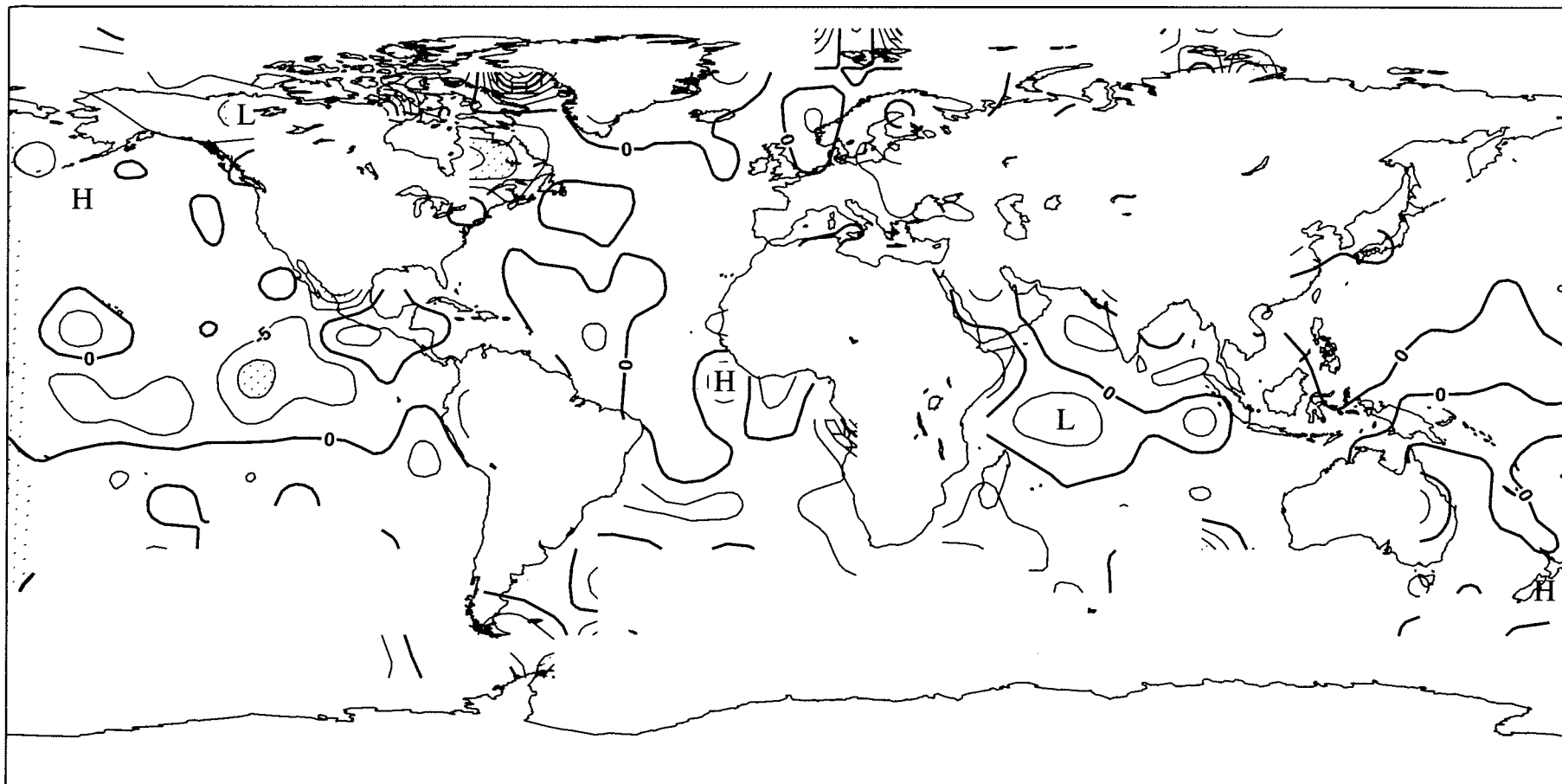


Figure 10: Standard Deviation of Ship O-B Wind Direction (degrees). Date:- July - December 2007

Only Observations passing quality control used in statistics

Contours drawn to 10 degree boxes, if the number of observations is greater than 10

Shaded areas have a standard deviation of greater than 40 degrees

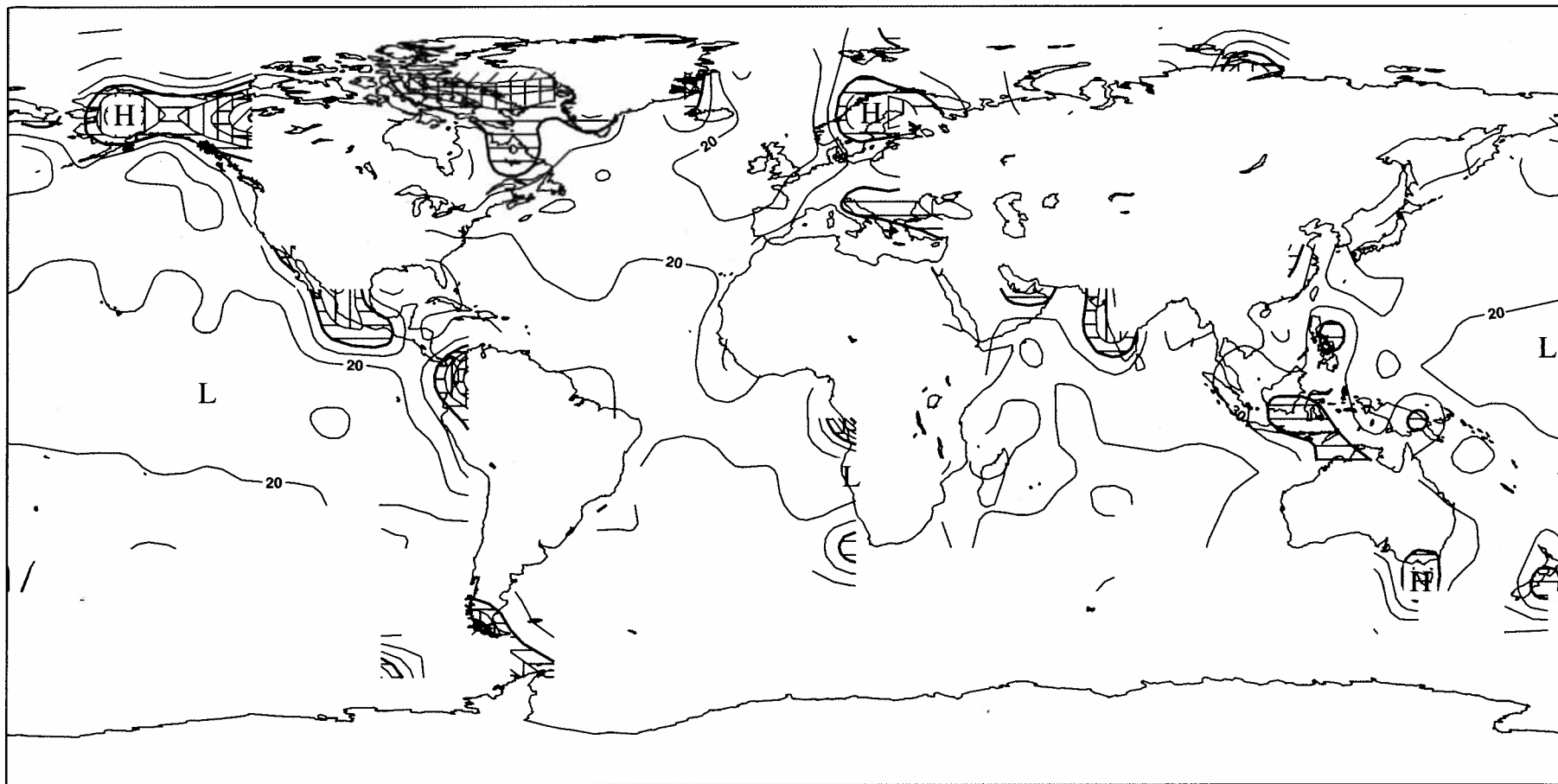


Figure 12: Bias of Ship O-B SST (degrees C). Date:- July - December 2007

Only observations passing quality control used in statistics

Contours drawn to 10 degree boxes, if the number of observations is greater than 10

Shaded areas have a bias of magnitude greater than 1.0 degree C

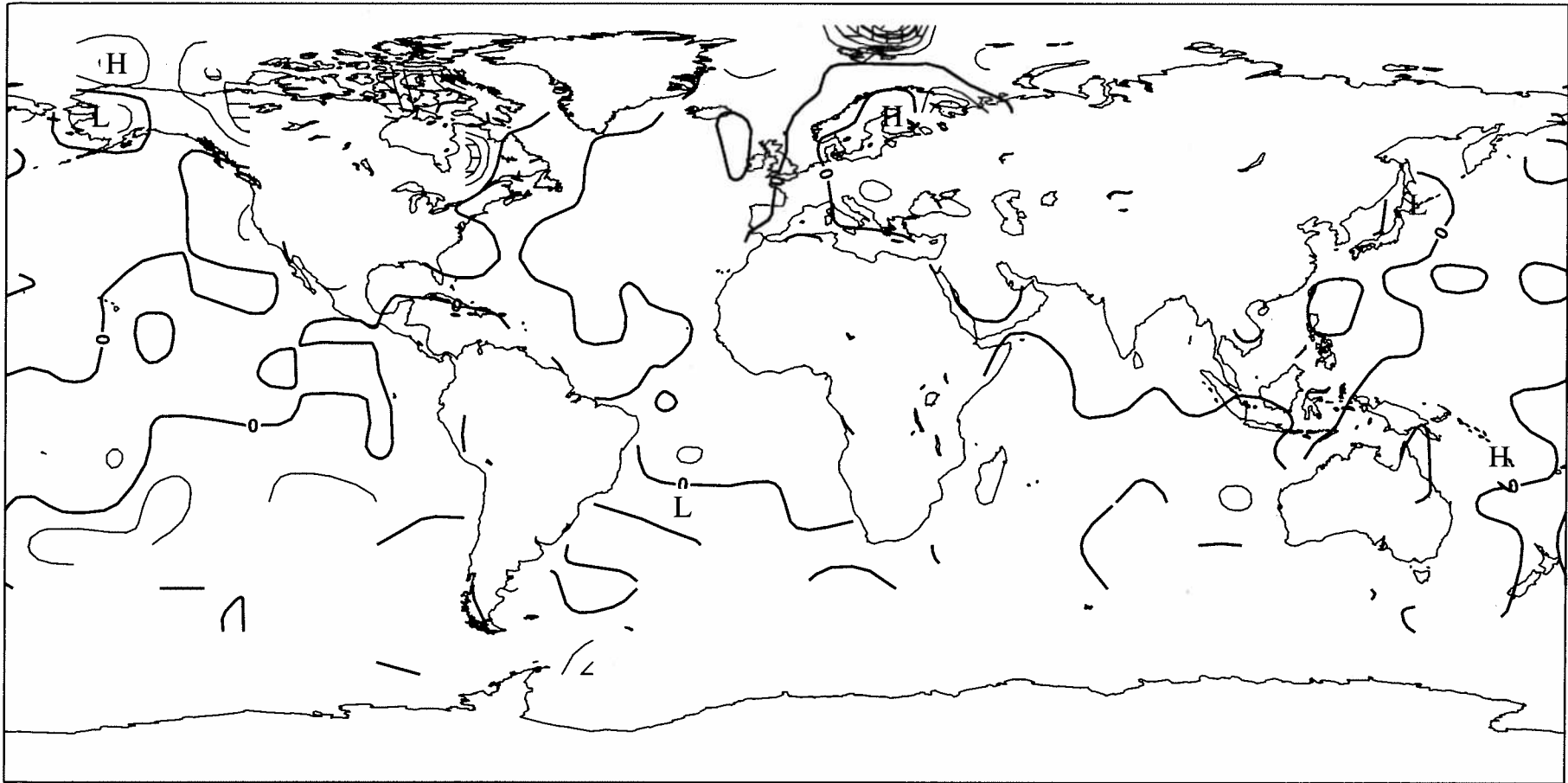


Figure 13: Standard Deviation of Ship O-B SST (degrees C). Date:- July - December 2007
Only Observations passing quality control used in statistics
Contours drawn to 10 degree boxes, if the number of observations is greater than 10
Shaded areas have a standard deviation of greater than 2.0 degrees C

