

WORLD METEOROLOGICAL ORGANIZATION

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INTERGOVERNMENTAL OCEANOGRAPHIC  
COMMISSION (OF UNESCO)

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JOINT WMO/IOC TECHNICAL COMMISSION FOR  
OCEANOGRAPHY AND MARINE METEOROLOGY  
(JCOMM)

SHIP OBSERVATIONS TEAM (SOT)

SEVENTH SESSION

VICTORIA, CANADA, 22-26 APRIL 2013

SOT-7/ Doc. 9.1.1  
(21.03.2013)

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ITEM: 9.1.1

Original: ENGLISH

## REGIONAL SPECIALISED METEOROLOGICAL CENTRE (RSMC), EXETER, VOS MONITORING REPORT

*(Submitted by Colin Parrett (United Kingdom), RSMC Exeter)*

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### Summary and purpose of the document

This document provides information on the VOS data quality monitoring conducted by the Regional Specialized Meteorological Centre (RSMC) operated by the United Kingdom Met Office in Exeter.

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### ACTION PROPOSED

The Team will review the information contained in this report, and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

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- Appendices:**
- A. Met Office on-line monthly VOS suspect list for February 2013
  - B. Current criteria for monthly monitoring of marine surface observations
  - C. Proposed criteria for monthly monitoring of marine surface observations
  - D. Timeliness of VOS observations received at the Met Office, February 2013
  - E. Met Office on-line time of receipt statistics for individual ships, February 2013
  - F. Met Office on-line time of receipt statistics for national fleets, February 2013
  - G. Scheme for ranking VOS ships by quantity and quality of reports

**- A - DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT**

**9.1.1 - Regional Specialized Meteorological Centre (RSMC) Exeter VOS monitoring report**

9.1.1.1 Ms Sarah North (United Kingdom) reported on the activities of the Regional Specialized Meteorological Centre (RSMC) Exeter, acting as CBS Lead Centre for monitoring the quality of surface marine observations. It routinely produces monthly and biannual quality reports as well as providing essential feedback to VOS operators regarding the quality of the data delivered by VOS ships.

9.1.1.2 The Met Office (RSMC Exeter) continues to compile lists of ships that have produced suspect observations each month (see Appendix A), which are available via the Met Office web site<sup>1</sup> and are also sent to the WMO Secretariat.

9.1.1.3 Following action 102 from SOT-6, the Met Office agreed that the criteria for labeling ships as 'suspect' should be substantially tightened for ships that report with automatic observing systems, because these systems are seen to be more reliable and less prone to errors than manual observing systems. Due to steady improvements in the background forecasts, the criteria for ships with manual observing systems should also be tightened slightly. The Team agreed that the monitoring criteria should be set at the values shown in Appendix C. To facilitate the separate monitoring of 'automatic ships' the station type ("ix") should be included in all reports; the alternative of using "atm" from the ship metadata would require changes at the Met Office, which may delay implementation of the separate monitoring of manual and automatic ships.

9.1.1.4 The Met Office also produces monthly lists of monitoring statistics for all VOS, which are sent to the VOS focal points and are also available from the Met Office web site. To maintain up to date lists of ships, the Met Office advised that it was using the latest data downloaded from the online E-SURFMAR metadata database, rather than from the WMO Pub47 database. In addition, the Met Office uses the masked call sign data available from the JCOMMOPS FTP site<sup>3</sup>.

9.1.1.5 It was noted that the SHIP masking scheme implemented by JMA in 2007 continues to prevent the Met Office from monitoring data from individual Japanese and possibly some US ships. Although the Met Office is able to collect data with real call-signs from JMA's FTP server, it is unable to route the data to its meteorological database due to problems with guaranteeing data security. In January 2013 there were 23457 reports of pressure from VOS with call-sign "SHIP", compared to just 3222 reports in March 2012, with the large increase being due to more automatic reports (now accounting for about 85% of the total) .

9.1.1.6 Timeliness information for VOS reports received at the Met Office is also made available from the observation monitoring web site<sup>2</sup> (see Appendices D and E). This information shows that the majority of ship reports continue to be received promptly, with about 70% received within 15 minutes and 90% within 60 minutes of the observation time. Timeliness information for individual ships is also available from the website. The Team agreed that the timeliness information for national fleets should be split into two, for automatic and manual reports.

9.1.1.7 The Team noted that the Met Office had made monthly VOS ranking scheme results available on their website for all VOS and for the national VOS fleets (action 101 from SOT-6). The monthly scheme is similar to the annual scheme that was described at SOT-6, ranking the VOS ships and whole fleets in terms of the timeliness, quantity and quality of their reports. Separate monthly lists of scores have been produced for automatic and manual ships. Details of the ranking scheme, an excerpt from the 2012 annual scores and national fleet rankings for February 2013 are shown in Appendix F. VOS operators were invited to consider the value of the monthly and annual performance ranking system and to advise the Met Office if they considered that the parameters used were appropriate.

<sup>1</sup> : <http://research.metoffice.gov.uk/research/nwp/observations/monitoring/index.html>

<sup>2</sup> : <http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/TOR/index.html>

<sup>3</sup> : <ftp://mask2real:vosmask@ftp.jcommops.org/mask2real.csv>

**The meeting decided on the following action items:**

- (i) RSMC to contact other monitoring centres regarding new monitoring criteria (***action; RSMC; August 2013***);
- (ii) Start using the new monitoring criteria (***action; RSMC & other monitoring centres; deadline to be agreed – possibly January 2014***);
- (iii) PMOs to contact ships on monthly suspect lists to rectify any problems (***action; PMOs; ongoing***);
- (iv) RSMC to separate timeliness information for manual and automatic ships (***action; RSMC; April 2014***).

**- B - BACKGROUND INFORMATION**

**Monitoring the quality and timeliness of VOS observations**

- 1 The Met Office (RSMC Exeter), as WMO-designated lead centre for monitoring the quality of surface marine meteorological data (observations from ships, buoys and other in situ marine platforms), compares observations from individual platforms with the Met Office's global model background 6-hour forecast fields for each variable. Platforms for which the observed values differ from the background by a significant amount are flagged as suspect.
- 2 Monthly lists of suspect marine platforms are sent to the WMO Secretariat and also exchanged among other monitoring centres (including JMA, NCEP, MeteoFrance and ECMWF) for comparison. Generally there is considerable agreement between the different centres, both in terms of suspect platforms (using the same criteria) and mean and standard deviation of differences from the background fields. The Met Office monthly suspect lists are available via the Met Office web site at <http://research.metoffice.gov.uk/research/nwp/observations/monitoring/index.html>. A recent example of our on-line VOS suspect list for February 2013 is shown in Appendix A. Monthly QC plots are also available from the website for each ship that is listed as suspect.
- 3 Originally only mean sea level pressure was monitored, but wind speed, wind direction, sea surface temperature, air temperature and relative humidity have been added to the information being exchanged on a monthly basis. The current monthly monitoring criteria for the 6 variables are shown in Appendix B. In response to action 102 from SOT-6, we propose some tightening of these monitoring criteria. The selection criteria for labeling ships as 'suspect' have remained unchanged for up to 25 years (for pressure), during which time there have been large improvements in data assimilation, numerical modeling and data coverage (with many more satellite data types assimilated by the models). Consequently, the short-range background forecasts are more accurate now, resulting in smaller observation-background (o-b) differences overall. Thus we suggest a slight tightening of the criteria for manual observations (for which the criteria were originally agreed), as shown in Appendix C (i).
- 4 Also, over recent years there has been a large increase in the number of ships that send in reports from automatic weather stations, which are generally more accurate and less prone to errors than manual reports. Therefore we suggest that the monitoring of 'automatic ships' be separated from the monitoring of 'manual ships' and tighter limits imposed for automatic ships, as shown in Appendix C (ii). These values are based on o-b statistics, with the mean (or bias) limits set at approximately 1.5 times the rms o-b values for all observations in each category over the past year. The meeting is invited to confirm that the monitoring criteria shown in Appendix C are set at the correct levels, or to propose more appropriate values. (N.B. The splitting of the monitoring into manual and automatic ships requires that "ix" be set correctly in all reports. The alternative of using "atm" from the ship metadata would require changes to the Met Office processing and may delay implementation of the separate monitoring of manual and automatic ships.)

- 5 The Met Office also produces monthly lists of monitoring statistics for the VOS fleets recruited by certain countries. To maintain up to date lists of the VOS fleets for each country concerned, the Met Office uses the meta-data available from the E-SURFMAR web-site.
- 6 Masked call sign data available from the JCOMMOPS Mask vs Real database is also taken into account when preparing the lists of VOS monitoring statistics.
- 7 National focal points are notified when the latest VOS monthly monitoring reports and suspect lists become available on the Met Office website by means of an email sent by the Met Office to the SOT, VOS and PMO mailing lists, which are maintained by JCOMMOPS. It is important therefore that focal points wishing to receive this monitoring information check that their mailing list information is kept up to date. However, national monthly monitoring statistics continue to be emailed directly to major VOS operating countries, and as mentioned in reports to previous SOT meetings, any other national focal points who may wish to receive directly emailed copies of the monthly monitoring lists or 'suspect' ship lists should advise the Met Office of their email address.
- 8 Every 6 months more detailed monitoring reports, for all platforms, are produced and made available to the WMO Secretariat via the Met Office web site. The statistics relating to suspect VOS operated by specific members are extracted from the report and distributed by the Secretariat to national focal points for the members concerned, under a covering letter requesting that remedial action be taken to correct the problems. The Team is invited to note that the Met Office intends to discontinue producing the individual time-series plots for each suspect platform, due to the time-consuming nature of this work and doubts as to the usefulness of these time-series for correcting problems, especially considering the monthly information available (mentioned above). If the general overview and statistics are still required these will continue to be produced and be available from the Met Office web site.
- 9 Timeliness statistics for VOS reports received at the Met Office are available from our web site at <http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/TOR/index.html> where monthly timeliness data for individual VOS is available as well as tables and graphs showing the relative timeliness of national VOS fleets. A graphical example for February 2013 data is shown in Appendix D, where it can be seen from the upper graph that the majority of ship reports were received promptly, with about 70% received within 15 minutes and more than 90% received within 60 minutes of the observation time. The cut-off time for operational NWP global data assimilation is typically 90-150 minutes after the analysis times of 00, 06, 12 and 18 UTC, so that about 95% of global VOS data are being received in time to be assimilated. An example of timeliness information for individual call-signs during February 2013 is shown in Appendix E. The timeliness has improved markedly over the last 4 years, mostly due to increased automation. The Met Office proposes separating the automatic ships from the manual ships to produce two sets of timeliness statistics for national VOS fleets.
- 10 For the last 2-3 years the Met Office has been producing annual lists of all VOS ships, ranked in order of importance to the numerical weather prediction (NWP) system, available from the Met Office web-site at <http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/VOSranking/index.html> . The ships are ranked in terms of their quantity, quality and timeliness of reports, largely to assist in presenting awards to the best performing ships (initially in the UK VOS fleet). The method and latest results for the UK fleet are shown in Appendix F. Recently this system has been extended to produce monthly scores and ranking lists, separately for automatic and manual ships and for national VOS fleets. These monthly lists are also available from the above link.
- 11 As mentioned at SOT-5 and SOT-6, the Met Office's role as CBS Lead Centre for monitoring marine data is incomplete, with Japanese ships not being monitored individually, due to JMA's

adoption of the 'SHIP' masking scheme. The Met Office continues to collect the original data from JMA's FTP server, but this data is not routed into our meteorological database due to issues concerning its security. Consequently, to ensure that the VOS can continue to be monitored efficiently, the Met Office (RSMC Exeter) would prefer that all countries adopt a masking method with a unique masked identifier for each ship, until a new ENCODE masking scheme is rolled out.

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Appendices: 7

## APPENDIX A

## MET OFFICE ON-LINE MONTHLY VOS SUSPECT LIST FOR FEBRUARY 2013

## Pub47 VOS Suspects for Feb 2013

To view the suspect threshold for each variable and statistic, hover your cursor over the relevant column. Please note that the bias and standard deviation statistics listed below exclude observations having gross errors.

PRESSURE (hPa)							
CTRY CODE	SHIP NAME	CALL SIGN	TOTAL	GE (%)	BIAS	SD	Graph
CA	SAMUEL RISLEY	CG2960	166	45	0.0	0.7	<a href="#">QC plot</a>
DE	MSC ALTAIR	A8YN2	25	0	-7.4	1.0	<a href="#">QC plot</a>
IT	COSTA FASCINOSA	ICPO	44	0	-4.5	4.3	<a href="#">QC plot</a>
NL	HAPPY RIVER	PCAW	46	0	-6.8	0.6	<a href="#">QC plot</a>
RU	VIKTOR TKACHEV	UCJX	29	0	7.0	1.6	<a href="#">QC plot</a>
RU	VILNUS	UFJN	33	12	-4.1	0.9	<a href="#">QC plot</a>
US	ENSIGN	WBN3012	26	0	-4.9	2.6	<a href="#">QC plot</a>
US	HONOR	WDC6923	29	0	-4.3	0.9	<a href="#">QC plot</a>
US	NIEUW AMSTERDAM	PBWQ	47	0	-4.9	1.0	<a href="#">QC plot</a>
US	VISION OF THE SEAS	C6SE8	27	0	-4.4	0.9	<a href="#">QC plot</a>

TEMPERATURE (deg C)							
CTRY CODE	SHIP NAME	CALL SIGN	TOTAL	GE (%)	BIAS	SD	Graph
CA	NEWFOUNDLAND LYNX	VAAZ	124	84	-12.4	3.7	<a href="#">QC plot</a>
CA	OCEANEX SANDERLING	VOLG	602	36	-0.4	1.1	<a href="#">QC plot</a>

WIND SPEED (m s-1)							
CTRY CODE	SHIP NAME	CALL SIGN	TOTAL	GE (%)	BIAS	SD	Graph
IT	LA SUPERBA	ICGK	90	3	5.9	3.4	<a href="#">QC plot</a>
US	EVER DELUXE	9V7953	60	10	8.2	3.5	<a href="#">QC plot</a>
US	TROPIC OPAL	J8NW	23	0	5.4	2.1	<a href="#">QC plot</a>

WIND DIRECTION (deg)							
CTRY CODE	SHIP NAME	CALL SIGN	TOTAL	GE (%)	BIAS	SD	Graph
CA	ALGOSCOTIA	VAAP	332	17	74.2	111.1	<a href="#">QC plot</a>
CA	NAMAO	CZ9742	51	0	-36.8	13.0	<a href="#">QC plot</a>
FR	MAIDO	FNHC	167	0	41.2	16.3	<a href="#">QC plot</a>
FR	MN COLIBRI (AWS)	FNHO	208	0	72.5	74.4	<a href="#">QC plot</a>
GB	Berge Atlantic	LAIP5	31	6	-54.3	68.3	<a href="#">QC plot</a>
GB	Grand Princess	ZCBU5	26	0	14.5	118.1	<a href="#">QC plot</a>
GB	Maersk Patras	MYSU5	27	0	-21.8	89.4	<a href="#">QC plot</a>
JP	NIKKEI PHOENIX	H9UY	21	0	-28.8	83.3	<a href="#">QC plot</a>
TR	HILDE A	TCXV7	31	0	61.5	24.1	<a href="#">QC plot</a>
US	BULWARK	WBN4113	25	0	-32.8	29.5	<a href="#">QC plot</a>
US	EAGLE TRENTON	S6NK4	26	0	-0.1	92.2	<a href="#">QC plot</a>
US	EVER DELUXE	9V7953	36	17	-39.0	30.3	<a href="#">QC plot</a>
US	LAURENCE M. GOULD (AWS)	WCX7445	121	0	12.7	82.0	<a href="#">QC plot</a>
US	MARCUS G. LANGSETH (AWS)	WDC6698	53	8	-19.2	87.5	<a href="#">QC plot</a>

RELATIVE HUMIDITY (%)							
CTRY CODE	SHIP NAME	CALL SIGN	TOTAL	GE (%)	BIAS	SD	Graph
CA	AIVIK	VOPP	426	7	31.2	15.5	<a href="#">QC plot</a>
CA	NEWFOUNDLAND LYNX	VAAZ	71	0	29.8	7.3	<a href="#">QC plot</a>
CA	OOCL MONTREAL	VRYO3	170	0	16.5	11.7	<a href="#">QC plot</a>
CA	SKAUBRYN	3FZK3	230	0	27.2	8.5	<a href="#">QC plot</a>

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**APPENDIX B****CRITERIA FOR MONTHLY MONITORING OF MARINE SURFACE OBSERVATIONS**

## Monitoring procedures

Period	:One calendar month.
Data monitored	:Reports from each unique identifier for ships, fixed buoys and platforms.
Standard of comparison	:Background field from Exeter global model.
Observation times	:All hours
Elements monitored	:Mean sea level pressure (hPa). :Wind speed ( $\text{ms}^{-1}$ ). :Wind direction (degrees). :Air temperature ( $^{\circ}\text{C}$ ). :Relative Humidity (%). :Sea surface temperature ( $^{\circ}\text{C}$ ).
Parameters monitored	
NOBS	:Number of observations received, excluding duplicates.
%GE	:Percentage of observations with gross errors.
%REJ	:Percentage of observations flagged, excluding those with gross errors.
SD	:Standard deviation of difference of observations from background values, excluding those with gross errors.
BIAS	:Mean difference of observations from background values, excluding those with gross errors (N.B. a positive bias indicates the wind observation is veered to the background).
RMS	:Root Mean Square difference of observations from background values, excluding those with gross errors.
GROSS ERROR LIMIT	:15 hPa (pressure) :25 $\text{ms}^{-1}$ (vector wind) :15 $^{\circ}\text{C}$ (air temperature) :50% (relative humidity) :10 $^{\circ}\text{C}$ (sea surface temperature)

SELECTION CRITERIA	:NOBS $\geq$ 20 , and one or more of the following:
1.Bias	$\geq$ 4 hPa (pressure) $\geq$ 5 $\text{ms}^{-1}$ (wind speed) $\geq$ 30 degrees (direction) $\geq$ 4 $^{\circ}\text{C}$ (air temperature) $\geq$ 15% (relative humidity) $\geq$ 3 $^{\circ}\text{C}$ (SST)
2.SD	$\geq$ 6 hPa (pressure) $\geq$ 80 degrees (direction) $\geq$ 6 $^{\circ}\text{C}$ (air temperature) $\geq$ 25% (relative humidity) $\geq$ 5 $^{\circ}\text{C}$ (SST)
3.PGE	$\geq$ 25

N.B. Observations of wind direction are only included in the wind direction statistics if the observed or background wind speed is greater than  $5 \text{ms}^{-1}$

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**APPENDIX C****PROPOSED NEW CRITERIA FOR MONTHLY MONITORING OF (I) MANUAL VOS, (II) AUTOMATIC VOS****I. Manual ships**

SELECTION CRITERIA

:NOBS  $\geq$  15 , and one or more of the following:

1.Bias	$\geq$	3 hPa	(pressure)
	$\geq$	4 ms <sup>-1</sup>	(wind speed)
	$\geq$	30 degrees	(direction)
	$\geq$	3 °C	(air temperature)
	$\geq$	15%	(relative humidity)
	$\geq$	2.5 °C	(SST)
2.SD	$\geq$	5 hPa	(pressure)
	$\geq$	70 degrees	(direction)
	$\geq$	5 °C	(air temperature)
	$\geq$	25%	(relative humidity)
	$\geq$	4 °C	(SST)
3.PGE	$\geq$	25	

**II. Automatic ships**

SELECTION CRITERIA

:NOBS  $\geq$  50 , and one or more of the following:

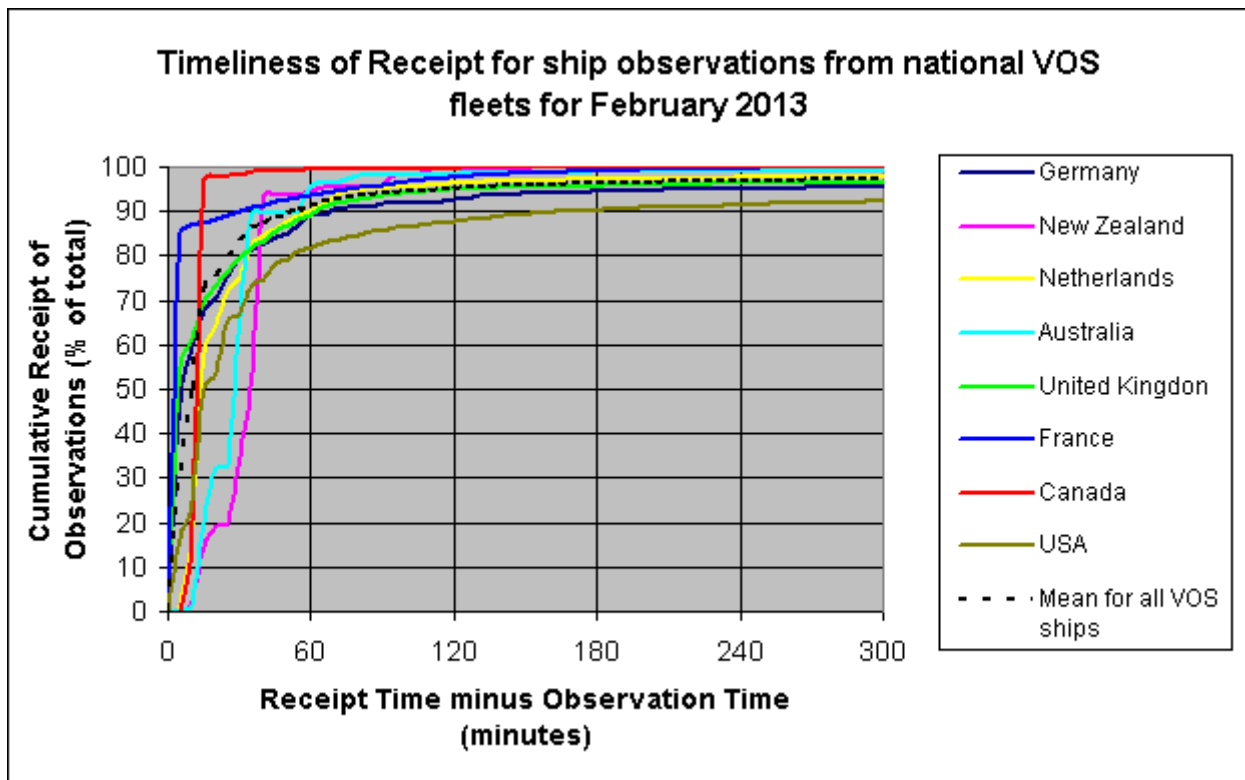
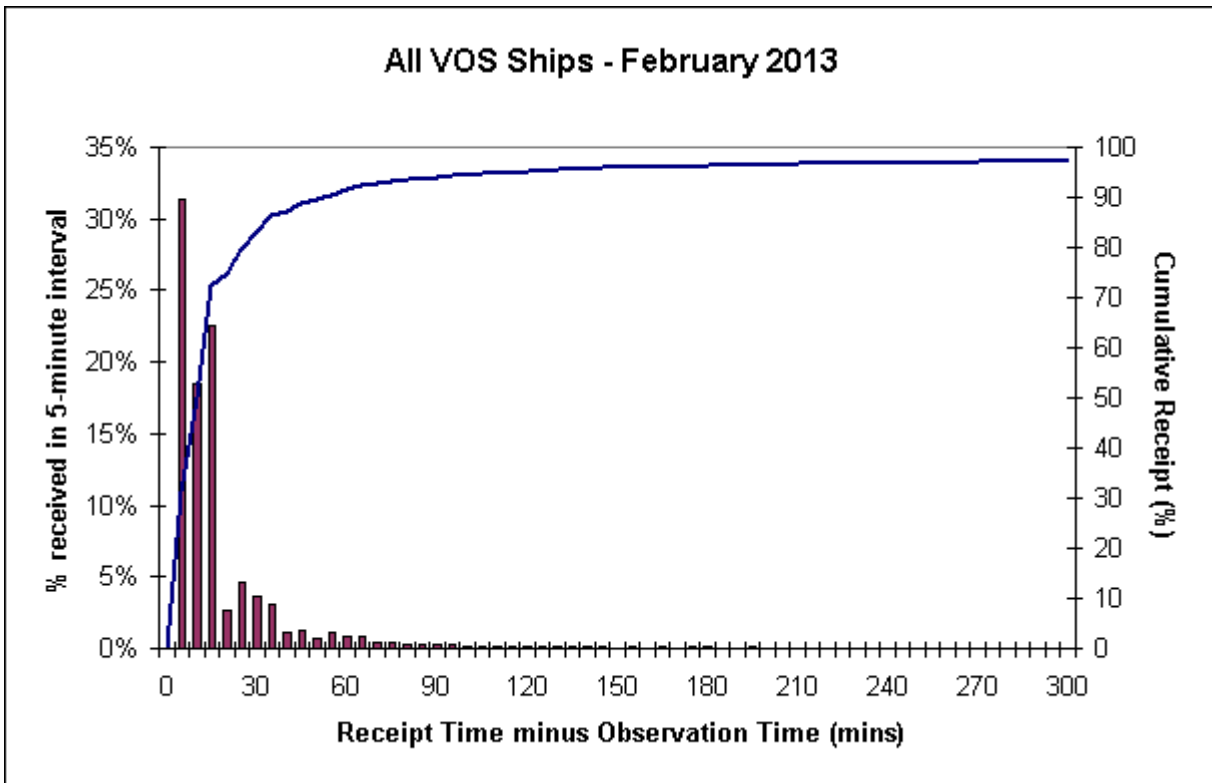
1.Bias	$\geq$	2 hPa	(pressure)
	$\geq$	4 ms <sup>-1</sup>	(wind speed)
	$\geq$	25 degrees	(direction)
	$\geq$	2.5 °C	(air temperature)
	$\geq$	12%	(relative humidity)
	$\geq$	2 °C	(SST)
2.SD	$\geq$	4 hPa	(pressure)
	$\geq$	50 degrees	(direction)
	$\geq$	4 °C	(air temperature)
	$\geq$	20%	(relative humidity)
	$\geq$	3 °C	(SST)
3.PGE	$\geq$	15	

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**APPENDIX D**

**TIMELINESS OF VOS OBSERVATIONS RECEIVED AT THE MET OFFICE, FEB 2013**



## APPENDIX E

## MET OFFICE ON-LINE TIME OF RECEIPT STATISTICS FOR INDIVIDUAL SHIPS, FEB 2013

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## Pub47 Time of Receipt Statistics by SHIP for February

CTRY	CALLSIGN	NAME	Observations	N<30	N<60	N<120	N>360	Average (R-O) (mins)
	TBWAA10		20	17	20	20	0	18.9
	N8Z001		11	10	11	11	0	19.4
NL	PCDE	ADMIRALENGRACHT	2	1	2	2	0	29.5
NL	PCKU	ALEXANDERGRACHT	17	15	15	17	0	21.5
NL	PCPR	AMSTELGRACHT	25	25	25	25	0	14.4
NL	PCGQ	ANJELIERSGRACHT	57	50	54	57	0	19.1
NL	PCSV	APOLLOGRACHT	37	36	37	37	0	14.8
NL	PHHD	ARNEBORG	34	31	34	34	0	16.1
NL	2EZE5	BERGE STAHL	31	19	26	27	3	94.7
NL	A8JH8	BUZZARD BAY	34	25	25	25	8	151.3
NL	PJRH	COLD STREAM	12	1	10	12	0	44.9
NL	PDKK	COOL EXPRESO	11	11	11	11	0	14.3
NL	PCFW	CORAL CARBONIC	8	4	4	4	4	598.8
NL	PHKM	CORAL FAVIA	15	11	14	15	0	23.4
NL	PDIB	CORAL MEANDRA	8	4	5	5	1	176.5
NL	ELXG9	CORAL PAVONA	18	17	18	18	0	12.8
NL	PBOF	DAMGRACHT	2	2	2	2	0	10.5
NL	PDNN	DANIELLA	14	5	7	14	0	46.2
NL	PDWZ	EDAMGRACHT	56	54	54	54	2	30.4
NL	OXOR2	EDITH MAERSK	83	67	74	77	2	41.5
NL	PDXQ	EEMSGRACHT	31	26	31	31	0	17.5
NL	PDVN	EENDRACHT	16	15	15	16	0	18.4
NL	PDWT	EGELANTIERSGRACHT	39	19	38	39	0	34.0
NL	PDYI	ELANDSGRACHT	10	10	10	10	0	14.3
NL	OXHY2	ELLY MAERSK	61	42	57	60	0	24.1
NL	A8IO2	ELSEBETH	50	34	44	48	0	28.2
NL	A8IP2	ELVIRA	61	51	58	60	0	20.8
NL	A8IP3	EMERALD	27	26	27	27	0	15.1
NL	PDYX	EMMAGRACHT	3	3	3	3	0	14.7
NL	A8IN8	ESMERALDA	85	70	83	85	0	4.6
NL	PDZS	EUROPA	55	21	50	54	0	33.9
NL	A8QJ7	EVA N	97	76	94	97	0	19.9
NL	OXHV2	EVELYN MAERSK	33	27	32	33	0	15.7
NL	PHEC	FAIRPARTNER	14	12	13	14	0	19.6
NL	A8IT2	FALCON BAY	22	2	10	20	0	81.2

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## APPENDIX F

## MET OFFICE ON-LINE TIME OF RECEIPT STATISTICS FOR NATIONAL FLEETS, FEB 2013

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## Pub47 Time of Receipt Statistics by COUNTRY for February

COUNTRY	Ships	Observations	Average (Obs/Ships)	N<30 mins	N<60 mins	N<120 mins	N>360 mins	%<30 mins	%<60 mins	%<120 mins	%>360 mins	Average (R-O) (mins)
AU	55	3964	72.1	2629	3787	3902	31	66%	96%	98%	1%	34.8
DK	2	736	368.0	736	736	736	0	100%	100%	100%	0%	3.6
EU	22	9314	423.4	8871	9312	9312	2	95%	100%	100%	0%	5.5
FR	56	16022	286.1	14397	15012	15658	5	90%	94%	98%	0%	13.0
GB	259	23889	92.2	19010	21320	22660	769	80%	89%	95%	3%	51.7
GR	2	5	2.5	4	4	5	0	80%	80%	100%	0%	23.8
NL	83	2868	34.6	2152	2589	2761	60	75%	90%	96%	2%	37.4
NZ	18	1043	57.9	360	989	1037	0	35%	95%	99%	0%	33.2
CA	41	21784	531.3	21432	21652	21712	12	98%	99%	100%	0%	12.3
DE	440	19637	44.6	15621	17475	18188	270	80%	89%	93%	1%	37.8
HK	28	449	16.0	15	414	428	12	3%	92%	95%	3%	78.7
IE	2	32	16.0	29	29	30	0	91%	91%	94%	0%	24.6
IL	4	49	12.2	41	45	45	4	84%	92%	92%	8%	65.7
IN	11	89	8.1	29	58	75	4	33%	65%	84%	4%	103.5
IS	3	112	37.3	105	107	111	0	94%	96%	99%	0%	4.3
IT	3	296	98.7	200	264	286	2	68%	89%	97%	1%	25.7
JP	13	1179	90.7	1068	1152	1166	7	91%	98%	99%	1%	38.1
KR	3	5	1.7	0	0	0	2	0%	0%	0%	40%	423.0
MY	3	97	32.3	0	93	97	0	0%	96%	100%	0%	56.6
NO	5	2758	551.6	2753	2757	2757	0	100%	100%	100%	0%	11.6
RU	57	1398	24.5	831	1230	1280	75	59%	88%	92%	5%	56.5
SE	16	817	51.1	418	483	742	58	51%	59%	91%	7%	95.9
US	429	24830	57.9	16639	20280	21796	1793	67%	82%	88%	7%	99.0
ZA	1	17	17.0	5	10	12	2	29%	59%	71%	12%	173.8
ZZ	2	36	18.0	20	35	35	1	56%	97%	97%	3%	59.7
Total	1558	131426	84.4	107365	119833	124831	3109	82%	91%	95%	2%	42.2

## APPENDIX G

### SCHEME FOR RANKING VOS SHIPS BY QUANTITY AND QUALITY OF REPORTS

#### Ranking Method

Statistics for each ship are accumulated for the year and these are used to rank the ships in terms of number of reports received, quality of the data and timeliness of the reports throughout the year.

#### The variables considered are:

- Pressure (P)
- Wind speed (Spd)
- Wind direction (Dir)
- Temperature (T)
- Relative humidity (RH)
- Visibility (Vis)
- Sea Surface Temperature (SST)

- these are the variables reported by SHIPs that are assimilated operationally at the Met Office.

#### Number of reports score

The set of numbers of reports received (Nobs) is 'capped' to limit the influence of any very high numbers from automatic stations, then a score is calculated for the number of observations (obs) received:

Firstly the values in Nobs are inversed to give low (good) scores to ships with high numbers of obs and vice-versa,  $\text{Nobs} = \text{MAX}(\text{Nobs}) - \text{Nobs}$

Secondly, so that ships with below average numbers have scores greater than 1.0, and vice-versa, we set  $\text{NumObsScore} = \text{Nobs} / \text{MEAN}(\text{Nobs})$

#### Quality score

Quality scores for each variable are calculated, based on the following observation-minus-background (O-B) statistics:

$\text{MeanScore} = (\text{Absolute value of mean O-B}) / \text{VariableLimit}$

$\text{SDScore} = (\text{Standard Deviation of O-B}) / \text{VariableLimit}$

[where the following **VariableLimit** values are used, based on the Met Office reject list thresholds:

**P = 2.0 hPa, Spd = 3.0 m/s, Dir = 40 degrees, T = 3.0 C, RH = 15.0 %, Log(Vis) = 1.0, SST = 3.0 C ]** and  $\text{GEScore} = (\text{Number of Gross Errors}) / (\text{Mean number of Gross Errors})$

(N.B. For ships with 100% gross errors, the Mean and SD scores are set to the worst in the set.)

All scores are capped at 2.0, then a "quality-score" is created for each variable:

$\text{QualityScore} = (\text{MeanScore} + \text{SDScore} + \text{GEScore}) / 3$

#### Time of receipt score

Time of receipt (ToR) scores are produced from yearly totals for the following ToR categories: reports received within 30 minutes of the report time, 30-60 minutes, 60-120 minutes, 120-360 minutes and after 360 minutes.

Each ship is given a score that is the sum of the following numbers of points for each category

multiplied by the number of observations in that category:

**points\_30 = 0.0, points\_60 = 30.0, points\_120 = 75.0, points\_360 = 225.0, points\_after = 345.0**

(These scores are just the values of the mid points of the ranges minus the mid-point of the first range (15 minutes) to make the best score zero; and 'points\_after' has just been set to 360 minus 15 as the range is unbounded.)

The ToR scores are then divided by the scores the ships would have received had all of their observations been received between 60 and 120 minutes, i.e. we are suggesting that observations should really have been received within two hours and that reports received later than that are less useful to NWP. The ToR scores are also capped at 2.0.

### Combined score

The **NumObs, Quality and ToR** scores are combined with weights of **0.4, 0.4 and 0.2**, respectively, for each variable.

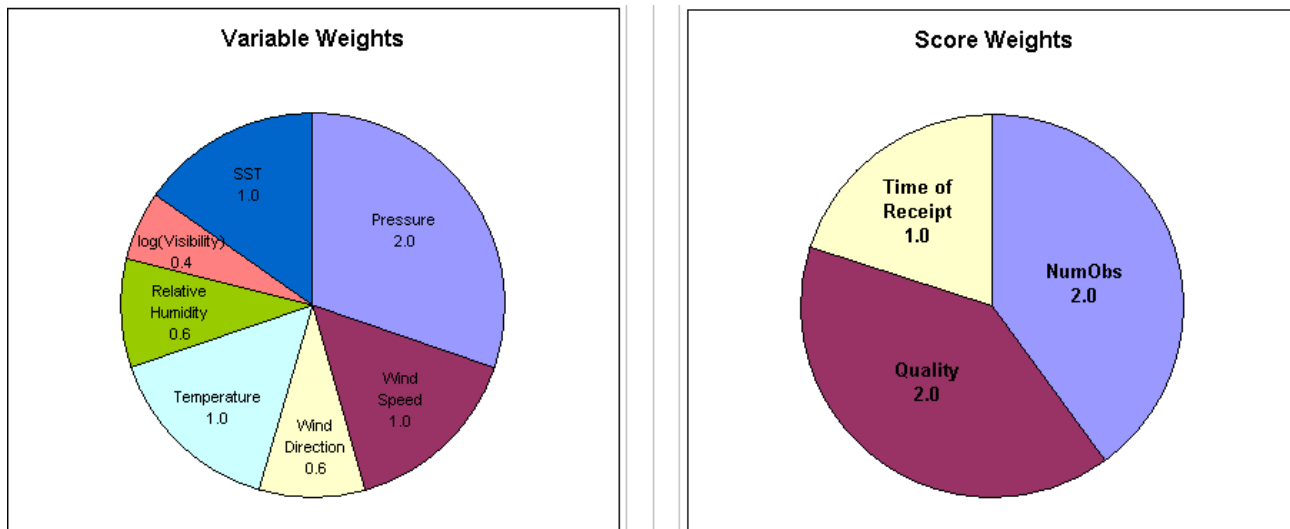
For ships that do not report certain variables the scores are set to the worst score for that variable (usually 2.0).

Then the scores for each variable are combined using the following weightings:

**P = 2.0, Spd = 1.0, Dir = 0.6, T = 1.0, RH = 0.6, Vis = 0.4, SST = 1.0 .**

These weightings are estimates of the relative importance of each variable to the NWP models (their values may need some further tuning).

### Weights



**N.B.** The above ranking scheme is only intended to give an indication of the relative performance of individual observing ships and marine platforms. It is primarily aimed at usefulness for NWP and therefore only takes into account observations that have been received in near real time. It takes no account of delayed mode observations collected for climate studies (for which timeliness is largely irrelevant).



Monthly VOS national fleet rankings for February 2013 – manual & automatic reports

February 2013 national VOS fleet scores for manual ship reports																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Country	NumSI	Combined	Pressure	Wind Speed	Wind Direction	Temperature	Relative Humidity	Visibility	Sea Surface Temp	Time of Receipt								
	NumOI	NumOI	P_Sc	SP_Sc	DR_Sc	T_Sc	RH_Sc	VI_Sc	TS_Sc	ToR_Sc								
"SHIP"	1	0.166	19518	0.231	2944	0.177	2946	0.167	2103	0.116	2938	0.120	2804	0.083	2940	0.134	2843	MISSING
NO	5	0.178	14281	0.061	2750	0.127	2758	0.208	1087	0.121	2758	0.163	2733	MISSING	0	0.088	2195	0.002
IT	3	0.493	1693	0.591	281	0.535	289	0.541	137	0.389	288	0.333	286	0.328	214	0.492	198	0.217
GR	1	0.551	28	0.545	4	0.642	4	0.513	4	0.532	4	0.609	4	0.488	4	0.503	4	MISSING
NZ	16	0.582	3702	0.584	591	0.594	591	0.546	410	0.530	590	0.560	569	0.499	420	0.549	531	0.206
NL	83	0.585	17665	0.553	2814	0.616	2798	0.577	1802	0.559	2803	0.568	2581	0.474	2731	0.528	2136	0.317
GB	217	0.592	46231	0.585	7260	0.625	7239	0.609	4326	0.541	7229	0.550	7019	0.482	7193	0.565	5965	0.389
Ancillary	2	0.601	223	0.572	35	0.638	35	0.625	19	0.582	35	0.621	35	0.518	32	0.649	32	0.262
SE	13	0.607	2719	0.585	465	0.583	464	0.517	352	0.511	464	0.656	48	0.492	462	0.492	464	0.248
AU	45	0.615	7511	0.590	1154	0.616	1184	0.589	705	0.568	1160	0.578	1149	0.488	1168	0.562	991	0.311
MY	3	0.617	628	0.589	97	0.724	96	0.671	58	0.561	95	0.575	89	0.477	97	0.564	96	0.419
IS	3	0.622	627	0.543	111	0.578	111	0.495	84	0.451	110	MISSING	0	0.451	111	0.421	100	0.111
JP	11	0.633	3384	0.549	525	0.566	530	0.545	362	0.527	527	0.579	392	0.460	530	0.516	518	0.568
DE	419	0.644	64532	0.636	10321	0.636	10325	0.602	5789	0.613	10301	0.638	9649	0.538	9985	0.597	8162	0.411
CA	4	0.694	317	0.732	53	0.683	53	0.509	32	0.656	53	0.564	52	0.639	47	0.505	27	0.016
US	409	0.716	127513	0.700	22363	0.679	23024	0.641	14244	0.626	21701	0.675	14067	0.596	14043	0.642	18071	0.791
HK	24	0.723	2764	0.763	431	0.699	427	0.680	254	0.681	432	0.688	396	0.581	433	0.672	391	0.604
RU	55	0.769	7181	0.741	1319	0.707	1292	0.642	750	0.687	1323	0.548	112	0.578	1312	0.607	1073	0.411
IL	4	0.778	255	0.754	43	0.665	46	0.615	38	0.672	46	0.699	14	0.539	46	0.608	22	0.297
Unknown	185	0.780	30071	0.791	5015	0.719	4994	0.663	2860	0.699	4989	0.713	2868	0.590	4641	0.660	4704	MISSING
IE	2	0.834	146	0.674	32	0.693	32	0.629	22	0.792	29	MISSING	0	0.575	31	MISSING	0	0.500
FR	1	0.887	8	0.679	2	MISSING	2	MISSING	0	0.650	2	0.648	2	0.782	2	MISSING	0	0.500
IN	9	0.924	451	0.953	78	0.791	82	0.770	24	0.801	84	0.867	82	0.724	83	0.838	18	0.900
ZA	1	0.948	102	0.831	15	1.320	15	1.427	14	0.787	15	0.838	15	0.893	14	0.773	14	1.306
KR	1	1.149	12	1.210	3	0.991	3	0.955	3	1.037	3	MISSING	0	MISSING	0	MISSING	0	2.000
MonthFleetStatsMan_1302																		
Ready																		
February 2013 national VOS fleet scores for automatic ship reports																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Country	NumSI	Combined	Pressure	Wind Speed	Wind Direction	Temperature	Relative Humidity	Visibility	Sea Surface Temp	Time of Receipt								
	NumOI	NumOI	P_Sc	SP_Sc	DR_Sc	T_Sc	RH_Sc	VI_Sc	TS_Sc	ToR_Sc								
"SHIP"	1	0.312	76880	0.277	16895	0.220	17942	0.191	6776	0.162	17859	0.186	14818	MISSING	0	0.101	2590	MISSING
DE	17	0.471	47949	0.442	8441	0.342	8869	0.321	4936	0.330	8864	0.368	8573	MISSING	0	0.289	8266	0.177
JP	2	0.616	3673	0.564	640	0.564	640	0.365	473	0.573	640	0.574	640	MISSING	0	0.427	640	0.008
AU	6	0.631	13290	0.445	2141	0.514	2551	0.572	972	0.431	2696	0.473	2565	MISSING	0	0.363	2365	0.218
CA	41	0.685	91962	0.337	20235	0.357	21720	0.499	7968	0.342	21630	0.456	17658	MISSING	0	0.622	2751	0.023
FR	54	0.723	79643	0.632	15864	0.702	13375	0.532	8458	0.637	15212	0.653	13677	0.449	808	0.528	12249	0.064
DK	2	0.797	3436	0.576	734	0.535	731	0.377	498	0.517	735	0.537	733	MISSING	0	1.417	5	MISSING
NZ	1	0.886	1613	0.442	448	0.851	194	0.757	75	0.532	448	0.549	448	MISSING	0	MISSING	0	0.347
GB	36	1.132	46192	0.490	14420	0.491	1716	0.316	1243	0.485	15396	0.537	12047	0.480	58	0.318	1312	0.266
Unknown	14	1.282	12243	0.875	2307	0.878	2715	0.814	1209	0.823	2318	0.567	1754	0.399	141	0.541	1799	MISSING
EU	22	1.286	18259	0.448	8713	0.794	2014	0.632	1166	0.417	2595	0.432	2595	MISSING	0	0.339	1176	0.021
SE	1	1.309	926	0.955	295	MISSING	0	MISSING	0	0.924	295	MISSING	0	MISSING	0	0.755	336	1.454