WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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. 9.1.3
(15.03.2013)

ITEM: 9.1.3

Original: ENGLISH

GLOBAL COLLECTING CENTRES (GCC) REPORT ON THE VOS

(Submitted by the GCCs of the United Kingdom and Germany)

Summary and purpose of the document

This document presents the 2012 Global Collecting Centre Annual Report including developments and future plans affecting GCC operations. It provides status on volume and frequency of delayed-mode data being received and processed by the GCCs which are then subsequently forwarded to the eight Responsible Members and VOSClim Data Assembly Centre. The document also mentions how masking schemes implemented per WMO Executive Council Resolution 27 (EC LIX) - both SHIP and MASK - have impacted on their operations.

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.

Appendices: A Full report of the GCCs to the seventh Session of the SOT
B GCC Annual Report 2012 (English)
C Layout of the International Maritime Meteorological Tape, Version 5 (IMMT-5)
D Minimum Quality Control Standard, Version 7 (MQCS-7)

- A - DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

9.1.3.1 The meeting recalled that under the revised Marine Climatological Summaries Scheme (MCSS), adopted by the eleventh session of the Commission for Marine Meteorology (CMM) (Lisbon, Portugal, April 1993), through Recommendation 11 (CMM-XI), the two Global Collecting Centres (GCCs) were established, in Germany and the United Kingdom, to: (i) collect all marine climatological data observed worldwide; (ii) ensure that minimum quality control procedures are applied; (iii) generate complete and duplicate global data sets; and (iv) provide these data sets to the Responsible Members under the MCSS.

9.1.3.2 The Team reviewed a consolidated report from the two GCCs. The report included a status on the volume and frequency of delayed-mode data being forwarded to the VOSClim Data Assembly Centre. The GCCs also reported on how callsign masking schemes implemented per WMO Executive Council Resolution 27 (EC LIX) - both SHIP and MASK - had impacted on their operations and the user community and discussed potential solutions to this wide impacting issue.

9.1.3.3 The Team considered the role of the GCCs in processing the delayed-mode IMMT (International Maritime Meteorological Tape-format) data and the associated quality control standards.

9.1.3.4 The Team considered the new Marine Climate Data System (MCDS) and how the roles of MCSS members will migrate to the new data flow structure when it is introduced.

9.1.3.5. The meeting made the following recommendations:

(i) All Contributing Members (CMs) should submit data files in one IMMT format only – preferably now IMMT-5 quality checked to the seventh version of the Minimum Quality Control Standard (MQCS-7) making use of its increased coding capabilities;

(ii) CMs not able to submit their data because of issues e.g. with digitizing or converting into the IMMT format, should contact GCCs for advice;

(iii) All VOSClim class ships should use the indicator for registered VOSClim ships in element 41 (observation Platform) of the newly adopted formats IMMT-4 and -5 ;

(iv) All VOSClim class ship observations should include the additional VOSClim elements;

(v) If possible CMs should ensure all masked callsigns (i.e. ‘SHIP’) are converted back to the original ID prior to submission;

(vi) SOT should stay up to date with the Task Team on the MCDS (TT-MCDS) developments.

9.1.3.6. The meeting decided on the following action items:

(i) Electronic logbook programmers to upgrade logbook software to allow coding in IMMT-5 format (***action; e-logbook developers; asap***);

(ii) All CMs that did not submit data during 2012 should do so in 2013 or alternatively contact GCC for advice (***action; CMs; 2013***).

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Appendices: 4

APPENDIX A

FULL REPORT OF THE GCCS TO THE SEVENTH SESSION OF THE SOT

1. VOS Data

The Marine Climatological Summaries Scheme (MCSS) was established by the WMO Commission for Marine Meteorology in 1963. In an effort to improve data flow and quality of global marine data two Global Collecting Centres (GCCs) were created in 1994.

The 2012 GCC report marks the 19th year of operation and is attached within Appendix B. The main highlights from the report are:

- 1,594,649 observations were received during 2012 from 19 countries (see Table 1). This is significantly more than in 2010 and 2011 combined.
- The increase in number of observations received is accounted for by specific countries processing large backlogs and contributing the data in 2012 (noting 2010 and 2011 totals were considerably less than usual, see GCC Annual Report (Appendix B), Figure 1).
- 1394 VOS ships made observations in 2012.
- 59% of data were observed in 2011 & 2012 and 80% during the last three years.
- 53% of the received observations used IMMT-3 format and 47% the IMMT-4 format adopted in 2010. Very small numbers of observations still used IMMT-1 or 2.
- The latest version, 5.0, of the Dutch electronic logbook software, TurboWin, has been updated to output IMMT-4. The USA is currently updating their SEAS e-logbook software to do the same.

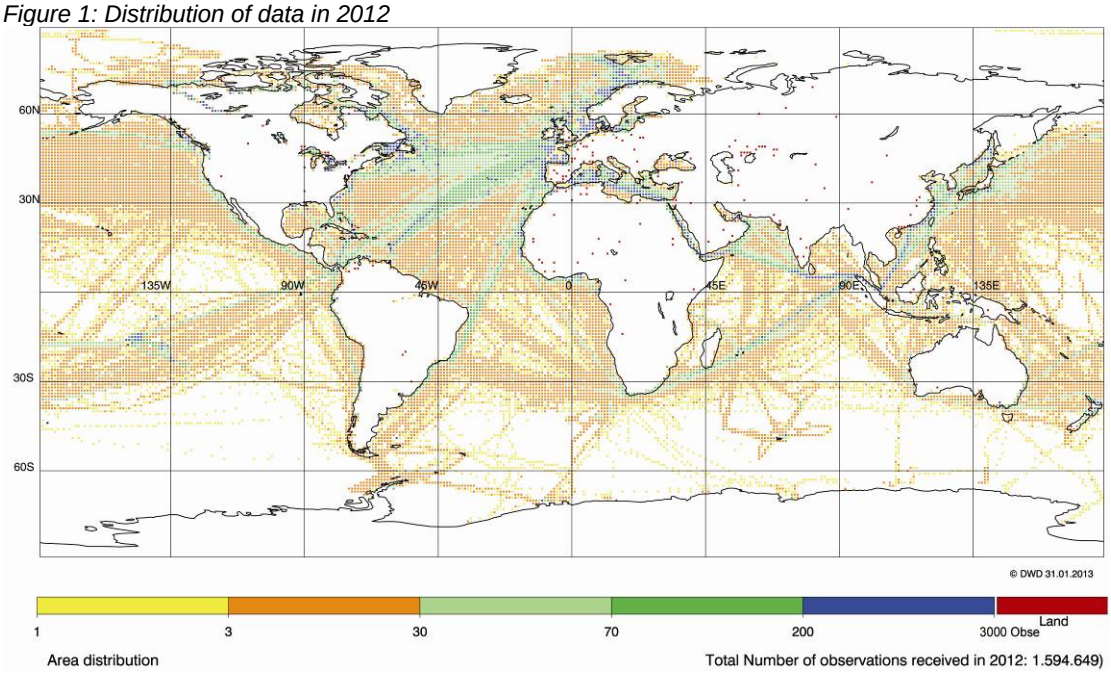
Table 1: Obs received by GCCs in 2012

Country Name	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Argentina					0
Australia					0
Brazil					0
Canada	137.397	263.293			400.690
Croatia					0
France	201.515	35.768	34.051	58.792	330.126
Germany	55.200	44.133	82.356	101.930	283.619
Greece		530			530
Hong Kong, China	451	453	495	634	2.033
India		440	180	595	1.215
Ireland	784		433	308	1.525
Israel		865	3.467		4.332
Japan	5.346	5.633	2.668	2.431	16.078
Kenya					0
Malaysia	1.191			26	1.217
Netherlands	20.399	7.556	12.904	9.018	49.877
New Zealand	2.844	2.326		1.951	7.121
Nigeria					0
Norway	269.405	16.588		12.151	298.144
Poland				538	538
Russian Federation	10.040	10.037	10.003	10.020	40.100
Singapore				427	427
South Africa		648			648
Sweden					0
United Kingdom	84.366	22.617	18.670	29.241	154.894
USA	511	410	614		1.535
19 of 26 Contributing Countries	**789.449**	**411.297**	**165.841**	**228.062**	**1.594.649**

- The majority of observations were of good quality. For example most reported elements such as wind direction/speed, air pressure and air temperature were flagged with a 1 in 98% of observations, which means ‘element appears correct’.

- Figure 1 shows the distribution of observations received during 2012 with red points highlighting the on land data (only 419 observations in 2012).
- Before quarterly data exchanges over 100,000 previously submitted duplicate observations were identified and deleted.

Figure 1: Distribution of data in 2012



2. VOSClim Data

The VOSClim Project was a long standing pilot within JCOMM's Voluntary Observing Ships' Scheme. It aimed at providing a high-quality subset of marine meteorological data with detailed information on how data have been obtained. These data are available in delayed mode and are of great value to both operational marine forecasting and global climate studies. It was agreed at SOT-5 in May 2009 (Geneva, Switzerland) to cease the VOSClim project and integrate the VOSClim fleet and its reporting practices into the wider VOS community. As a consequence the new IMMT-4 and 5 formats have been updated accordingly to include a VOSClim data indicator which should be selected if a ship has this capability.

As of 31st December 2012 there were 10 CMs in total with 435 recruited VOSClim ships registered with the VOSClim Data Assembly Centre (DAC).

Table 2: VOSClim Data Received in 2012 by Quarter

Total Number of Observations from VOSClim-Ships / Number of Observations with VOSClim-Elements from VOSClim-Ships / Number of Observations with VOSClim-Elements from not listed ships 2012

Country Name	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			Total		
Australia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canada	137.133	0	0	263.115	0	0	0	0	0	0	0	0	400.248	0	0
France	148.032	148.032	52.357	31.750	31.750	1.824	32.195	32.195	1.856	50.924	50.924	7.868	262.901	262.901	63.905
Germany	5.617	5.556	0	3.123	2.928	0	13.392	12.365	152	24.730	21.293	215	46.862	42.142	367
India	0	0	0	71	0	0	31	0	0	136	0	0	238	0	0
Japan	0	0	0	3.061	3.061	0	0	0	0	0	0	0	3.061	3.061	0
Netherlands	4.461	1.732	291	2.296	1.707	505	5.239	4.161	627	4.711	4.379	628	16.707	11.979	2.051
New Zealand	644	643	6	404	0	0	0	0	0	257	257		1.305	900	6
United Kingdom	14.838	12.821	4.214	8.018	7.403	6.539	9.307	8.531	78	15.915	12.535	802	48.078	41.290	11.633
USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 of 10 Countries	310.725	168.784	56.868	311.838	46.849	8.868	60.164	57.252	2.713	96.673	89.388	9.513	**779.400**	**362.273**	**77.962**

Since July 2008, at the end of each quarter all VOS data received by the GCCs is made available to the VOSClim DAC in the USA. Data from VOSClim ships is then extracted from the quarterly file and stored at the DAC.

During 2012:

- 779,400 observations originating from VOSClim ships were received (see Table 2).
- 49% of all data received by GCCs was from VOSClim ships, the largest number of VOSClim observations received since collection began in 2003.
- This increase in the number of VOSClim observations is likely due to VOSClim now being a 'VOS class' (IMMT element 41, Observation Platform).
- Data was received from 8 of the 10 CMs with recruited VOSClim ships.
- In 2012, the GCCs received data from over 330 listed VOSClim ships.
- 362,273 VOSClim observations (46%) contained the VOSClim defined additional elements.
- 77,962 observations from non-VOSClim registered ships were received with VOSClim defined additional elements.

3. Callsign Masking

Masking of VOS callsigns in many GTS data starting around December 2007 remains a critical problem, preventing the association of platform-instrumental metadata from WMO Pub. 47 to the actual observation itself. Not only does this make some aspects of QC impossible it also inhibits users from identifying bias corrections etc. There have been discussions within and across many countries regarding when it should be appropriate to release the real callsign after an observation is created. Various proposals of 30-day to 90-day release periods have been suggested but in some cases this is not suitable and some callsigns will never be released. A proposed encryption scheme developed partially by ETMC holds the promise to possibly alleviate these problems in the longer-term, if successfully developed, implemented and adopted. In the meantime the GCCs ask CMs (and PMOs) to ensure, where possible, data be submitted with unmasked callsigns when it is no longer sensitive.

4. Developments and Future Changes

There has been progress made with improvements to the MCSS during 2011/2012:

- Formats & Standards: As of 1st January 2011, IMMT-4 and MQCS-6 was the preferred format and quality standard for use by delayed-mode VOS observations. The most notable differences from IMMT-3 and MQCS-5 are the inclusion on a VOSClim & AWS indicator, IMO number, relative humidity and new definitions of observation platform. The next version of the IMMT & MQCS format and standard (IMMT-5 and MQCS-7) were adopted at JCOMM-4 in May 2012 and were in effect from June 2012. These include only minor updates of wording and QC limits (see appendices C & D for the full IMMT-5 & MCQS-7). The 'MQC-software for CMs' was updated to MQCS-7 and the 5th version is available at http://www.wmo.int/pages/prog/amp/mmop/mqc_soft.html.

- MCDS: The very initial concept of the Marine Climate Data System (MCDS) was first devised and discussed by the GCCs at SOT-6, Hobart, Australia, April 2011 and then shortly after presented at the Marine Climate Data Workshop, MARCDAT-3, Frascati, Italy, May 2011. The proposed vision was well received and an MCDS workshop took place in November/December 2011 in Hamburg, Germany. The group explored the idea of defining a generic data flow structure with defined roles and tasks to be applied to all data types across JCOMM for the management of their climate data. As a result of the discussions a MCDS vision for 2020 and implementation plan were proposed and endorsed by JCOMM-4. The new JCOMM task team on the Marine Climate Data System (TT-MCDS) was formed and absorbs the work and tasks of the TT-DMVOS & TT-MOCS. TT-MCDS met alongside ETMC-IV in Ostend, Belgium, November 2012 where work concepts and definitions and data flow were discussed further.

  During the coming years the MCDS data-flow shall replace the MCSS which will mean that CMs will then act as Data Acquisition Centres (DACs) and the GCCs as Global Data Assembly Centres (GDACs), processing delayed mode data as well as real time data. In addition the existing VOSClim DAC will migrate to a GDAC. It will no longer be necessary for RMs to archive data as CMOCs will check, archive and provide all observations for all

areas worldwide. The goal is to have only one standardised quality checked dataset, mirrored at two or more places (see SOT-7 Item 9.4).

- WIS DCPC: Both GCCs have been identified as 'Data Collection & Production Centres' (DCPCs) for the WMO Information System (WIS) and are able to provide nearly 17.7 millions MQCS-checked and flagged observations received by the GCCs from 1996 to 2012. Additionally all contributed original records are saved and available at http://gisc.dwd.de/GISC_DWD/toExtendedSearch.do

- HQCS: DWD continues to make progress in the development of a new standardised Higher Quality Control Standard (HQCS). The goal is to create a uniform checking of all types of VOS observations, easy handling, documented steps and graphic demonstration of erroneous values and simple ways of correction (to be used by the new MCDS GDACs). A revised and improved land-sea mask will soon be available and climatological checking with ERA-Interim-data has led to satisfying results. GCC UK and the ICOADS team will test the first version of HQCS during 2013.

- Improved TurboWin QC: During 2012 the GCC UK reviewed the embedded QC checks within the KNMI electronic logbook software, TurboWin. As a result many more QC checks have been recommended to KNMI and are due to be included within the next release.

- Problems Uncovered: During the first quarter of 2013 the GCCs discovered problems with coding of relative humidity in TurboWin version 5 and with the UK GCC processing of IMMT-4 and 5 data. RMs were made aware while both GCCs worked hard to resolve the issues. Problems with the UK processing software have now been rectified and the relative humidity issue will be addressed in the next TurboWin release. All contributed data affected by the TurboWin relative humidity problem will be corrected before the next quarterly exchange.

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APPENDIX B

Global Collecting Centre

Annual Report 2012

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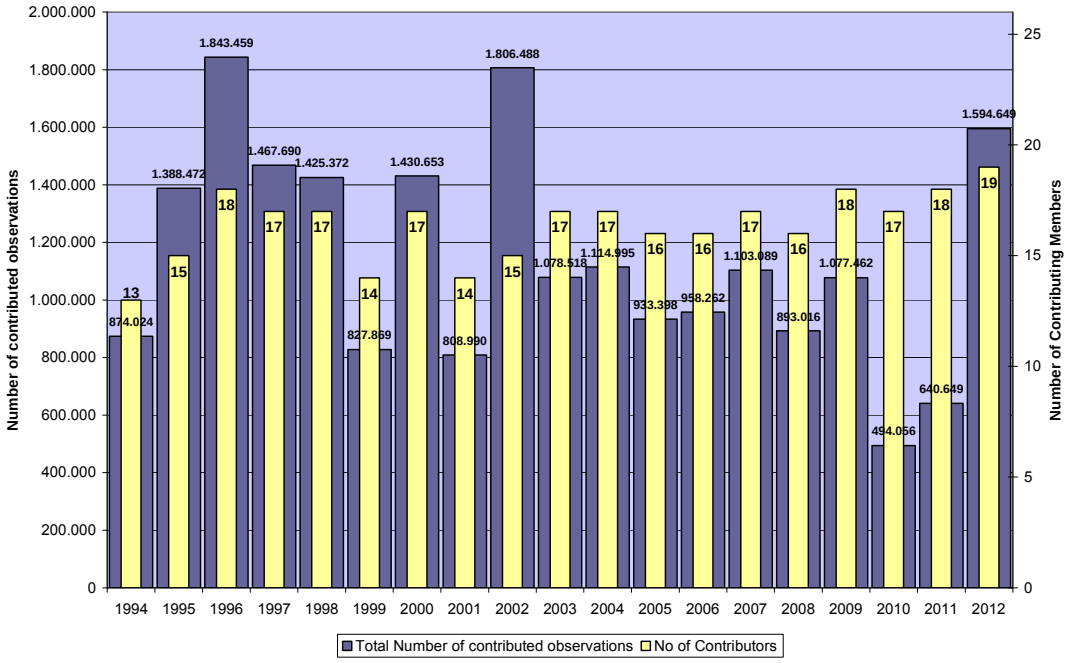
Background

The two Global Collecting Centres (GCCs) for JCOMM's Marine Climatological Summaries Scheme (MCSS) were set up in 1993 to improve data flow and quality of delayed-mode Voluntary Observing Ship (VOS) data. Data is received regularly by the GCCs (figure 1 & appendix A) from the MCSS Contributing Members (CMs) (appendix B). This is then quality ensured to the Minimum Quality Control Standard (MQCS-7) and, once quarterly, made available to Responsible Members (RMs) via FTP. For further information about the MCSS and GCCs work, terms of reference, data format and QC standards see WMO Manual 558 & WMO Guide 471.
2012 marks the 19th year of GCC operation.

Figure 1: Numbers of contributed observations and active Contributing Members by year since GCCs began to operate



VOS Data Volumes 2012

- 1,594,649 observations were received and processed by the GCCs during 2012.

- 19 CMs contributed data out of a total of 26 registered Members/Member States.
- 1394 VOS ships made observations in 2012.
- Date of contributed data ranged: from 1996 to 2012.
- 59% of data were observed in 2011 & 2012 and 80% during the last three years.
- 53% of the received observations used IMMT-3 format and 47% the IMMT-4 format which was adopted in 2010. There were still 2459 (0.15%) observations received in IMMT-1 format and 124 in IMMT-2 format.

Figure 2: Number of observations by CMs for each quarter of 2012.

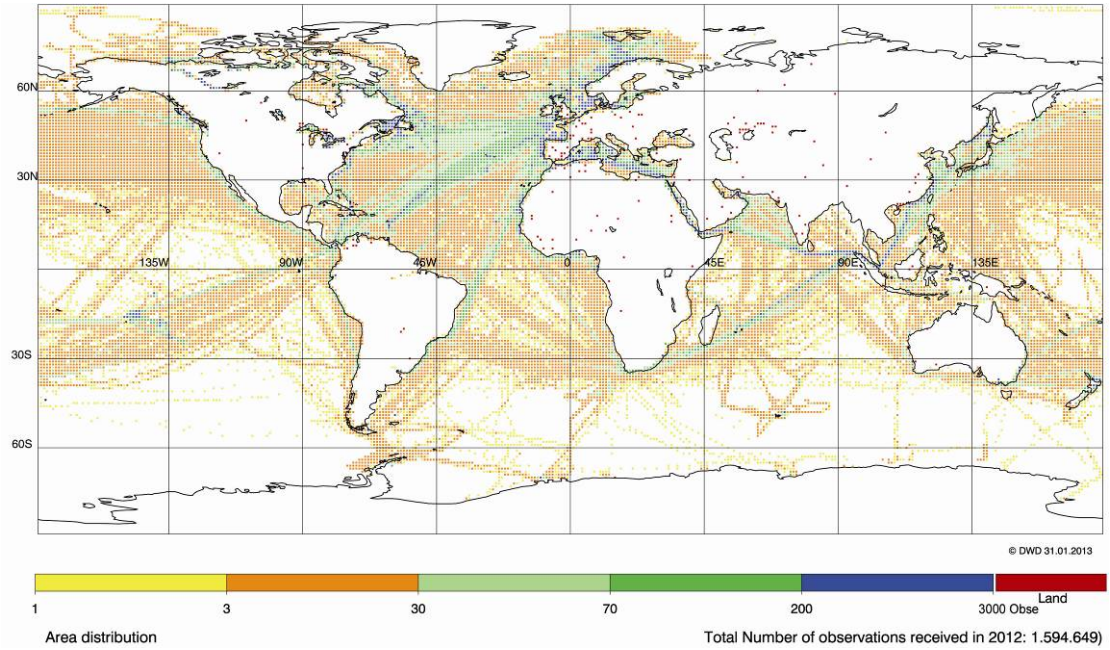
Country Name	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Argentina					0
Australia					0
Brazil					0
Canada	137.397	263.293			400.690
Croatia					0
France	201.515	35.768	34.051	58.792	330.126
Germany	55.200	44.133	82.356	101.930	283.619
Greece		530			530
Hong Kong, China	451	453	495	634	2.033
India		440	180	595	1.215
Ireland	784		433	308	1.525
Israel		865	3.467		4.332
Japan	5.346	5.633	2.668	2.431	16.078
Kenya					0
Malaysia	1.191			26	1.217
Netherlands	20.399	7.556	12.904	9.018	49.877
New Zealand	2.844	2.326		1.951	7.121
Nigeria					0
Norway	269.405	16.588		12.151	298.144
Poland				538	538
Russian Federation	10.040	10.037	10.003	10.020	40.100
Singapore				427	427
South Africa		648			648
Sweden					0
United Kingdom	84.366	22.617	18.670	29.241	154.894
USA	511	410	614		1.535
19 of 26 Contributing Countries	**789.449**	**411.297**	**165.841**	**228.062**	**1.594.649**

CMs without any contribution in 2012 are marked in red

VOS Data Quality 2012

- The majority of observations were again of good quality. For example the most reported elements like wind direction and speed, air pressure and air temperature were flagged in over 98 % with a 1, which means 'element appears correct'.
- There were 419 observations (0.03%) with on land positions. These are plotted as red dots in Figure 3.
- Quarterly analysis of the exchanged datasets identified 215 observations (0.01%) that were rejected by the MQCS. Analysis of the yearly dataset highlighted that the number of observations rejected increased noticeably to 4469. These observations failed MQC but were included at quarterly exchange. However, these still only accounts for 0.28% of total observations received.
- Before the quarterly data exchanges over 100,000 previously submitted duplicate observations were identified and deleted.
- Many observations containing erroneous positions or observations from ships that were not recruited by the CM were selected and, after consultation with the appropriate CM, were deleted.

Figure 3: Distribution of observations received in 2012



VOSClim Class Data 2012

- 779,400 observations were received and processed from VOSClim registered ships by the GCCs during 2012.
- This makes up 49% of data received by the GCCs from the VOS fleet in 2012 which is the largest number of received VOSClim observations since collection began in 2003.
- 8 of the 10 CMs with registered VOSClim ships submitted observations (Figure 4) in 2012.
- In 2012, the GCCs received data from over 330 listed VOSClim ships.
- 362,273 of VOSClim observations (46%) contained the VOSClim defined additional elements.
- 77,962 observations from non-VOSClim registered ships were received with VOSClim defined additional elements.
- This increase in the number of VOSClim observations is likely due to VOSClim now being a 'VOS class' (IMMT element 41, Observation Platform).

Figure 4: VOSClim class observations submitted by CMs for each quarter of 2012

Total Number of Observations from VOSClim-Ships / Number of Observations with VOSClim-Elements from VOSClim-Ships / Number of Observations with VOSClim-Elements from not listed ships 2012

Country Name	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			Total		
Australia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canada	137.133	0	0	263.115	0	0	0	0	0	0	0	0	400.248	0	0
France	148.032	148.032	52.357	31.750	31.750	1.824	32.195	32.195	1.856	50.924	50.924	7.868	262.901	262.901	63.905
Germany	5.617	5.556	0	3.123	2.928	0	13.392	12.365	152	24.730	21.293	215	46.862	42.142	367
India	0	0	0	71	0	0	31	0	0	136	0	0	238	0	0
Japan	0	0	0	3.061	3.061	0	0	0	0	0	0	0	3.061	3.061	0
Netherlands	4.461	1.732	291	2.296	1.707	505	5.239	4.161	627	4.711	4.379	628	16.707	11.979	2.051
New Zealand	644	643	6	404	0	0	0	0	0	257	257		1.305	900	6
United Kingdom	14.838	12.821	4.214	8.018	7.403	6.539	9.307	8.531	78	15.915	12.535	802	48.078	41.290	11.633
USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 of 10 Countries	310.725	168.784	56.868	311.838	46.849	8.868	60.164	57.252	2.713	96.673	89.388	9.513	**779.400**	**362.273**	**77.962**

CMs without any contribution in 2012 are marked in red

Recent Developments

Formats & Standards

The latest version of the IMMT & MQCS format and standard (IMMT-5 and MQCS-7) were adopted at JCOMM-4 in May 2012 and were in effect from 1st June 2012. These versions include only minor updates of wording and QC limits.

The MQC-software for CMs was updated to MQCS-7. The 5th version is available at http://www.wmo.int/pages/prog/amp/mmop/mqc_soft.html.

The different lists of registered VOSClim ships (administered by ESURFMAR/France and NOAA/USA) were updated and assimilated at the request of the GCCs to ensure they were in agreement. In the newly adopted IMMT formats 4 and 5 it is a requirement to indicate that a ship is a registered VOSClim ship using element 41 'Observation platform'.

Meetings and Activities

In May 2012 at JCOMM-4 in Yeosu, Republic of Korea, the new JCOMM task team on Marine Climate Data System (TT-MCDS), which combines the work and tasks of the TT-DMVOS & the TT-MOCS, was adopted. Also the vision of the MCDS-Strategy with the Initial Implementation Plan was discussed and approved. The new data flow structure of MCDS proposes that all data types across JCOMM should be gathered for better access to marine meteorological and oceanographic climatological data (met-ocean climate data). The update of the Manual on and the Guide to Marine Meteorological Services (WMO No. 558, and 471 respectively) were agreed as well as the formats and standards.

The two GCCs met in Hamburg in September 2012 to discuss the new HQCS and prepare for the ETMC meeting in Ostend, Belgium in November.

At ETMC-4 in November 2012 in Ostend, Belgium, the data-flow diagram for the MCDS was reviewed and a new version, which better highlights the role of the IODE was agreed upon. At the meeting the potential contributions and roles of the various actors and stakeholders in the MCDS, concerning foreseen Data Acquisition Centres (DACs), Global Data Assembly Centres (GDACs), and Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs) were clarified. During the coming years the MCDS data-flow shall replace the MCSS which will mean that CMs will then act as DACs and the GCCs as GDACs, which will process delayed mode data as well as real time data. It will be no longer necessary for the RMs to archive the data as CMOCs will check, archive and provide all observations for all areas worldwide. The goal is to have only one standardised quality checked dataset, mirrored at two or more places.

High number of submitted data

During 2012 the GCCs received a much larger volume of data than in the two years previous. This fluctuation in contributions results from a variety of CM issues including software, staff and technical problems. The increase in the volume of data can mainly be accounted for by Canada, France, Norway and the UK all processing large backlogs and contributing the data in 2012. Additionally data was received from Singapore again after a number of years without any submissions. Unfortunately a quarter of the listed CMs still did not contribute any data during 2012. (Appendix A)

Interoperable MCSS data

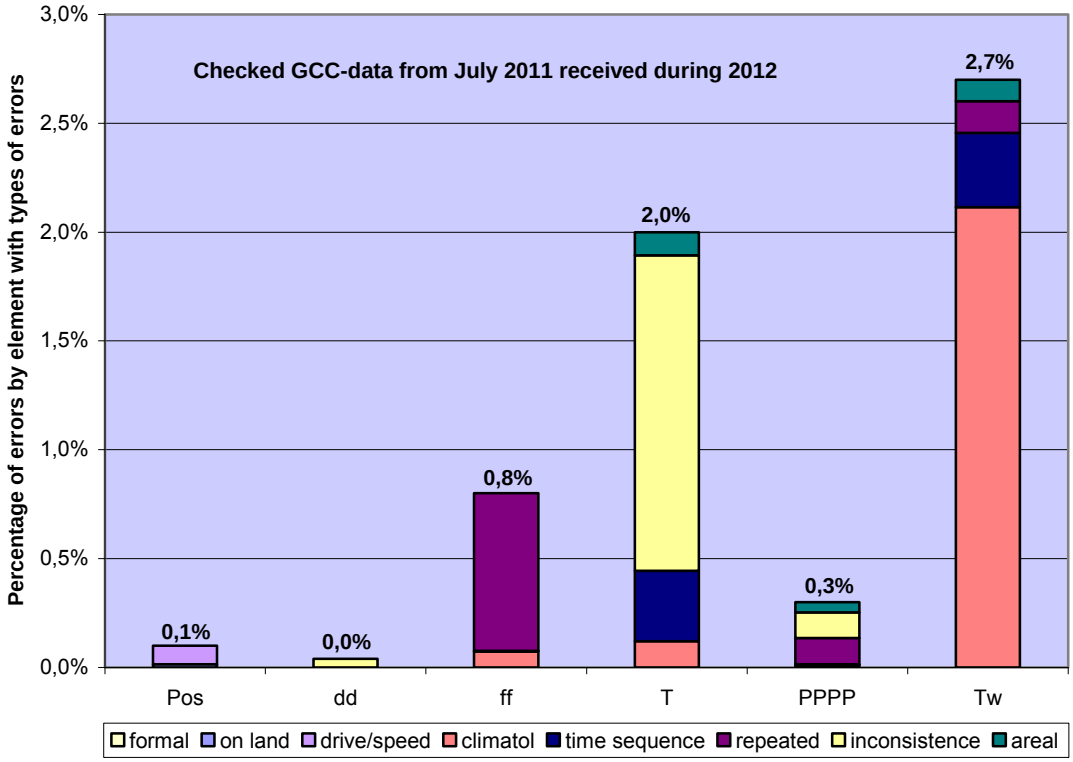
Both GCCs have been identified as DCPCs for the WIS and are able to provide nearly 17.9 million MQCS-checked and flagged observations received by the GCCs during 1996 to 2012. Additionally all contributed original records are saved and available.
Interoperable MCSS datasets can be searched and accessed from the German WMO Information System's (WIS) GISC http://gisc.dwd.de/GISC_DWD/toSimpleSearch.do In addition since early 2012 MCSS data were also available from the IODE Ocean Data Portal http://www.oceandataportal.org/

Higher Quality Control Standard

DWD continues to make progress in the development of a new standardised Higher Quality Control Standard (HQCS). The goal is a uniform checking of all types of VOS observations, easy handling, documented steps and graphic demonstration of erroneous values and simple ways of correction. A revised and improved land-sea mask will soon be made available and climatological checking with ERA-Interim-data have led to satisfying results. The UK GCC and the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) team will test the first version of the HQCS during 2013.

As an example of the new HQCS observations received in 2012 from July 2011 were tested and the output has been displayed in Figure 5 below.

Figure 5: Percentage of the type's errors detected by the new HQC



The graph shows the percentage of error type detected by the new HQC.
The software checks are performed in the following order:
- **formal** errors, checks of invalid characters and defined limits
- **on-land positions**
- **drive and speed**, comparisons of course of the ship
- **climate checks**, against ERA Interim extremes
- **time sequence**, checks of changes against limits
- **repeated** (stuck) values
- **inconsistency**, checks of internal consistency of the record
- **areal**, comparisons of near-neighbouring values

The output figure is based on 62.298 observations received by the GCCs during 2012 from July 2011 for the parameters of position, wind direction and speed, air temperature, air pressure and sea surface temperature. All parameters are quality flagged separately.

Recommendations

To improve data availability and quality, and in light of the recent developments, the GCCs make the following recommendations:

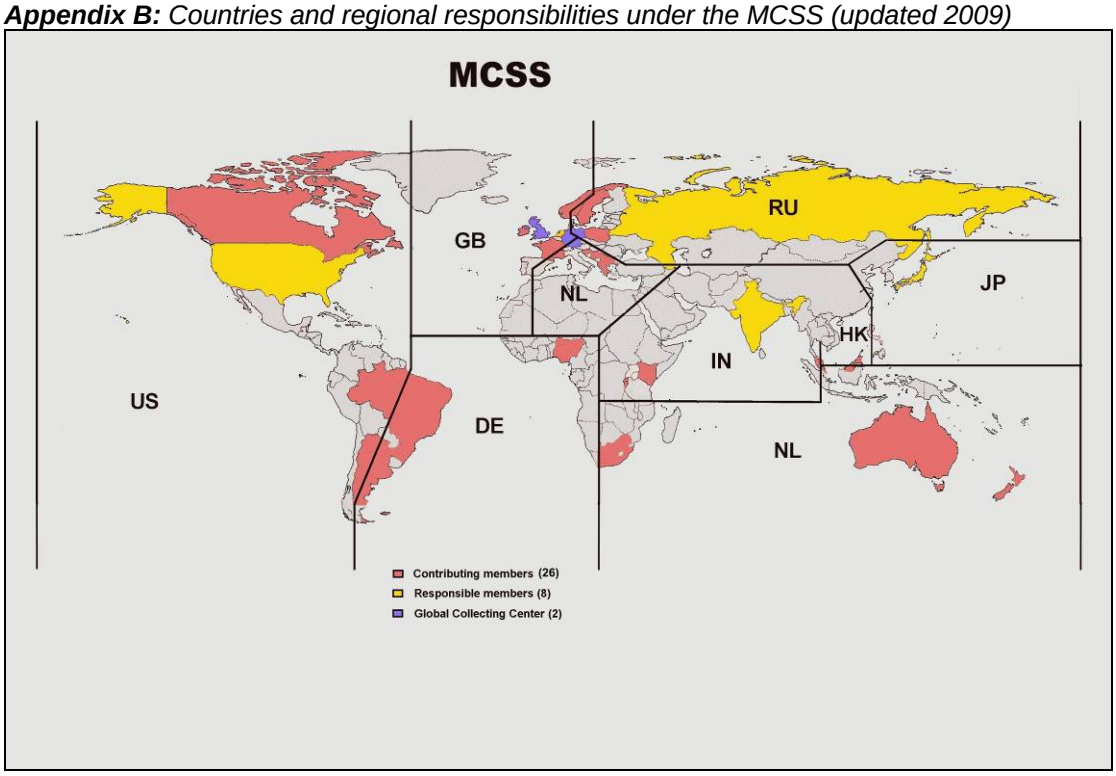
- CMs should submit the observations only once. But if there is a requirement to resubmit data (e.g. quality improvements) then the GCCs should be made aware of this.
- CMs should submit data files in one IMMT format only – preferably now IMMT-5.
- CMs not able to submit their data because of issues e.g. with digitising or converting into the IMMT format, should contact GCCs for advice.
- By applying MQCS to data prior to submission, CMs can identify and solve significant problems, in particular, issues within date, time and position.
- All VOSClim class ships should use the indicator for registered VOSClim ships in element 41 (observation Platform) in the newly adopted formats IMMT-4 and -5 with the option set to 4.

- All VOSClim class ship observations should include the additional VOSClim elements.
- CMs with VOSClim class ships that have still not successfully submitted data to the GCCs are encouraged to do so at their earliest convenience or contact GCCs for advice.
- If possible convert all masked callsigns (i.e. 'SHIP') back to the original ID prior to submission.
- CMs and RMs should stay up to date with TT-MCDS developments in order to ensure they know how they might be affected in the future or how they may contribute in the present. This can be done by attending meetings or reading reports etc.

***Appendix A**: CM contribution by year since GCCs began operations in 1994*

	ISO Alpha-2 code																			Number of Years with Contributions 1994 - 2012
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Argentina	AR								X		X	X	X	X	X	X					**7**
Australia	AU							X		X	X	X	X		X	X	X	X	X		**10**
Brazil	BR	X	X	X	X																**4**
Canada	CA																		X	X	**2**
Croatia	HR				X	X	X	X	X												**5**
France	FR	X	X	X	X	X			X		X	X	X	X	X	X	X		X	X	**15**
Germany	DE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**19**
Greece	GR																	X		X	**2**
Hong Kong, China	HK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**19**
India	IN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**19**
Ireland	IE			X	X	X				X							X	X	X	X	**8**
Israel	IL		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	**17**
Japan	JP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**19**
Kenya	KE																				**0**
Malaysia	MY	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	**17**
Netherlands	NL	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	**17**
New Zealand	NZ													X	X	X	X	X	X	X	**7**
Nigeria	NG																				**0**
Norway	NO	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	**16**
Poland	PL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**19**
Russian Federation	RU		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**18**
Singapore	SG		X	X	X	X					X	X	X	X						X	**9**
South Africa	ZA						X	X	X	X	X	X	X	X	X	X	X	X	X	X	**14**
Sweden	SE			X													X	X	X		**4**
United Kingdom	GB	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	**17**
United States	US	X	X	X	X	X	X	X		X	X				X	X	X	X	X	X	**15**

Appendix B: *Countries and regional responsibilities under the MCSS (updated 2009)*



Appendix C*: List of acronyms*

CM	Contributing Member
CMOC	Centres for Marine Meteorological and Oceanographic Climate Data
DAC	Data Acquisition Centres
DWD	Deutscher Wetterdienst
ETMC	Expert Team on Marine Climatology
GCC	Global Collecting Centre (MCSS / JCOMM)
GDAC	Global Data Assembly Centres
GISC	Global Information System Centres (of WIS)
E-SURFMAR	EUCOS Surface Marine Programme
HQCS	Higher Quality Control Standard
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA)
IMMT	International Maritime Meteorological Tape Format
IOC	Intergovernmental Oceanographic Commission of UNESCO
IODE	International Oceanographic Data and Information Exchange
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
MCDS	Marine Climate Data System
MCSS	Marine Climatological Summaries Scheme
MQCS	Minimum Quality Control Standards
NOAA	National Oceanic and Atmospheric Administration (USA)
ODP	Ocean Data Portal
RM	Responsible Member
TT-MCDS	Task Team on Marine Climate Data System (ETMC)
TT-DMVOS	Task Team on Delayed Mode VOS Data
TT-MOCS	Task Team on Marine Meteorological and Oceanographic Climatological Summaries
UK	United Kingdom
VOS	Voluntary Observing Ship
VOSClim	VOS Climate (Subset for High Quality Data)
WIS	WMO Information System
WMO	World Meteorological Organization

APPENDIX C

LAYOUT FOR THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT) FORMAT

IMMT-5 (Version 5)

Notes:

(a) The representation for missing data in any field is all blank(s).

(b) Many of the "Codes" in the IMMT format match "symbolic letters" as defined in the *Manual on Codes* (WMO–No.306) for the traditional alphanumeric (e.g. FM 13) SHIP code. However, the elements added for the VOSClim project (as introduced for IMMT-2), for example, did not appear in WMO–No.306, thus an effort was made to select unique new Codes to avoid conflicts in meaning between symbolic letter groups in WMO–No.306 versus Codes defined only in IMMT.

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*
1	1	i_T	Format/temperature indicator	3 – temperatures in tenths of °C 4 – temperatures in halves of °C 5 – temperatures in whole °C [Note: codes 1-2 were previously used to refer to the obsolete IMMPC format; current codes all refer to the IMMT format]
2	2-5	AAAA	Year UTC	Four digits
3	6-7	MM	Month UTC	01 – 12 January to December
4	8-9	YY	Day UTC	01 – 31
5	10-11	GG	Time of observation	Nearest whole hour UTC, WMO specifications
6	12	Qc	Quadrant of the globe	WMO code table 3333
7	13-15	$L_aL_aL_a$	Latitude	Tenths of degrees, WMO specifications
8	16-19	$L_oL_oL_oL_o$	Longitude	Tenths of degrees
9	20		Cloud height (h) and visibility (VV) measuring indicator	0 – h and VV estimated 1 – h measured, VV estimated 2 – h and VV measured 3 – h estimated, VV measured
10	21	h	Height of clouds	WMO code table 1600
11	22-23	VV	Visibility	WMO code table 4377
12	24	N	Cloud amount	Oktas, WMO code table 2700; show 9 where applicable
13	25-26	dd	True wind direction	Tens of degrees, WMO code table 0877; show 00 or 99 where applicable
14	27	i_w	Indicator for wind speed	WMO code table 1855
15	28-29	ff	Wind speed	Units of knots or meters per second, hundreds omitted; values in excess of 99 knots are to be indicated in units of meters per second and i_w encoded accordingly; the method of estimation or measurement and the units used (knots or meters per second) are indicated in element 14. Wind is at observation height or anemometer height (i.e. it is not reduced to 10m).

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*	
16	30	s_n	Sign of temperature	WMO code table 3845	
17	31-33	TTT	Air temperature	Tenths of degrees Celsius	
18	34	s_t	Sign of dew-point temperature	0 – positive or zero measured dew-point temperature 1 – negative measured dew-point temperature 2 – iced measured dew-point temperature 5 – positive or zero computed dew-point temperature 6 – negative computed dew-point temperature 7 – iced computed dew-point temperature	
19	35-37	$T_dT_dT_d$	Dew-point temperature	Tenths of degrees Celsius	
20	38-41	PPPP	Air pressure	Tenths of hectopascals	
21	42-43	ww	Present weather	WMO code table 4677 or 4680	
22	44	W_1	Past weather	WMO code table 4561 or 4531	
23	45	W_2	Past weather	WMO code table 4561 or 4531	
24	46	N_h	Amount of lowest clouds	As reported for C_L or, if no C_L cloud is present, for C_M, in oktas; WMO code table 2700	
25	47	C_L	Genus of CL clouds	WMO code table 0513	
26	48	C_M	Genus of CM clouds	WMO code table 0515	
27	49	C_H	Genus of CH clouds	WMO code table 0509	
28	50	s_n	Sign of sea-surface temperature	WMO code table 3845	
29	51-53	$T_WT_WT_W$	Sea surface temperature	Tenth of degrees Celsius	
30	54		Indicator for sea-surface temperature measurement	0 – Bucket thermometer 1 – Condenser inlet 2 – Trailing thermistor 3 – Hull contact sensor 4 – “Through hull” sensor 5 – Radiation thermometer 6 – Bait tanks thermometer 7 – Others	
31	55		Indicator for wave measurement	Shipborne wave recorder	0 – Wind sea and swell estimated 1 – Wind sea and swell measured 2 – Mixed wave measured, swell estimated 3 – Other combinations measured and estimated
				Buoy	4 – Wind sea and swell measured 5 – Mixed wave measured, swell estimated 6 – Other combinations measured and estimated

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*	
				Other measurement system	7 – Wind sea and swell measured 8 – Mixed wave measured, swell estimated 9 – Other combinations measured and estimated
32	56-57	P_WP_W	Period of wind waves or of measured waves	Whole seconds; show 99 where applicable in accordance with Note (3) under specification of P_WP_W in WMO–No.306.	
33	58-59	H_WH_W	Height of wind waves or of measured waves	Half-meter values. Examples: Calm or less than ¼m to be encoded 00; 3½m to be encoded 07; 7m to be encoded 14; 11½m to be encoded 23.	
34	60-61	$d_{W1}d_{W1}$	Direction of predominant swell waves	Tens of degrees, WMO code table 0877; encoded 00 or 99 where applicable. Blanks = no observation of waves attempted.	
35	62-63	$P_{W1}P_{W1}$	Period of predominant swell waves	Whole seconds; encoded 99 where applicable (see under element 32)	
36	64-65	$H_{W1}H_{W1}$	Height of predominant swell waves	Half-meter values (see under element 33)	
37	66	I_s	Ice accretion on ships	WMO code table 1751	
38	67-68	E_sE_s	Thickness of ice accretion	In centimeters	
39	69	R_s	Rate of ice accretion	WMO code table 3551	
40	70		Source of observation	0 – Unknown 1 – Logbook (paper) 2 – National Telecommunication channels 3 – National Publications 4 – Logbook (electronic) 5 – Global Telecommunication channels (GTS) 6 – International Publications [Note: Formerly (usage now discontinued): codes 1-3 also referred to “National data exchange,” and codes 4-6 also referred to “International data exchange”; distinction added between paper and electronic logbook]	
41	71		Observation platform	0 – Unknown 1 – Selected ship 2 – Supplementary ship 3 – Auxiliary ship 4 – Registered VOSClim ship 5 – Fixed sea station (e.g., rig or platform) 6 – Coastal station [Note: 7 – Reserved] [Note: 8 – Reserved] 9 – Others/data buoy [Note: Formerly (usage now discontinued): code 4 referred to “Automated station/data buoy;” and codes 7-8 referred to “Aircraft” and “Satellite,” respectively]	
42	72-78		Ship’s call sign	Ship’s call sign stored left-justified (with right-blank fill) as follows: 7-character call sign: columns 72–78 6-character call sign: columns 72–77	

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*	
				5-character call sign: columns 72–76 4-character call sign: columns 72–75 3-character call sign: columns 72–74	
43	79-80		Country which has recruited the ship	According to the 2-character alphabetical codes assigned by the International Organization for Standardization (ISO)	
44	81		National use		
45	82		Quality control indicator	0 – no QC has been performed 1 – manual QC only 2 – automated QC only (such as using only MQC) 3 – automated QC only (with time sequence checks) 4 – manual and automated QC (superficial) 5 – manual and automated QC (superficial; with time-sequence checks) 6 – manual and automated QC (intensive; with time-sequence checks) 7 – [reserved] 8 – [reserved] 9 – national system of QC (information to be furnished to WMO)	
46	83	i_X	Weather data indicator	1 – Manual	
				4 – Automatic	If present and past weather data included Code tables 4677 and 4561 used
				7 – Automatic	If present and past weather data included Code tables 4680 and 4531 used
47	84	i_R	Indicator for inclusion or omission of precipitation data	WMO code table 1819	
48	85-87	RRR	Amount of precipitation which has fallen during the period preceding the time of observation, as indicated by t_R	WMO code table 3590	
49	88	t_R	Duration of period of reference for amount of precipitation, ending at the time of the report	WMO code table 4019	
50	89	s_w	Sign of wet-bulb temperature	0 – positive or zero measured wet-bulb temperature 1 – negative measured wet-bulb temperature 2 – iced measured wet-bulb temperature 5 – positive or zero computed wet-bulb temperature 6 – negative computed wet-bulb temperature 7 – iced computed wet-bulb temperature	
51	90-92	$T_bT_bT_b$	Wet-bulb temperature	In tenths of degree Celsius, sign given by element 50	

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*
52	93	a	Characteristic of pressure tendency during the three hours preceding the time of observation	WMO code table 0200
53	94-96	ppp	Amount of pressure tendency at station level during the three hours preceding the time of observation	In tenths of hectopascal
54	97	D_s	True direction of resultant displacement of the ship during the three hours preceding the time of observation	WMO code table 0700
55	98	v_s	Ship's average speed made good during the three hours preceding the time of observation	WMO code table 4451
56	99-100	$d_{W2}d_{W2}$	Direction of secondary swell waves	Tens of degrees, WMO code table 0877; encoded 00 or 99 where applicable. Blanks – no observation of waves attempted.
57	101-102	$P_{W2}P_{W2}$	Period of secondary swell waves	Whole seconds; encoded 99 where applicable (see under element 32)
58	103-104	$H_{W2}H_{W2}$	Height of secondary swell waves	Half-meter values (see under element 33)
59	105	c_i	Concentration or arrangement of sea ice	WMO code table 0639
60	106	S_i	Stage of development	WMO code table 3739
61	107	b_i	Ice of land origin	WMO code table 0439
62	108	D_i	True bearing of principal ice edge	WMO code table 0739
63	109	z_i	Present ice situation and trend of conditions over the preceding three hours	WMO code table 5239
64	110		FM code version	0 – previous to FM 24-V 1 – FM 24-V 2 – FM 24-VI Ext. 3 – FM 13-VII 4 – FM 13-VIII 5 – FM 13-VIII Ext. 6 – FM 13-IX 7 – FM 13-IX Ext. 8 – FM 13-X 9 – FM 13-XI A – FM 13-XII Ext. B – FM 13-XIII

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*
				C – FM 13-XIV Ext. [Note: etc. for future configurations]
65	111		IMMT version	0 – IMMT version just prior to version number being included 1 – IMMT-1 (in effect from 2 Nov. 1994) 2 – IMMT-2 (in effect from Jan. 2003) 3 – IMMT-3 (in effect from Jan. 2007) 4 – IMMT-4 (in effect from Jan. 2011) 5 – IMMT-5 (in effect from June 2012) [Note: etc. for future configurations]
66	112	Q_1	Quality control indicator for (h)	0 – no QC has been performed on this element 1 – QC performed; element appears correct 2 – QC performed; element appears inconsistent with other elements 3 – QC performed; element appears doubtful 4 – QC performed; element appears erroneous 5 – QC performed; element changed (possibly to missing) as a result 6 – QC flag amended: element flagged by CM as correct (1), but according to MQCS still appears suspect (2-4) or missing (9) 7 – QC flag amended: element flagged by CM as changed (5), but according to MQCS still appears suspect (2-4) 8 – [reserved] 9 – element is missing
67	113	Q_2	QC indicator for (VV)	- idem -
68	114	Q_3	QC indicator for (N and clouds: elements 12, 24–27)	- idem -
69	115	Q_4	QC indicator for (dd)	- idem -
70	116	Q_5	QC indicator for (ff)	- idem -
71	117	Q_6	QC indicator for (s_n and TTT)	- idem -
72	118	Q_7	QC indicator for (s_t and $T_dT_dT_d$)	- idem -
73	119	Q_8	QC indicator for (PPPP)	- idem -
74	120	Q_9	QC indicator for (weather: ww, W_1, W_2; elements 21–23)	- idem -
75	121	Q_{10}	QC indicator for (s_n and $T_WT_WT_W$)	- idem -
76	122	Q_{11}	QC indicator for (P_WP_W)	- idem -
77	123	Q_{12}	QC indicator for (H_WH_W)	- idem -
78	124	Q_{13}	QC indicator for (swell: elements 34–36, 56–58)	- idem -
79	125	Q_{14}	QC indicator for	- idem -

Element Number	Character Number	Code	Element	Coding procedure
			(i_RRRRt_R)	
80	126	Q_{15}	QC indicator for (a)	- idem -
81	127	Q_{16}	QC indicator for (ppp)	- idem -
82	128	Q_{17}	QC indicator for (D_s)	- idem -
83	129	Q_{18}	QC indicator for (v_s)	- idem -
84	130	Q_{19}	QC indicator for (s_w and $T_bT_bT_b$)	- idem -
85	131	Q_{20}	QC indicator for ships' position	- idem -
86	132	Q_{21}	Version identification for Minimum Quality Control Standard (MQCS)	1 – MQCS-1 (Original version, Feb. 1989): CMM-X 2 – MQCS-2 (Version 2, March 1997) CMM-XII 3 – MQCS-3 (Version 3, April 2000) SGMC-VIII 4 – MQCS-4 (Version 4, June 2001): JCOMM-I 5 – MQCS-5 (Version 5, July 2004): ETMC-I 6 – MQCS-6 (Version 6, November 2009)) JCOMM-III 7 – MQCS-7 (Version 7, in effect from June 2012) JCOMM-IV [Note: etc. for future configurations]
			Additional Requirements for VOSClim:	
87	133-135	HDG	Ship's heading; the direction to which the bow is pointing, referenced to true North	(001-360); e.g. 360 = North 090 = East
88	136-138	COG	Ship's ground course; the direction the vessel actually moves over the fixed earth and referenced to True North	(000-360); e.g. 360 = North 000 = No Movement 090 = East
89	139-140	SOG	Ship's ground speed; the speed the vessel actually moves over the fixed earth	(00-99); Round to nearest whole knot
90	141-142	SLL	Maximum height in meters of deck cargo above Summer maximum load line (reference level)	(00-99); Round to nearest whole meter
91	143	s_L	Sign of departure of reference level	0 = positive or zero, 1 = negative
92	144-145	hh	Departure of reference level (Summer maximum load line) from	Difference to the nearest whole meter (00-99) between the Summer maximum load line and the sea level (water line); positive when the Summer maximum load line is above the level

Element Number	*Character Number*	*Code*	*Element*	*Coding procedure*
			actual sea level	of the sea and negative if below the water line
93	146-148	RWD	Relative wind direction in degrees off the bow	Relative wind direction; e.g. 000 = no apparent relative wind speed (calm conditions on deck). Reported direction for relative wind = 001-360 degrees in a clockwise direction off the bow of the ship. When directly on the bow, RWD = 360.
94	149-151	RWS	Relative wind speed indicated by i_w (knots or m s^{-1})	Reported in either whole knots or whole meters per second (e.g. 010 knots or 005 m s^{-1}). Units established by i_w (element 14) [Note: RWS is a 3-character field to store values of RWS larger than ff (if i_w indicates knots), e.g. ff=98 knots, RWS=101 knots; see also element 15.]
95	152	Q_{22}	QC indicator for (HDG)	[Note: coding as for element 66]
96	153	Q_{23}	QC indicator for (COG)	– idem –
97	154	Q_{24}	QC indicator for (SOG)	– idem –
98	155	Q_{25}	QC indicator for (SLL)	– idem –
	156		blank	[Note: Formerly (usage now discontinued): QC indicator for (s_L); now Q_{27} serves as the indicator for both s_L and hh]
99	157	Q_{27}	QC indicator for (s_L and hh)	– idem –
100	158	Q_{28}	QC indicator for (RWD)	– idem –
101	159	Q_{29}	QC indicator for (RWS)	– idem –
102	160-163	RH	Relative humidity	Tenths of Percentage
103	164	RHi	Relative humidity indicator	0 – Relative humidity in tenths of Percentage, measured and originally reported 1 – Relative humidity in whole Percentage, measured and originally reported [Note: 2 – Reserved] 3 – Relative humidity in tenths of Percentage, computed 4 – Relative humidity in whole Percentage, computed
104	165	AWSi	AWS indicator	0 – No Automated Weather Station (AWS) 1 – AWS 2 – AWS plus Manual Observation
105	166-172	IMOno	IMO number	Seven digits (or left justified with right-blank fill)

APPENDIX D

MINIMUM QUALITY CONTROL STANDARD (MQCS)

MQCS-7 (Version 7)

Notes:

(a) See the specifications for setting quality control Indicators Q_1 to Q_{29} at the end of this Annex

(b) Δ = space (ASCII 32)

Element	***Error***	***Action***
1	$i_T \neq 3 - 5$, Δ	Correct manually otherwise 3
2	AAAA ≠ valid year	Correct manually otherwise reject
3	MM ≠ 01 - 12	Correct manually otherwise reject
4	YY ≠ valid day of month	Correct manually otherwise reject
5	GG ≠ 00 - 23	Correct manually otherwise reject
6	Qc ≠ 1, 3, 5, 7	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	Q_c = Δ	$Q_{20} = 2$
7	$L_aL_aL_a \neq$ 000-900	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$L_aL_aL_a$ = ΔΔΔ	$Q_{20} = 2$
8	$L_oL_oL_oL_o \neq$ 0000-1800	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$L_oL_oL_oL_o$ = ΔΔΔΔ	$Q_{20} = 2$
	$L_aL_aL_a = L_oL_oL_oL_o$ = ΔΔΔ(Δ)	Correct manually otherwise reject
Time sequence checks		
	Change in latitude > 0.7°/hr	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 0.7 °/hr when lat. 00-39.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 1.0 °/hr when lat. 40-49.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 1.4 °/hr when lat. 50-59.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 2.0 °/hr when lat. 60-69.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 2.7 °/hr when lat. 70-79.9	Correct manually otherwise $Q_{20} = 3$
9	Indicator ≠ 0-3, Δ	Correct manually, otherwise Δ
10	h ≠ 0-9	Correct manually and $Q_1 = 5$, otherwise $Q_1 = 4$
	h = Δ	$Q_1 = 9$
11	VV ≠ 90-99	Correct manually and $Q_2 = 5$, otherwise $Q_2 = 4$
	VV = ΔΔ	$Q_2 = 9$
12	N ≠ 0-9, Δ	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 4$
	$N < N_h$	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 2$
13	dd ≠ 00-36, 99	Correct manually and $Q_4 = 5$, otherwise $Q_4 = 4$
	dd = ΔΔ	$Q_4 = 9$
	dd versus ff	
	dd = 00, ff ≠ 00	Correct manually and Q_4 or $Q_5 = 5$ otherwise $Q_4 = Q_5 = 2$
	dd ≠ 00, ff = 00	Correct manually and Q_4 or $Q_5 = 5$ otherwise $Q_4 = Q_5 = 2$
14	$i_w \neq 0, 1, 3, 4$	Correct manually, otherwise $Q_5 = Q_{29} = 4$
15	ff > 80 knots	Correct manually and $Q_5 = 5$, otherwise $Q_5 = 3$
	ff = ΔΔ	$Q_5 = 9$
16	$s_n \neq 0, 1$	Correct manually, otherwise $Q_6 = 4$
17	TTT = ΔΔΔ	$Q_6 = 9$
	If -25 > TTT >40 then	
	when Lat. < 45.0	
	TTT < -25	$Q_6 = 4$
	TTT > 40	$Q_6 = 3$
	when Lat. ≥ 45.0	
	TTT < -25	$Q_6 = 3$
	TTT > 40	$Q_6 = 4$
TTT versus humidity parameters		

Element	***Error***	***Action***
	TTT < WB (wet bulb)	Correct manually and Q_6 = 5, otherwise Q_6=Q_{19}= 2
	TTT < DP (dew point)	Correct manually and Q_6 = Q_7 = 5, otherwise Q_6 = Q_7 = 2
18	$s_t \neq$ 0, 1, 2, 5, 6, 7	Correct manually, otherwise Q_7 =4
19	DP > WB	Correct manually and Q_7 = 5, otherwise Q_7=Q_{19} = 2
	DP > TTT	Correct manually and Q_7 = 5, otherwise Q_7 = Q_6 =2
	WB = DP = ΔΔΔ	Q_7 =Q_{19} = 9
20	930 > PPPP > 1050 hPa	Correct manually and Q_8 = 5, otherwise Q_8 = 3
	870 > PPPP > 1070 hPa	Correct manually and Q_8 = 5, otherwise Q_8 = 4
	PPPP = ΔΔΔΔ	Q_8 = 9
21	ww = 22-24, 26, 36-39, 48, 49, 56, 57, 66-79, 83-88	Correct manually and Q_9 = 5, otherwise Q_9= 4
	93-94 and latitude <20°	Correct manually and Q_9 = 5, otherwise Q_9 = 3
	if i_x = 7: w_aw_a = 24 - 25, 35, 47-48, 54-56, 64-68, 70-78, 85-87 and latitude <20°	Correct manually and Q_9 = 5, otherwise Q_9= 4
22, 23	W_1 or W_2 = 7 and latitude <20°	Correct manually and Q_9 = 5, otherwise Q_9= 4
	$W_1 < W_2$	Correct manually and Q_9 = 5, otherwise Q_9 = 2
	$W_1 = W_2$ = ww = ΔΔΔΔ	Q_9 = 9
24-27	N = 0, and $N_hC_LC_MC_H \neq$ 0000	Correct manually and Q_3 = 5, otherwise Q_3 = 2
	N = Δ, and $N_hC_LC_MC_H \neq$ ΔΔΔΔ	Correct manually and Q_3 = 5, otherwise Q_3 = 2
	N = 9, and not (N_h =9 and $C_LC_MC_H \neq$ ΔΔΔ	Correct manually and Q_3 = 5, otherwise Q_3 = 2
	N=Δ, and $N_hC_LC_MC_H$=ΔΔΔΔ	Q_3 = 9
28	$s_n \neq$ 0, 1	Correct manually otherwise Q_{10} = 4
29	$T_WT_WT_W$ = ΔΔΔ	Q_{10} = 9
	if -2.0 > $T_wT_wT_w$ > 37.0 then when Lat. < 45.0	
	$T_WT_WT_W$ < -2.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 4
	$T_wT_wT_w$ > 37.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 3
	when Lat. ≥ 45.0	
	$T_WT_WT_W$ < -2.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 3
	$T_WT_WT_W$ > 37.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 4
30	Indicator ≠ 0-7, Δ	Correct manually, otherwise Δ
31	Indicator ≠ 0-9, Δ	Correct manually, otherwise Δ
32	20 < P_wP_w < 30	Q_{11} = 3
	P_WP_W ≥ 30 and ≠ 99	Q_{11} = 4
	P_WP_W = ΔΔ	Q_{11} = 9
33	35< HwHw < 50	Q_{12} = 3
	H_WH_W ≥ 50	Q_{12} = 4
	H_WH_W = ΔΔ	Q_{12} = 9
34	d_{w1} $d_{w1} \neq$ 00-36, 99	Correct manually and Q_{13} = 5, otherwise Q_{13} = 4
	$swell_1$ = $swell_2$ = Δ	Q_{13} = 9
35	25 < $P_{w1}P_{w1}$ < 30	Q_{13} = 3
	$P_{w1}P_{w1}$ ≥ 30 and ≠ 99	Q_{13} = 4
36	35 < $H_{w1}H_{w1}$ < 50	Q_{13} = 3
	$H_{w1}H_{w1}$ ≥ 50	Q_{13} = 4
37	$I_s \neq$ 1-5, Δ	Correct manually, otherwise Δ
38	$E_sE_s \neq$ 00-99, ΔΔ	Correct manually, otherwise ΔΔ
39	$R_s \neq$ 0-4, Δ	Correct manually, otherwise Δ
40	Source ≠ 0-6	Correct manually, otherwise Δ
41	Platform ≠ 0-9	Correct manually, otherwise Δ
42	No call sign	Insert manually, mandatory entry
43	No country code	Insert manually
44	No Quality Control	
45	Q ≠ 0-6, 9	Correct manually, otherwise Δ
46	$i_x \neq$ 1-7	Correct manually, otherwise Δ
47	i_R = 0-2 and RRR = 000, ΔΔΔ	Correct manually, otherwise Q_{14} = 4
	i_R = 3 and RRR ≠ ΔΔΔ	Correct manually, otherwise Q_{14} = 2
	i_R = 4 and RRR ≠ ΔΔΔ	Correct manually, otherwise Q_{14} = 2
	$i_R \neq$ 0- 4	Correct manually, otherwise Q_{14} = 4
48	RRR ≠ 001-999 and iR = 1, 2	Correct manually and Q_{14} = 5, otherwise Q_{14} = 2
49	$t_R \neq$ 0-9, Δ	Correct manually and Q_{14} = 5, otherwise Q_{14} = 4
50	$s_w \neq$ 0, 1, 2, 5, 6, 7	Correct manually, otherwise Q_{19} = 4

Element	***Error***	***Action***
51	WB < DP	Correct manually and Q_{19} = 5, otherwise Q_{19}=Q_7=2
	WB = ΔΔΔ	Q_{19} = 9
	WB > TTT	Correct manually and Q_{19}= 5, otherwise Q_{19}=Q_6=2
52	a ≠ 0-8	Correct manually and Q_{15} = 5, otherwise Q_{15} = 4
	a = 4 and ppp ≠ 000	Correct manually and Q_{15} or Q_{16} = 5, otherwise Q_{15}=Q_{16}=2
	a =1,2,3,6,7,8 and ppp=000	Correct manually and Q_{15} or Q_{16} = 5, otherwise Q_{15}=Q_{16} = 2
	a = Δ	Q_{15} = 9
53	250 ≥ ppp > 150	Correct manually and Q_{16} = 5, otherwise Q_{16} = 3
	ppp > 250	Correct manually and Q_{16} = 5 otherwise Q_{16} = 4
	ppp = ΔΔΔ	Q_{16} = 9
54	D_s ≠ 0-9	Correct manually and Q_{17} = 5, otherwise Q_{17} = 4
	D_s = Δ	Q_{17} = 9
55	V_s ≠ 0-9	Correct manually and Q_{18} = 5, otherwise Q_{18} = 4
	V_s = Δ	Q_{18} = 9
56	$d_{w2}d_{w2}$ ≠ 00-36, 99, ΔΔ	Correct manually and Q_{13} = 5, otherwise Q_{13} = 4
57	25 < $P_{w2}P_{w2}$ < 30	Q_{13} = 3
	$P_{w2}P_{w2}$ ≥ 30 and ≠99	Q_{13} = 4
58	35 < $H_{w2}H_{w2}$ < 50	Q_{13} = 3
	$H_{w2}H_{w2}$ ≥ 50	Q_{13} = 4
59	c_i ≠ 0-9, Δ	Correct manually, otherwise Δ
60	S_i ≠ 0-9, Δ	Correct manually, otherwise Δ
61	b_i ≠ 0-9, Δ	Correct manually, otherwise Δ
62	D_i ≠ 0-9, Δ	Correct manually, otherwise Δ
63	z_i ≠ 0-9, Δ	Correct manually, otherwise Δ
64	version ≠ 0-9, A-C, Δ	Correct manually, otherwise Δ
65	version ≠ 0-4, Δ	Correct manually, otherwise Δ
86	Minimum Quality Control Standard (MQCS) version identification	1= MQCS-1 (Original version, Feb. 1989) CMM-X 2= MQCS-2 (Version 2, March 1997) CMM-XII 3= MQCS-3 (Version 3, April 2000) SGMC-VIII 4= MQCS-4 (Version 4, June 2001) JCOMM-I 5= MQCS-5 (Version 5, July 2004) ETMC-I 6 = MQCS-6 (Version 6, November 2009) JCOMM-III) 7 = MQCS-7 (Version 7, in effect from June 2012) JCOMM-IV
87	HDG ≠ 001-360	Correct manually and Q_{22} = 5, otherwise Q_{22} = 4
	HDG = ΔΔΔ	Q_{22} = 9
88	COG ≠ 000-360	Correct manually and Q_{23} = 5, otherwise Q_{23} = 4
	COG = ΔΔΔ	Q_{23} = 9
89	SOG ≠ 00 - 99	Correct manually and Q_{24} = 5, otherwise Q_{24} = 4
	SOG = ΔΔ	Q_{24} = 9
	SOG > 33	Correct manually and Q_{24} = 5, otherwise Q_{24} = 3
90	SLL ≠ 00-99	Correct manually and Q_{25} = 5, otherwise Q_{25} = 4
	SLL = ΔΔ	Q_{25} = 9
	SLL > 40	Correct manually and Q_{25} = 5, otherwise Q_{25} = 3
91	s_L ≠ 0,1	Correct manually and Q_{27} = 5, otherwise Q_{27} = 4
92	hh ≠ 00 – 99	Correct manually and Q_{27} = 5, otherwise Q_{27} = 4
	hh = ΔΔ	Q_{27} = 9
	hh >= 13	Correct manually and Q_{27} = 5, otherwise Q_{27} = 3
	hh < -01	Correct manually and Q_{27} = 5, otherwise Q_{27} = 4
93	RWD ≠ 000 - 360, 999	Correct manually and Q_{28} = 5, otherwise Q_{28} = 4
	RWD = ΔΔΔ	Q_{28} = 9
94	RWS ≠ 000 - 999	Correct manually and Q_{29} = 5, otherwise Q_{29} = 4
	RWS = ΔΔΔ	Q_{28} = 9
	RWS > 110 kts	Correct manually and Q_{29} = 5, otherwise Q_{29} = 3
RWD versus RWS		
	RWD = 000, RWS ≠ 000	Correct manually and Q_{28} or Q_{29} = 5, otherwise Q_{28} = Q_{29} = 2
	RWD ≠ 000, RWS = 000	Correct manually and Q_{28} or Q_{29} = 5, otherwise Q_{28} = Q_{29} = 2

Element	***Error***	***Action***
Specifications for setting quality control Indicators Q_1 to Q_{29}		
0	No quality control (QC) has been performed on this element	
1	QC has been performed; element appears to be correct	
2	QC has been performed; element appears to be inconsistent with other elements	
3	QC has been performed; element appears to be doubtful	
4	QC has been performed; element appears to be erroneous	
5	The value has been changed as a result of QC	
6	The original flag is set “1” (correct) and the value will be classified by MQCS as inconsistent, dubious, erroneous or missing	
7	The original flag is set “5” (amended) and the value will be classified by MQCS as inconsistent, dubious, erroneous or missing	
8	Reserve	
9	The value of the element is missing	