Global Collecting Centres for Marine Climatological Data

Annual Report 2010

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1. Introduction

1.1 Origin of the GCCs

In 1963, the WMO Commission for Marine Meteorology (CMM) established the Marine Climatological Summaries Scheme (MCSS). Their objective was to develop and maintain a joint effort of all maritime nations in the collection of marine data and the production of climatological statistics. To achieve this, eight Responsible Members (RMs) were appointed; Germany, Hong Kong, India, Japan, Russia, The Netherlands, UK and USA. Each of the eight RMs were assigned a specific area of responsibility (see Appendix A) for which they were to manage and archive the data. Any queries/data requests regarding these areas are to be directed to the appropriate RM.

In 1993, the WMO CMM agreed there was a need to improve the flow and quality control of global marine data. As a result, two Global Collecting Centres (GCCs) were established; one based at the DWD (Germany) and the other at the Met Office (UK). The GCCs are collecting, processing and distribution points for delayed mode marine Voluntary Observing Ship (VOS) data.

It is the responsibility of each Contributing Member (CM) to collect data from VOS, apply a minimum quality control and regularly submit these to both GCCs. The GCCs ensure these data meet the Minimum Quality Control Standards (MQCS) and, four times a year (at the beginning of April, July, October and January), re-distribute the data to the eight RMs. It is important that the GCCs work in close co-operation and apply identical procedures. This ensures that even in the event one centre fails, the data flow can continue unaffected.

For further details of the GCCs' work see websites above.

1.2 The 2010 report of the GCCs

This 2010 report marks the 17th year of GCC operation.

The GCC report is split into six sections that highlight data processing/quality information, new developments, future planning and MCSS activities over the past year. Section 2 details VOS data received throughout 2010 which includes the amounts of data received, data

quality and problems encountered while GCC processing. Section 3 describes the distribution of all data received. Future development within the GCCs and the report summary is contained within section 4 & 5. Section 6 provides information on contributions to JCOMM's VOSClim ships, detailing volumes and quality of data received from VOSClim registered ships.

2. Voluntary Observing Ships (VOS)

2.1 VOS Data Contributions 2010

In 2010 the GCCs received data from 17 countries contributing to 489,117 observations in total (Table I). This is significantly less than in previous years (in fact the lowest since the GCCs began) being about half the amount usually expected in one year (Figure 1). The reason for this decrease is a combination of factors, including (i) no data backlogs were contributed in 2010 – for many years now various CMs have contributed a large batch of data all at once which for one reason or another they had not been able to contribute previously; (ii) in the past considerable volumes of buoy/GTS data have been contributed by some CMs but in 2010 this was greatly reduced (this contributed to a reduction of around 150k observations), and (iii) generally CMs just contributed less data in 2010 – 11 CMs submitted nothing or less than 2009 whereas only 6 CMs contributed more.

During the year the GCCs have where possible provided assistance to CMs that have had trouble submitting their data. This enabled Greece, Israel & Sweden to contribute which would otherwise not have been possible. Also Canada has sent VOS observations in FM13 SHIP code, which will eventually be added to the MCSS after the GCCs convert to IMMT format. Contributions from these CMs are expected to continue into 2011 and the GCCs will actively encourage more CMs to make their data available.

A detailed analysis in Table II displays which CMs have contributed each year since the GCCs began their work. The table shows that some CMs that have contributed (often regularly) in the past failed to do so in 2010. The GCCs would ask these countries in particular to get in contact with the GCCs so they can provide advice and support if possible.

The majority of data received by the GCCs arrive by email and anonymous FTP transfer. Data are contributed in IMMT format with most submissions in 2010 received in the preferred IMMT-3 (92.4% IMMT-3, 4.3% IMMT-2, 3.3% IMMT-1). CMs are reminded that as of 1st January 2011 IMMT-4 is the new and preferred format.

In 2008 a problem became apparent that significant volumes of data were being re-submitted in later quarters. When data are resubmitted during different quarters/years these duplicates cannot be rejected by routine GCC processing and thus distributed to RMs for archival. Only during RM's further quality processing might this problem be identified. After highlighting this problem in correspondence with some CMs and in the 2008/2009 Annual Reports the GCCs are now pleased to note that during 2010 this did not appear to be a problem with quarterly duplicates differing only slightly from the complete year's dataset.

The number of observations received each month by the GCCs during 2010 is shown in figure 2. Data was received from as far back as 1987 (Figure 3 and 6) and although data spans 24 years 67% of observations were from 2009 and 2010 alone. Figure 4 displays the number of ships sending data for each year reported with, predictably, most ships sending observations for 2009 and 2010. The GCCs appreciate prompt submission of data, however, old data is still important and welcomed as a valuable addition to the global database.

It has been previously mentioned in the 2007-2009 GCC Annual Reports that there is a continuing problem with an increasing number of ships reporting under the anonymous/masked callsign of 'SHIP' (or similar). This is still an issue and is mostly done because of security concerns. It is not solely a problem for real-time data. When callsigns

are masked it is not possible for GCCs and RMs to fully quality control these data; comparisons with real-time, verifying positions/routes and identifying duplicates can prove extremely difficult. It is crucial that CMs ensure masked callsigns are converted back to true IDs prior to submission and that the GCCs are informed of the real-time callsign for comparison. Where possible, the GCCs ask CMs to submit their delayed mode data only when it is no longer sensitive and does not require masking.

2.2 VOS Data Processing

To ensure data meets the JCOMM agreed Minimum Quality Control Standard (MQCS-V in 2010), data are processed through a series of GCC programs. Processing draws attention to invalid dates, invalid positions, out-of-range values, invalid coding (i.e. '/' instead of blank) and missing indicators. At the final stage of processing, elements are given flags related to their quality and these are compared to flags set by the CM.

During GCC processing there are some instances where simple errors within the date, time, position or identifier (IMMT elements 2-8, 42) are noted. Although simple, errors of this sort can be detrimental to the validity of the whole observation, but these can normally be corrected after GCC consultation with the CM. Checking of data by the CM before submission would save time and help alleviate this problem. On occasion, however, some errors are not corrected and these data are then rejected from the dataset to a 'dregs' file. Occurrences of this sort, mostly due to duplicated data, equated to 486 observations (0.1%) received in 2010.

Correct positioning is still an issue to be considered, with on-land observations being reported. The areal distribution map in figure 5 shows the main shipping lanes between continents and much data concentrated at the coasts. The locations of observations reported erroneously on-land are highlighted in red. This problem remains relatively small with only 134 (0.03%) observations reported on-land from submissions during 2010 (2009: 0.02%, 2008:0.07%). This may be helped by the increasing use of electronic logbooks with their built-in QC of on-land positioning.

2.2.1 VOS Data Processing – Detailed Analysis

A detailed analysis of GCC processing identified further issues in the reporting of observations. Some data are still submitted with FM13 coding of "/" or "-" instead of a blank as required by IMMT. This use of invalid coding decreased in 2010 to less than 0.01% of occasions (2009: 0.09%, 2008: 0.06%).

The MQC software compares CM flags already set on the data to those the MQCS-V would set. This showed that in 2010 the percentage of observations from CMs without any flags set significantly decreased to 0.3% (2009: 8.1%, 2008: 4.1%). 92.9% of data were checked with MQC standards or higher before contributed to the GCCs, but still 7% were submitted without any quality control. Further analysis identifies 6,557 (0.05%) occasions where flags conflicting with MQCS-V required resetting to a level of 6 or 7 (see extract from GCC 1994 report in Appendix B for details of flag values).

There is evidence to show that the percentage of elements reported blank has varied frequently over past years (figure 7). The most commonly reported blank elements are still precipitation, swell direction and height of lowest cloud. 2007-2009 showed an increase in most elements being reported as blank but results from 2010 show a significant decrease - this is likely to be due to the reduced number of observations contributed to the GCCs from automated stations (which usually omit visual-based elements). Interestingly there has been a significant increase in the occurrence of blanks values for both dewpoint and wet-bulb temperature.

Throughout the year detailed two-way email correspondence was conducted with many CMs on the improvement of data quality and resolvution of problems.

3. Dispatch of Data

During the year, four data collectives are dispatched via FTP server to RMs (and is available to all CMs if requested), one after the end of each quarter. The collectives are checked by MQCS-V, and as a consequence the quarterly dispatched data are distributed in IMMT-3 format. The data's original IMMT format may be different and is coded in IMMT element 65. Since the 1st quarterly data exchange 2010 the data has also been distributed in IMMA format.

The dispatched data comprises of three files; the 'good' file holding all reports which successfully passed the MQC, the 'dregs' containing data which were rejected due to errors in organisational information and the third 'msgs' or 'warn' file holding information on the 'dregs' observations and other problems arising within the file. It is the responsibility of each RM to decide how to proceed with these data, either omitting or correcting the 'dregs' and other data.

RMs not only receive data for their area of responsibility but they now all receive the full global dataset. Requests for data/summaries can be made directly to any of the RMs, however, the cost of processing is sometimes charged.

4. Developments & Activities

TT-DMVOS: The JCOMM Data Management Coordination Group (DMCG) has previously agreed that maintaining the delayed-mode VOS data flow is important, but the way in which this is done through the MCSS needs to be modernised. As recommended, a Task Team on Delayed-Mode Voluntary Observing Ship data (TT-DMVOS) was officially established at the ETMC meeting in 2007. The team has been tasked with improving the data flow to suit modern user needs, establishing requirements for the IMMT & MQCS format, investigating the reconciliation of IMMT and IMMA formats, establishing a more detailed QC (HQC), and creating a web site to share any relevant information. A task list was agreed by members during August 2007 and work has commenced. A side-conference of the TT-DMVOS is planned along side the MARCDAT conference in Frascati, Italy, in May 2011.
For details of the TT-DMVOS refer to the JCOMM website:
http://www.jcomm.info/index.php?option=com_oe&task=viewGroupRecord&groupID=158

ETMC-III: The ETMC met for the 3rd time in February 2010 in Melbourne, Australia. Amongst much fruitful discussion and collaboration it was decided a new Task Team should be proposed and ToR defined for a new WMO-IOC Data Centre CMOC - a formal recommendation should be made at JCOMM-IV 2012. *[see photo 1]* Meeting documentation can be found at on the JCOMM website:
http://www.jcomm.info/index.php?option=com_oe&task=viewEventDocs&eventID=557

Future VOS Data-Flow: In addition to tasks highlighted in the 2008 GCC Annual Report, the TT-DMVOS have proposed a new future VOS data flow (see Appendix C), incorporating real-time data, more advanced quality control procedures (HQC), single point data storage & access and new modernized end products. User requirements and development of the new data flow has been discussed at length within the wider VOS community and was endorsed by JCOMM-III.

New Higher Level Quality Standard (HQCS): Development of a more detailed QC is underway. The DWD plan to present plans and work to date at the JCOMM Ship Observations Team (SOT) Scientific and technical Workshop in Hobart, Australia in April 2011.

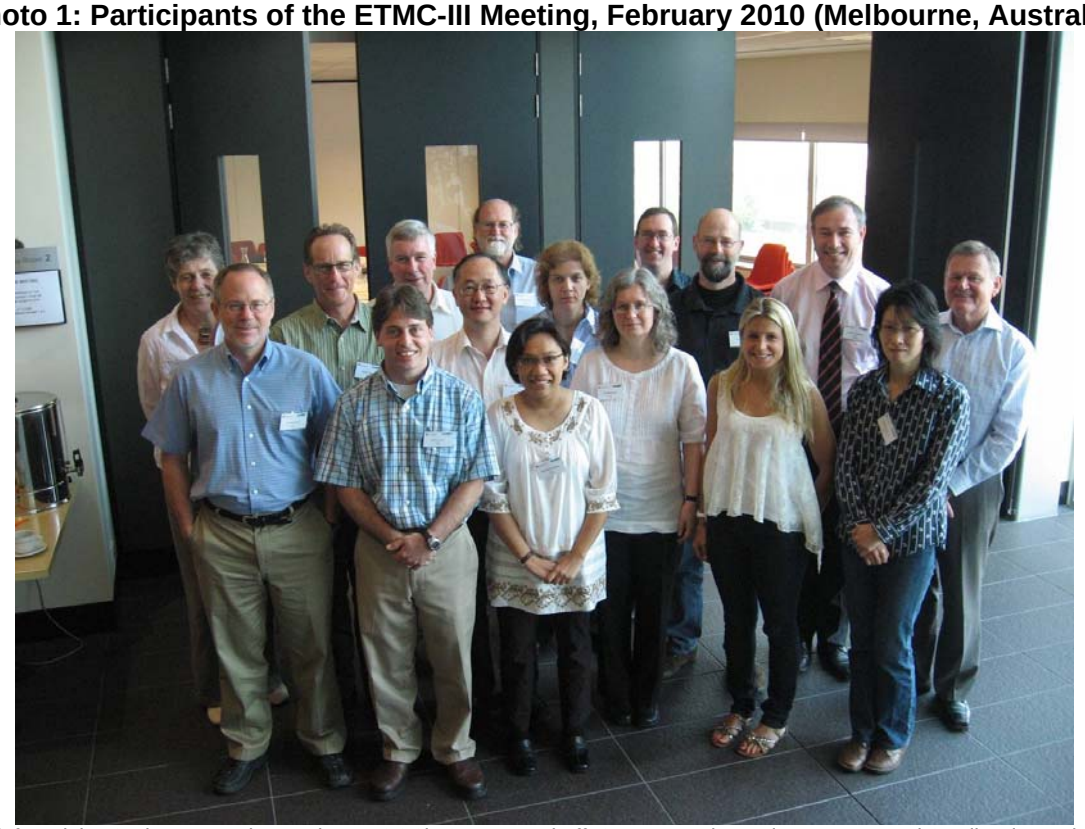
New Versions of IMMT/MQCS: IMMT-4 & MQCS-6 have been adopted by JCOMM-III (Nov 2009) for general use from 1st January 2011. Changes include the addition of a VOSClim indicator, IMO Number, Relative Humidity and an AWS indicator. It has been suggested, and generally agreed to, that the next changes to IMMT/MQCS after version 4 and 6 respectively will be a radical change throughout – allowing for more modern requirements i.e. high resolution position, minutes, the new flags resulting from a new HQCS etc. Discussions regarding a future format have already begun within the VOS community.

Quarterly Exchange in IMMA format: In line with aspirations of greater interoperability between WMO systems (WIGOS Framework) the TT-DMVOS recommended that the quarterly dataset be made available in the ICOADS IMMA format in additional to the usual IMMT. Since the 1st quarter 2010 the GCCs have made quarterly exchange data available in both IMMT-3 and IMMA via FTP transfer.

The WIGOS Pilot Project for JCOMM: Over the past couple of years the GCC has been involved in the WMO Integrated Global Observing System (WIGOS) initiative http://www.jcomm.info/index.php?option=com_content&task=view&id=42&Itemid=54. The GCC was a member of the pilot project steering team taking a role of data provider. As a consequence the ocean data portal (ODP) has been installed at the Met Office and it is expected that during 2011 the GCC data will be made available via this website http://odp.oceandataportal.net/odp/data/search.

Developments with the WIS (WMO Information System: The GCC as DCPC are also testing their functions under the German GISC and now the quarterly MQCS checked GCC data as well as the original raw files from 1994 onwards are available at http://gisc.dwd.de/GISC_DWD/toSimpleSearch.do.

Photo 1: Participants of the ETMC-III Meeting, February 2010 (Melbourne, Australia)



From left to right: Gudrun Rosenhagen (DWD GCC), Scott Woodruff, Steven Worley, Eric Freeman, Val Swail, Wing-Tak Wong, Martin Rutherford, Nelly Florida Riama, Sissy Iona, Elizabeth Kent, Shawn Smith, Frits Koek, Nicky Scott (UK GCC), Etienne Charpentier, Mizuho Hoshimoto & Greg Reed.

5. Summary

To summarise, the GCCs continue to receive data from a number of CMs regularly and the quality remains good. The amount of data received in 2010 was less than half the amount received in previous years but beside others this is understood to have been due the decision to no longer submit some buoy/GTS data to the GCCs. Data amounts are expected to be higher than this in 2011, however, there could potentially be many more observations received by the GCCs each year if CMs having trouble submitting data seek advice from the GCCs.

There are still delays between our received and controlled data in the archives of the RMs and the collected and flagged data in other real-time international datasets. We would like to encourage all CMs to submit their observations, and if their ships do not record in a logbook they should submit their MQCS checked GTS data. This will give RMs the opportunity to check data with higher quality control for their archives and further processes.

There are some points from the report that need consideration from CMs.

- Each observation should only be submitted once. But if there is a requirement to resubmit this should be highlighted to the GCCs.
- If the CMs do not contribute their data in delayed mode they should submit their MQCS checked GTS data to make RMs able to check the data with higher quality control.
- Masked callsigns (i.e. 'SHIP') should be converted back to original prior to submission, if possible.
- Data files should be sent in one IMMT format only – from 1st January 2011 in IMMT-4 preferably.
- By applying MQCS to data prior to submission CMs can identify and rectify significant problems, in particular, issues within date, time and position.
- With improved compilation of observations, the presence of '/' and incorrect/missing flags could be addressed before submission.

During 2010 there were further advances made with modernizing the current MCSS. Further work is planned for 2011/2012.

There is increasing demand from areas in climate research, marine forecasting, satellite calibration, climate modeling and maritime industries for marine data. Therefore, it is hoped CMs appreciate the importance of their submissions and the value they add to the global marine database.

The GCCs would like to thank CMs for data that was submitted during 2010 and for their continued co-operation. As always, all members are invited to provide further feedback which may benefit the whole system and integrity of the marine database.

6. VOSClim Data 2010

6.1 VOSClim Project

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-V in May 2009 (Geneva, Switzerland) to cease the VOSClim project and integrate the VOSClim fleet and its reporting practises into the wider VOS community. As a consequence the new IMMT-4 format has been updated accordingly to include a VOSClim data indicator which should be selected if a ship has this capability.

The IMMT-2 format, which allowed delayed mode submission of VOSClim elements (element 87-93), came into effect in January 2003. Then the IMMT-3 format, which allows flags to be set on these additional elements (element 94-101), was formally accepted at the second session of JCOMM in September 2005.
For further details and information, refer to the VOSClim website http://www.ncdc.noaa.gov/oa/climate/vosclim/vosclim.html

As of 31st December 2010 there were 10 CMs in total with 355 recruited VOSClim ships worldwide. This is 23% more than at the end of 2009 which demonstrates VOSClim's progressive integration into the VOS community.

6.2 VOSClim Contributions

In 2010, VOSClim submissions were received from only seven of the ten CMs. The GCCs received 67,398 observations from VOSClim ships (Table III & IV), contributing to 14% of the total submissions for 2010 (Figure 8). The number of observations containing additional VOSClim elements is always notably less (60,222) than the total submitted but encouragingly this has been growing over the years to now around 90% of VOSClim data containing the extra elements. It is noted that the number of VOSClim ship observations remains relatively consistent over the last few years, even though the total number of VOS observations decreased in 2010.

There are still a considerable number of observations with additional elements received from non-VOSClim ships (see Table III - amounting to 6,304 in 2010). This number now appears to be decreasing as VOSClim capabilities are rolled out to the wider VOS community.

When initially processing VOSClim data there can be software issues involved which can delay submission to the GCCs. Any CMs having such problems are encouraged to make GCCs aware of this, because advice may be available to help.

As mentioned in section 2.1 masking of ship callsigns is becoming a considerable international problem. The UK Met Office's Real Time Monitoring Centre commitment for VOSClim data is unable to be properly fulfilled as VOSClim ships reporting under a masked callsign in real time cannot be effectively identified. Thankfully in 2010 there were very little data received in delayed mode by the GCCs with masked call signs so fortunately all VOSClim data were able to be forwarded to the DAC.

6.3 VOSClim Data Processing & Analysis

As with VOS contributions, observations are processed through a series of programs to ensure they pass the MQCS. In recent years it has been seen that reporting of SLL

(IMMT element 90) is an issue for the MQCS. In the first half of 2008 10% of VOSClim data were reported with SLL higher than the MQCS limit of 32m. This is most likely due to new ships and their deck cargo height being larger than before and so the MQCS-V limits have to be adapted for this new generation of ships. In August 2008 the ETMC agreed that the GCCs were allowed to use a corrected MQCS-V with a higher limit of 40m for SLL. The new MQCS-VI (to be used generally from 1st January 2011) includes this limit change also. Interestingly though in 0.5% of all VOSClim observations the element SLL is still greater than the new limit of 40m. Also the reported departure of summer maximum load line from actual sea level (hh, IMMT element 91-92) is a problem with 0.9% greater than the limit of 13m.

The GCCs are aware that some CMs are having problems sending VOSClim data in the newer formats. On occasion data has been submitted to the GCCs from VOSClim ships without inclusion of extra elements and then at a later date, these have been resubmitted with the VOSClim elements added. The GCCs would ask CMs to please hold submission until full observations can be sent, else RMs receive a great deal of duplicated data.

6.4 Dispatch of Data

As a result of an action from the TT-DMVOS, the way in which VOSClim data are now distributed has changed. Since July 2008 the complete quarterly dataset containing VOSClim data has been dispatched to RMs and to the Data Assembly Center in the USA. Previously, VOSClim data were extracted from the quarterly file and sent to the DAC, however, this was not always possible to do accurately if the VOSClim ship log was not up-to-date. As a result of this change in process, the DAC take responsibility of evaluating VOSClim observations and statistics. For details of quarterly VOSClim observations refer to information within Table III & IV which are provided by the Data Assembly Center in the USA.

Resubmitted data within later datasets is no longer an issue for VOSClim data.

6.5 Summary

2010 saw seven out of the ten CMs make submissions from VOSClim ships but there is still one CM left who has never contributed its VOSClim ship submissions to the GCCs. The GCCs would like to provide help to the CM with making these submissions, so please make contact.

There are some points from the report that need consideration from CMs.

- All VOSClim ship data submissions should include additional VOSClim elements.
- CMs with data not yet submitted from VOSClim ships are encouraged to send the data at their earliest convenience or contact GCCs if having trouble.
- Convert masked callsigns (i.e. ‘SHIP’) back to original prior to submission, if possible.
- To avoid duplicates please do not submit split observations (without VOSClim additional elements/flags). If CMs experience problems in exchanging the newer IMMT formats, wait until it is possible to do so before sending observations.
- The VOSClim project has now ceased and practices adopted within the wider VOS.

The GCCs would like to thank the CMs for their VOSClim data that has been submitted in 2010 and the continual co-operation. As you are in no doubt aware, data of this sort and quality are extremely important for climate change studies and research.

Abbreviations

CM	Contributing Member
CMM	Commission for Marine Meteorology (the forerunner to JCOMM)
CMOC	Centres for Marine-Meteorological and Ocean Climatological Data
DAC	Data Assembly Center
DCPC	Data Collecting and Production Centre
DE	Deutschland/Germany
DWD	Deutscher Wetterdienst
ETMC	Expert Team on Marine Climatology
GCC	Global Collecting Centre (MCSS / JCOMM)
GISC	Global Information System Centres (of WIS)
GTS	Global Telecommunication System
HQC	Higher Quality Control
IMMA	International Maritime Meteorological Archive Format
IMMT	International Maritime Meteorological Tape Format
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
MCSS	Marine Climatological Summaries Scheme
MQC	Minimum Quality Control (WMO Standard)
MQCS-V	Minimum Quality Control Standards (Version 5, July 2004)
MQCS-VI	Minimum Quality Control Standards (Version 6, June 2010)
NWP	Numerical Weather Prediction
ODP	Ocean Data Portal
RM	Responsible Member
SLL	Maximum height of deck cargo above summer load line (IMMT-2 & IMMT-3 element 90)
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 - Project)
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization

Table I: Number of CM Observations 2010

Country Name	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Argentina					
Australia	2,584	4,140	929	2,964	10,617
Brazil					
Canada					
Croatia					
France					
Germany	83,931	43,021	30,239	35,023	192,214
Greece	45,203				45,203
Hong Kong, China		460	375	450	1,285
India	181		730		911
Ireland			2,153	104	2,257
Israel	2,622		1,218	3,180	7,020
Japan	2,197	2,702	4,357	28,703	37,959
Kenya					
Malaysia	600		508	475	1,583
Netherlands	16,030		22,537		38,567
New Zealand	3,915	1,174	1,789	1,448	8,326
Nigeria					
Norway					
Poland				640	640
Russian Federation	10,027	10,113	10,019	10,036	40,195
Singapore					
South Africa	15	835	324		1,174
Sweden	5,677	7,072	3,775	8,679	25,203
United Kingdom	13,540	18,794	26,401	12,130	70,865
USA	2,765	848	1,485		5,098
17 of 26 Contributing Countries	189,287	89,159	106,839	103,832	**489,117**

Table II: Contributions by CM per year

MCSS-Member	ISO Alpha-2 code																	Number of Years with Contributions 1994 - 2010
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Argentina	AR								X		X	X	X	X	X	X			**7**
Australia	AU							X		X	X	X	X		X	X	X	X	**9**
Brazil	BR	X	X	X	X														**4**
Canada	CA																		**0**
Croatia	HR				X	X	X	X	X										**5**
France	FR	X	X	X	X	X			X		X	X	X	X	X	X	X		**13**
Germany	DE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**17**
Greece	GR																	X	**1**
Hong Kong, China	HK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**17**
India	IN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**17**
Ireland	IE			X	X	X				X							X	X	**6**
Israel	IL		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	**15**
Japan	JP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**17**
Kenya	KE																		**0**
Malaysia	MY	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	**15**
Netherlands	NL	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	**15**
New Zealand	NZ													X	X	X	X	X	**5**
Nigeria	NG																		**0**
Norway	NO	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		**15**
Poland	PL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**17**
Russian Federation	RU		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**16**
Singapore	SG		X	X	X	X					X	X	X	X					**8**
South Africa	ZA						X	X	X	X	X	X	X	X	X	X	X	X	**12**
Sweden	SE			X													X	X	**3**
United Kingdom	GB	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	**15**
United States	US	X	X	X	X	X	X	X		X	X				X	X	X	X	**13**

Table III: 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 2010

Country Name	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			Total		
Australia	0	0	31	1,322	1,125	243	191	190	0	1,208	1,191	0	2,721	2,506	274
Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Germany	8,829	8,572	0	3,557	3,554	0	3,542	3,477	0	5,448	5,362	0	21376	20,965	0
India	77	0	0	0	0	0	280	0	0	0	0	0	357	0	0
Japan	0	0	0	0	0	0	0	0	0	21,417	21,417	3,608	21,417	21,417	3,608
Netherlands	2,454	1,550	204	0	0	0	7,517	4,955	694	0	0	0	9971	6,505	898
New Zealand	333	333	0	190	190	0	239	239	0	181	0	0	943	762	0
United Kingdom	2,217	1,527	662	1,756	1,007	96	3,456	2,502	766	3,184	3,031	0	10,613	8,067	1,524
USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 of 10 Countries	13,910	11,982	897	6,825	5,876	339	15,225	11,363	1,460	31,438	31,001	3,608	67,398	60,222	6,304

Table IV: Obs from VOSClim-Ships / Obs with VOSClim-Elements 2008 - 2010

Country Name	2008		2009		2010	
Australia	8,224	3,422	6,437	2,360	2,721	2,506
Canada					0	0
France	10,452	9,957	12,706	12,201	0	0
Germany	12,465	11,157	22,219	20,426	21376	20,965
India	1,422		30		357	0
Japan	1,029	1,029			21,417	21,417
Netherlands	8,642	6,002	23,101	16,450	9971	6,505
New Zealand	464	463	683	891	943	762
United Kingdom	191		5,880	5,637	10,613	8,067
USA	46				0	0
	42,935	**32,030**	**71,056**	**57,965**	**67,398**	**60,222**

Figure 1: Contributed and Distributed Obs 1994-2010

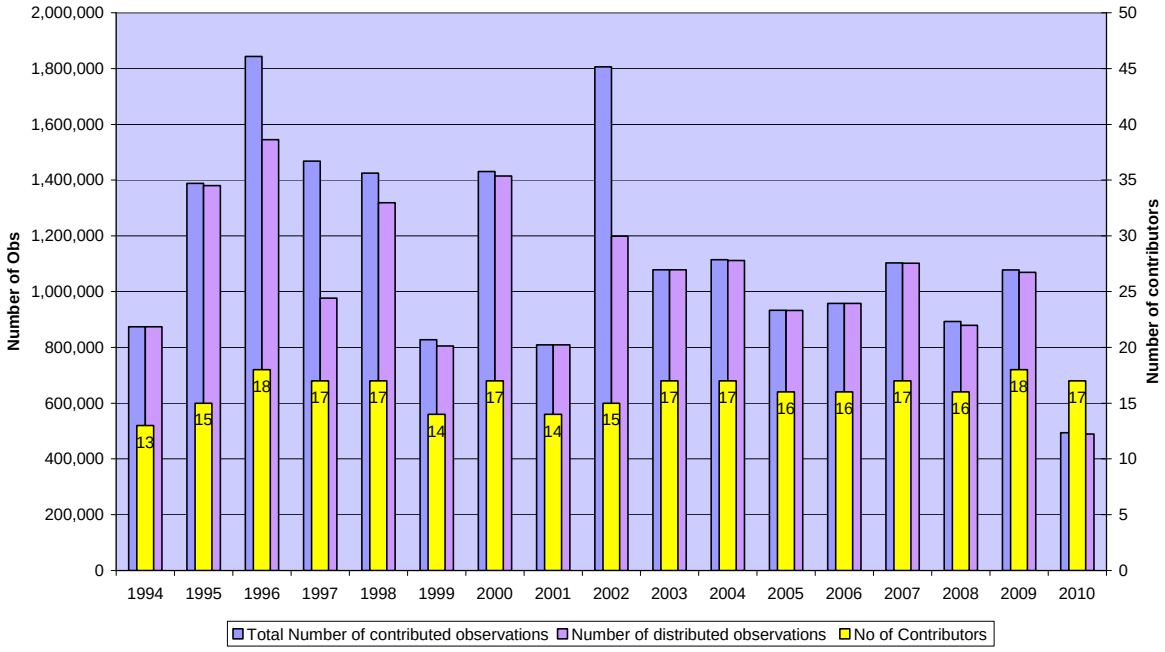


Figure 2: Number of Obs Received by Month in 2010

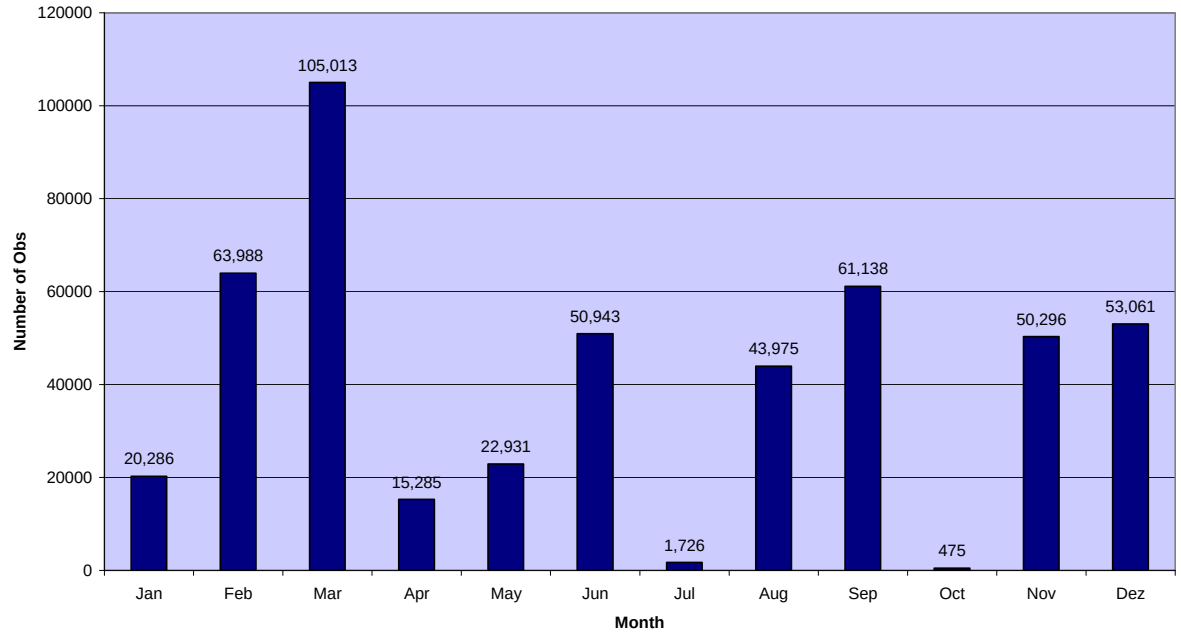


Figure 3: Distribution of data received in 2010

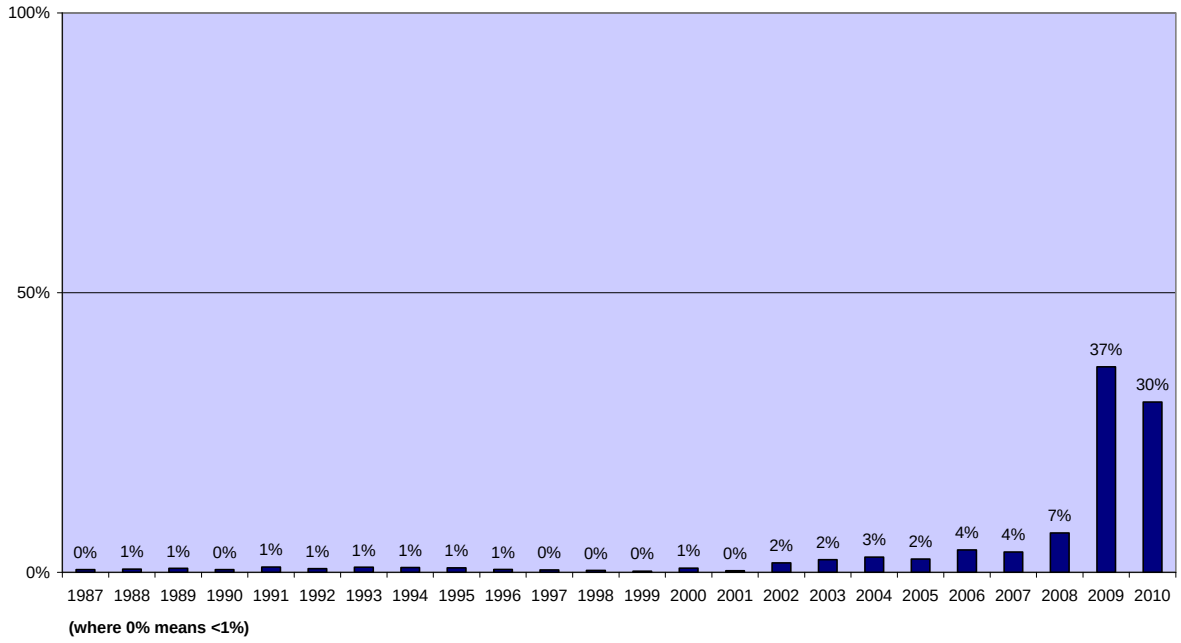


Figure 4: Number of Ships Contributing in 2010

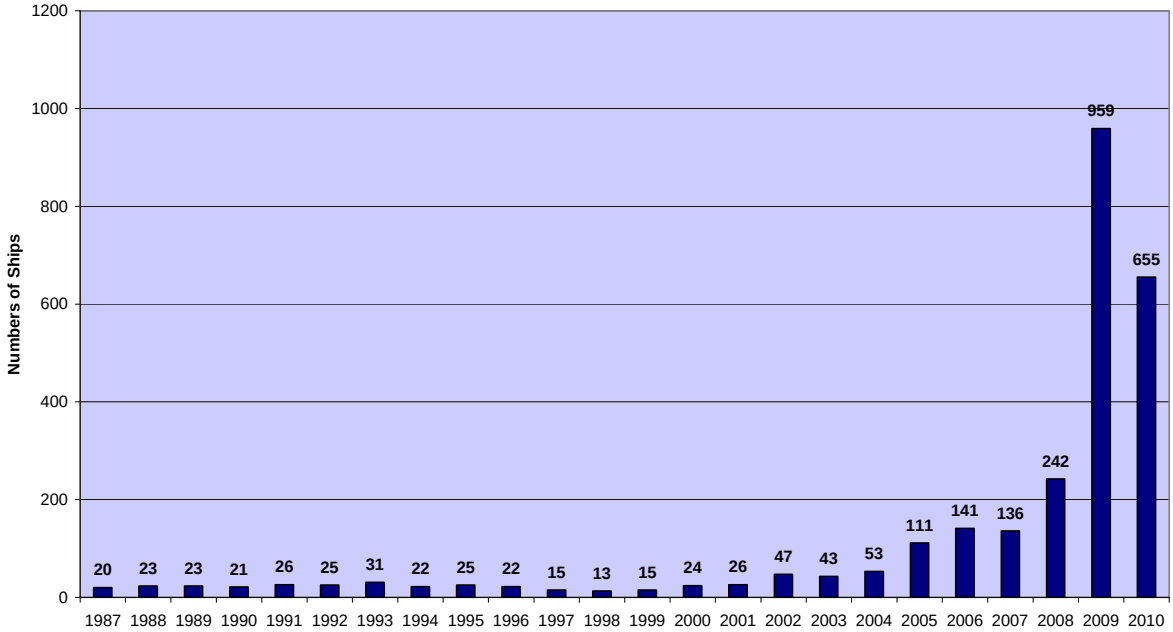


Figure 5: Distribution of Reported Positions 2010

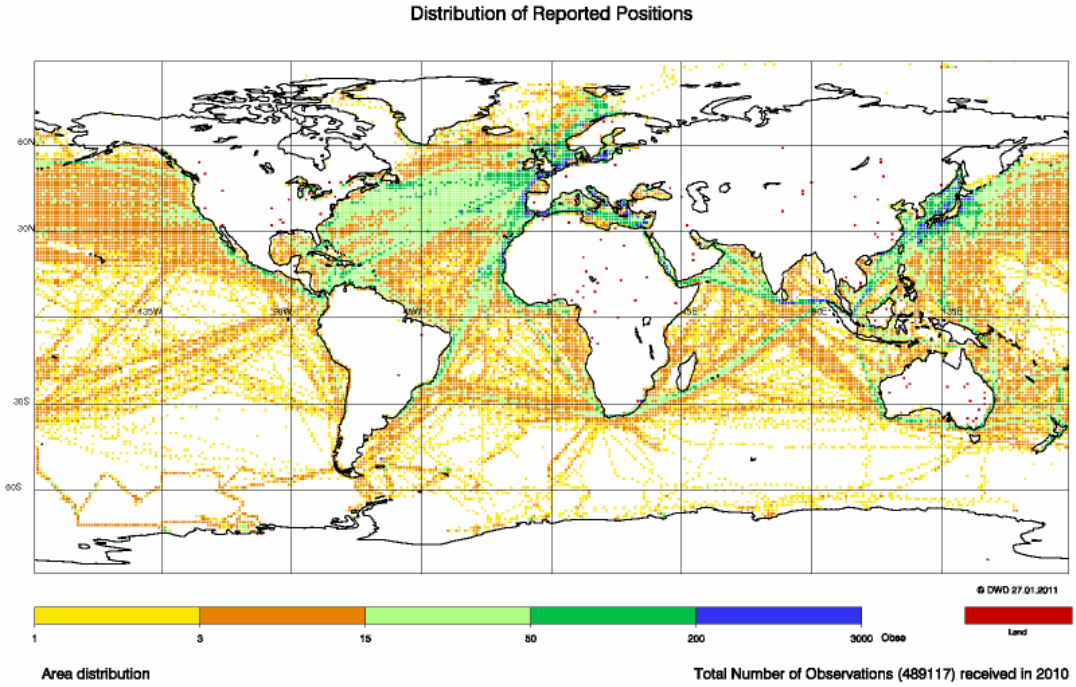


Figure 6: Data Distribution by Country

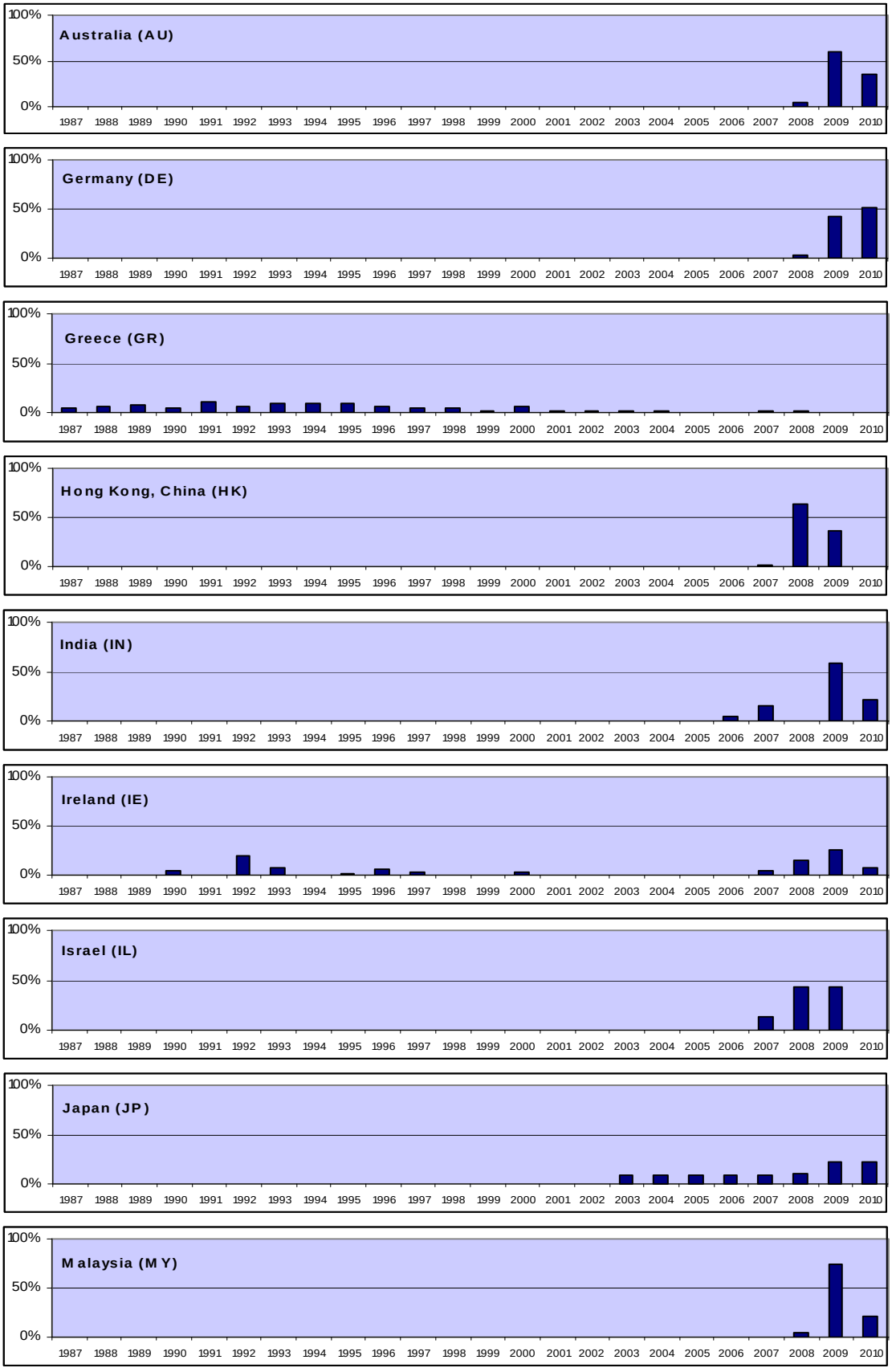


Figure 6 (cont): Data Distribution by Country

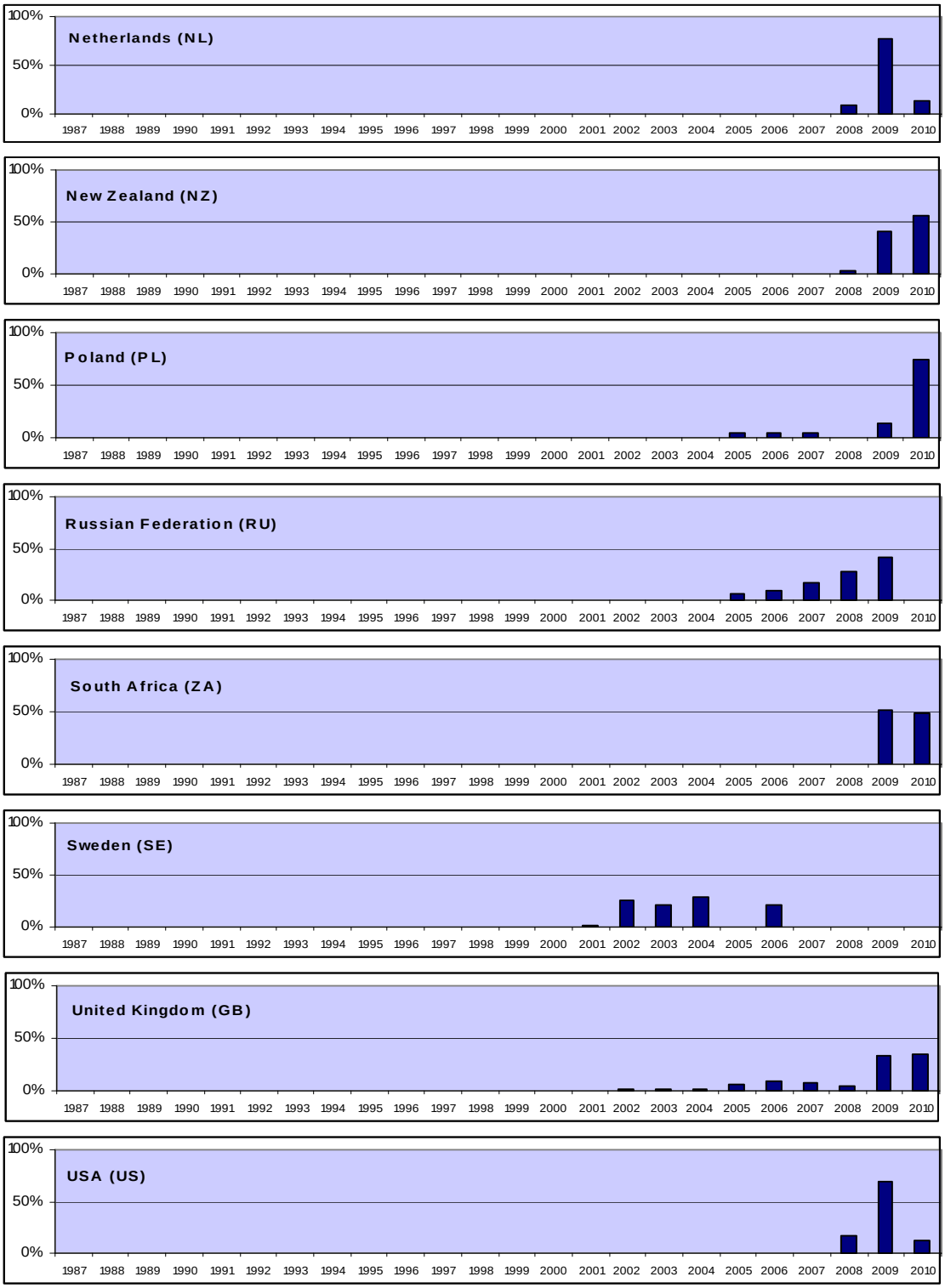


Figure 7: Elements reported blank 2007-2010

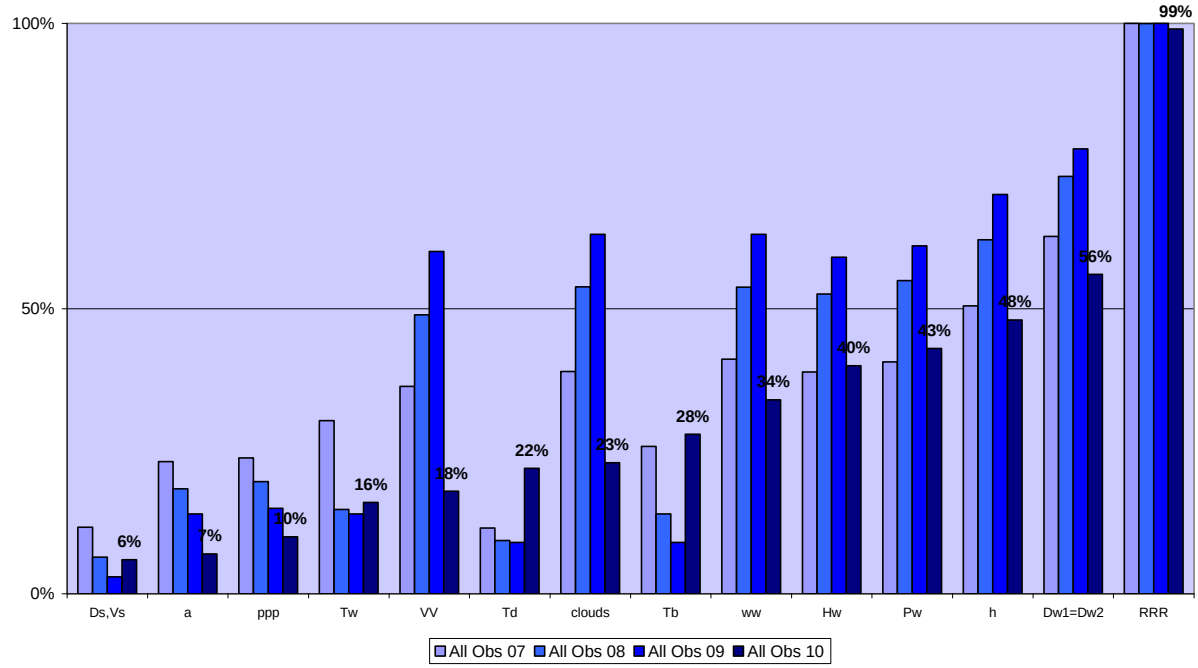
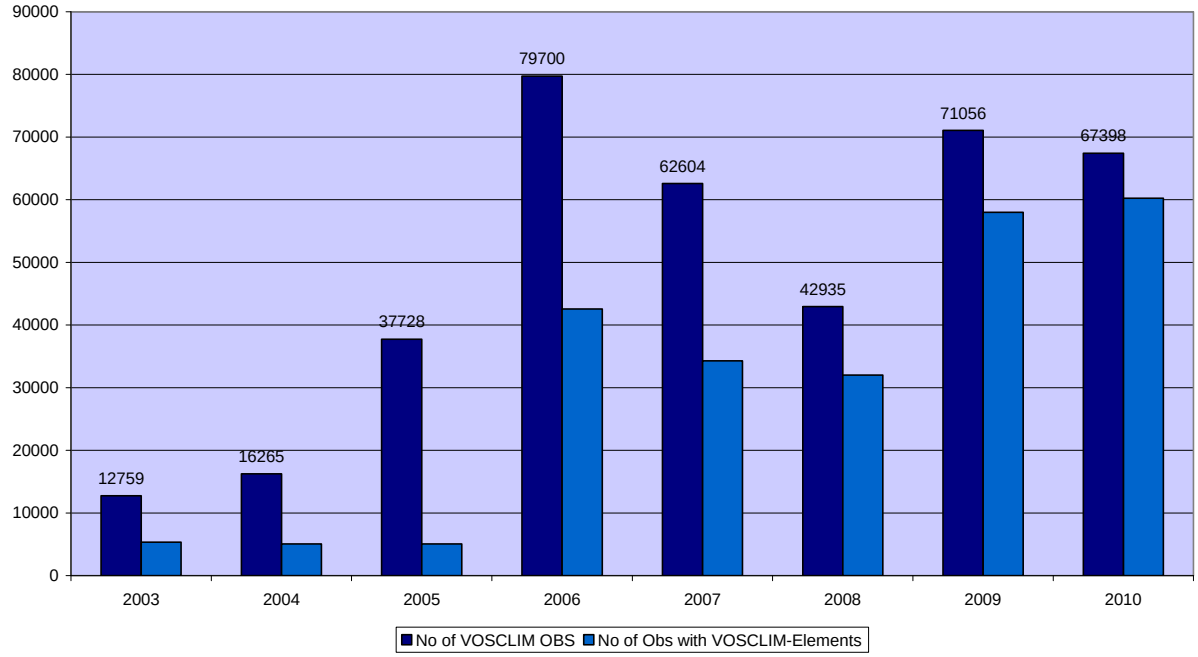
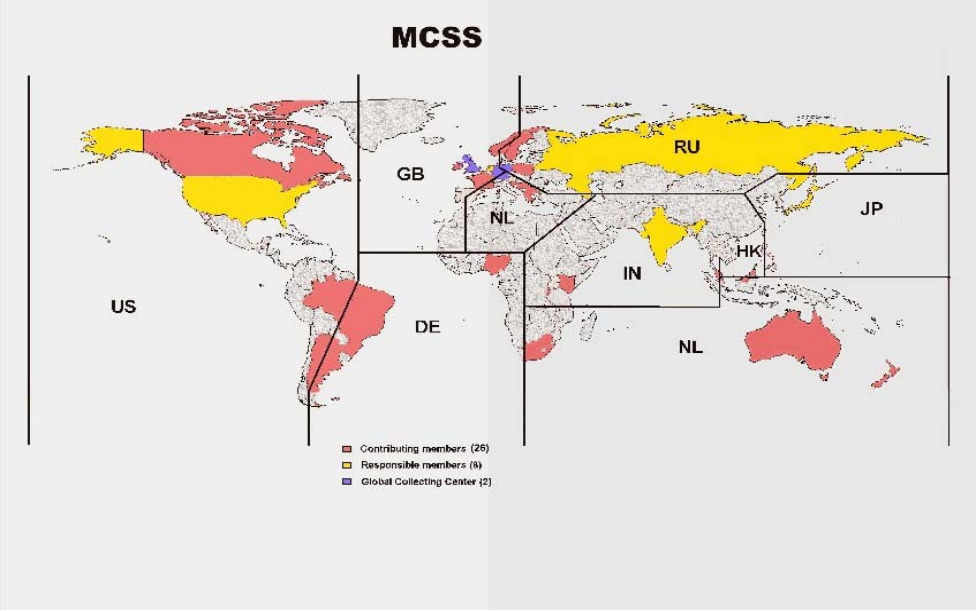


Figure 8: VOSClim Input 2003-2010



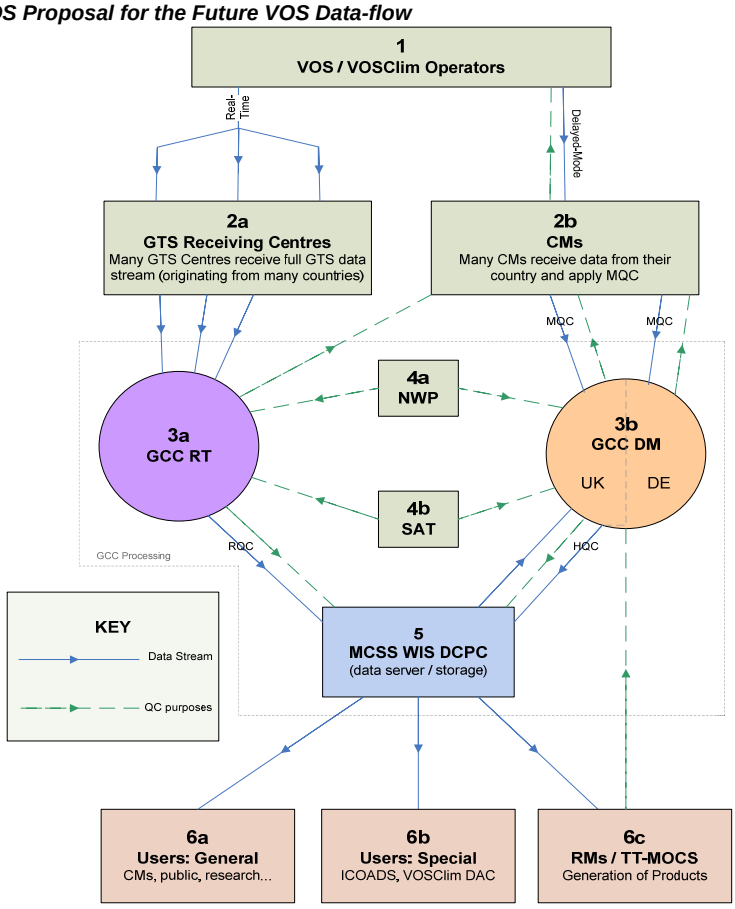
Appendix A: Responsible/Contributing Member Countries (updated 2009)



Appendix B: Extract from 1994 GCC Report

"A special problem arises if original flags claim 'correct' (flag=1) or 'value corrected by quality control' (flag=5) but the MQC check flags as erroneous or dubious. This discrepancy may be real, because MQC is not a sophisticated, high-quality check routine. This discussion led to the view that such cases may be of interest, especially with respect to climatological extreme values, and so should be highlighted. In order to direct attention to such events the following procedure was applied by GCCs, using the available flag values of 6 and 7.
** flag is set to "6" if the original flag is set "1" (correct) and the value will be classed by MQC as inconsistent, dubious, erroneous or missing,*
** flag is set to "7" if the original flag is set "5" (amended) and the value will be classed by MQC as inconsistent, dubious, erroneous or missing.*
Otherwise, no original flag will be overwritten."

Appendix C**: **TT-DMVOS Proposal for the Future VOS Data-flow



Detailed description of Appendix C (notes by box number)

1. **VOS/VOSClim Operators:** actual ships making the observations, with observers ordinarily sending data in both real-time (GTS) and delayed mode (paper or electronic logbooks).

2a. **GTS Receiving Centres:** Major GTS centres (e.g., across RMs) receiving all VOS and buoy data (FM 13, FM 18, or BUFR) from the GTS/WIS. Their role is to forward all relevant marine data that comes to them regularly (e.g. daily, or initially monthly) on a regular schedule to GCC-RT. The forwarding format are anticipated to be primarily FM 13, FM 18, or BUFR (additional marine codes).

2b. **CMs:** The Contributing Members (currently numbering 26) are responsible for:

a) collecting DM VOS data from their recruited vessels
b) applying Minimum QC (MQC) to these data
c) forwarding MQC data to GCC-DM
d) investigating problems identified and reported by GCC-DM or GCC-RT
e) informing VOS or VOSClim (and/or Port Meteorological Officers) about identified problems

3a. **GCC Real-Time (GCC-RT):** The GCC-RT is responsible for:

a) assembling all of the real-time data from the GTS Receiving Centres (2a)
b) resolving duplications within and among the GTS datastreams
c) identifying data that are unique among datastreams, to assist GTS monitoring activities
d) applying Real-time QC (RQC; proposed for development)
e) comparing observations with co-located model NWP results to identify possible problems (or linking as appropriate to existing monitoring efforts such as UK Met Office)
f) comparing with available satellite products to identify possible VOS data problems
g) notifying respective CM of possible problems
h) forwarding the data (both original and quality controlled) to the Server (5) on an appropriate timescale (in IMMA/IMMT or other suitable format)

3b. **GCC Delayed Mode (GCC-DM):** The GCC-DM is responsible for [Note: partly representative of current GCC processing at the GCCs in Germany and UK, including (a)-(b) and (e)]:

a) assembling the delayed mode data received from CM
b) ensuring MQC is applied to the delayed mode data
c) comparing real-time and delayed mode data via Server (5)
d) identifying and flagging/linking of duplicates of real-time and delayed mode data
e) notifying the respective CM of any systematic data problems identified, and resolving issues where possible
f) applying the proposed Higher QC (HQC), e.g. track checking, comparisons with NWP and satellite products to real-time and delayed mode data
g) forwarding the dataset to the Server (5), as soon as possible (in IMMA/IMMT or other suitable format)

4a. **NWP:** One or more NWP centres producing analysis and forecasts with GTS data that can provide model fields to compare to real-time and delayed-mode data. These fields are provided regularly (preferably daily or longer time frames as appropriate).

4b. **Satellite:** One or more satellite centres with fields of variables that are also found in GTS data. These fields are delivered regularly (preferably daily or longer time frames as appropriate).

5. **MCSS WIS DCPC (data server / storage):** Being a Data Collection and Production Centre (DCPC) involves being part of WMO Information System (WIS) and providing both data and discovery metadata. The server contains (or links to) separate or integrated database(s) (real-time and delayed-mode, original and quality controlled). The WIS will hold all discovery metadata for data within the server/storage point. Software recommended by WIGOS will be used.

The MCSS WIS DCPC is responsible for:

a. providing appropriate access to the discovery metadata and data (ICOADS and other users) via the WIS;
b. providing a data-bank to hold the data

6a. **Users - General:** General users (CMs, research, public) may access the Server (5).

6b. **Users - Special** (**ICOADS & VOSClim DAC):** Special users have access to the Server (5) and may feedback to GCCs and interconnect separately with the WIGOS Pilot Project as appropriate.

6c. **RMs / TT-MOCS**: Use data from server to produce state-of-the-art products (climatologies, etc.).