

Report on the Quality of Marine Surface Observations

Report Number 51

January to June 2014

REPORT ON THE QUALITY OF MARINE SURFACE OBSERVATIONS:

JANUARY TO JUNE 2014

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This report and other related documents can be found at the following URL:
<http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/Biannual/index.html>

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1. INTRODUCTION

In 1985, the WMO 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. NCEP was given responsibility for aircraft and satellite data and ECMWF responsibility for upper-air data. 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 report number 51 and covers the period January to June 2014. 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 global 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 sighted 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 where there are other observations nearby. However, such quality checks are unable to identify errors on all occasions and it is recognised that numerical data assimilation systems 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 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. Due to the thermal-inertia of the oceans and the slowly varying nature of SST, the background SST is in fact the previous analysis (daily analyses are produced at the Met Office from an assimilation of both surface and satellite observations).

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. These O-B differences are generally made up from random errors in the background fields and/or the observations, which are statistically of similar magnitude. However, there is a smaller group of observations that depart 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 appropriately 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 their departures from the model background values. All observations are used, both synoptic and asynoptic, and the background fields are interpolated to the observation time.

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

Wind		
1.	mean of O-B	≥ 5.0 ms ⁻¹ (Speed) $\geq 30^\circ$ (Directn)
2.	standard deviation of O-B	$\geq 80^\circ$ (Directn)
3.	percentage of gross errors	≥ 25

Criteria used for monthly monitoring

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, so that occasional extreme 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.

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, due to different cut-off times. There are also some unexplained variations in the data receipt between the centres, which may be due to problems on 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.

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

Wind

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

SST

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

Criteria used for biannual monitoring

Those 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 5°C pre-2000 and NCEP use 15°C.)

The limits on the bias and standard deviation of O-B are slightly 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 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, January to June 2014, 4939909 observations of pressure were monitored at Exeter from 2363 manual ships, 978 drifting buoys, and 649 automatic ships. The number of reports received from individual ships varies greatly as Table 1 demonstrates: apparently a large percentage of ships continue to report only once, which may be due to erroneous call signs, caused by errors in the part of the message giving the ship identifier. A comparison with the corresponding table in report number 50 shows small increases in the number of manual and automatic ships and fixed buoys reporting, but another quite large increase in the number of drifting buoys reporting during the period (following a large decrease from report number 48). 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, there continues to be a slow decline in the number of manual ships reporting, whereas the number of drifting buoys reporting has returned to values close to the peak reached during 2010 and 2011.

Table 2 and Figure 1 show the number of observations of pressure that have been received over the GTS at the Met Office and processed, over past 6-month periods. 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 up to 2008, with the number of observations of pressure nearly doubling between reports 11 and 16 (1994-1996) and doubling again between reports 33 and 40 (2005-2008). The first increase was largely due to the increase in number of drifting buoy reports, due to the larger number of reports from each drifting buoy. The second increase was due to increased numbers of both drifting buoys and automatic ships, with the number of reports from manual ships remaining fairly constant over recent years, despite the slow reduction in the number of manual ships reporting pressure. The number of reports from drifting buoys seems to have peaked through 2008-2011, with a decrease of ~25% from 2011 to 2013, but the numbers have increased again now to the 2011 value. Reports from drifting buoys now account for 55% of the total, while those from manual ships make up just 10% of the total, and those from automatic ships account for the remaining 35%. 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' began to be processed, rather than only one report per 6-hour assimilation period, as previously. From 1998 through to 2011 there was a fairly steady increase in the total number of pressure reports from automatic ships, but that increase seems to have stopped since 2011.

A histogram of O-B differences for all ship pressure reports in the period January to June 2014 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 94% 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 1.0 hPa. The principal contribution to the standard deviation is assumed to be from background and representativeness 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). Figures 3 and 4 show the geographical distributions of the mean and standard deviation of the values of O-B from ship observations that passed the quality control checks, calculated for 10-degree latitude-longitude boxes. In most areas, the magnitude of the mean is less than 0.5 hPa, the exceptions being generally where the sample size is small. The standard deviation is generally in the range 0.5 to 1.5 hPa. The number of ship pressure reports that passed the quality control checks are 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 January to June 2014. 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.

Most of the errors identified here (as seen in the time-series charts) can be attributed to a bias in the observed pressure. In some cases the bias is constant over most of the monitoring period; although some values depart greatly from the sample mean due to some gross errors in the observation. In fewer cases there are regular large random departures from background. Those observing platforms listed in Table 3 which appeared in report number 50 (July to December 2013) have been indicated with an asterisk.

Statistics for those marine observing platforms listed in report number 50 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 of the pressure observations from these platforms are not given. Less than 40 reports were received in the 6-month period for some of these platforms, but the other 62% of platforms on the list have shown 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 affect the measurement. (These factors do not apply to those ship observations where wind speed is based on visual estimates of the sea state.)

In these monitoring results, the background winds are valid at a height of 10 metres above mean sea level; rather 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 (i) observations from oil rigs or tankers with anemometer heights of 50m or more, although the wind speeds reported by most rigs are now adjusted on board to be nominal 10m values, and (ii) buoys, where the anemometer can be as low as 2m.

In the period January to June 2014, 2162373 wind observations were available for monitoring at the UK Met Office, from 2372 manual ships, 28 drifting buoys, and 623 automatic ships (more detail is given in Table 1). The number of reported manual ship identifiers shows the same trends as for pressure, but with slightly more identifiers reporting wind.

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 the 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, with a speed bias of 0.4 ms^{-1} relative to the background and a direction bias of just 0.6° .

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 about 2 ms^{-1} in middle latitudes and around 1.5 ms^{-1} in the tropics. The |bias| is generally less than 1 ms^{-1} , but exceeds 2 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 5 degrees in most places, but is greater than 10 degrees in a few data sparse areas. The standard deviation is generally between 15 and 30 degrees globally, but in some data-sparse areas and near some coasts it is greater 40 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 January to June 2014, 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 for these identifiers are not included in this report.

3.3 Sea-surface temperature

In the 6-month period January to June 2014, a total of 7338665 observations of SST were monitored at the Met Office, from 1960 manual ships, 1796 drifting buoys and 590 automatic ships. Of the total, 342903 were from manual ships, 5425837 from drifting buoys and 1569925 from automatic ships. (More detail is given in Table 1.) For the same reasons as stated for pressure observations, it appears that many ship identifiers report only once during the 6-month period. There are similar numbers of manual ships reporting SST as there are drifting buoys and automatic ships combined, but manual ships account for only about 5% of the total number of observations. This is due to the greater frequency of automatic ship and buoy observations, hourly in many cases, with manual 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, with a bias of just 0.2°C relative to the background and a standard deviation of 0.7°C .

Figures 12 and 13 show the geographical distributions over the 6-month period of the mean and standard deviation of O-B for ship observations that passed the quality control checks. The numbers of reports used to generate these statistics are presented in Figure 14. The bias is generally less than 0.5°C and the standard deviation is around 1°C .

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

There are 36 marine observing platforms listed as producing suspect observations of pressure over the period January to June 2014, 91 as producing suspect wind observations and 64 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 similar numbers of suspects, around 80. There was an increase in suspect numbers during 1999 and 2000, then the numbers fluctuated around an average of 130 through to the end of 2008; they dropped slightly during 2009 and have averaged about 70 until 2012, since when they have dropped further. Considering the fluctuations in numbers of platforms reporting and observations monitored, there seems to be little overall trend in observation quality, as measured by the percentage of suspect platforms; although there are signs of some improvement in quality over the past few years.

For wind observations, over the years up to 2002 there was a tendency for a small increase in the number of wind observing platforms listed as suspect, then the numbers fluctuated between about 100 and 150 until 2008. There was a slight decrease in the number of suspect wind platforms up to 2010 and since then the number has averaged about 75.

The number of SST observing platforms listed as being suspect has been fairly constant since 2007, averaging about 60, following a decrease in numbers from a high value of 225 in 2005.

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 reason for listing a platform is either a bias in the reported wind speed or a large standard deviation in wind direction, with fewer having a bias in wind direction. For sea-surface temperature observations, bias is again the most common cause of error.

The selection criteria have been set appropriately 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, JANUARY TO JUNE 2014.

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	234	236	156	1	2	5	38	41	41
2-10	302	307	279	8	0	9	20	21	18
11-20	159	164	149	4	1	9	9	8	6
21-40	221	224	215	2	0	6	8	11	14
41-100	500	501	412	15	1	20	10	12	12
101-200	444	454	346	27	1	40	24	26	20
201-500	366	361	294	41	3	126	30	36	42
501-1000	52	49	48	94	1	180	46	50	64
1001-1500	19	22	19	76	5	148	55	55	40
1500+	66	54	42	710	14	1253	409	363	333
Total	2363	2372	1960	978	28	1796	649	623	590
(Report 50)	(2283)	(2299)	(1931)	(811)	(32)	(1609)	(640)	(640)	(611)

* numbers are for fixed buoys only

TABLE 2: NUMBER OF OBSERVATIONS OF PRESSURE RECEIVED AT EXETER ON THE GTS
FOR EACH OF THE 6-MONTH PERIODS COVERING THESE WMO REPORTS

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
Jan - Jun 2008	39	444253	2397246	1156968	3998467
Jul - Dec 2008	40	481513	2605728	1315696	4402937

continued ...

Period	WMO report number	Number of Observations			
		Manual ships	Drifting buoys	Automatic ships	Total
cont					
Jan - Jun 2009	41	466628	2551270	1201762	4219660
Jul - Dec 2009	42	452548	2473739	1381174	4307461
Jan - Jun 2010	43	442069	2606292	1325666	4374027
Jul - Dec 2010	44	534594	2730518	1563232	4828344
Jan - Jun 2011	45	470337	2631956	1608822	4711115
Jul - Dec 2011	46	545536	2651020	1889732	5086288
Jan - Jun 2012	47	515154	2242441	1687722	4445317
Jul - Dec 2012	48	491700	2331570	1899860	4723130
Jan - Jun 2013	49	457038	1723955	1646432	3827425
Jul - Dec 2013	50	484885	2042223	1896909	4424017
Jan - Jun 2014	51	470934	2707428	1761547	4939909

TABLE 3: LIST OF MARINE OBSERVING PLATFORMS REPORTING SUSPECT PRESSURE OBSERVATIONS OVER THE PERIOD JANUARY TO JUNE 2014.

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 July to December 2013)

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
13972	48	48	---	---	1	0	1	0	0	GE
15635	161	62	1.8	6.2	1	1	1	1	0	Bias
23967	550	140	4.6	2.1	1	0	0	1	0	Bias
26543	1175	1175	---	---	2	2	0	0	0	GE
33567	167	58	3.4	-9.3	1	1	1	1	0	Bias
46540	1140	375	0.6	0.4	1	1	1	1	0	GE
54955	152	3	2.7	4.7	1	0	1	1	0	Bias
56558	96	28	4.3	1.4	1	1	1	1	0	GE
72514	148	53	5.8	5.3	1	1	1	1	0	Bias
73650	571	77	6.4	-0.2	1	1	1	1	0	SD

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

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
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Table 3b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
31262 *	1630	1630	---	---	3	3	0	0	0	GE
3FOC5	61	1	2.5	-4.1	1	0	1	0	0	Bias
3FYO6	51	0	3.0	3.9	1	0	1	0	0	Bias
62087	891	201	6.3	-0.4	1	2	1	1	0	SD
C6ZL6	58	0	12.0	2.0	0	0	0	0	0	Bias
ELPP9	80	0	2.7	-3.7	2	0	2	0	0	Bias
FKWL	55	0	1.5	4.3	1	0	1	0	0	Bias
HQTEST	293	0	0.6	-12.5	1	0	0	0	0	Bias
IBJD	53	2	4.2	-6.5	1	0	1	1	0	Bias
UASU	56	18	2.0	-1.0	1	0	1	0	0	GE
UBVF4	95	1	3.6	-4.2	1	0	1	0	0	Bias
UBXS *	125	106	0.7	14.2	0	0	0	0	0	Bias
UCTS *	137	39	3.5	4.0	2	0	2	0	0	Bias & GE
UDKG	43	8	7.2	-2.7	1	0	1	0	0	SD
UDYG	94	64	1.3	0.8	2	0	1	0	0	GE
UFCK	42	0	2.4	-3.9	1	0	1	0	0	Bias
V7UT6	64	0	6.4	-4.7	0	0	0	0	0	Bias & SD
VRHE3	75	0	7.2	0.2	0	0	0	0	0	SD & bias
VRKX8	40	0	1.4	-5.9	0	0	0	0	0	Bias
VRWK5	41	2	2.9	5.6	1	0	1	0	0	Bias
VRWS5	69	0	5.8	0.0	1	0	1	0	0	SD
WCX7445	2008	583	5.1	-2.4	4	2	4	0	0	Bias
WDE3569	93	1	2.2	3.8	0	0	0	0	0	Bias
WDE8264	156	9	6.9	0.3	3	0	2	0	0	SD
WWMZ	45	1	3.1	7.4	1	0	1	0	0	Bias

TABLE 4: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 3 BUT LISTED AS SUSPECT OVER THE PERIOD JULY TO DECEMBER 2013.

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
AUTR	24	0	1.7	5.6	Less than 40 reports
AUYN	43	0	1.1	-0.4	Reduced GE
AVLQ	23	0	2.1	-0.9	Less than 40 reports
C6ZI9	414	10	4.1	2.2	Reduced SD
CFK9698	7	0	2.0	-4.1	Less than 40 reports
ICGU	232	0	1.0	-0.1	Reduced SD
LAOW5	58	0	1.9	-0.8	Reduced bias
OUJN2	32	0	1.3	1.7	Less than 40 reports
UAEV	187	39	3.7	-0.6	Reduced SD
UCJX	26	0	4.1	4.0	Less than 40 reports
UCUC	88	0	1.3	-1.3	Reduced bias
UFJN	50	0	1.1	-3.3	Reduced SD
V7JX5	54	14	2.3	1.0	Reduced bias & SD
VCTV	2	2	---	---	Less than 40 reports
VGMV	14	0	4.4	1.5	Less than 40 reports
VRDT7	100	1	4.8	-1.2	Reduced bias
VRJZ9	263	1	2.0	1.2	Reduced SD
WC5932	690	1	1.3	2.5	Reduced SD
WCX9104	38	0	4.6	5.0	Less than 40 reports
WDB7815	504	2	1.8	-0.4	Reduced bias
WXY6216	2592	9	3.6	0.6	Reduced bias

TABLE 5: LIST OF MARINE OBSERVING PLATFORMS REPORTING SUSPECT WIND SPEED OBSERVATIONS OVER THE PERIOD JANUARY TO JUNE 2014.

- 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 (July to December 2013)

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

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
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Table 5b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
31053	3995	0	3.2	-7.3	6	6	6	6	-	Bias
62087	2200	1	3.6	-7.0	4	6	4	0	-	Bias
CGCX *	1419	0	4.5	-6.8	3	0	3	0	-	Bias
SYSV	70	0	6.0	5.9	1	0	1	0	-	Bias & SD
UDKG	44	5	6.6	3.0	0	0	0	0	-	SD

TABLE 6: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 5 BUT LISTED AS SUSPECT OVER THE PERIOD JULY TO DECEMBER 2013.

- 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
31262	1639	0	1.4	-2.8	Reduced bias
UFJN	49	0	1.7	0.7	Reduced SD

TABLE 7: LIST OF MARINE OBSERVING PLATFORMS PRODUCING SUSPECT WIND DIRECTION OBSERVATIONS OVER THE PERIOD JANUARY TO JUNE 2014 .

- 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 5ms^{-1} . If no significant speed bias was present, the statistics and plots refer to direction reports with an observed speed greater than 5ms^{-1} .
 3. Observing platforms marked with an asterisk were listed in the previous report (July to December 2013)

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
48533	70	1	36.5	40.5	5 0 0 0 5	Bias

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

Identifier	N Obs.	NGE	SD	Bias	B E F T W	Comments
48597	2829	6	41.9	75.3	6 0 0 0 2	Bias
48598	1724	0	37.8	54.5	2 0 0 0 0	Bias

Table 7b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B E F T W	Comments
23002	426	0	27	-52.3		Bias
23170	694	0	54.4	-30.8		Bias
23492	* 568	0	44.9	42.2		Bias
31051	* 394	1	115.6	26.1		SD
31260	1789	0	59.1	58.3		Bias
3FFL8	69	1	93.3	3.6		SD
3FTO6	220	6	88.8	35.2		Bias + SD
3FZO8	* 122	0	51.7	-31.5		Bias
45022	1833	0	70.9	47.2		Bias + SD
45027	* 1007	0	41.3	-32.3		Bias
45136	164	0	92.5	11.7		SD
45166	* 3649	0	36.8	45.6		Bias
46092	2449	0	44.2	-56.1		Bias
46131	4036	0	46.9	68.2		Bias
4XFV	73	0	66.3	-10.3		SD
53005	2066	0	29.7	-64.8		Bias
53040	2010	0	163.9	-8.4		SD
53056	2079	0	157.4	22.6		SD
53057	671	0	156.5	44.9		Bias + SD
62086	1855	109	107.2	20.6		SD
9HJC9	1056	0	54.4	-41.6		Bias
9HJG9	49	0	102.5	-18.1		SD
9KWH	113	0	62	3.1		SD
9V7956	88	0	75.9	-23.3		SD
9V9144	74	0	64.2	-11.2		SD
9V9746	639	0	65.8	-0.2		SD
9VAX2	82	0	68.8	-12.3		SD
9VKQ2	107	0	72.2	-5.9		SD
A8HO3	130	0	60.1	-9.9		SD
A8NF2	122	2	100.6	-10.6		SD
A8PQ7	129	0	67.7	-10.4		SD
A8PX5	133	3	93.6	11.2		SD
A8RW5	127	0	64.2	21.7		SD
A8SC4	83	0	72.1	-24.1		SD
A8VG3	64	0	71.8	10.7		SD
C6AB8	173	2	68.8	-16		SD
C6QK	71	0	70.3	-32.9		Bias + SD
CGCX	698	0	92.8	-10.9		SD
DDSC2	217	14	84.1	34.3		Bias + SD
DVRF	242	0	52.7	-52.1		Bias

Identifier	N Obs.	NGE	SD	Bias	B E F T W	Comments
continued						
H3VR	64	0	44.8	-35.6		Bias
H9XE	122	0	62	10.6		SD
J8NW	29	0	70.4	-26.7		SD
J8NY	137	0	62.7	-8.1		SD
J8PB	183	0	58.5	-38.8		Bias
J8PD	* 115	0	25.4	-85.6		Bias
J8PE4	* 523	1	51.4	-49.8		Bias
KCDK	182	0	60.3	-31.2		Bias + SD
LAQJ7	174	0	60.7	-1.4		SD
LAVW4	160	1	62.4	-0.6		SD
MHNN5	96	0	73.7	-5.6		SD
MMER9	217	2	60.1	-4.8		SD
MVQP8	175	1	64.6	-7.5		SD
MYSU5	237	8	62.4	-3.8		SD
ONFI	* 104	0	66.8	-5.5		SD
OXBB2	242	1	62.9	39.7		Bias + SD
PCCL	98	0	63.5	14.8		SD
PENR	148	7	80.2	-16.4		SD
S6ES6	1609	1	68.5	2.8		SD
S6NK3	87	1	57.2	-32.9		Bias
TBWUK47	* 238	0	65.3	31.4		Bias + SD
UBBH5	* 66	2	61	-5		SD
UDYG	* 84	0	54.7	42.2		Bias
UFLC	176	0	67.8	-5.3		SD
UFLT	251	0	64.7	-8.9		SD
UISD	86	0	60.5	5.4		SD
V7AT9	48	0	67.9	21.3		SD
V7UT8	237	4	78	9		SD
VRBQ2	144	1	60.4	-16.2		SD
VRCQ2	80	0	60.6	-9		SD
VREF5	114	0	61.4	-20.6		SD
VRFI2	137	0	63.8	-7		SD
VRGN7	93	0	69.1	-1.9		SD
VRGO2	100	0	64.8	10.7		SD
VRKC8	142	1	63.1	-5.2		SD
VRWS4	89	0	61	0.1		SD
VRWY9	81	0	63.7	-21.3		SD
VRZZ2	57	0	44.3	-32.3		Bias
WBN4113	* 436	0	60.5	-16.9		SD
WBP3210	* 1505	9	64.5	6.8		SD
WCX7445	* 2002	4	79.4	-6.8		SD
WCX9106	* 160	1	51.9	-42		Bias
WDE8264	166	5	65.2	-10.3		SD
WTEF	* 713	0	80.3	-27.9		SD

TABLE 8: LIST OF PLATFORMS REPORTING IN SHIP CODE NOT APPEARING IN TABLE 7 BUT LISTED AS SUSPECT OVER THE PERIOD JULY TO DECEMBER 2013.

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
3ETA7	485	8	57.7	3.4	Reduced SD
3EZP7	1	0	0	3.9	Less than 40 reports
3FAV5	70	0	50.3	3.2	Reduced SD
46053	1835	0	42.8	-26.9	Reduced bias
9VHG	574	0	44.6	2.1	Reduced SD
A8EH3	69	0	60.9	11.7	Reduced bias
A8IY2	105	0	42.6	14.4	Reduced SD
A8OH5	107	0	31.9	8.8	Reduced bias
C6NI8	146	1	58.4	-21.5	Reduced SD
DDYL2	150	0	22.5	1.7	Reduced SD
DQVH	234	0	37.6	-4.9	Reduced SD
MZDL7	47	0	41.4	1	Reduced SD
NRLY	120	0	33.3	-17.5	Reduced SD
ONGA	208	0	51.6	-5.2	Reduced SD
OZDB2	183	0	55.9	10	Reduced SD
SBPQ	2903	0	31.4	4.4	Reduced SD
TBWUK31	390	0	53.5	5.5	Reduced SD
UBZG2	67	0	44.3	7.9	Reduced SD
UCAD	58	0	49.4	-9	Reduced SD
UFMK	68	0	55.1	7.6	Reduced SD
VRDF2	222	0	37.3	3.7	Reduced SD
VRDO9	3	0	58.5	-27.6	Less than 40 reports
VRJM7	117	0	50.3	13	Reduced bias
VRKM2	83	2	56.2	-12.7	Reduced SD
VRLQ3	61	0	57.7	-3.1	Reduced SD
WDG8555	222	1	50.1	-7.6	Reduced SD
ZCDU9	129	0	39.9	0.5	Reduced SD
ZCDY2	289	0	35.2	-8.6	Reduced SD
ZCEG4	95	0	51	0.1	Reduced SD
ZQCP3	130	0	20.1	0.9	Reduced SD

TABLE 9: LIST OF MARINE OBSERVING PLATFORMS REPORTING SUSPECT SEA SURFACE TEMPERATURE OBSERVATIONS OVER THE PERIOD JANUARY TO JUNE 2014.

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 (July to December 2013)

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
11902	178	178	---	---	1	-	1	-	0	Bias/GE
13574	755	337	0.1	0.1	1	-	1	-	0	Bias/GE
13587	233	233	---	---	1	-	1	-	0	Bias/GE
14924	965	255	3.3	-1.7	1	-	1	-	0	Bias/GE
22716	57	1	2.6	-5.1	0	-	1	-	0	Bias
23660	1238	51	4.0	-1.6	1	-	0	-	0	SD
25618	4317	1679	4.0	-4.3	5	-	1	-	0	Bias
25650	3026	1754	1.1	-8.3	5	-	0	-	0	Bias
26538	1294	9	3.9	-0.8	1	-	1	-	0	Bias
31507	1005	270	3.5	-2.4	1	-	1	-	0	Bias
31533	543	3	4.3	3.8	1	-	0	-	0	Bias
31868	1163	542	0.6	0.1	1	-	1	-	0	GE
33658	244	7	1.1	6.3	2	-	2	-	0	Bias
43567	215	97	0.5	-9.7	1	-	1	-	0	Bias
46540	1147	0	4.7	-3.3	1	-	0	-	0	Bias
48524	237	0	0.7	-6.6	1	-	0	-	0	Bias
48550	1323	618	3.7	5.5	3	-	3	-	0	Bias
55619	74	4	2.8	4.3	1	-	0	-	0	Bias
55634	701	46	3.3	-3.6	1	-	0	-	0	Bias
56560	445	384	0.3	-0.1	1	-	1	-	0	GE
64931	411	58	3.3	-5.5	1	-	0	-	0	Bias
72514	172	140	0.3	9.6	1	-	1	-	0	Bias

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

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
25605	4307	2817	4.0	-2.4	5	-	0	-	0	Bias
26537	1338	49	4.1	-0.3	1	-	1	-	0	Bias
32627	204	0	0.3	7.9	1	-	0	-	0	Bias
41651	99	56	2.8	2.3	1	-	1	-	0	GE
47580	855	97	2.8	4.0	2	-	2	-	0	Bias

Table9b: Platforms reporting in SHIP code

Identifier	N Obs.	NGE	SD	Bias	B	E	F	T	W	Comments
45027	1054	0	1.1	-3.0	1	-	0	-	0	Bias
45166	316	0	0.4	4.6	1	-	0	-	0	Bias
46199	* 144	144	---	---	0	-	1	-	0	GE
9V8798	* 138	5	1.5	5.6	3	-	2	-	0	Bias
A8AX8	61	0	1.0	-3.1	1	-	0	-	0	Bias
A8MW8	* 218	0	1.3	3.2	4	-	5	-	0	Bias
A8SC4	* 81	0	1.1	-3.0	1	-	1	-	0	Bias
AUTV	60	1	2.1	3.0	0	-	0	-	0	Bias
BATFR12	1062	0	0.6	4.0	6	-	5	-	0	Bias
C6FY8	68	36	1.3	1.4	1	-	1	-	0	GE
C6RM7	* 54	0	1.0	-2.9	0	-	0	-	0	Bias
C6YZ5	154	0	2.1	-3.5	1	-	2	-	0	Bias
CFO383	71	71	---	---	1	-	0	-	0	GE
CQIU	214	0	1.5	3.6	4	-	4	-	0	Bias
DCCM2	* 47	0	0.7	3.0	0	-	0	-	0	Bias
DGTX	481	0	1.6	3.1	3	-	4	-	0	Bias
ELWG7	171	0	2.3	3.1	2	-	2	-	0	Bias
HO7723	48	0	1.6	-3.2	0	-	0	-	0	Bias
ICIC	235	0	3.3	-3.1	3	-	3	-	0	Bias
J8PB	* 167	0	1.1	3.8	3	-	3	-	0	Bias
KGTZ	127	68	3.0	-0.6	3	-	0	-	0	GE
LF3F	1297	127	5.0	-3.0	5	-	4	-	0	Bias
TBWUK69	116	0	1.8	3.0	1	-	1	-	0	Bias
UBSF2	* 60	0	2.1	3.3	0	-	0	-	0	Bias
UCTS	135	42	3.5	-3.3	1	-	1	-	0	Bias
UDKG	52	0	2.4	4.5	1	-	1	-	0	Bias
V2OB9	* 290	0	1.9	4.4	3	-	3	-	0	Bias
VCRG	422	0	1.2	3.5	2	-	4	-	0	Bias
VREO9	202	2	2.8	3.2	4	-	4	-	0	Bias
VYNG	77	4	3.3	5.1	2	-	2	-	0	Bias
WCF301	* 1018	1015	0.3	9.8	3	-	0	-	0	GE
WDE919	* 137	31	1.1	-0.3	2	-	0	-	0	GE
WDF3296	76	4	2.0	4.2	2	-	2	-	0	Bias
WL3108	* 1334	1334	---	---	3	-	0	-	0	GE
WOSI	58	0	3.5	-3.4	2	-	0	-	0	Bias
WZJD	487	1	1.5	-3.5	5	-	5	-	0	Bias
WZZF	123	0	1.1	3.1	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 JULY TO DECEMBER 2013.

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
9V7962	272	5	3.2	-2.5	Reduced bias
9V8472	63	5	3.5	-0.9	Reduced bias
9VHG	172	8	3.4	-1.7	Reduced bias
A8IX8	32	1	0.7	-3.6	Less than 40 reports
A8KC6	180	0	1.2	1.8	Reduced bias
AUYP	8	0	1.5	-2.4	Less than 40 reports
C6FN4	132	2	1.6	-1.7	Reduced bias
CCCH	3	0	1.4	-4.5	Less than 40 reports
DCDO2	2	0	0.4	4.7	Less than 40 reports
KIRH	443	6	2.5	-0.2	Reduced bias
S6JO	64	4	4.6	-0.3	Reduced bias
S6NK5	307	26	3.5	-2.0	Reduced bias
S6TF	146	1	2.7	-0.4	Reduced bias
UCJB	37	0	5.0	1.2	Less than 40 reports
VMGO	144	0	2.5	-2.9	Reduced bias
VRET5	3	0	0.0	0.7	Less than 40 reports
VRJS2	46	0	2.3	2.9	Reduced bias
WADN	68	2	2.2	1.0	Reduced bias
WCX7445	1324	117	3.3	2.8	Reduced bias
WSLH	28	0	1.6	-3.9	Less than 40 reports
WZA4027	1	0	0.0	-3.8	Less than 40 reports
WZD2465	52	0	2.8	-0.5	Reduced bias

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

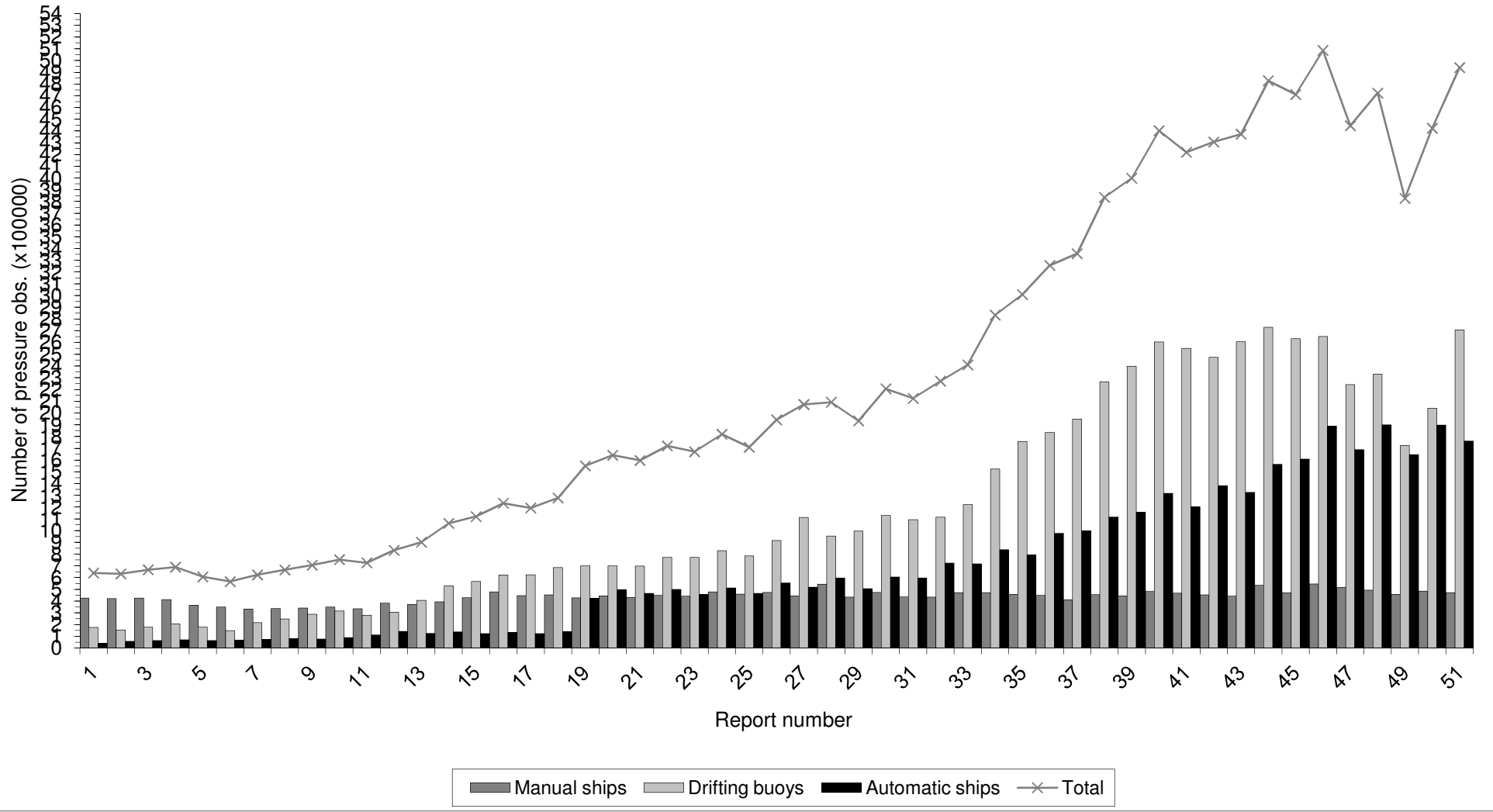


Figure 2a: Distribution of ship O-B pressure (hPa)
Period of data: JAN-JUN 2014 Data used: All observations

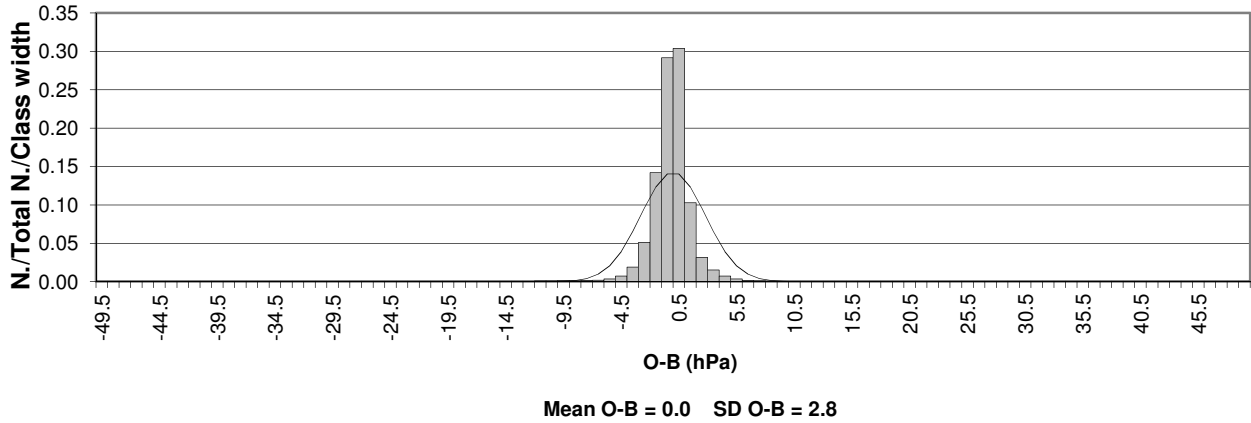


Figure 2b: Distribution of ship O-B pressure (hPa)
Period of data: JAN-JUN 2014 Data used: Flagged observations

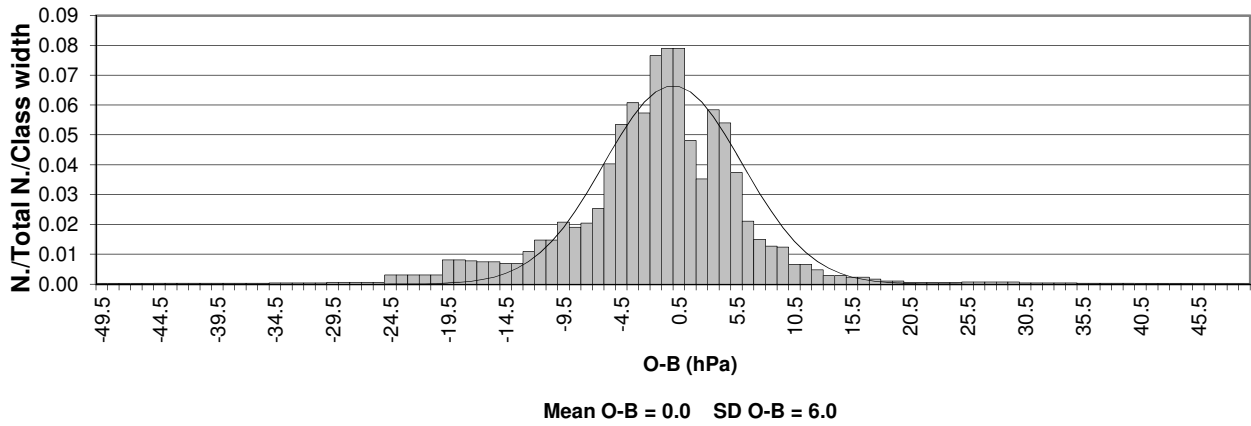


Figure 2c: Distribution of ship O-B pressure (hPa)
Period of data: JAN-JUN 2014 Data used: Unflagged observations

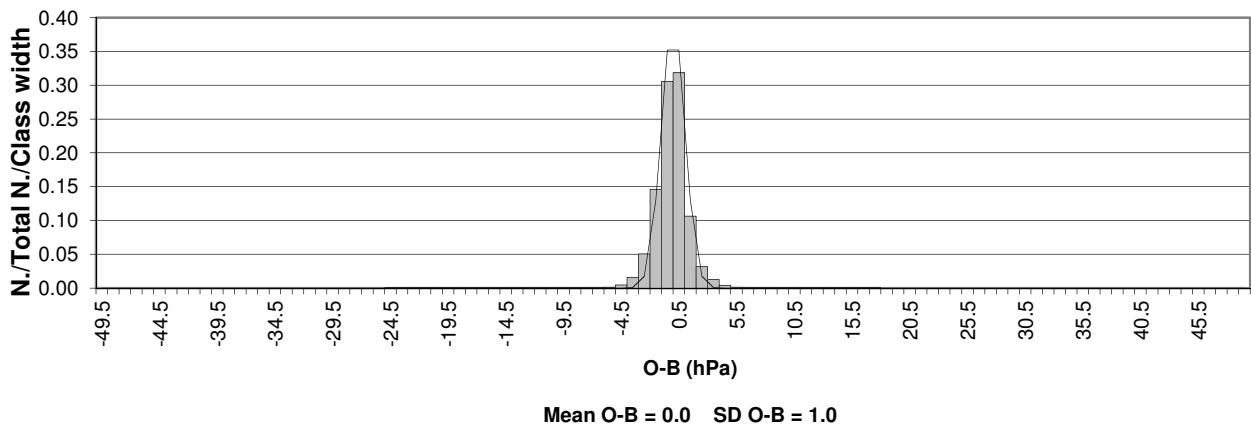


Figure 2d: Distribution of ship O-B wind speed (ms^{-1})
Period of data: JAN-JUN 2014 Data used: All observations

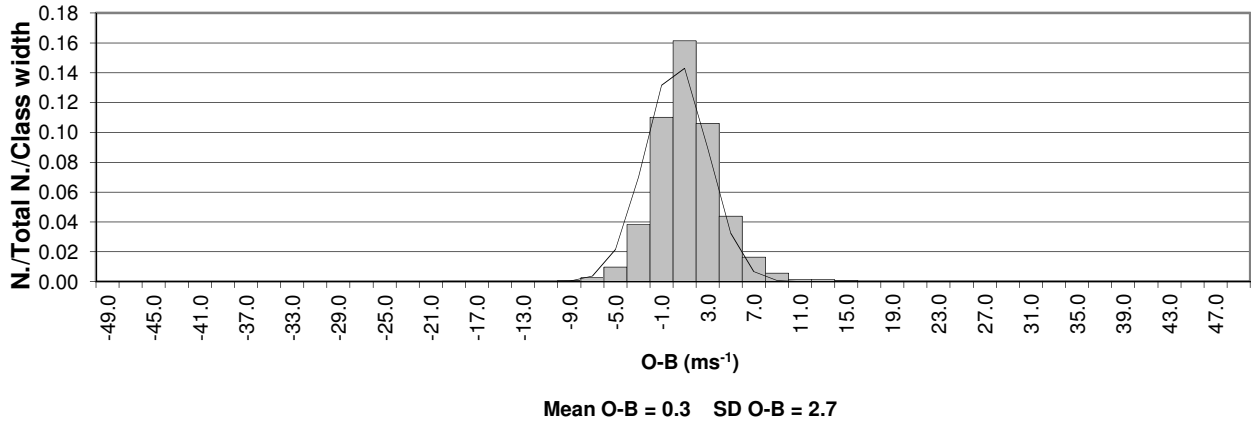


Figure 2e: Distribution of ship O-B wind speed (ms^{-1})
Period of data: JAN-JUN 2014 Data used: Flagged observations

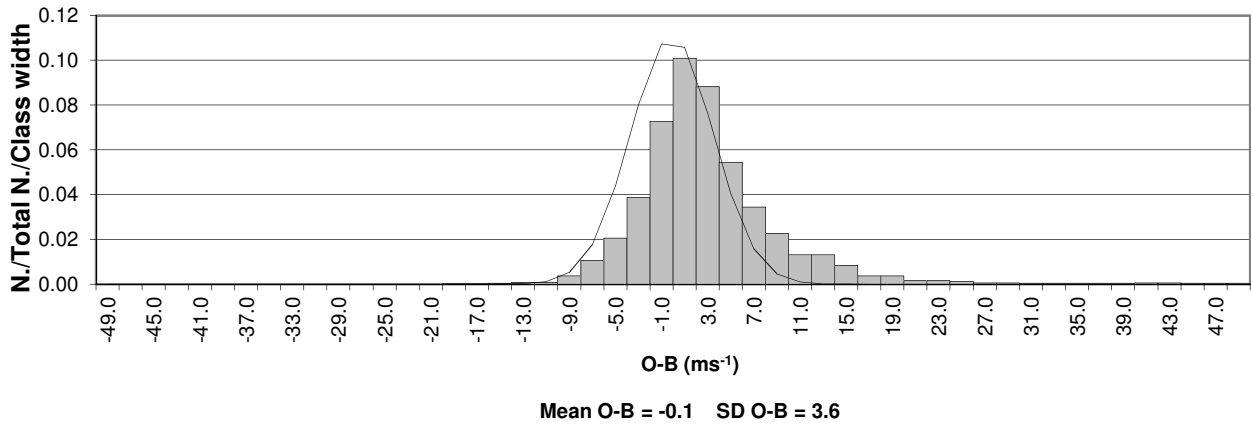


Figure 2f: Distribution of ship O-B wind speed (ms^{-1})
Period of data: JAN-JUN 2014 Data used: Unflagged observations

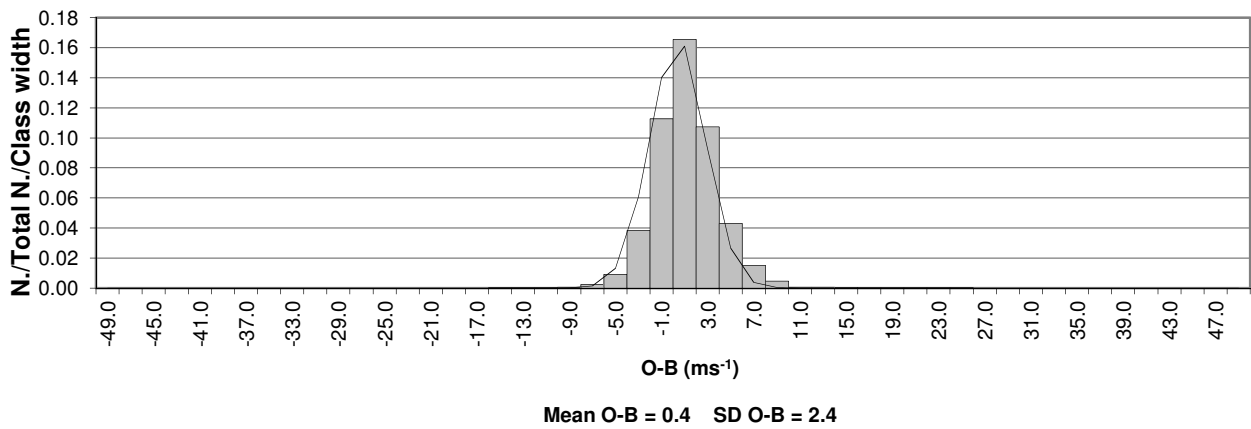


Figure 2g: Distribution of ship O-B wind direction (degrees)
Period of data: JAN-JUN 2014 Data used: All observations

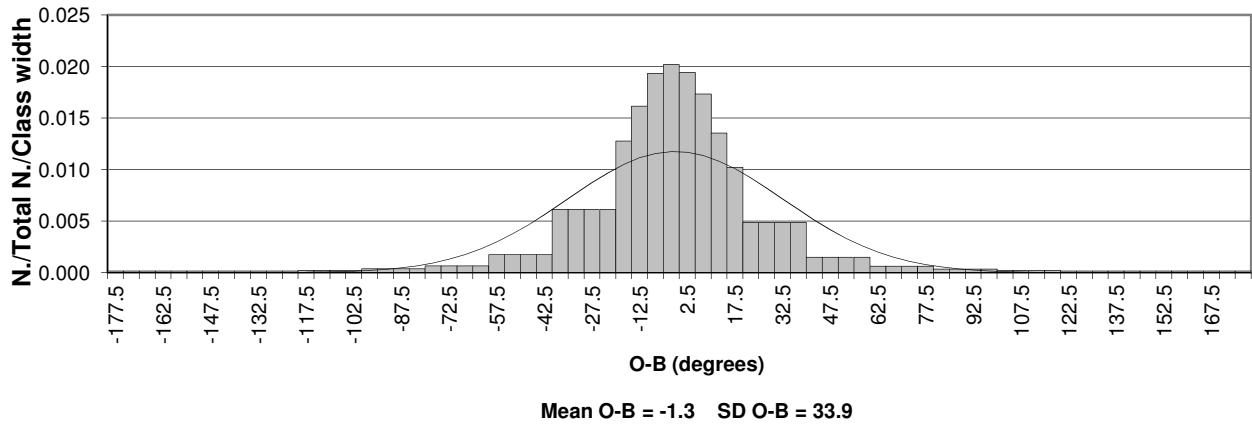


Figure 2h: Distribution of ship O-B wind direction (degrees)
Period of data: JAN-JUN 2014 Data used: Flagged observations

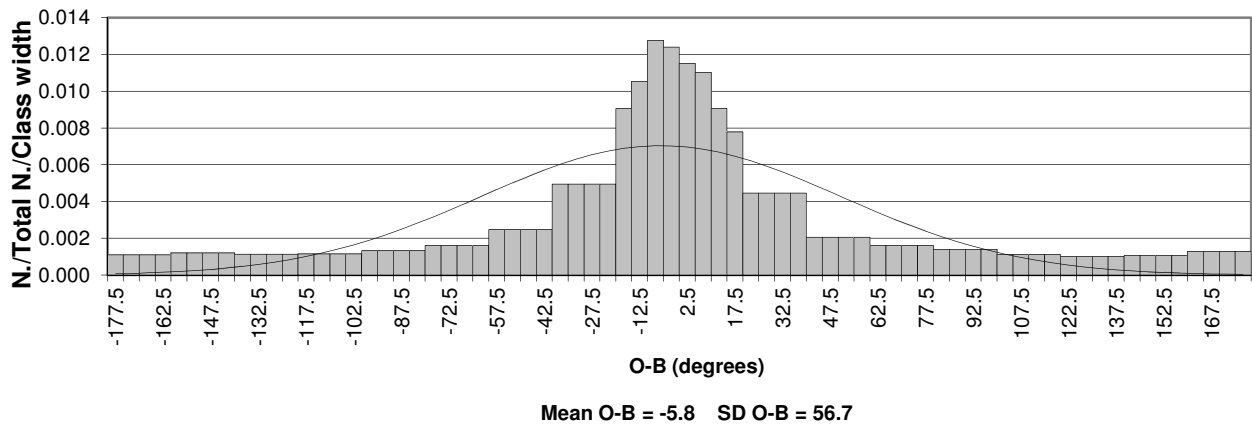


Figure 2i: Distribution of ship O-B wind direction (degrees)
Period of data: JAN-JUN 2014 Data used: Unflagged observations

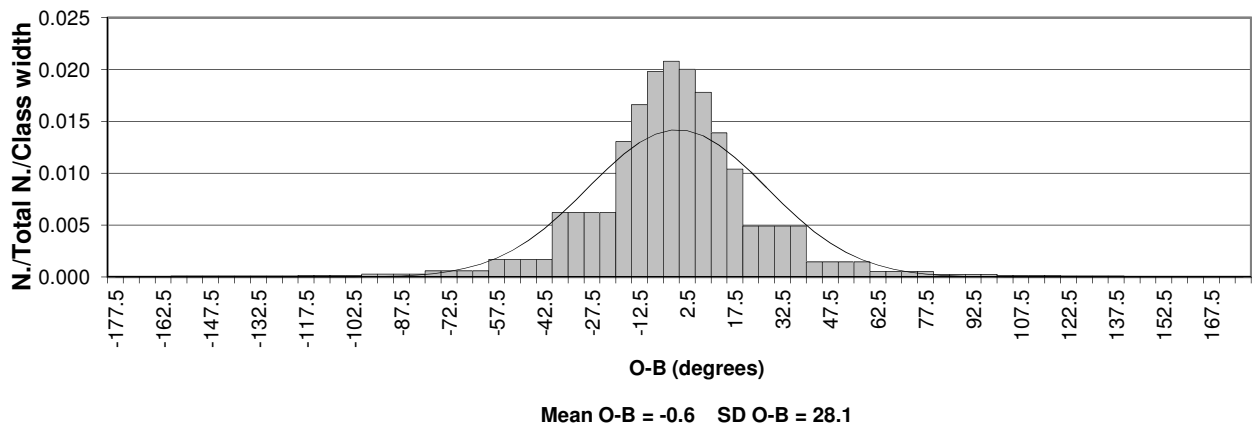


Figure 2j: Distribution of ship O-B SST (°C)
Period of data: JAN-JUN 2014 Data used: All observations

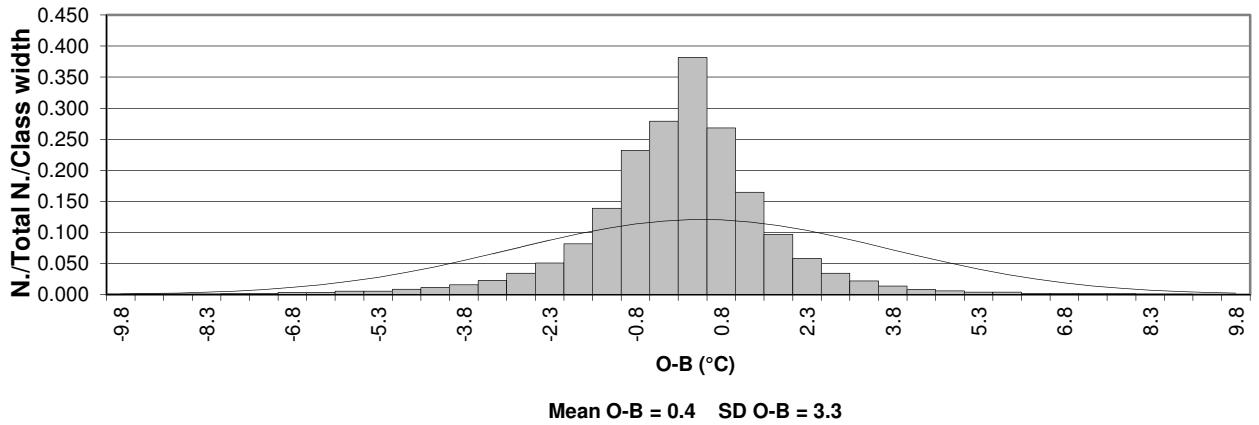


Figure 2k: Distribution of ship O-B SST (°C)
Period of data: JAN-JUN 2014 Data used: Flagged observations

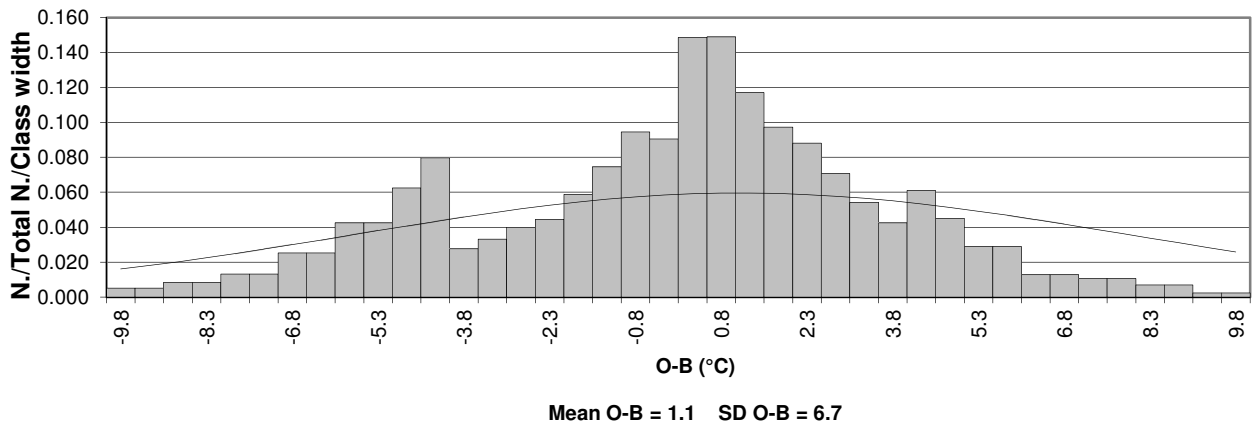


Figure 2l: Distribution of ship O-B SST (°C)
Period of data: JAN-JUN 2014 Data used: Unflagged observations

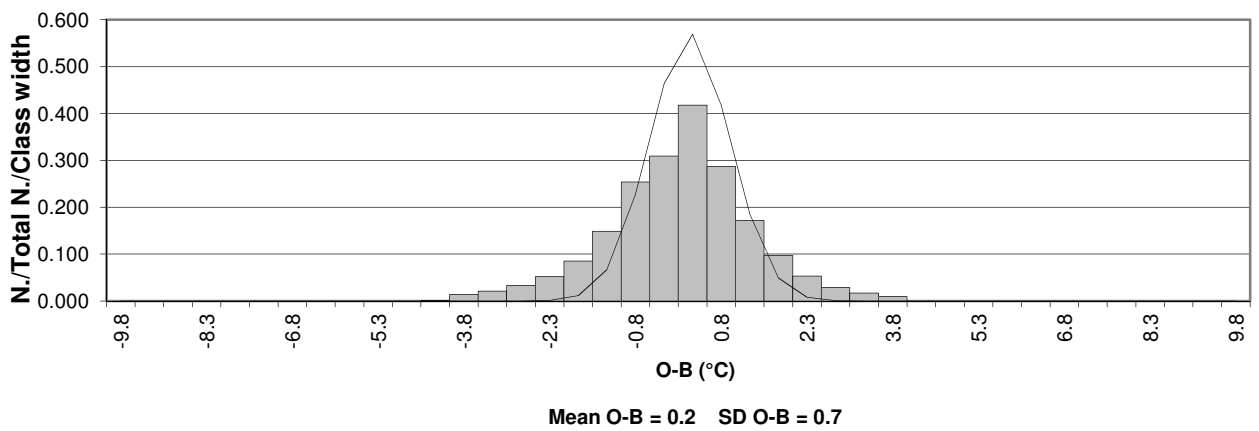


Figure 3: Bias of Ship O-B Pressure (hPa). Date:- January - June 2014
 Only observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

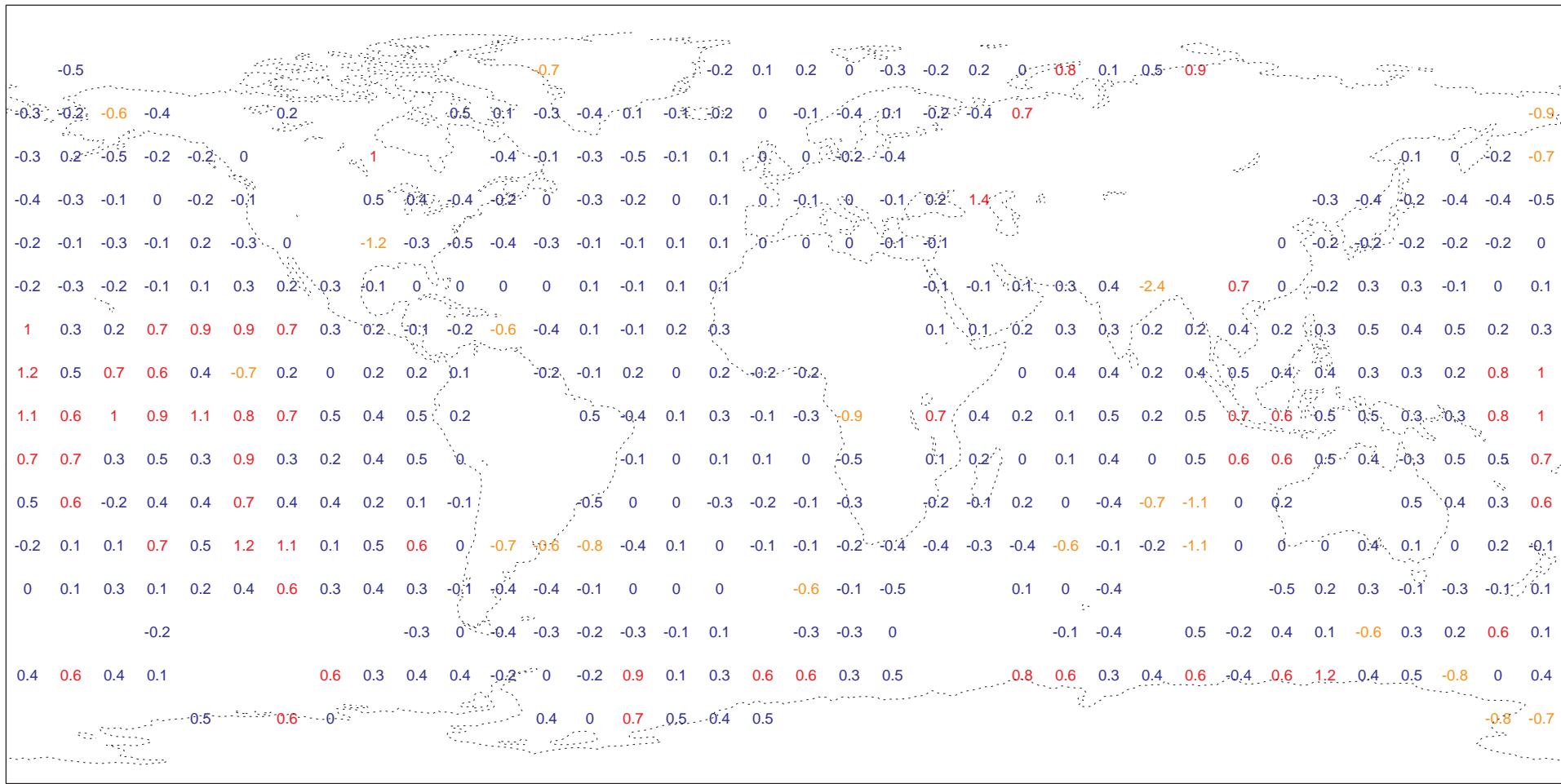


Figure 4: Standard Deviation of Ship O-B Pressure (hPa). Date:- January - June 2014
 Only Observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

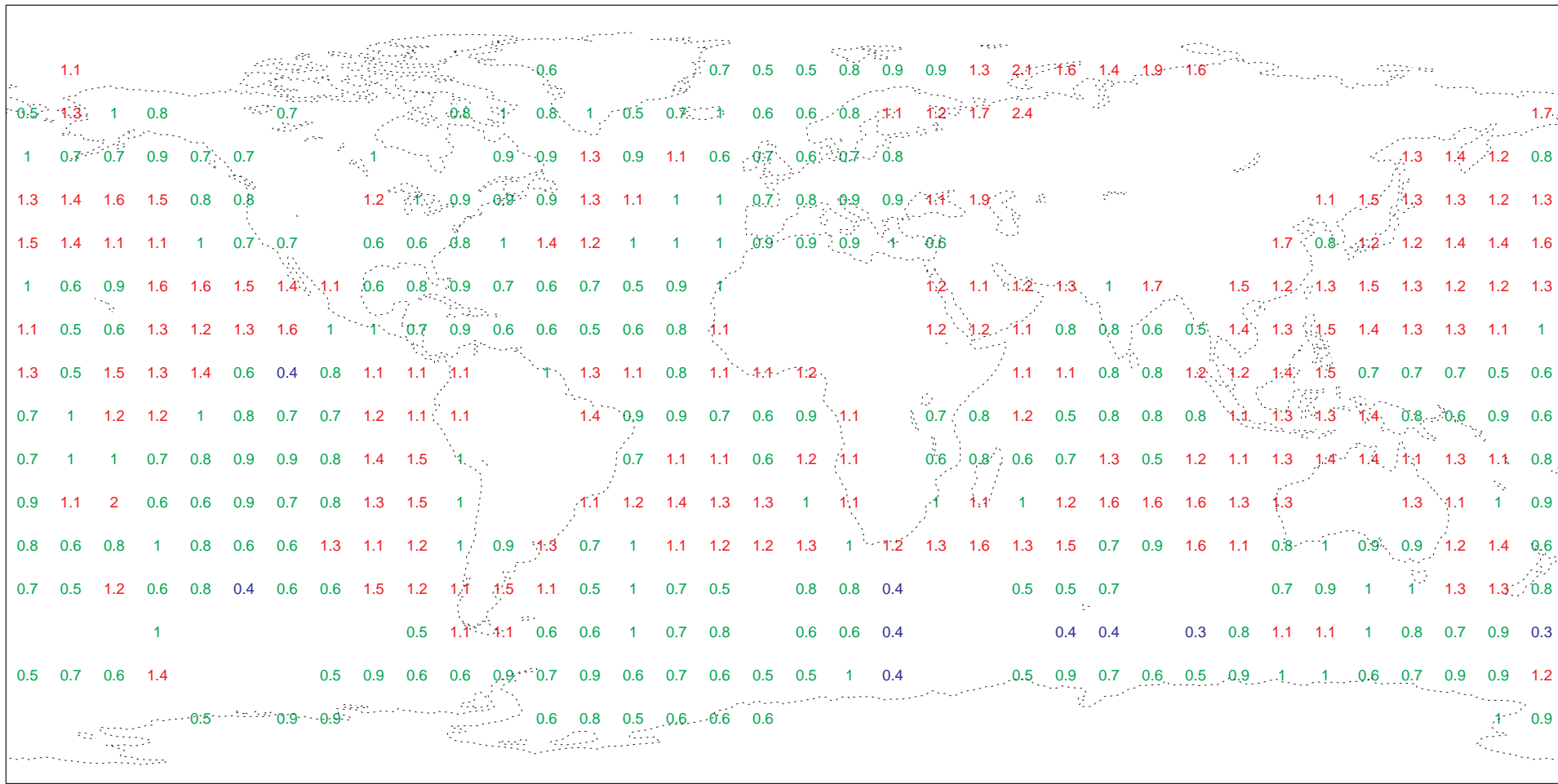


Figure 5:
 Plot of the Number of Ship Pressure Observations. Date:- January - June 2014
 Only observations passing quality control included

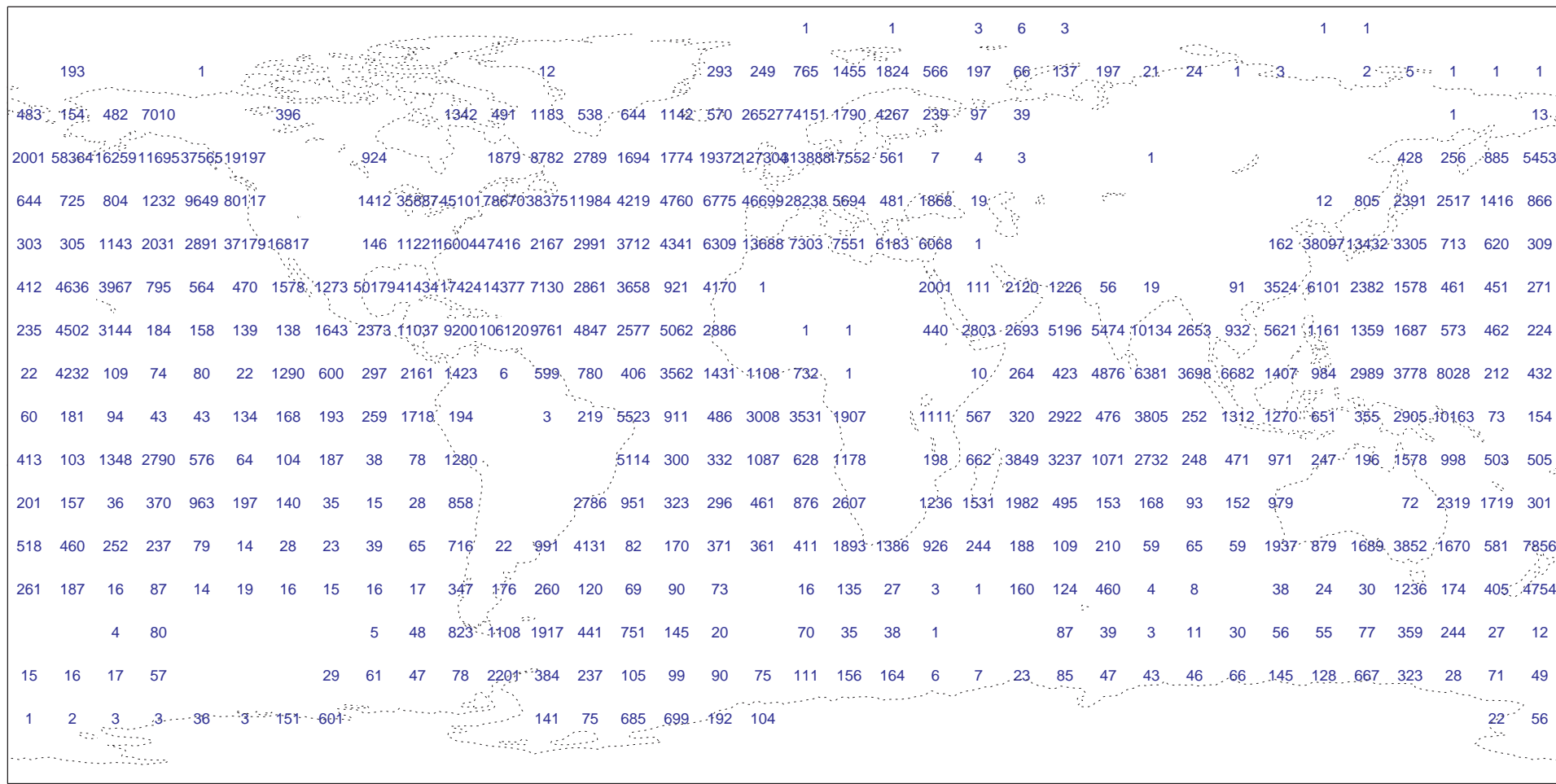


Figure 6: Bias of Ship O-B Wind Speed (ms-1). Date:- January - June 2014
 Only observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

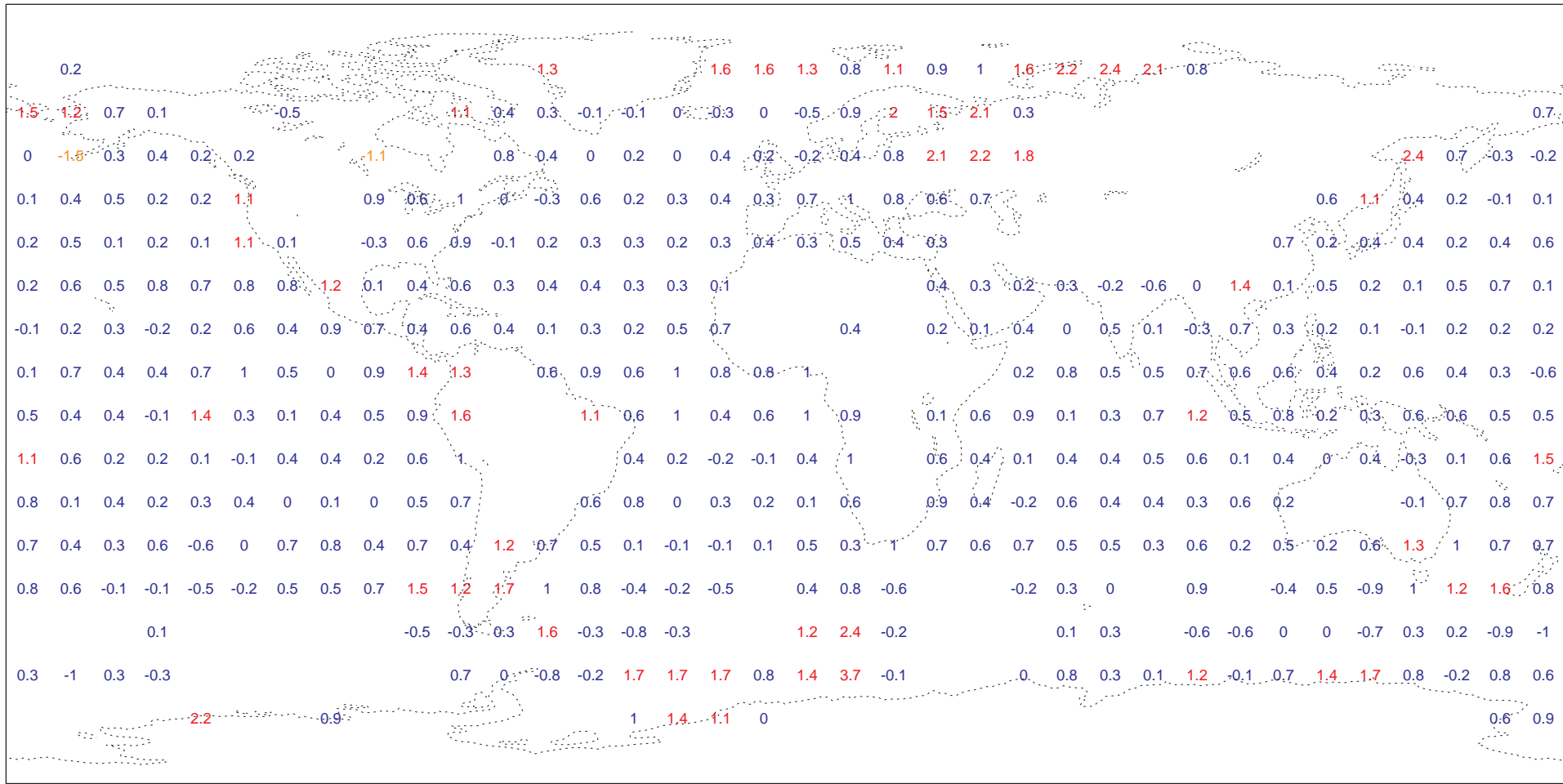


Figure 7: Standard Deviation of Ship O-B Wind Speed (ms-1). Date:- January - June 2014
 Only Observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

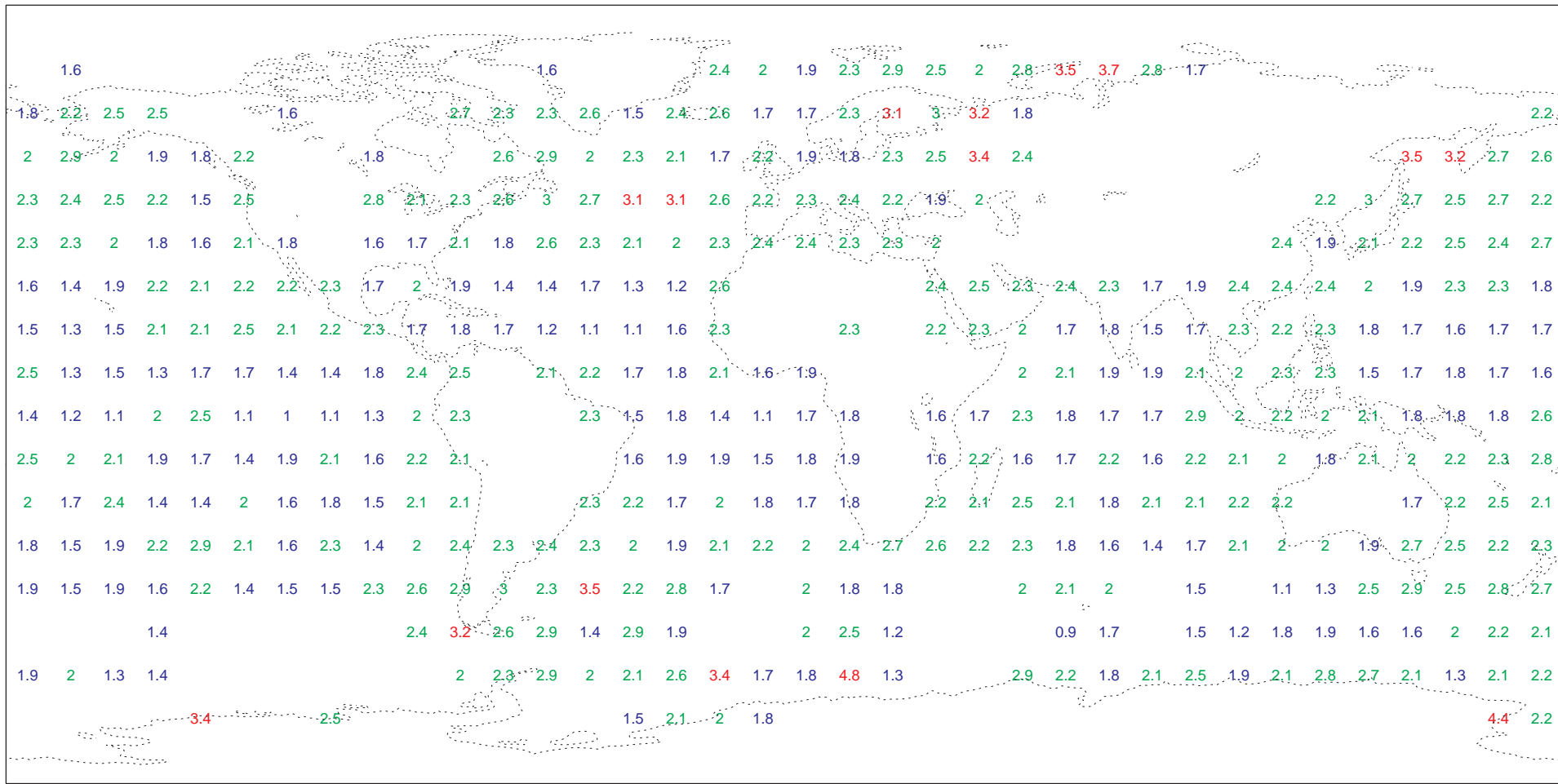


Figure 9: Bias of Ship O-B Wind Direction (degrees). Date:- January - June 2014
 Only observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

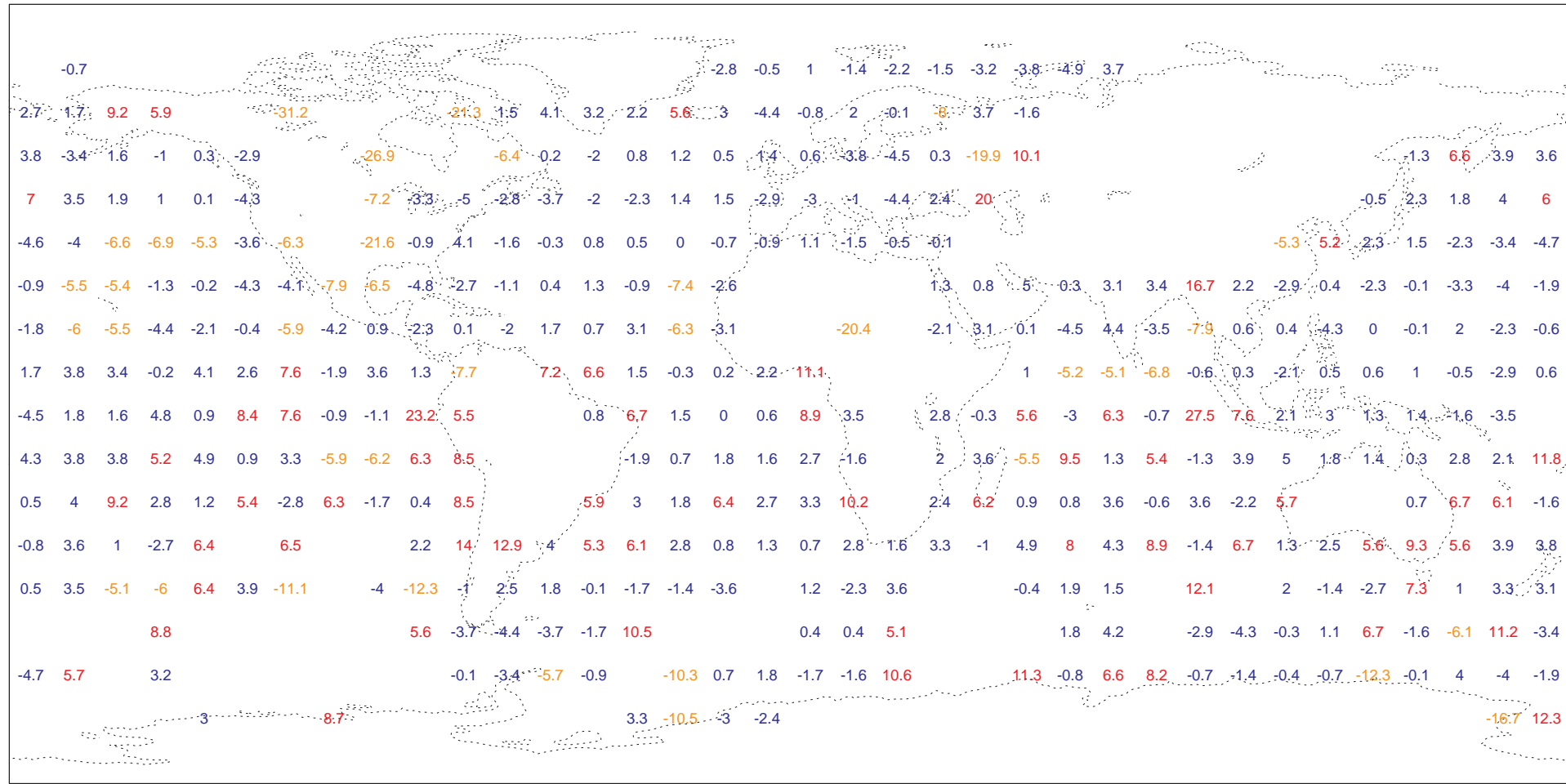


Figure 10: Standard Deviation of Ship O-B Wind Direction (degrees). Date:- January - June 2014
 Only Observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

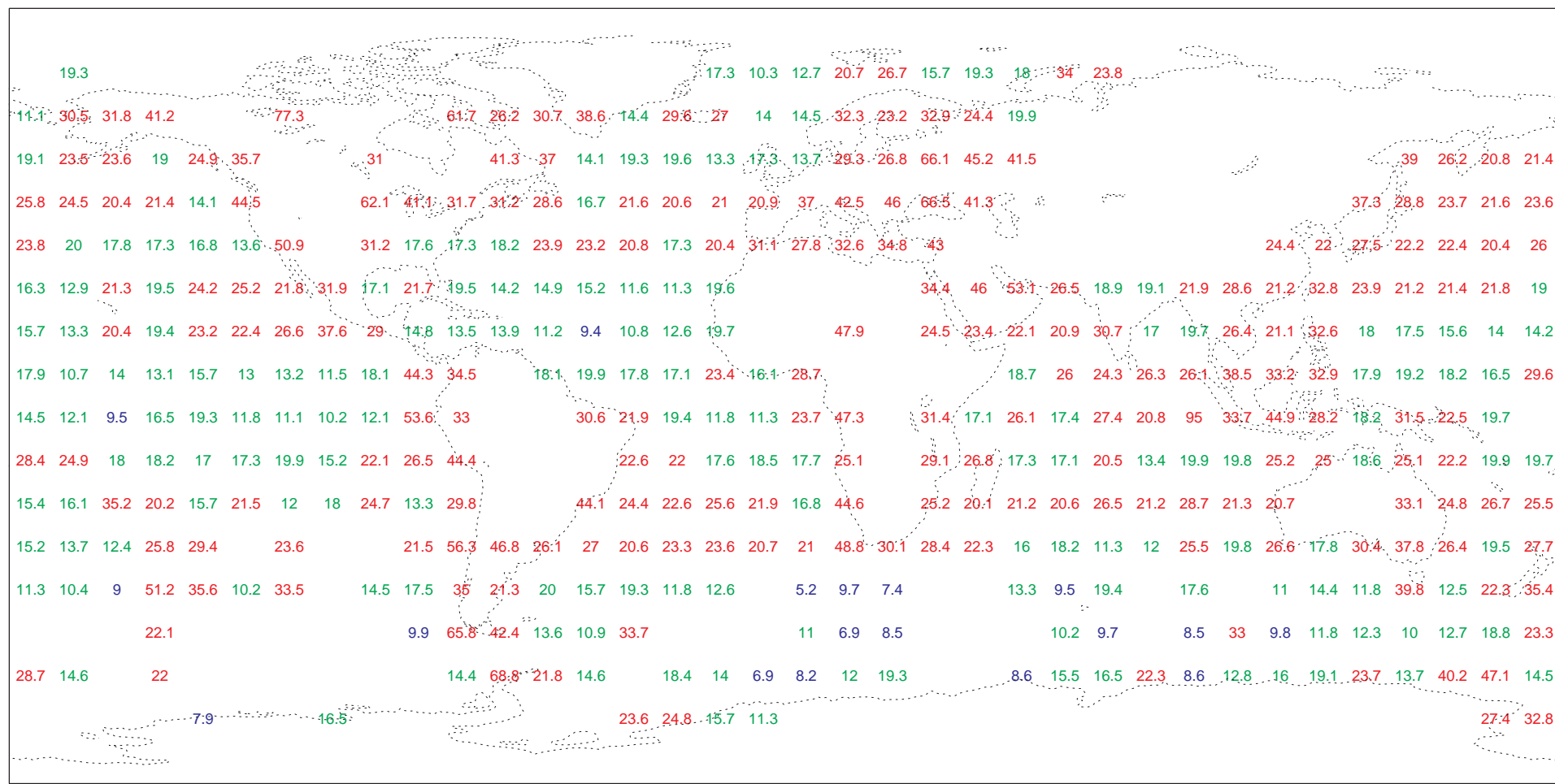


Figure 13: Standard Deviation of Ship O-B SST (degrees C). Date:- January - June 2014
 Only Observations passing quality control used in statistics
 10 degree box values plotted if the number of observations is greater than 10

