Global Collecting Centres for Marine Climatological Data

Annual Report 2009

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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 all 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 2009 report of the GCCs

This 2009 report marks the 16th 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 2009 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 project, detailing volumes and quality of data received from VOSClim registered ships.

2. Voluntary Observing Ships (VOS)

2.1 VOS Data Contributions 2009

In 2009 the total number of observations received by the GCCs was 1,069,118 (Table I) which is an increase on 2008 collections (Figure 1). The contributions came from 18 countries which, together with 1996, is the highest number of contributing countries ever. During 2009 the GCCs have where possible provided assistance to CMs which had trouble submitting their data. This enabled Ireland, Israel & Sweden to contribute which would otherwise not have been possible. Contributions from these CMs are expected to continue into 2010 with Greece expecting to contribute for the first time also.

A detailed analysis in Table II displays which CMs have contributed each year since the GCCs began their work. Many countries submitting data in 2009 did so only once or twice throughout the year. The GCCs remind CMs to send their observations regularly, preferably on a quarterly basis.

61% of data came from automated, fixed stations or data buoys (Observing platform coding 4 and 5 – IMMT element 41) in 2009 (Figure 3). The diagram shows how these data types have rapidly increased since 2006 documenting the move away from manual sites to (more cost-saving) automated systems.

Looking at source of observation (IMMT element 40) shows that 67% came from national or international telecommunication channels, only 29% from paper or electronic logbooks, whereas, the rest are unknown or incompletely coded.

The majority of data received by the GCCs arrive by email and anonymous FTP transfer. They arrive in IMMT format with most submissions in 2009 received in the preferred IMMT-3 (88.9% IMMT-3, 9.3% IMMT-1, 1.8% IMMT-2).

As shown in figure 1, the volume of incoming (blue columns) and outgoing (purple columns) data differs only slightly since 2003 whereas considerable discrepancies occurred before.

However, in 2008 another problem came to light, noting that significant volumes of data are being re-submitted in later quarters. When data are resubmitted during different quarters/years these duplicates cannot be rejected by routine GCC processing and are thus distributed to RMs for archival. Only during RM's further quality processing can this problem be identified. Not only does this generate extra work for the GCCs and RMs, it also significantly affects the yearly statistics within the Annual Report. It has been noted that this was the case for over 18,000 observations in 2008 alone. This number surpasses considerably the number of 605 rejected observations identified during the quarterly exchange process. In 2009 there were more than 10,000 duplicates within different quarters identified by the RMs compared to 3,164 rejected observations. Furthermore, additional duplicates are to be expected taking into account previous years. This problem can only be solved by CMs <u>not</u> re-submitting previously contributed data. But if it is necessary then please make GCCs aware of this to allow replacement within the archives.

The number of observations received each month by the GCCs during 2009 is shown in figure 2. Data was received from as far back as 1992 (Figure 4 and 7). Although data is widely spread 60% of observations were from 2008 and 2009 alone and 96% from the last

four years. Figure 5 displays the number of ships sending data for each year reported with, predictably, most ships sending observations for 2008 and 2009. 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 & 2008 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 extremely important 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 (latest version MQCS-V), data are processed through a series of GCC programs. Processing draws attention to invalid dates, 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 are mostly due to duplicated data equating to 3,164 observations (0.3%) received in 2009.

Correct positioning is still an issue to be considered, with on-land observations being reported. The areal distribution map in figure 6 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. Each year this problem seems to be improving with only 230 (0.02%) observations reported on-land from submissions during 2009 (2008:0.07%, 2007:0.15%). This continued reduction may be due to the increasing use of electronic logbooks with their built-in QC of on-land positions.

2.2.1 VOS Data Processing – Detailed Analysis

A detailed analysis of the 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 increased a little in 2009 to 0.09% of occasions (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 2009 the percentage of observations from CMs without any flags set significantly increased to 8.1% (2008: 4.1%, 2007: 1.8%). 90.4% of the data were checked with MQC standards or higher before contributed to the GCCs, 7% were submitted without any quality control. Further analysis identifies 9,883 (0.03%) 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 8a). The most commonly reported blank elements are still precipitation, swell direction and height of lowest cloud. 2007 & 2008 showed an increase in most elements being reported as blank and results from 2009 show an increase again of around 5-10% for manually reported elements (visibility, period/height of waves, present weather, clouds & swell). Whereas the increase of easily-automated elements have (in most instances) reduced the occurrences of blanks by 1-5%.

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

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 all now 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 new 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. For details of the TT-DMVOS refer to the JCOMM website:
http://www.jcomm.info/index.php?option=com_oe&task=viewGroupRecord&groupID=158

During March 2009 the GCCs met again in Hamburg, Germany (see photo below) to discuss aspects of the TT-DMVOS working plan, including agreeing a new proposal for an advanced HQC and planning tasks for the rest of 2009.

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. Nominations for fulfilling new roles within the future data-flow are expected to be requested during 2010.

New Versions of IMMT/MQCS: IMMT-IV & MQCS-VI have been adopted by JCOMM-III for general use by 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. The GCCs plan to make the IMMA data available by FTP from the first quarterly exchange in 2010.

5. Summary

To summarise, the GCCs continue to receive data from a number of CMs regularly and the quality remains good. However, there could potentially be even more observations received by the GCCs each year if CMs having trouble submitting data seek help through 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.

- Observations should be submitted regularly on a quarterly basis.
- Each observation should only be submitted once. But if there is a requirement to resubmit this should be highlighted to the GCCs.
- 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 – IMMT-3 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 2009 there was further advances made with modernising the current MCSS. Further work is planned for 2010/2011 and progress will be reported to ETMC.

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 will appreciate the importance of their submissions and the value they add to the global marine database.

The GCCs would like to thank the CMs for their data that was submitted during 2009 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.

Joint GCC Meeting Hamburg, Germany: 16th-18th March 2009

From left to right: Heike Haar (DE), Hildrun Otten-Balaccanu (DE), Reinhard Zoellner (DE), Nicky Scott (UK), Gudrun Rosenhagen (DE), Fraser Cunningham (UK), Christel Lefebvre (DE) & Wolfgang Gloeden (DE).

6. VOSClim Data 2009

6.1 VOSClim Project

The VOSClim Project is an ongoing pilot within JCOMM's Voluntary Observing Ships' Scheme. It aims at providing a high-quality subset of marine meteorological data with detailed information on how the 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.

The IMMT-2 format, which allowed delayed mode submission of VOSClim elements (element 87-93), came into effect in January 2003. The more recent 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 project website http://www.ncdc.noaa.gov/oa/climate/vosclim/vosclim.html

It was recommended and decided 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. The IMMT-IV format has been updated accordingly to include a VOSClim indicator.

As of 31st December 2009 there were 10 CMs in total with 289 recruited VOSClim ships worldwide.

6.2 VOSClim Contributions

In 2009, VOSClim submissions were received from seven of the ten CMs. The GCCs received 71,056 observations from VOSClim ships (Table III, IV & V), contributing to 7% of the total submissions for the last 3 years (Figure 9). It is interesting to see in figure 10, that the CMs still contribute observations back to 2006, but 96% were observed in 2008 and 2009. The number of observations containing additional VOSClim elements, however, is always considerably less (57,965) than the total submitted. Nevertheless it is encouraging to see the numbers of observations are the highest since the pilot project began and are being submitted regularly from most of the CMs in the project.

There are still a considerable number of observations with additional elements received from non-VOSClim ships (see Table V - amounting to 10,083 in 2009).

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 and it also has serious implications to the VOSClim project. The UK Met Office's Real Time Monitoring Centre commitment for VOSClim is unable to be properly fulfilled as VOSClim ships reporting under a masked callsign cannot be effectively identified. As a consequence, these VOSClim data will not be sent to the Data Assembly Centre (DAC) at the National Climatic Data Center, USA, and monitored. The GCCs strongly request CMs, where possible, to ensure masked callsigns are converted back to true IDs prior to submission to the GCCs.

6.3 VOSClim Data Processing & Analysis

As with VOS contributions, observations are processed through a series of programs to ensure they pass the MQCS. It is noted that VOSClim data still are of higher standard compared with

VOS. In 2009 all observations had corresponding flags reported for the common weather elements, however, there were only 72.7% of observations with flags attached to the VOSClim elements.

The area distribution map in figure 12 shows that VOSClim ships prefer the main shipping lanes between continents, but are also spread ocean wide. There were 21 (0.03%) observations reported on-land by VOSClim ships in 2009 which is a similar proportion to VOS. However, there were still observations where the common weather flags were inconsistent with the MQCS-V and subsequently reset. This occurred on 0.17% of occasions and in 0.07% the special VOSClim flags were reset because of inconsistencies with MQCS-V.

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 SLL. The new MQCS-VI (to be used generally by 1st January 2011) includes this limit change also. In 2% of all VOSClim observations the element SLL is still greater than the limit of 40m.

In figure 8b VOSClim observations can also be seen with high proportions of blank elements. Wet-bulb temperature, visibility, cloud types/amounts, wind wave height/period and height of lowest cloud were reported blank, but this is less than for VOS ships. Figure 11 displays an increase in reported blank elements from VOSClim ships compared to 2008.

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 is 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 & V (provided by the Data Assembly Center in the USA).

During preparation of this Annual Report there were major updates made to the lists of registered VOSClim ships. Not only did this impact statistics for 2009 VOSClim data but it also had quite an impact on previous years. Therefore, values within tables/figures in this Annual Report are as up-to-date as possible but may differ with past reports. In light of these new statistics, it is interesting to see that VOSClim contributions peaked in both 2006 & 2009 with more than 70,000 observations, but it was in 2009 that had most records containing the additional VOSClim elements attached (Table IV).

As mentioned in section 2.2 it has been reported by some RMs that occasionally CMs have resubmitted data within later datasets. This is also an issue for VOSClim data and can only be identified by the RMs during further quality processing. In 2009 alone, 2167 VOSClim observations (3.2%) were resubmitted in different quarters.

6.5 Summary

2009 saw seven out of the ten CMs making submissions from VOSClim ships and it is encouraging to see that data quality generally proves to be better than for VOS.

There is still one CM left to contribute 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 is now to be ceased and practices to be adopted within the wider VOS.

The GCCs would like to thank the CMs for their VOSClim data that has been submitted in 2009 and the continual co-operation. As you are in no doubt aware, the data from the project is extremely important for climate change studies and research.

Abbreviations

CM	Contributing Member
CMM	Commission for Marine Meteorology (the forerunner to JCOMM)
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)
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)
NWP	Numerical Weather Prediction
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)
WIS	WMO Information System
WMO	World Meteorological Organization

Table I: CM Observations 2009

Country Name	1st Q	2nd Q	3rd Q	4th Q	Total
Argentina					
Australia	14603	17229	14193	17,514	63,539
Brazil					
Canada					
Croatia					
France	13677				13,677
Germany	391454	77376	179152	44,210	692,192
Greece					
Hong Kong, China	605	625	575	380	2,185
India	698				698
Ireland		8398			8,398
Israel				1,200	1,200
Japan	3516	3102	2825	3,015	12,458
Kenya					
Malaysia	539	480	1094	151	2,264
Netherlands	15989	28138		31,476	75,603
New Zealand	2256	1748	1720	1,958	7,682
Nigeria					
Norway		11178		74,224	85,402
Poland				1,112	1,112
Russian Federation	10004	9344	10265	10,024	39,637
Singapore					
South Africa	794	439	379	1586	3,198
Sweden				3,222	3,222
United Kingdom	7316	4420	8286	11,797	31,819
USA	6707	10496	3277	4,352	24,832
18/26 Countries	**468,158**	**172,973**	**221,766**	**206,221**	**1,069,118**

Table II: Contributions by CM per year

MCSS-Member	ISO Alpha-2 code																	Number of Years with Contributions 1994 - 2009
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Argentina	AR								X		X	X	X	X	X	X		**7**
Australia	AU							X		X	X	X	X		X	X	X	**8**
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	**16**
Greece	GR																	**0**
Hong Kong, China	HK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**16**
India	IN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**16**
Ireland	IE			X	X	X				X							X	**5**
Israel	IL		X	X	X	X	X	X	X	X	X	X	X	X	X		X	**14**
Japan	JP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**16**
Kenya	KE																	**0**
Malaysia	MY	X		X	X	X	X		X	X	X	X	X	X	X	X	X	**14**
Netherlands	NL	X	X	X		X	X	X	X		X	X	X	X	X	X	X	**14**
New Zealand	NZ													X	X	X	X	**4**
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	**16**
Russian Federation	RU		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**15**
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	**11**
Sweden	SE			X													X	**2**
United Kingdom	GB	X	X	X	X	X	X	X		X	X	X		X	X	X	X	**14**
United States	US	X	X	X	X	X	X	X		X	X				X	X	X	**12**

Table III: Obs from VOSClim Ships / Obs with VOSClim Elements 2009

Country Name	1st Q		2nd Q		3rd Q		4th Q		Total	
Australia	1,470	359	2,219	1,127	1,131	191	1,617	683	6,437	2,360
Canada	0	0	0	0	0	0	0	0	0	0
France	12,706	12,201	0	0	0	0	0	0	12,706	12,201
Germany	3006	2,378	7891	7,167	6,013	5,804	5,309	5,077	22219	20,426
India	30	0	0	0	0	0	0	0	30	0
Japan	0	0	0	0	0	0	0	0	0	0
Netherlands	4016	3,443	9974	6,647	0	0	8,903	6,360	22893	16,450
New Zealand	236	236	306	306	208	208	141	141	891	891
UK	0	0	0	0	0	0	0	0	0	0
USA	0	0	0	0	607	605	5,273	5,032	5,880	5,637
	21,464	**18,617**	**20,390**	**15,247**	**7,959**	**6,808**	**21,243**	**17,293**	**71,056**	**57,965**

Table IV: Obs from VOSClim Ships / Obs with VOSClim Elements 2003 - 2009

Country Name	2003		2004		2005		2006		2007		2008		2009	
Australia	2,663		3258		3657				26,096	10,247	8,224	3,422	6,437	2,360
Canada														
France					17,619		18,567		7,315		10,452	9,957	12,706	12,201
Germany	6,692	5,338	8,856	5,073	5,315	5,057	8,478	7,500	9,968	9,373	12,465	11,157	22,219	20,426
India	3,118		3,222		4,260		2,671	791	1,773	465	1,422		30	
Japan			29		4,439				2,862	2,862	1,029	1,029		
Netherlands	203		602		2,438		1,144	954	5,419	4,363	8,642	6,002	23,101	16,450
New Zealand									339	339	464	463	683	891
UK			298				48,840	33,314	8,634	6,655	191		5,880	5,637
USA	83								198		46			
	12,759	**5338**	**16,265**	**5,073**	**37,728**	**5,057**	**79,700**	**42,559**	**62,604**	**34,304**	**42,935**	**32,030**	**71,056**	**57,965**

Table V: Total No. Obs from VOSClim Ships / No. Obs with VOSClim Elements from VOSClim Ships / No. Obs with VOSClim Elements from non-listed ships 2009

Country Name	1st Q			2nd Q			3rd Q			4th Q			Total		
Australia	1,470	359	0	2,219	1,127	0	1,131	191	0	1,617	683	31	6,437	2,360	31
Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	12,706	12,201	971	0	0	0	0	0	0	0	0	0	12,706	12,201	971
Germany	3006	2,378	1,490	7891	7,167	1,695	6,013	5,804	0	5,309	5,077	0	22219	20,426	3,185
India	30	0	0	0	0	0	0	0	0	0	0	0	30	0	0
Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	4016	3,443	1,257	9974	6,647	2,502	0	0	0	8,903	6,360	1158	22893	16,450	4,917
New Zealand	236	236	0	306	306	0	208	208	0	141	141	0	891	891	0
South Africa	0	0	0	0	0	213	0	0	0	0	0	345	0	0	558
United Kingdom	0	0	0	0	0	0	607	605	146	5,273	5,032	275	5,880	5,637	421
USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21,464	18,617	**3,718**	20,390	15,247	**4,410**	7,959	6,808	**146**	21,243	17,293	**1,809**	71,056	57,965	**10,083**

Figure 1: Contributed & Distributed Obs 1994-2009

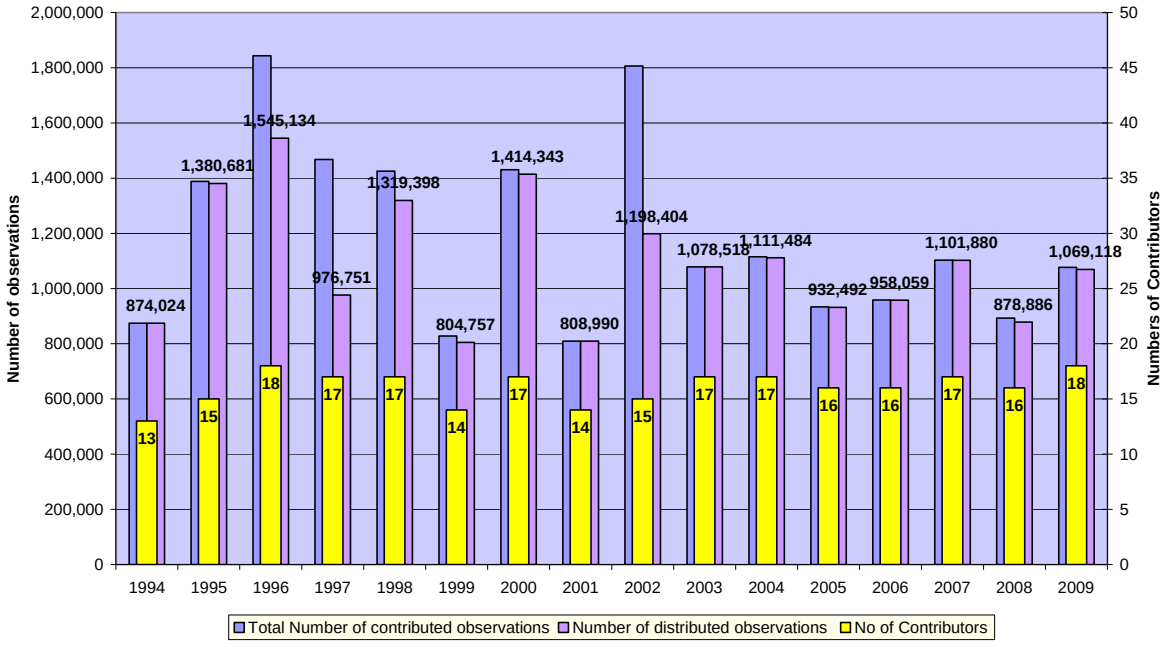


Figure 2: No. Obs Received by Month in 2009

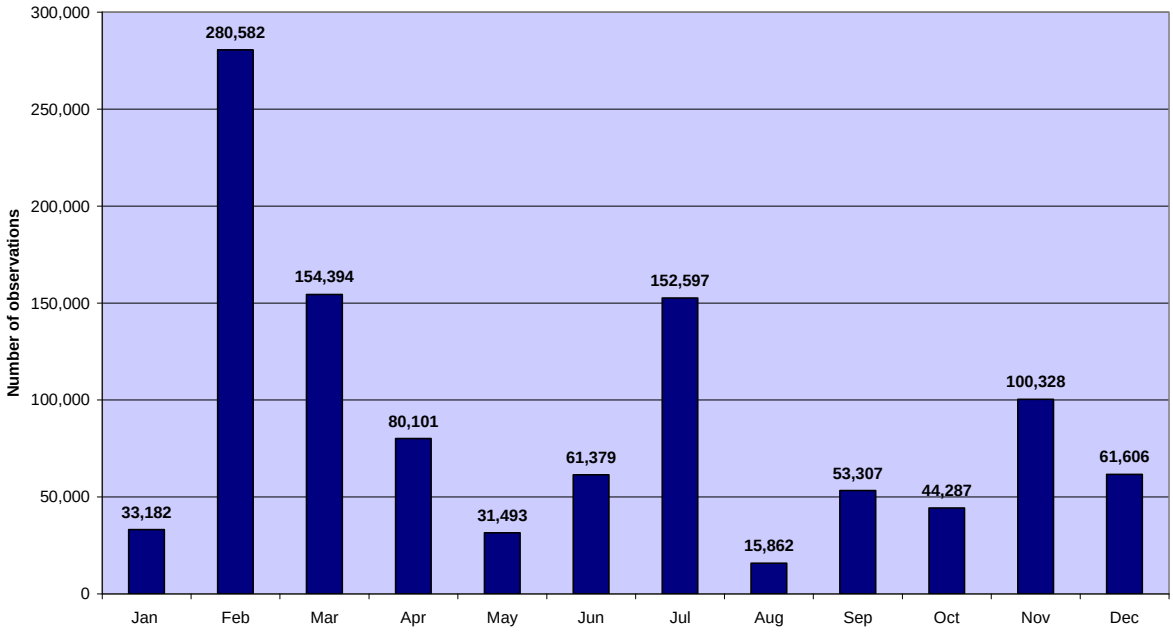


Figure 3: Percentage of Observing Platform (2006 - 2009)

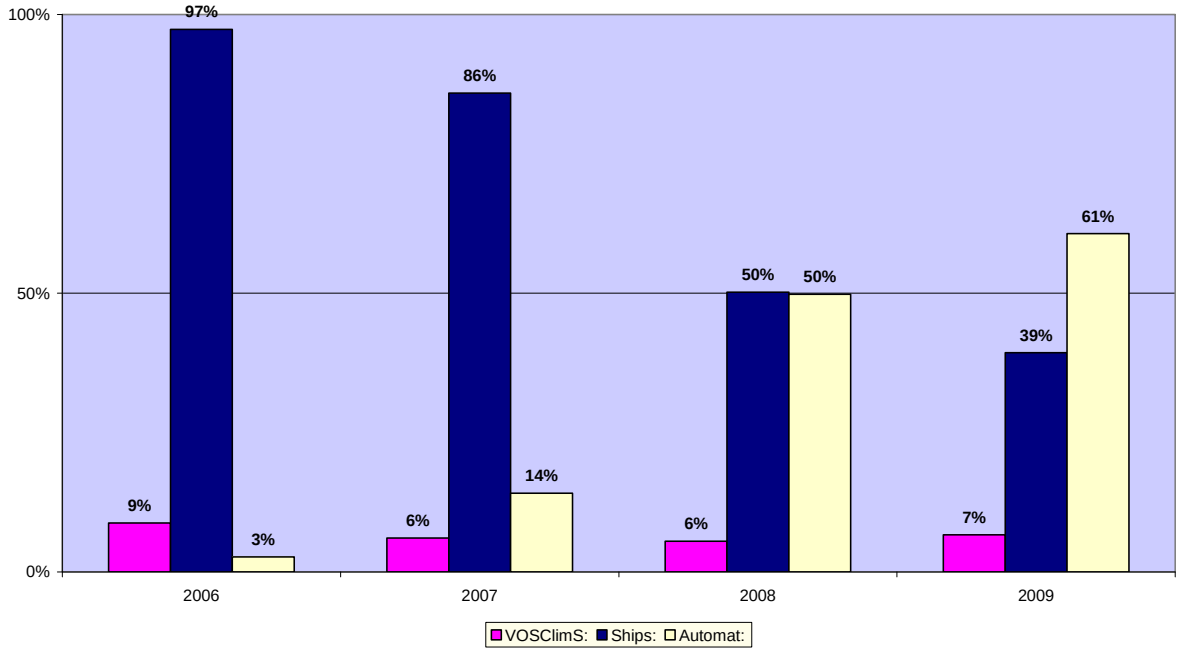


Figure 4: Distribution of Data received in 2009

(where 0% means <1%)

Figure 5: No. of Ships Contributing in 2009

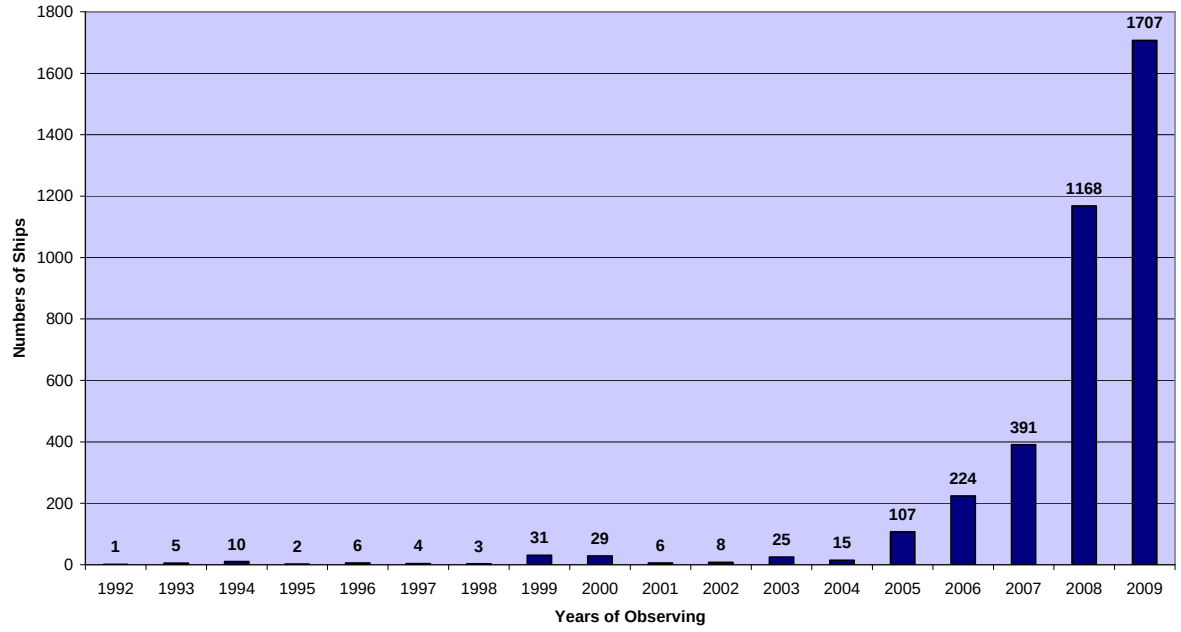


Figure 6: Distribution of Reported Positions 2009

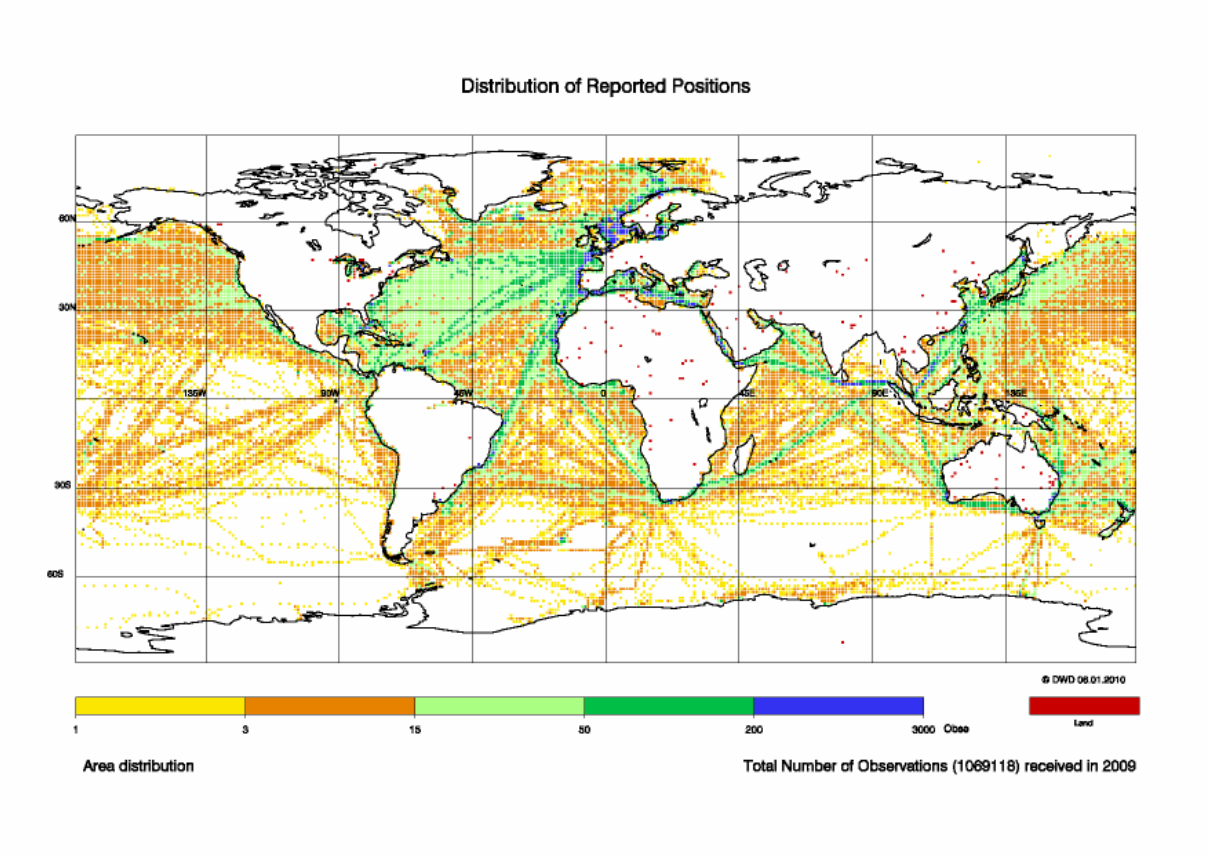


Figure 7: Data Distribution by Country

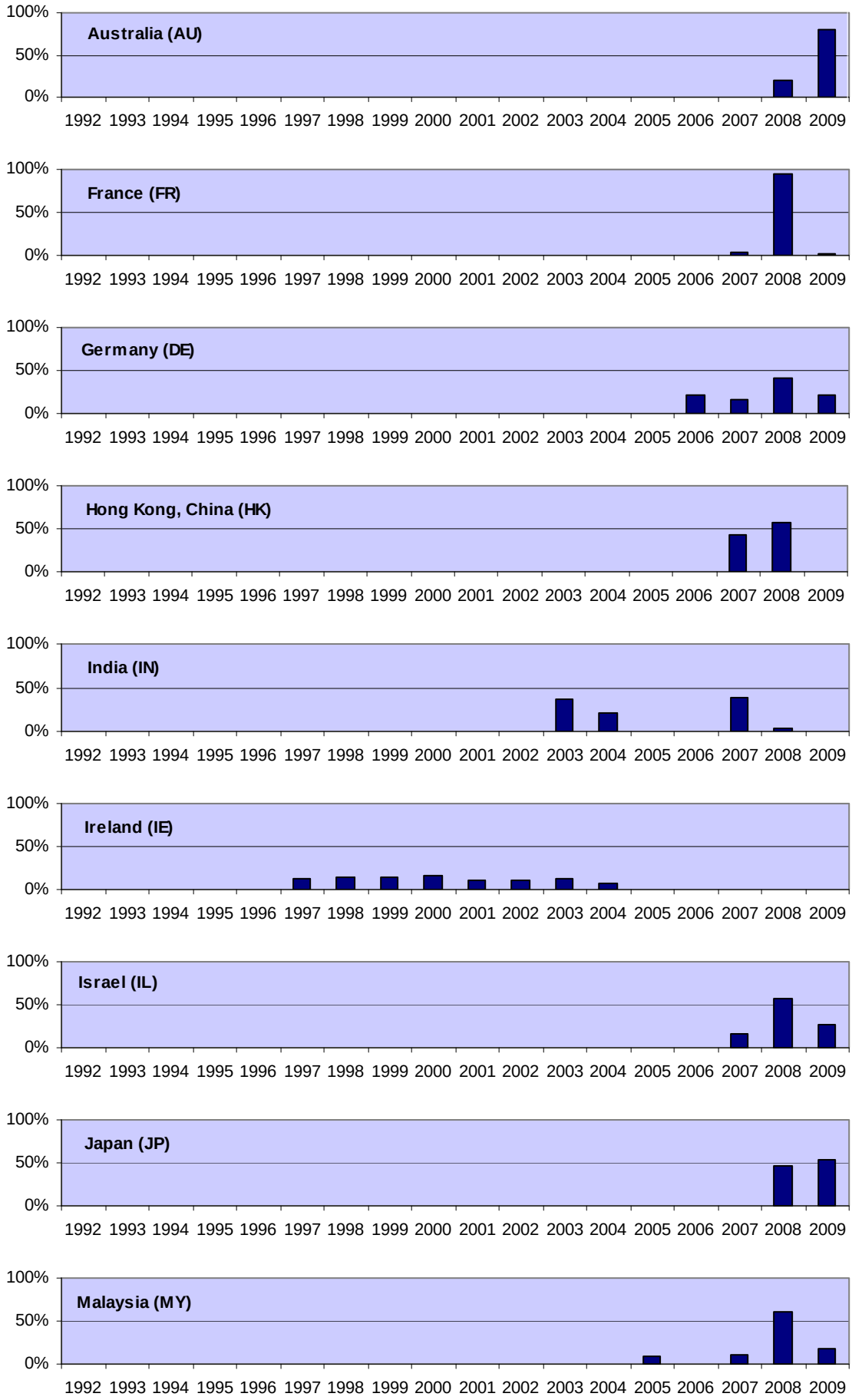


Figure 7 (cont): Data Distribution by Country

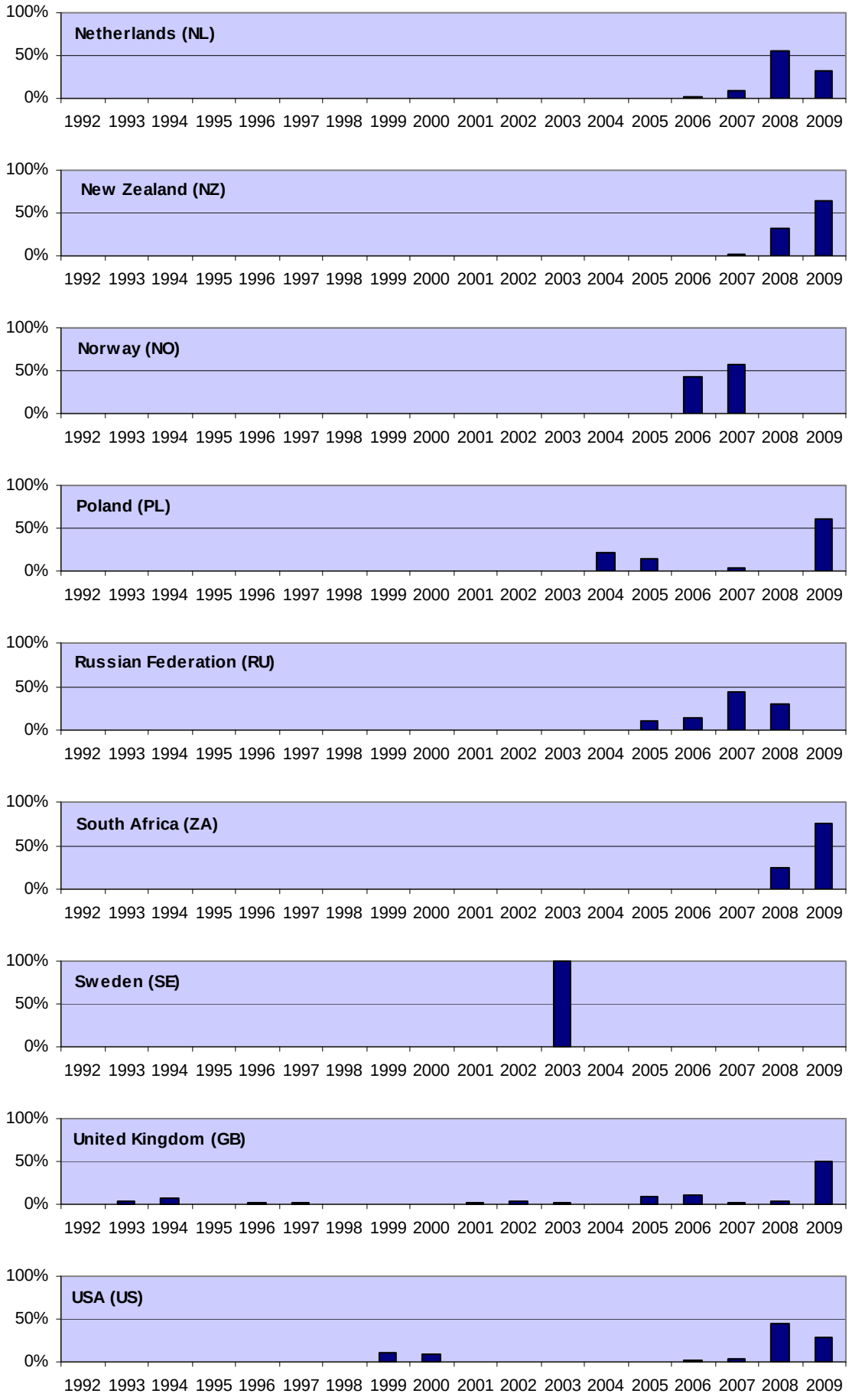


Figure 8a: Elements reported blank 2007 - 2009

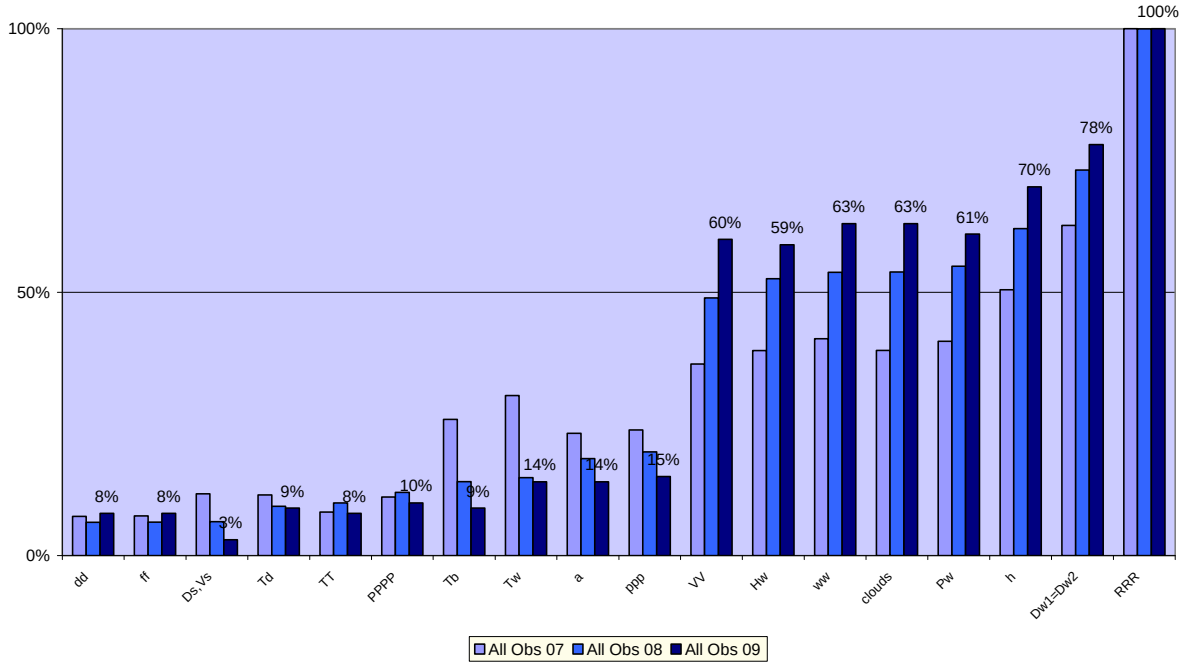


Figure 8b: Elements Reported Blank 2009

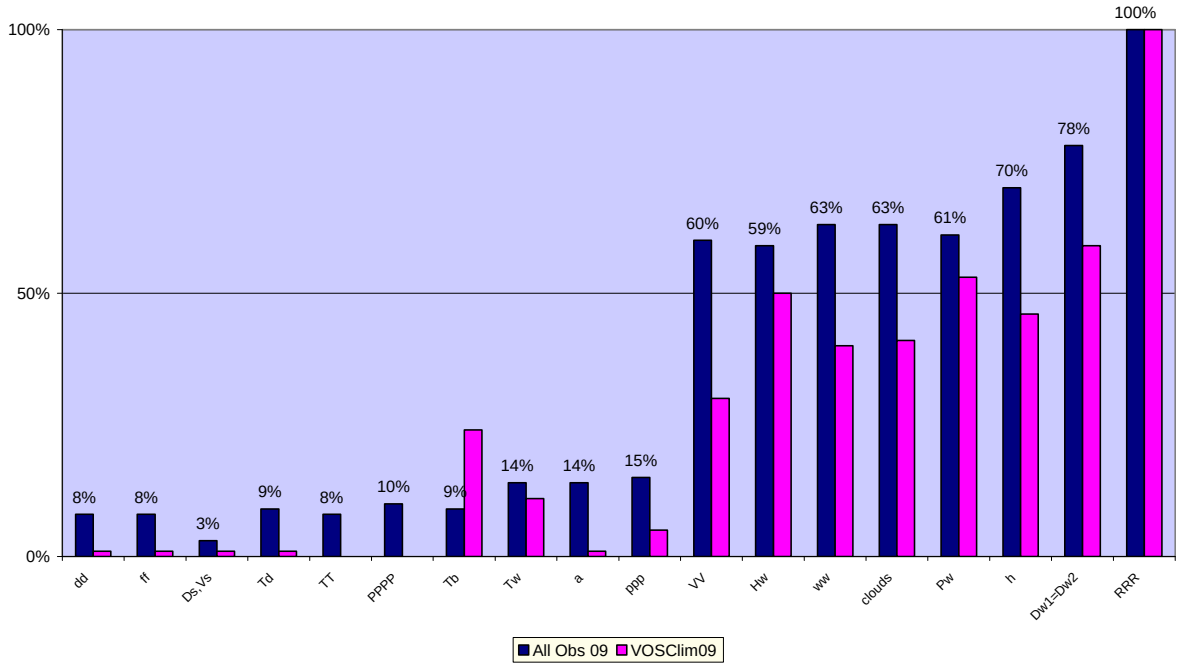


Figure 9: VOSClim Input 2003 - 2009

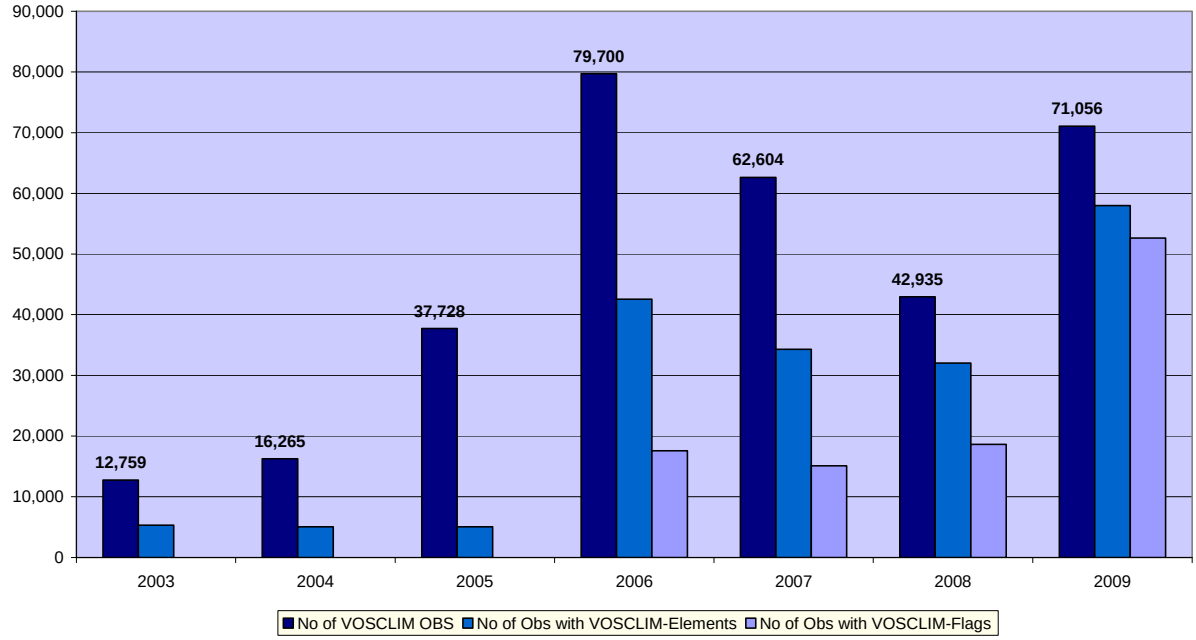


Figure 10: Distribution of VOSClim Data Received 2009

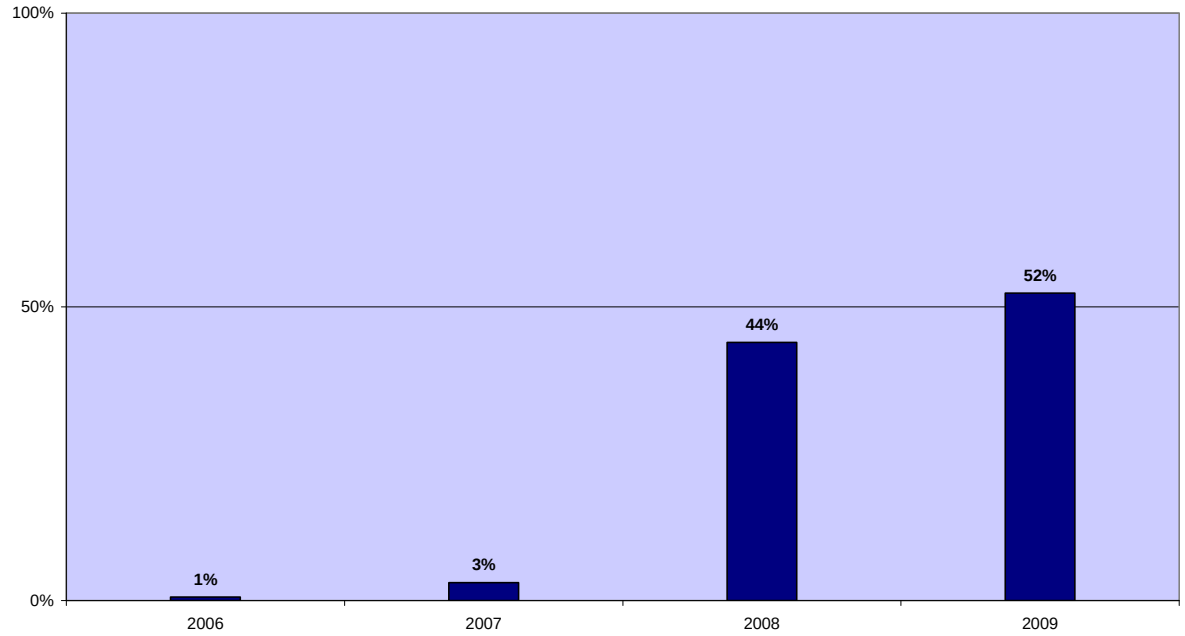


Figure 11: VOSClim Elements Reported Blank 2007 - 2009

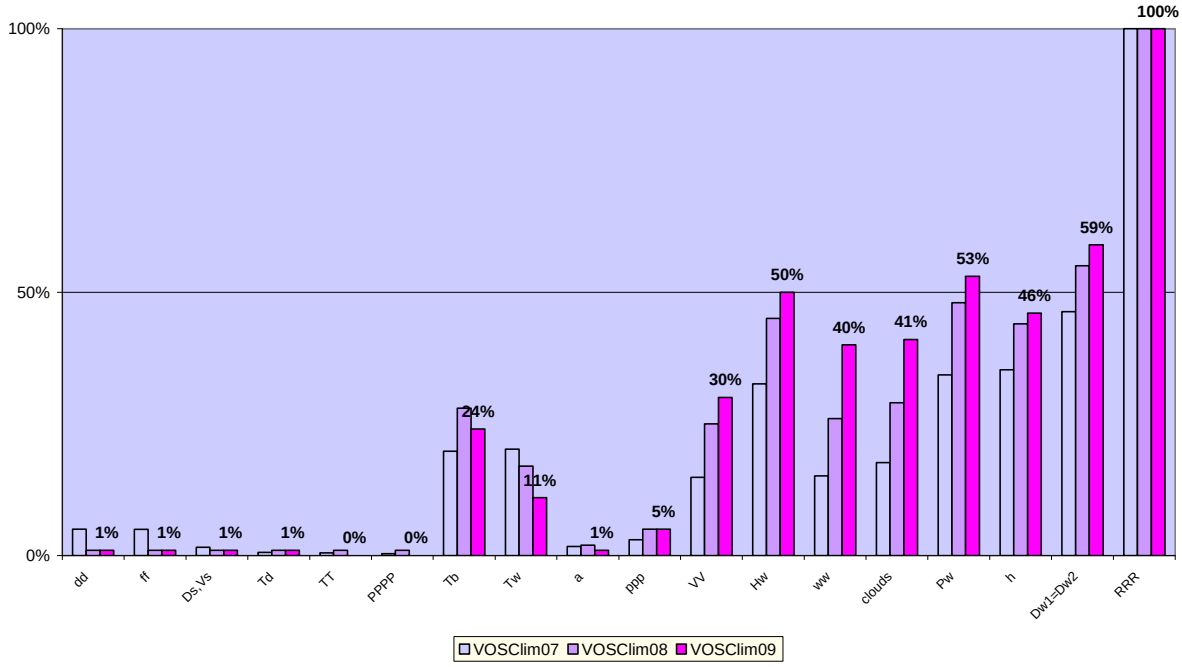
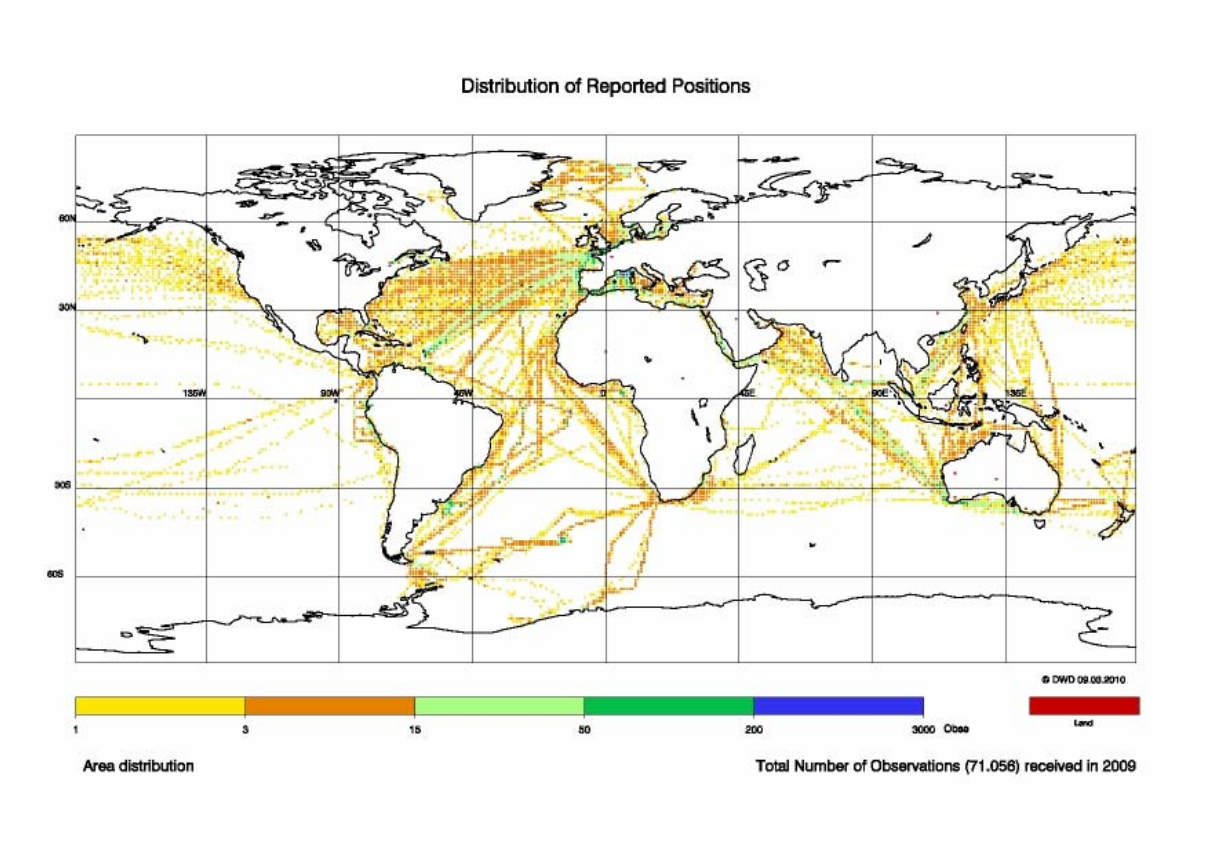
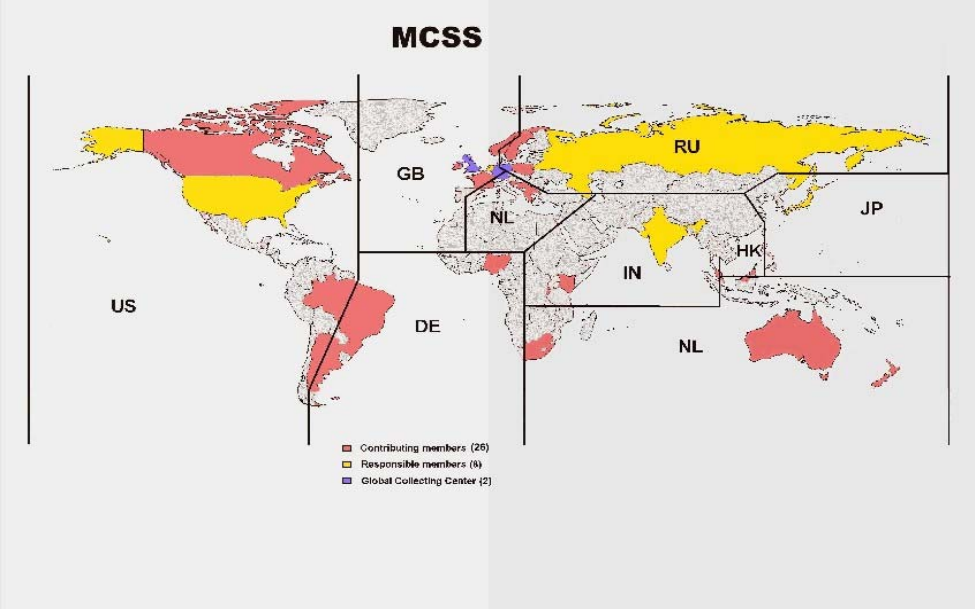


Figure 12: Distribution of VOSClim Reported Positions 2009



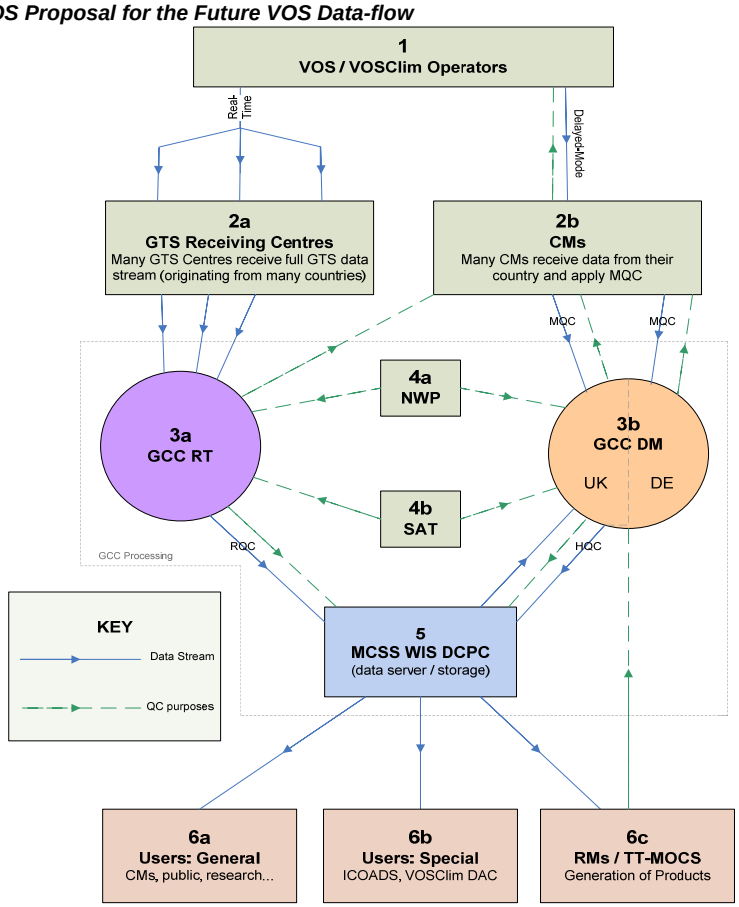
Appendix A: Responsible/Contributing Member Countries (updated 2009)



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.).