INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

WORLD METEOROLOGICAL ORGANIZATION

DATA BUOY COOPERATION PANEL

DBCP-XXIV/Doc. 11.2
(26.IX.2008)

TWENTY-FOURTH SESSION

ITEM: 11.2

CAPE TOWN, SOUTH AFRICA
13-16 OCTOBER 2008

ENGLISH ONLY

BUOY DATA MANAGEMENT CENTRES

(Submitted by Mr Jean Rolland (Météo-France) for SOC / DB and Mr Bruce Bradshaw (ISDM) for RNODC / DB)

Summary and Purpose of the Document

This document contains reports by the two buoy data management centres, the Responsible National Oceanographic Data Centre for Drifting Buoys, operated by ISDM, Canada, and the Specialized Oceanographic Centre for Drifting Buoys, operated by Météo-France.

ACTION PROPOSED

The Panel 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. Report of the RNODC for Drifting Buoys (August 2007 – July 2008); and

B. SOC for Drifting Buoys Report 2007 – 2008.

- A - DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

11.2.1 The Panel reviewed the report of the IOC International Oceanographic Data and Information Exchange (IODE) Responsible National Oceanographic Data Centre (RNODC) for drifting buoys (RNODC / DB), operated by the Integrated Science Data Management (ISDM, formerly MEDS) of Canada. Mr Bruce Bradshaw, ISDM presented the report.

11.2.2 The Panel then reviewed the report of the JCOMM Specialized Oceanographic Centre (SOC) for drifting buoys, operated by Météo-France, presented by Mr Jean Rolland.

11.2.3 The Panel thanked both centres for their reports. These reports are reproduced in the accompanying CD-ROM.

11.2.4 As noted at the previous DBCP Session, the two respective IODE and JCOMM centres are completely separate but provide similar functions. The Panel requested again the two centres to liaise between themselves and to work out a better strategy for providing a coherent system for archiving the buoy data (**action, RNODC / DB and SOC**).

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REPORT OF THE RNODC FOR DRIFTING BUOYS

Integrated Science Data Management (ISDM)
(August 2007 to July 2008)

Submitted to the DBCP-24
13-16 October 2007
Cape Town, Republic of South Africa

Introduction

The Integrated Science Data Management (ISDM), previously the Marine Environmental Data Service (MEDS), of the Department of Fisheries and Oceans in Canada became a Responsible National Oceanographic Data Centre (RNODC) for Drifting Buoy Data on behalf of the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO) in January 1986. The RNODC is a national data centre assisting the World Data Centres (WDCs) for Oceanography, and was developed to enable the international exchange system to cope with the increasing variety and volume of oceanographic data being collected. As part of its role, RNODC-ISDM acquires, processes, quality controls and archives real-time drifting buoy messages reporting over the Global Telecommunications System (GTS), as well as delayed-mode data acquired from other sources. All data are made available to the international scientific community through an online request system. Although ISDM was officially recognized as an RNODC in 1986, its archive started in late 1978 with the First GARP Global Experiment (FGGE) program and is currently growing at a rate of 1 million messages per month.

At IODE-XVIII (Oostende Belgium, April 2005), a resolution was adopted to abolish the system of RNODC's. This was in response to a review of IODE activities and in particular, the lack of understanding and use of the RNODC system. The resolution instructed the Chairperson of IODE to discuss with RNODC host centres how their operations, if considered essential for the international community, could be maintained and properly acknowledged. The services provided by ISDM as the RNODC for drifting buoys were determined to be essential for the international community and as such will continue operating as an RNODC until the proper accreditation has been established.

Overall annual statistics summary

All statistics, with the exception of the maps and unless otherwise stated, refer to data received in BUOY code which includes both drifter and moored buoys.

During the period August 2007 to July 2008, ISDM archived an average of 906,000 BUOY reports per month (Figure 1) and received reports from an average of 1488 drifting and moored buoys per month (Figure 2), which is about the same as last year. On average, each buoy is reporting 20 messages a day (Figure 3). Figure 4 shows the number of some of the meteorological / oceanographic observations posted on the GTS and Figure 5 shows the number of drifting buoys that reported Sea Surface Temperature (SST) and other meteorological observations. Drifting buoy tracks during the year can be seen in Figure 6. Of the BUOY messages received, 98% of the locations were quality flagged as good (Figure 7) and required on average 32 days from observation to reach the archive (Figure 8) (See Data Flow to ISDM). The size of the drifting buoy archive is approximately 29 GB with 68 million drifting and moored buoy records from 1978 to July 2008.

Summary of work carried out during the year

DBCP QC Guidelines for Location Data

The ISDM sent its first message on the BUOY-QC distribution list (buoy-qc@vedur.is) in October 2002, and continues to participate by sending monthly statistics on the number of erroneous positions on the distribution list. Maps displaying buoys tracks of the previous month for the Arctic, Antarctic and the rest of the world can be seen here: http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Prog_Int/RNODC/Buoy-QC/Buoy-QC.htm. The maps serve as a visual aid to the statistics file and allows the user to "mouse over" tracks to determine which buoys are reporting erroneous locations. Figure 7 shows quality control percentages of all position data during this past year.

Implementing New BUFR Software

Drifting buoy data is now being reported on the GTS in both BUOY and BUFR (Binary Universal Form for Data Representation) format. New software was written to read and decode each BUFR message into an internal format for update to our archives. Functionality related to new editions was added, decoding compressed data is almost completed and a thorough comparison of the two formats to ensure consistency is still needed. The software has been further developed to decode and encode Argo data reported in BUFR.

Update SVP Data Submission

The ISDM is, along with Atlantic Oceanographic and Meteorological Laboratory (AOML), the Data Assembly Centre (DAC) for Surface Velocity Profile (SVP) data collected by drifting buoys. AOML handles the initial processing of the data received through Service Argos. They carry out quality control on the data and generate the interpolated files. On a regular basis, they forward the data (krigged, edited and raw) to ISDM who function as the archive and distribution centre.

Due to internal restructuring as resulting from the merger with CHS and staff turn over, ISDM has been unable to completely process all data from the 2006 and 2008 AOML DAC submissions. ISDM currently has a backlog of RAW data from January 2004 to June 2007 and KRIG / P&S data from March 2006 to June 2007 for all basins. Processing, to the ISDM archives and web updates should be complete by December 2008. Please check the ISDM website for notices and updates.

Goals for 2008/2009

Update 2006 and 2008 data submission from AOML.

The ISDM is expecting to receive a call for proposals from the IPY Project Office for long-term data management of oceanographic data from the various IPY related projects and programmes. This could lead to opportunities for develop into new areas and enhance or update existing projects.

The DFO and ISDM are still in the early stages of significant IT restructuring and, as such, all of the ISDM systems and software will be upgraded to newer technologies over the coming years. This upgrade will require a significant amount of time and resources with the effect that ISDM will be reluctant to undertake new developments with the current processing and archival systems.

Changes to the Departmental Website are driving changes on the ISDM sites, which will result in some content and applications changing URL. ISDM is using the opportunity to renovate and update content and develop new online applications and data products. Improved inventories and search capabilities within the Drifting Buoy Programmes is anticipated.

If there is still a need for the Buoy QC archive of messages to the BUOY-QIR e-mail distribution ISDM will update the online application that failed due to email attachments and a Departmental switch to exchange mail services.
http://www.meds-sdmm.dfo-mpo.gc.ca/MEDS/Databases/DRIBU/buoyqc/search_e.asp

Working with IABP and Ignatius Rigor, ISDM hopes to produce an update to the IABP CD ROM produced in 2000.

Data flow to ISDM

In the real-time drifting buoy processing system, GTS data are ftp'd to ISDM every half hour from the Canadian Ice Service, a branch of the Meteorological Service of Canada (MSC) of Environment Canada (EC). Every hour, these messages are sorted through to extract BUOY messages, as well as other oceanographic reports such as BATHY and TESAC. Once a day, the BUOY messages are decoded into an in-house format after which automated tests are run to check for acceptable ranges of values in several measurements (SST, atmospheric pressure, air temperature, wind direction / speed, sub-surface temperature / salinity and wave height / period) and meta-data (date / time, latitude and longitude). The data are stored in a file for a month at which time software to detect duplicates is run, making the data available for quality control. Trained scientific personnel review plots of buoy time series of the measurements, drift tracks and speed graphs. Flags are set according to the international QC flag definitions derived from IGOSS, now JCOMM. Once completed, the data are added into the archive and the website is updated.

With a monthly QC system, it takes anywhere between one and eight weeks for BUOY data to be added into the archive. Last year, on average, the delay between reception and update was 32 days. Frequency of the data arriving into the archive as compared to observation date, and time can be seen in Figure 8. With the increasing number of messages received each month, the QC process takes longer and therefore increases the time it takes to update the archive. This, along with a growing need for real-time drifter data in a more timely manner, is prompting ISDM to look at increasing the frequency of its archive updates.

Data distribution

ISDM continues to distribute the data upon request, on a regular basis and via the web. Last year, ISDM received 35 requests for drifting buoy data. Requests came mostly from universities, government organizations and private consulting companies. Of the 35 requests, five were for the International Arctic Buoy Programme (IABP) CD that was created by ISDM in 2000. The CD contains data, products and documents that were produced under the IABP between 1979 and 1999.

Regular data distributions include sending raw drifting buoy GTS messages daily to the US National Oceanographic Data Center (NODC) by FTP, as well, a yearly file of all the QC'd drifting buoy data on DVD. Hourly raw data of buoy id, date / time, and meteorological data are posted on ISDM's ftp site for use by the Canadian Coast Guard in Search and Rescue.

The ISDM website is updated after the monthly QC and contains many trajectories, inventories and statistics of the buoy archive by month and year on a global scale, as well as for specific regions such as the Arctic, Antarctic, North Pacific, Southern Atlantic, EGOS (European Group on Ocean Stations) and Indian Ocean. Except for Arctic data for the current month, data are not available on the website and must be requested through the on-line Data Request Form. The current month's data for the Arctic is made available through a special application designed for the IABP Region, which shows real-time tracks of Arctic floats on a scalable map with the option to view specific buoy data. The URL for drifting buoy data and information at ISDM is http://www.meds-sdmm.dfo-

mpo.gc.ca/meds/Databases/DRIBU/drifting_buoys_e.htm.

Archive Information

Figures 10-13 show information derived from the entire archive. The maps show all the buoy tracks in three projections, global, Arctic and Antarctic and the graph displays the growth of the top five parameters (from both drifter and moored buoys) throughout the years 1978 - 2007.

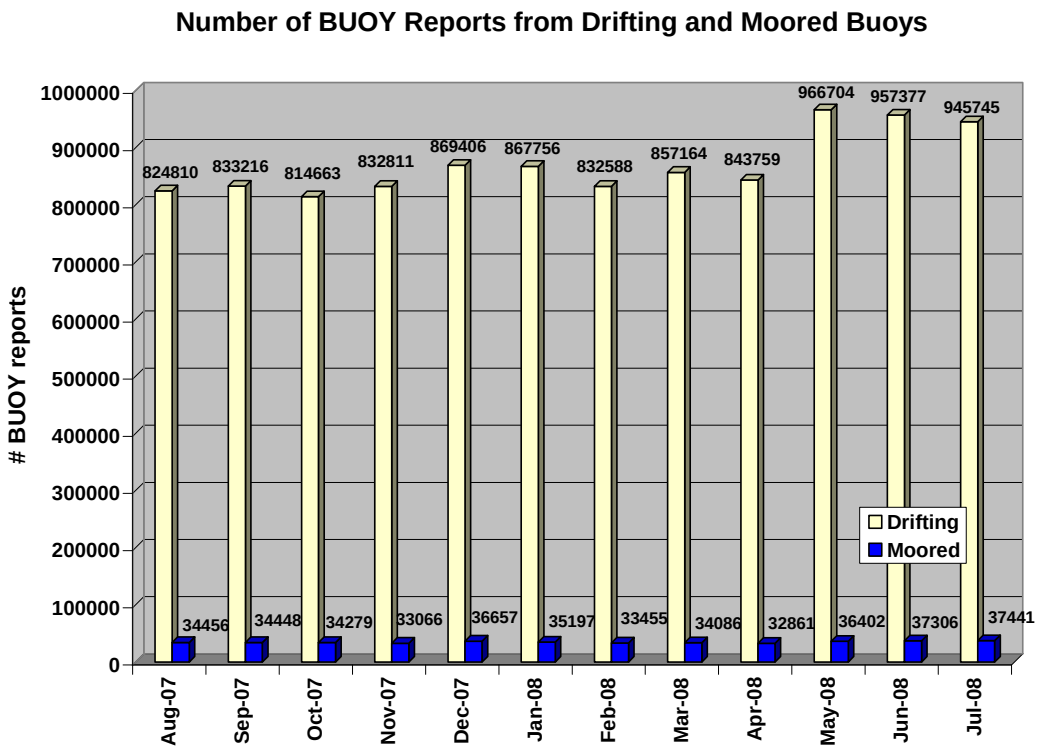

Number of BUOY Reports from Drifting and Moored Buoys
BUOY reports
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
824810
833216
814663
832811
869406
867756
832588
857164
843759
966704
957377
945745
34456
34448
34279
33066
36657
35197
33455
34086
32861
36402
37306
37441
Drifting
Moored
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08

Figure 1

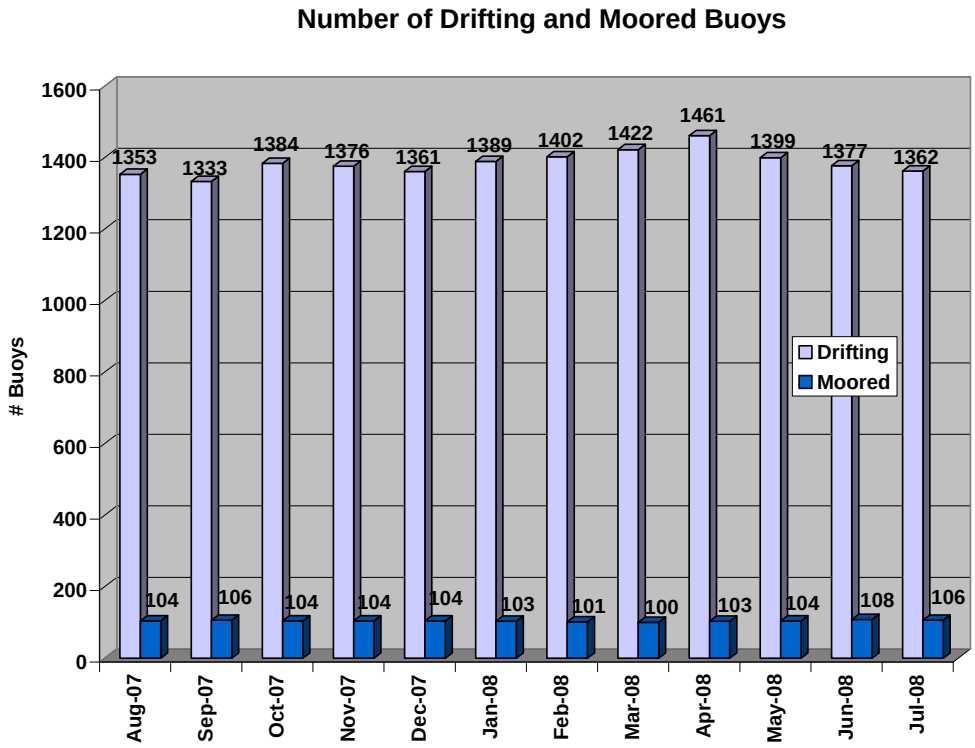

Number of Drifting and Moored Buoys
Buoys
1600
1400
1200
1000
800
600
400
200
0
1353
1333
1384
1376
1361
1389
1402
1422
1461
1399
1377
1362
104
106
104
104
104
103
101
100
103
104
108
106
Drifting
Moored
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08

Figure 2

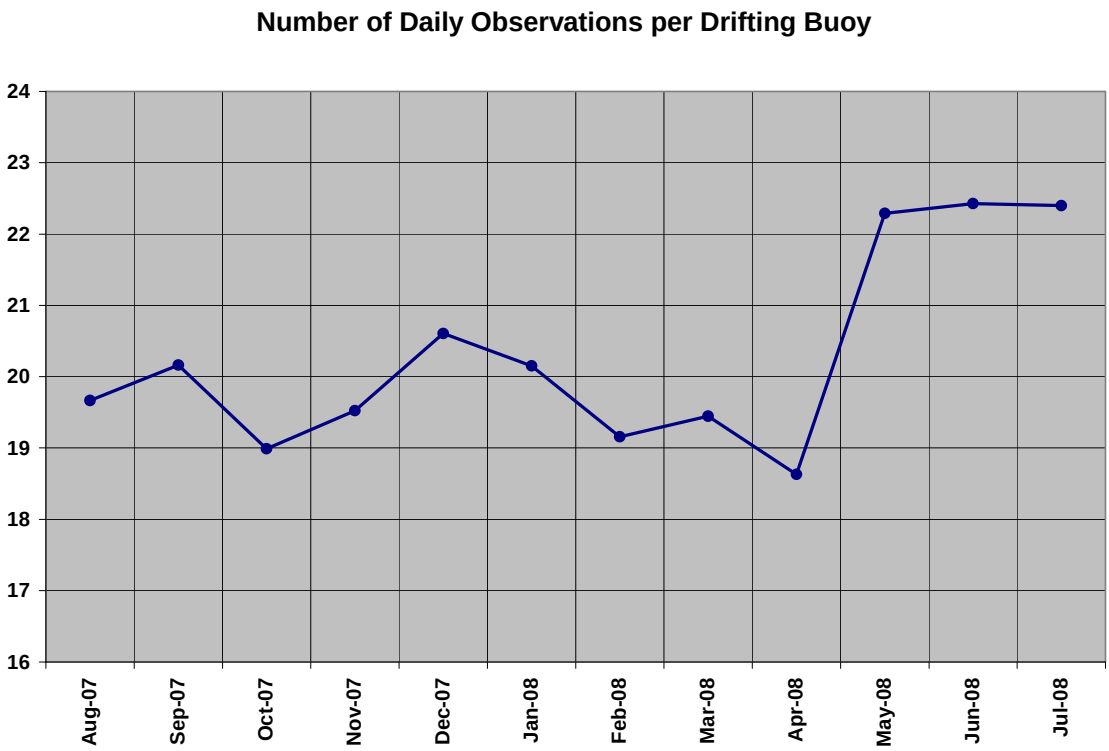
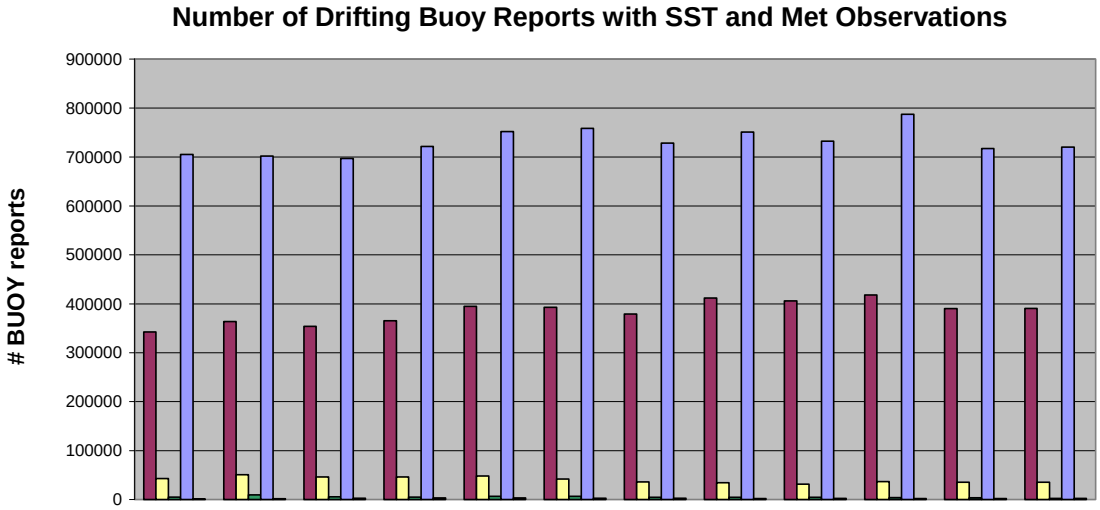

Number of Daily Observations per Drifting Buoy
24
23
22
21
20
19
18
17
16
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08

Figure 3



	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08
Pressure	342623	363632	354165	365198	394779	392832	379107	411939	406182	418080	390450	390747
Air Temp	42912	50773	46118	46236	48416	41927	36295	34684	31585	36754	35353	35332
Wind	5070	9515	5619	5006	6743	6496	4524	4494	4477	4363	3890	2547
SST	705379	701836	697133	721557	751934	758440	728704	751211	732193	787080	717134	720379
Salinity	1416	1485	2907	3352	3382	2985	2764	1995	2523	1994	1877	2485

Figure 4

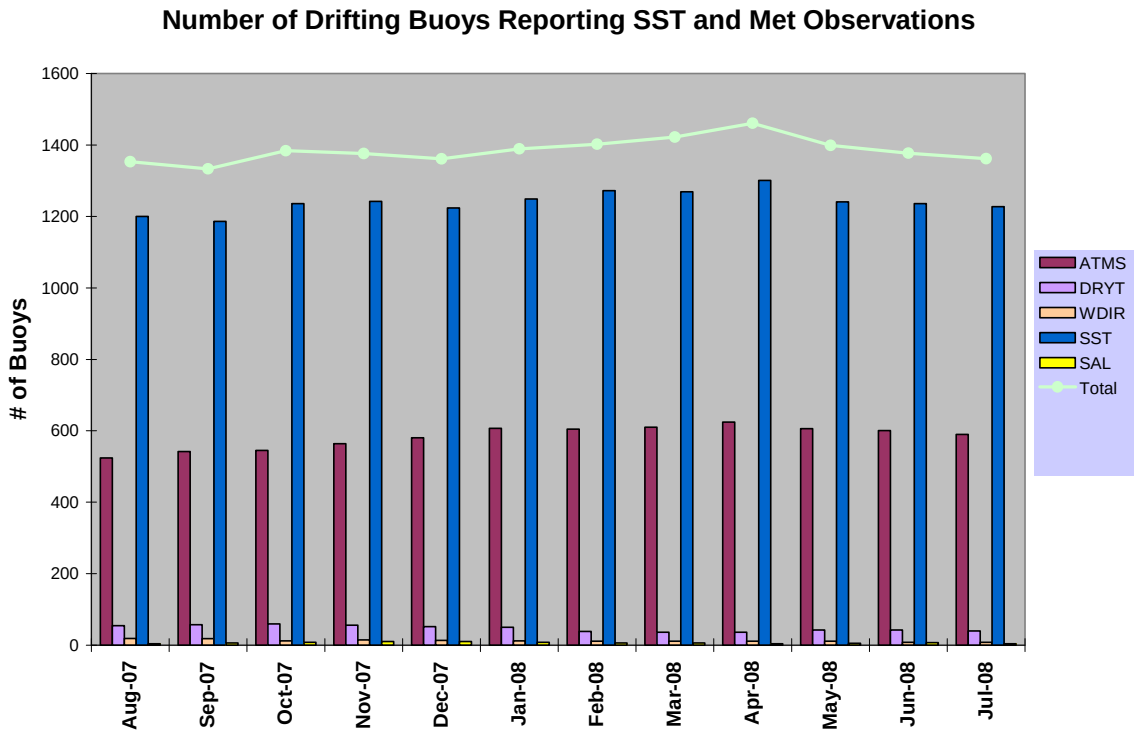

Number of Drifting Buoys Reporting SST and Met Observations
# of Buoys
1600
1400
1200
1000
800
600
400
200
0
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
ATMS
DRYT
WDIR
SST
SAL
Total

Figure 5

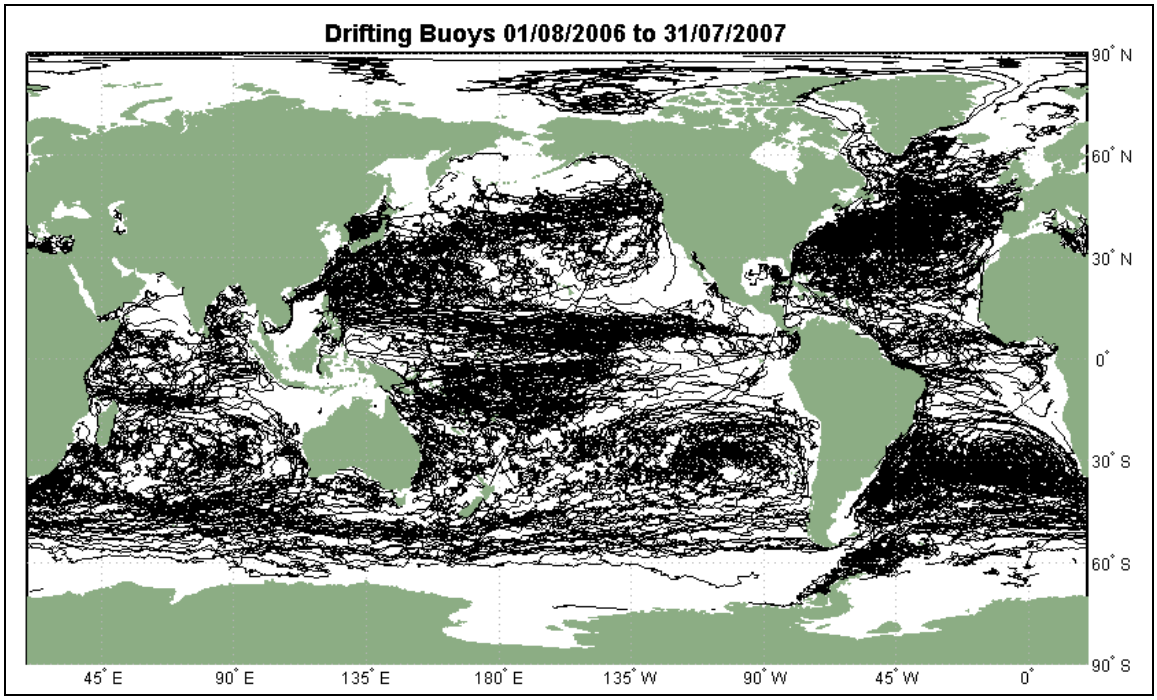

Drifting Buoys 01/08/2006 to 31/07/2007
90° N
60° N
30° N
0°
30° S
60° S
90° S
45° E
90° E
135° E
180° E
135° W
90° W
45° W
0°

Figure 6

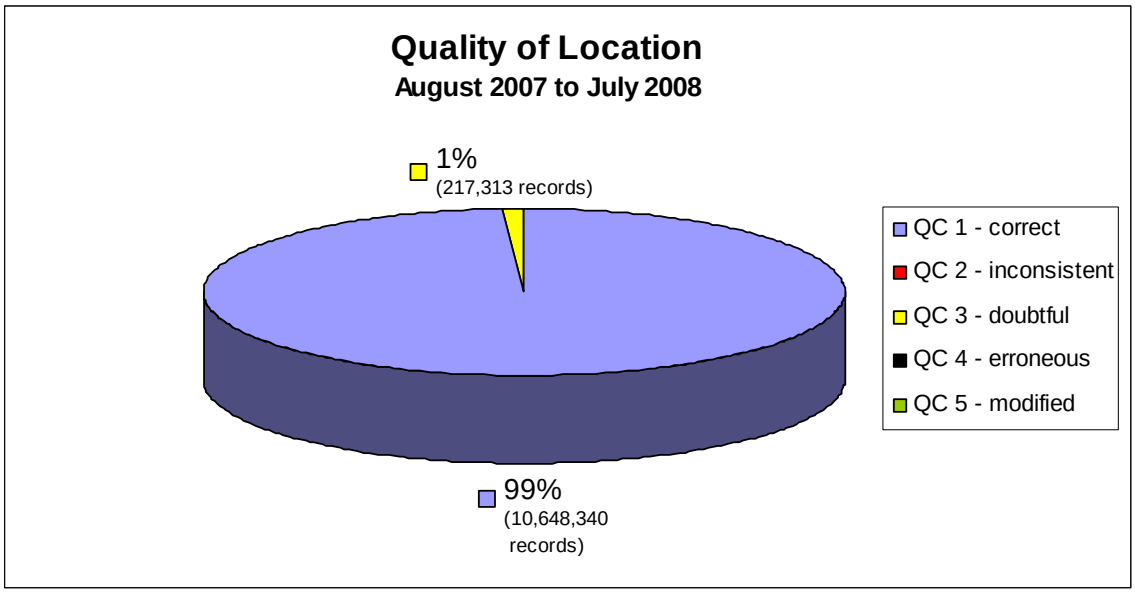

Quality of Location
August 2007 to July 2008
1%
(217,313 records)
99%
(10,648,340 records)
QC 1 - correct
QC 2 - inconsistent
QC 3 - doubtful
QC 4 - erroneous
QC 5 - modified

Figure 7

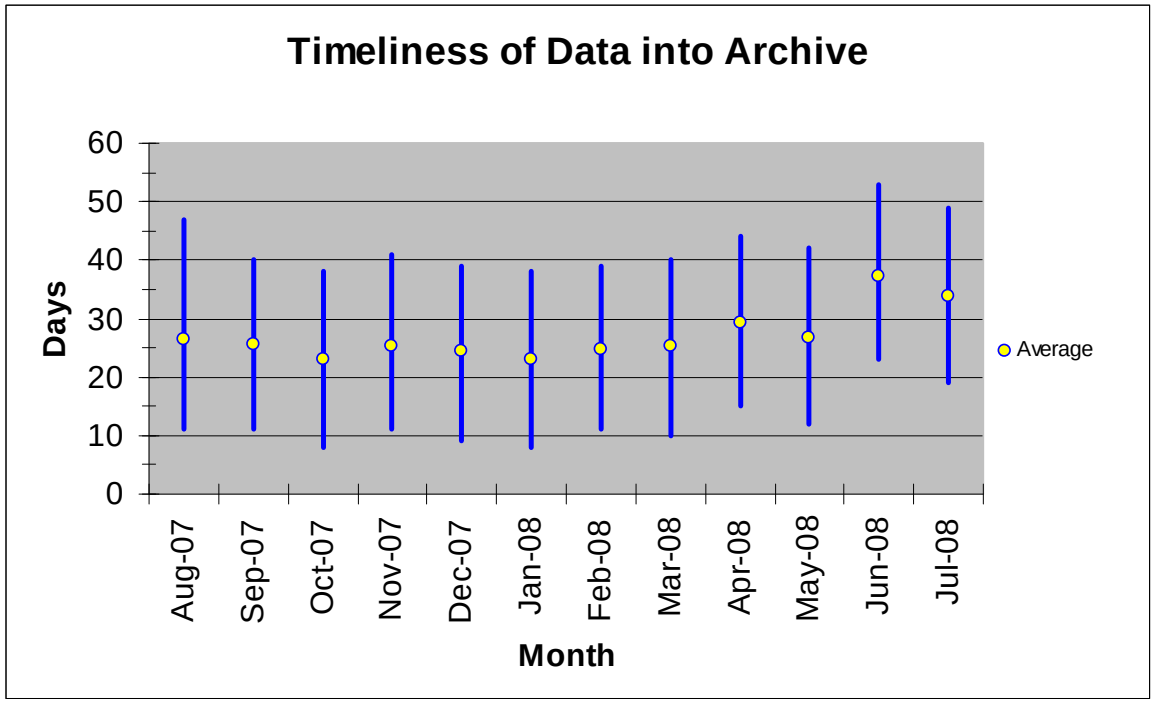

Timeliness of Data into Archive
Days
60
50
40
30
20
10
0
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Month
Average

Figure 8

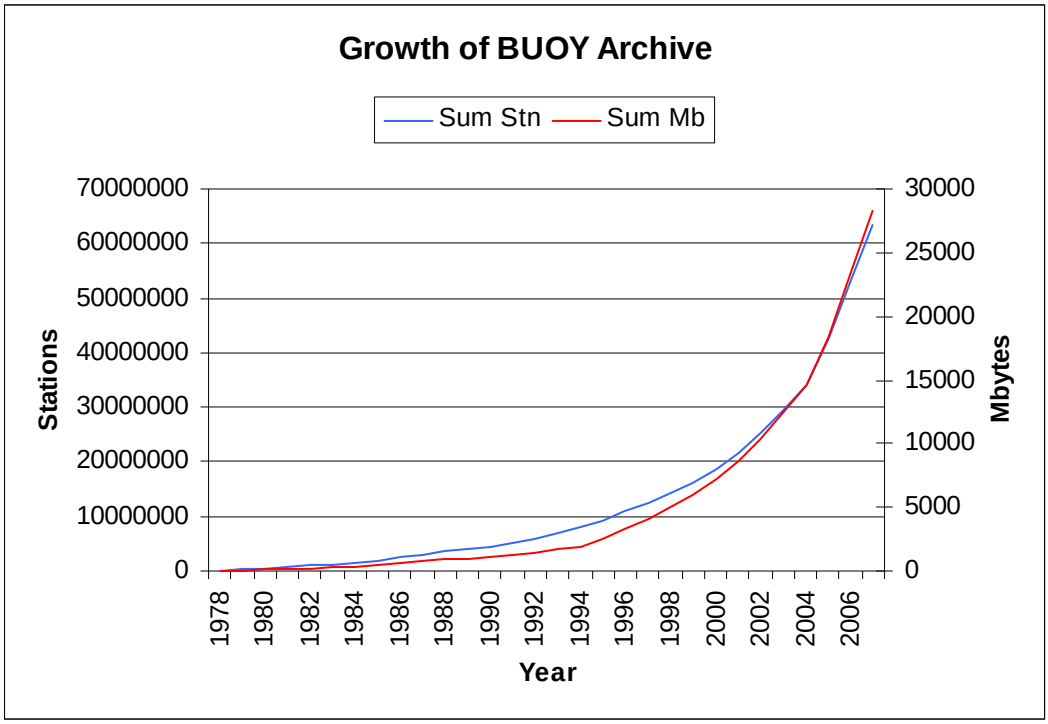

Growth of BUOY Archive
Sum Stn
Sum Mb
70000000
60000000
50000000
40000000
30000000
20000000
10000000
0
Stations
30000
25000
20000
15000
10000
5000
0
Mbytes
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year

Figure 9

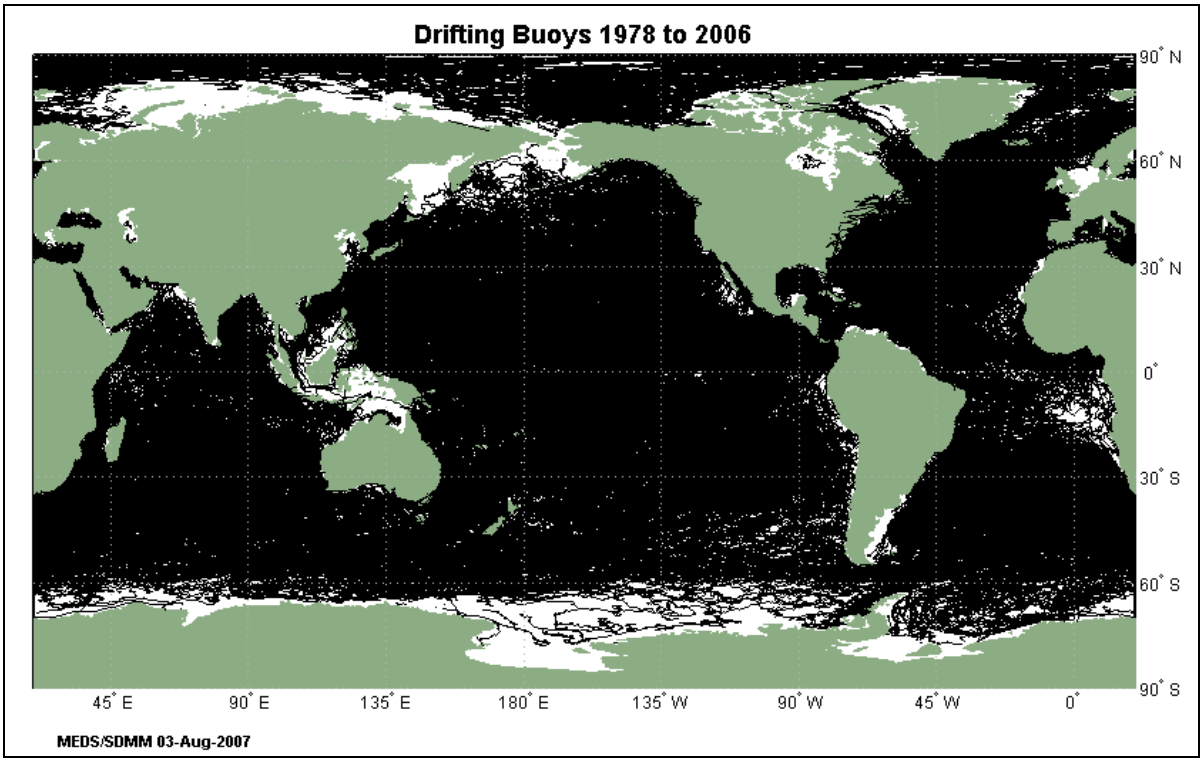

Drifting Buoys 1978 to 2006
90° N
60° N
30° N
0°
30° S
60° S
90° S
45° E
90° E
135° E
180° E
135° W
90° W
45° W
0°
MEDS/SDMM 03-Aug-2007

Figure 10

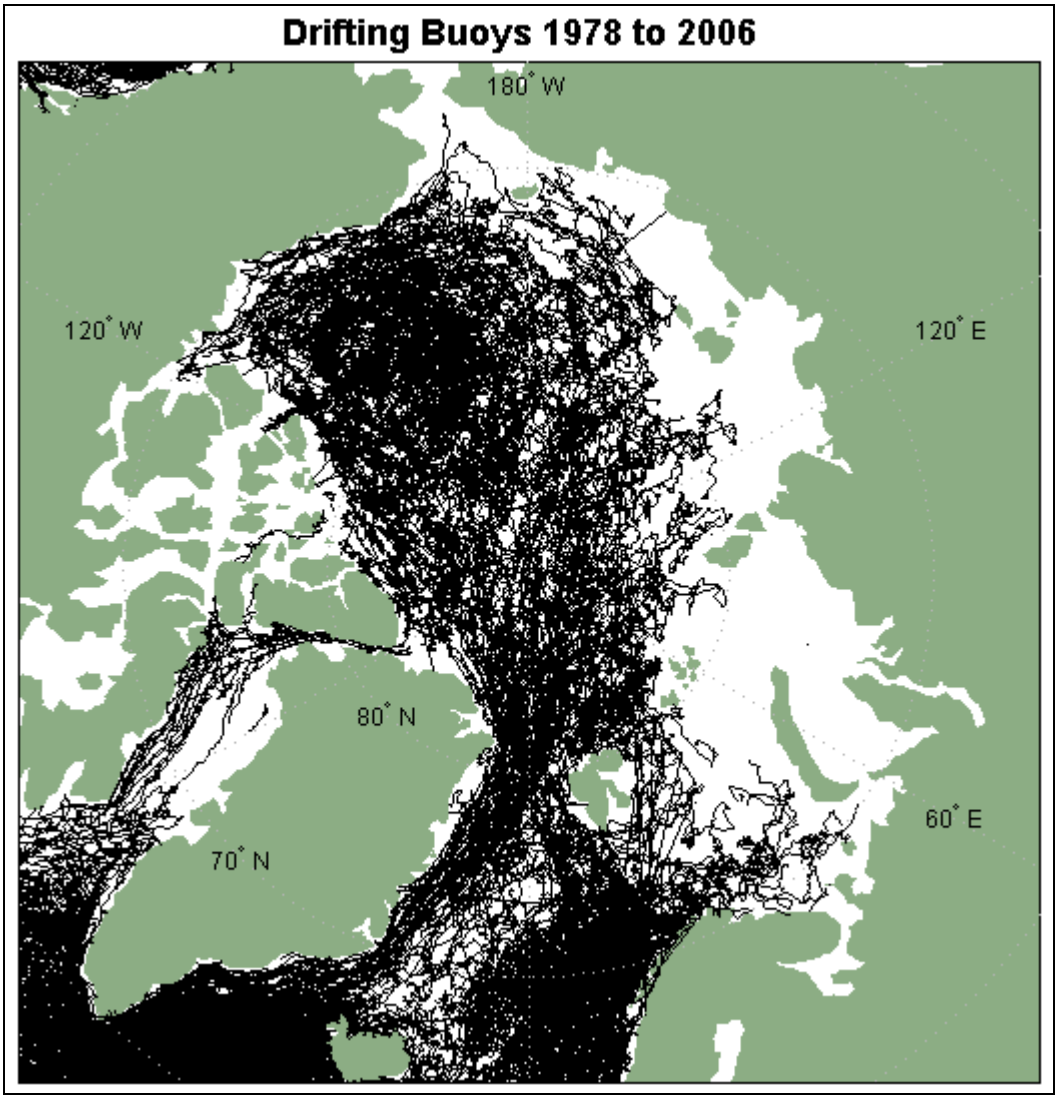


Figure 11

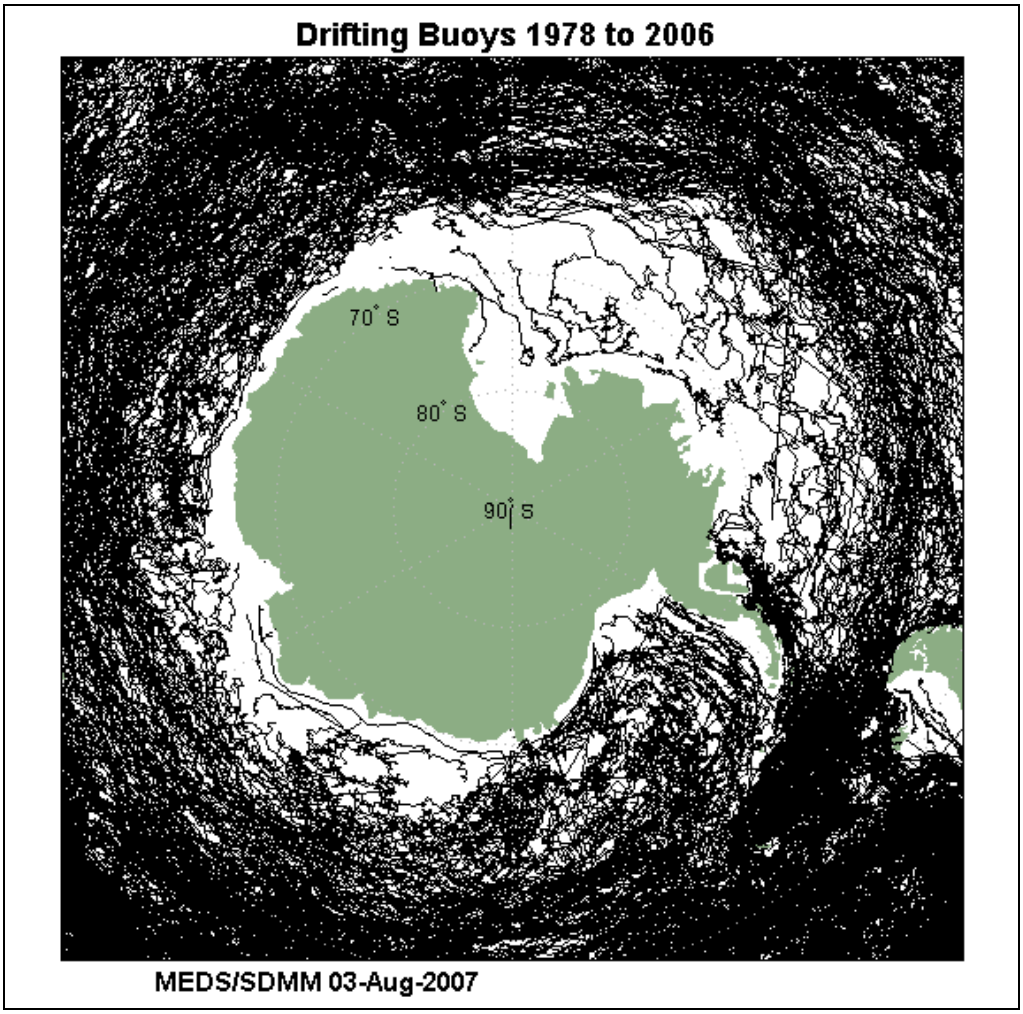
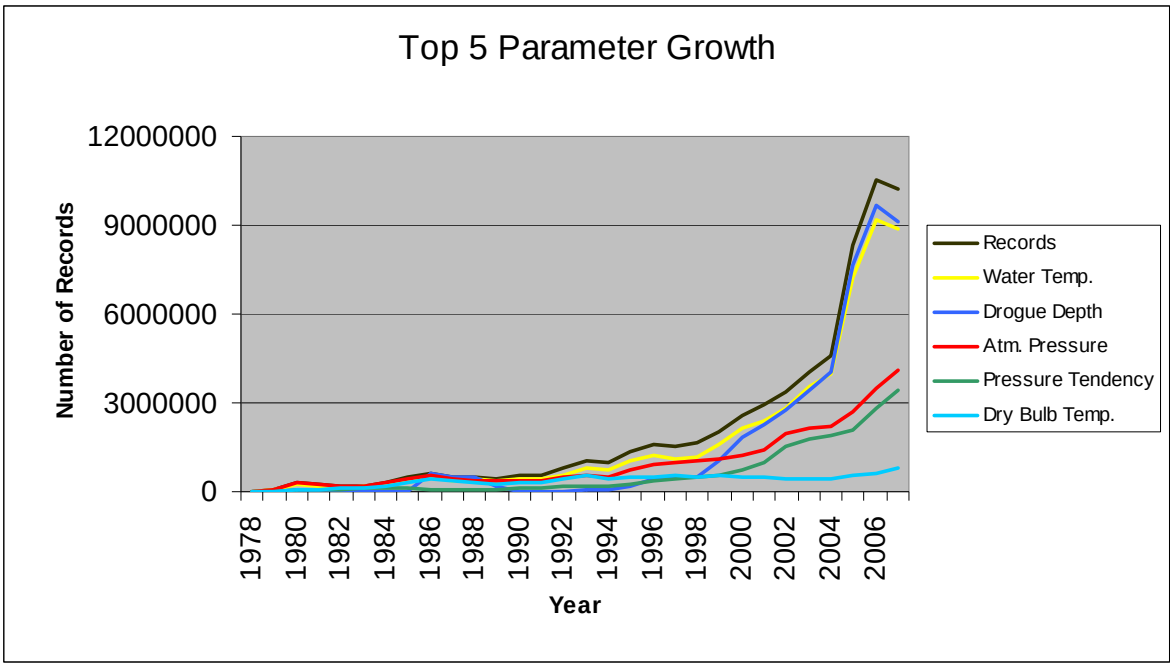


Figure 12


Top 5 Parameter Growth
Number of Records
12000000
9000000
6000000
3000000
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year
Records
Water Temp.
Drogue Depth
Atm. Pressure
Pressure Tendency
Dry Bulb Temp.

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METEO FRANCE
Toujours un temps d'avance

SOC FOR DRIFTING BUOYS REPORT

2007 – 2008

Generalities

The Specialized Oceanographic Center (SOC) for Drifting Buoys has been run continuously during year 2007-2008. SOC is made of Météo-France teams in Toulouse and Brest as well as teams involved in the inter-agency program Coriolis (Ifremer leading the program, and in charge for delayed mode aspects, portal to external users, etc). A daily collection and archiving of buoy reports from the global ocean is performed by Météo-France. Collaboration within the Coriolis project (*www.coriolis.eu.org*), with JCOMMOPS and also CLS-Argos are main aspects of this SOC, beside regular exchanges with other data centres, measurement teams and agencies, and with users.

Météo-France operates quality control (QC) procedures on drifting buoys data. Warning messages are sent to the *buoy-qir@vedur.is* mailing list of Internet, when a problem appears (e.g. bad location detected, wrong acceleration and loss of drogue, sensor drift, etc) or when a modification seems needed (i.e. to recalibrate or to remove a sensor from GTS) via the JCOMMOPS interface. Statistics on comparisons with analysis fields are set up for each buoy. Monthly statistics are sent to the *buoy-qir@vedur.is* mailing list too.

Buoy data QC tools developed by Météo-France are available on the Internet (*www.meteo.shom.fr/qctools*) to help buoy operators to check their own buoys: monthly statistics carried out by 4 meteorological centres for individual buoys; plots of data and differences with model outputs; blacklists of buoys reporting dubious air pressure values or being perhaps ashore can be seen. It is foreseen to modify the TESAC QC during the second half of 2008 in the following way: up to now, reports with incomplete levels (temperature or salinity missing) were fully rejected; they should be soon kept, missing data being indicated by slash groups). Few more tenths of reports should pass through QC every day.

Statistics

In addition to the products linked to buoy QC, the SOC for Drifting Buoys produces monthly products for buoys, moored buoys, drifting buoys, ships. Data are delivered on request, or on a regular basis and via Internet (*http://esurfmar.meteo.fr/doc/o/daim*). Examples are given (see Annex) for the last year.

- Figures 1, 2, 3 and 4 shows the time evolution of reports for wind and for pressure respectively for all BUOY reports (showing all buoys, moored buoys and Drifting Buoys) and SHIP reports, since January 2007.

- Figure 5 shows the time evolution of WAVEOB reports and sensors since January 2007.

Each month, mapping position plot charts and Marsden square distribution are produced for BATHY, BUOY, SHIP, TESAC, and TRACKOB.

- Figures 6a, b to 10a, b show these products for June 2008. "a" stands for mapping position plot charts, and "b" for Marsden square distribution. Figures 6a and 6b:

BATHY, Figures 7a and 7b: BUOY, Figures 8a and 8b: SHIP, Figures 9a and 9b: TESAC, and Figures 10a and 10b: TRACKOB.

Each month, Marsden square distribution charts of mean monthly data availability (top) and percentage of BUOY reports compared to SHIP + BUOY reports (bottom) for wind, pressure, air temperature, sea surface temperature are produced.

- Figures 11 to 14 show such products for June 2008. Figure 11: Wind, Figure 12: Pressure, Figure 13: Air temperature, Figure 14: Sea surface temperature.

The annual statistics show a general trend with more reports in 2008 than in 2007. In the details, different signals appear, depending on reports types (see below Tables 1 and 2).
In the case of Buoy reports, the number of reports is very stable, but with a substantial increase of pressure measurements (+18%), corresponding to a similar increase (17%) of drifting buoy reports with pressure data. Even if they contribute at the level of 4% to BUOY reports, the moored buoys are producing significantly more reports (+16%) in 2008 than in 2007 and pressure measurements increase even by 34%. For wind data, these moored buoys do more than counterbalancing the reduction of drifting buoy wind data (overall increase of 7%).
The number of SHIP reports jumps up with 21% in 2008.
WAVEOB reports increase by 20%. At the same time, the number of sensors increase by 25%. The average production of reports by sensor is therefore slightly decreasing.

	BUOY			**Moored BUOY**			**Drifting BUOY**		
	Total	Wind	Pressure	Total	Wind	Pressure	Total	Wind	Pressure
2006-2007	1019840,8	28245,8	351882,3	40491,3	22018,4	8650,5	979349,7	6227,3	343231,8
2007-2008	1026038,3	30343,3	414185,7	46780,4	25117,9	11624,8	979257,8	5225,3	402560,9
Difference	6197,5	2097,5	62303,4	6289,2	3099,5	2974,3	-91,8	-1002,0	59329,2
%	1%	7%	18%	16%	14%	34%	0%	-16%	17%

Table1 : Interannual comparison of monthly average reports numbers for BUOY

	SHIP			**WAVEOB**	
	Total	Wind	Pressure	Reports	Sensors
2006-2007	275739,0	220052,4	229661,3	57266,9	85,2
2007-2008	333200,3	250417,8	253583,3	68695,3	106,7
Difference	57461,3	30365,3	23921,9	11428,3	21,5
%	21%	14%	10%	20%	25%

Table 2: Interannual comparison of monthly average reports numbers for SHIP and WAVEOB

Coriolis
Since the 1st of January 2002, Météo-France has been providing the Coriolis Data Centre with surface current data computed thanks to SVP drifter tracks. Coriolis contributes to the French operational oceanographic project with in-situ data. Buoy positions, obtained from the GTS, are interpolated every 3 hours. Surface current data are computed over 6 hours, on a weekly basis. Data are flagged with drogue presence indexes. Since mid-2004, wind speed and wind stress data from ECMWF analysis model coupled with sampled surface current data are delivered too and used by operational oceanography centres (such as Mercator, French component of the Godae international experiment).

Figure 1: Time evolution of BUOY reports number for wind and pressure:

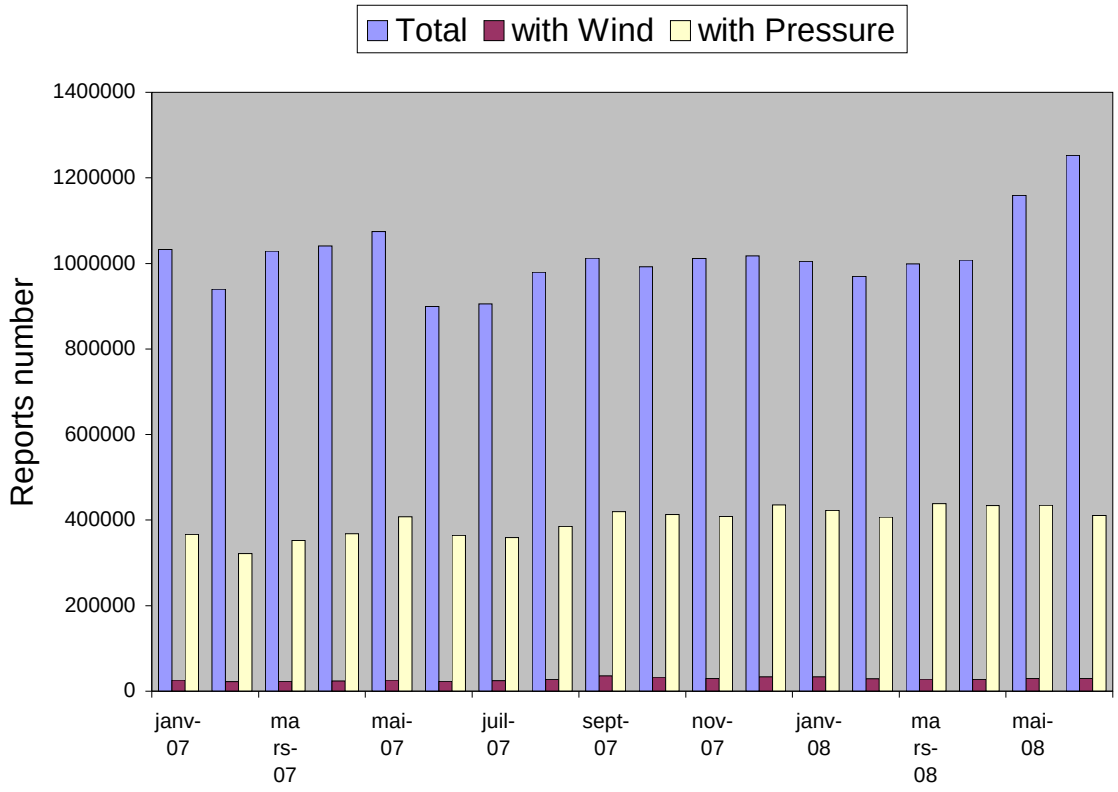

Figure2: Time evolution of Moored BUOY reports number for wind and pressure:

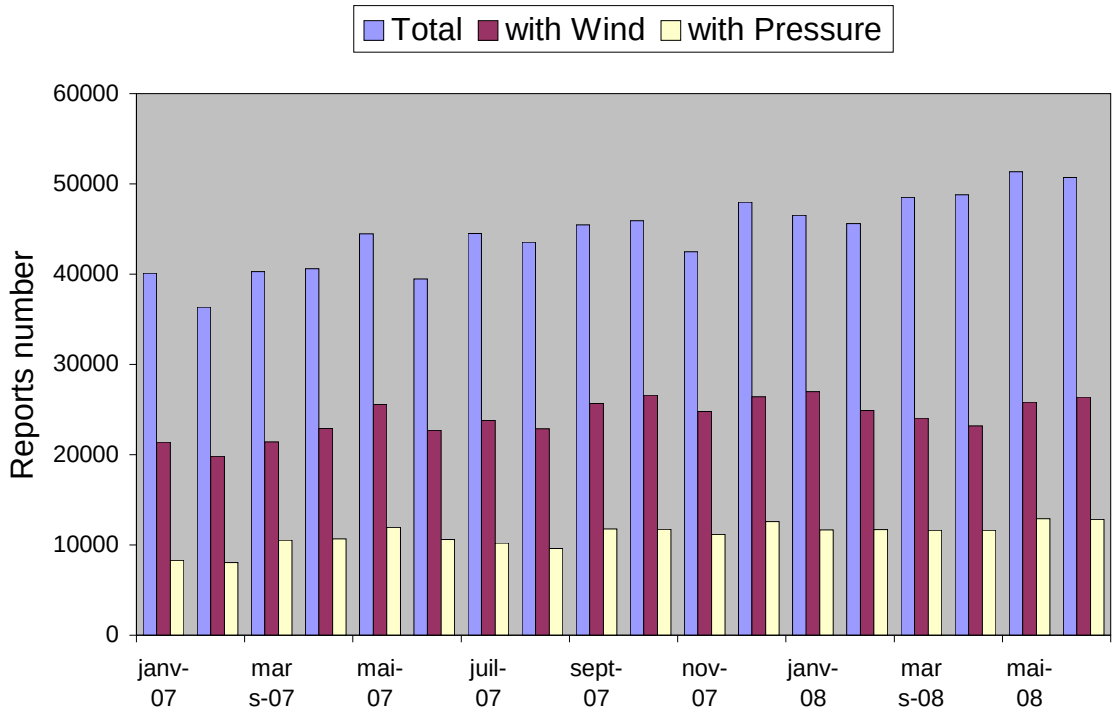

Figure 3: Time evolution of Drifting BUOY reports number for wind and pressure:

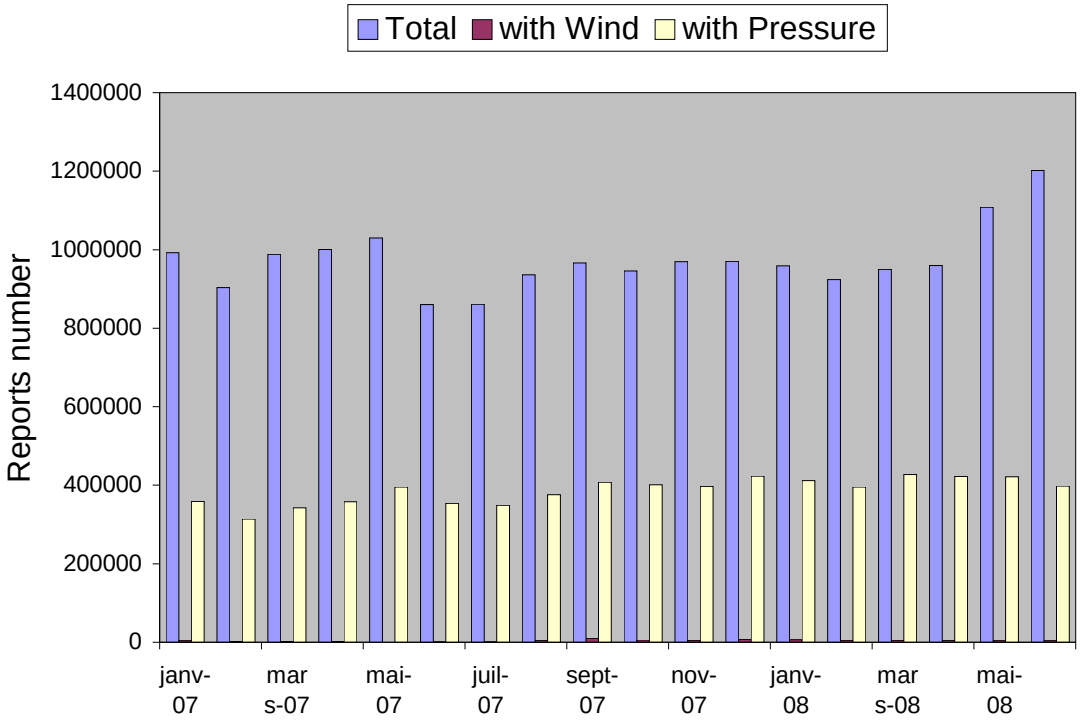

Figure 4: Time evolution of SHIP reports number for wind and pressure:

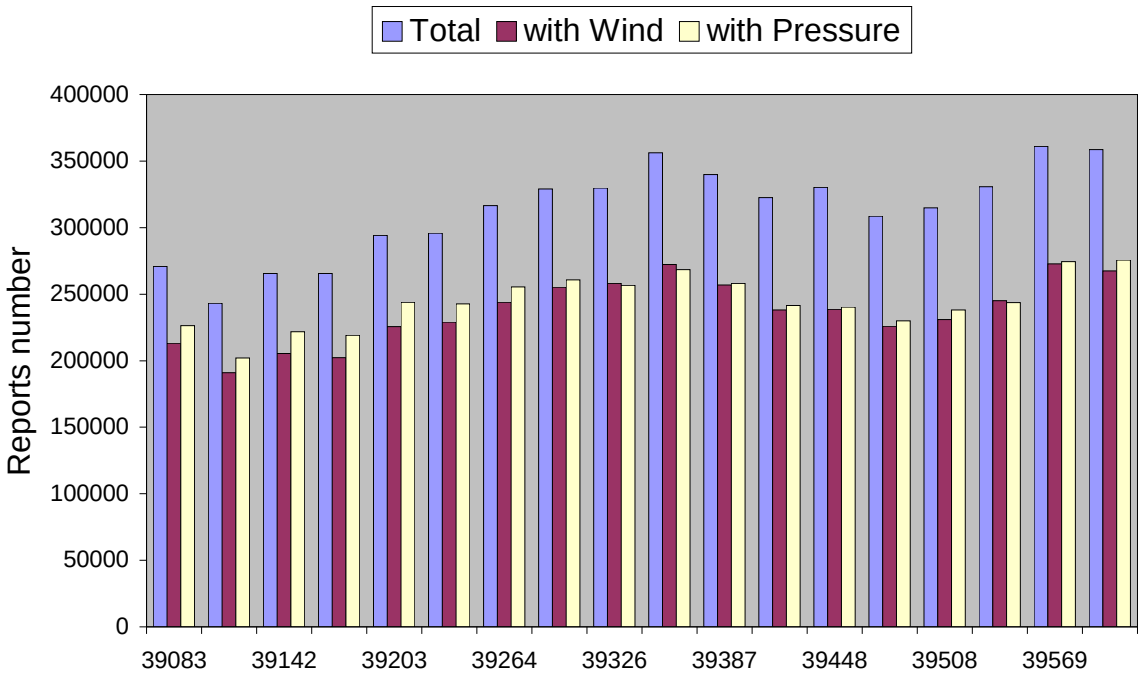

Figure 5: Time evolution of WAVEOB reports and sensors number:

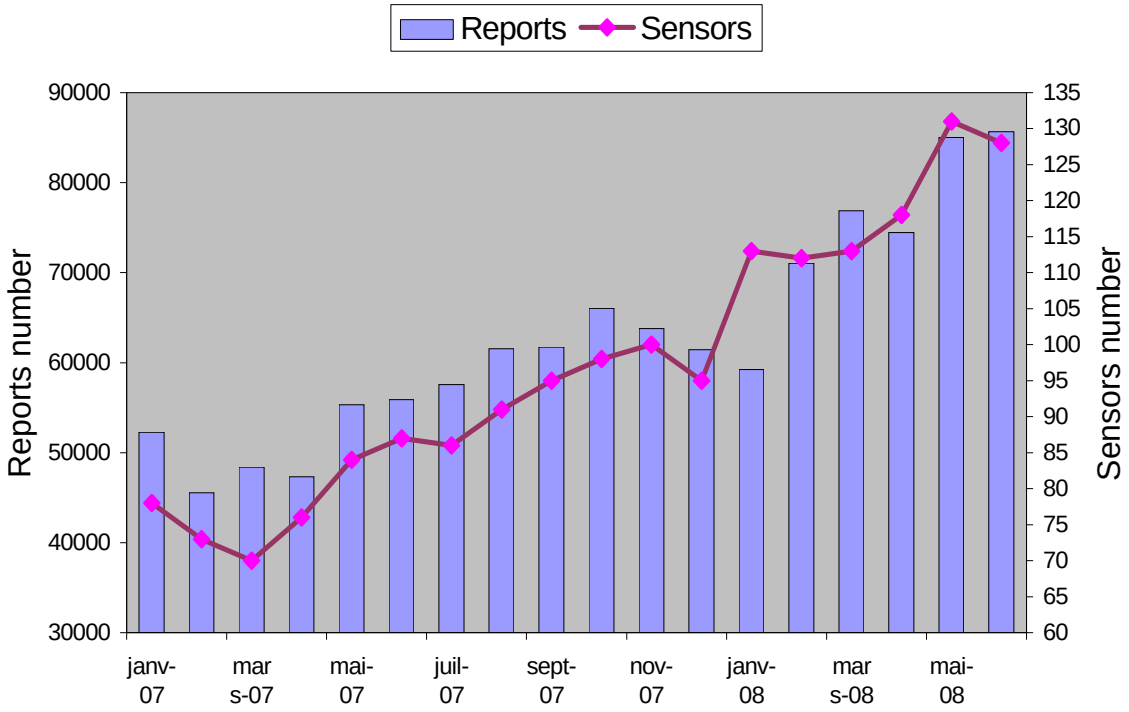

Figure 6a: Mapping position plot chart of data received during June 2008 (BATHY):

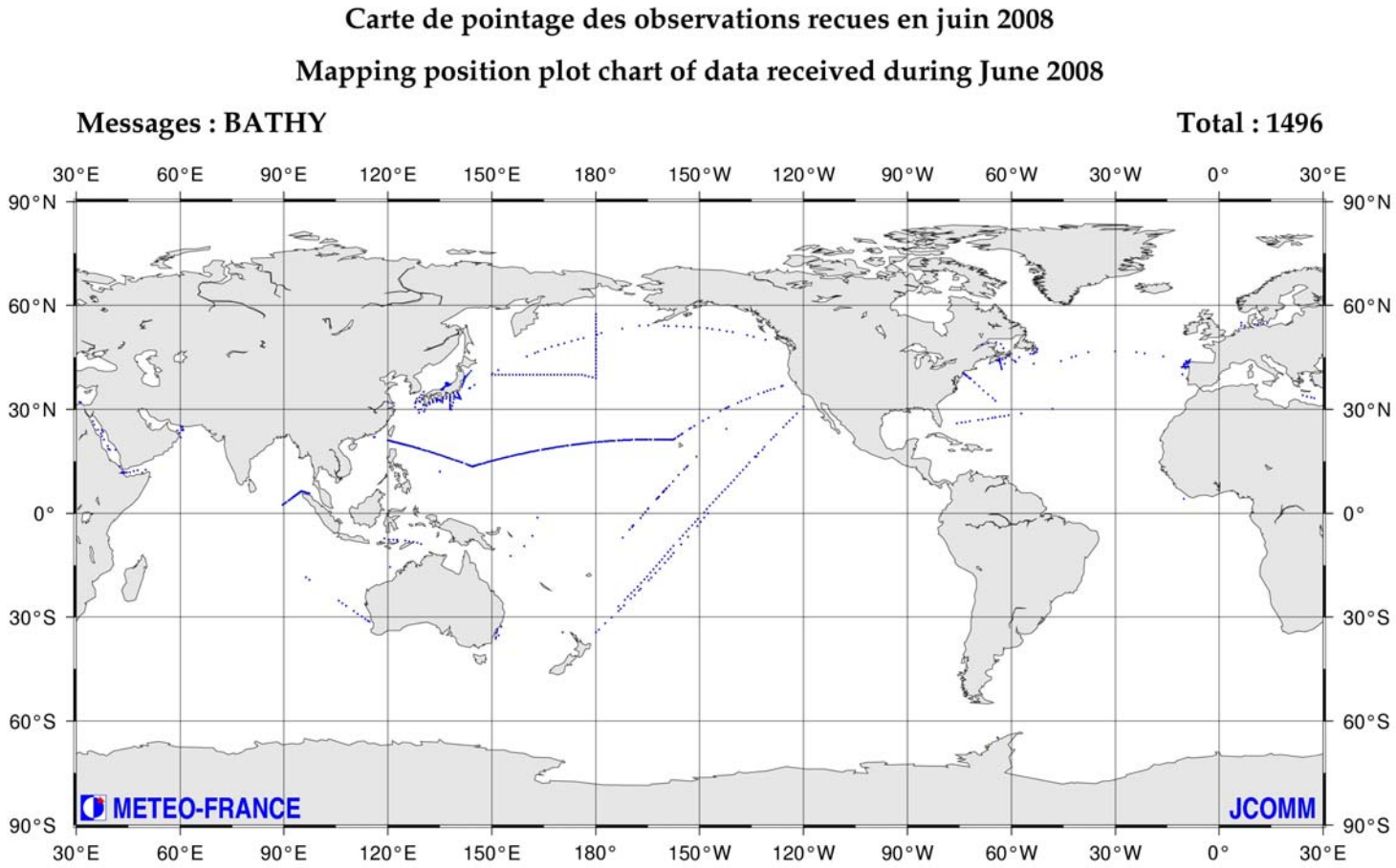

Figure 6b: Marsden square distribution chart of data received during June 2008 (BATHY):

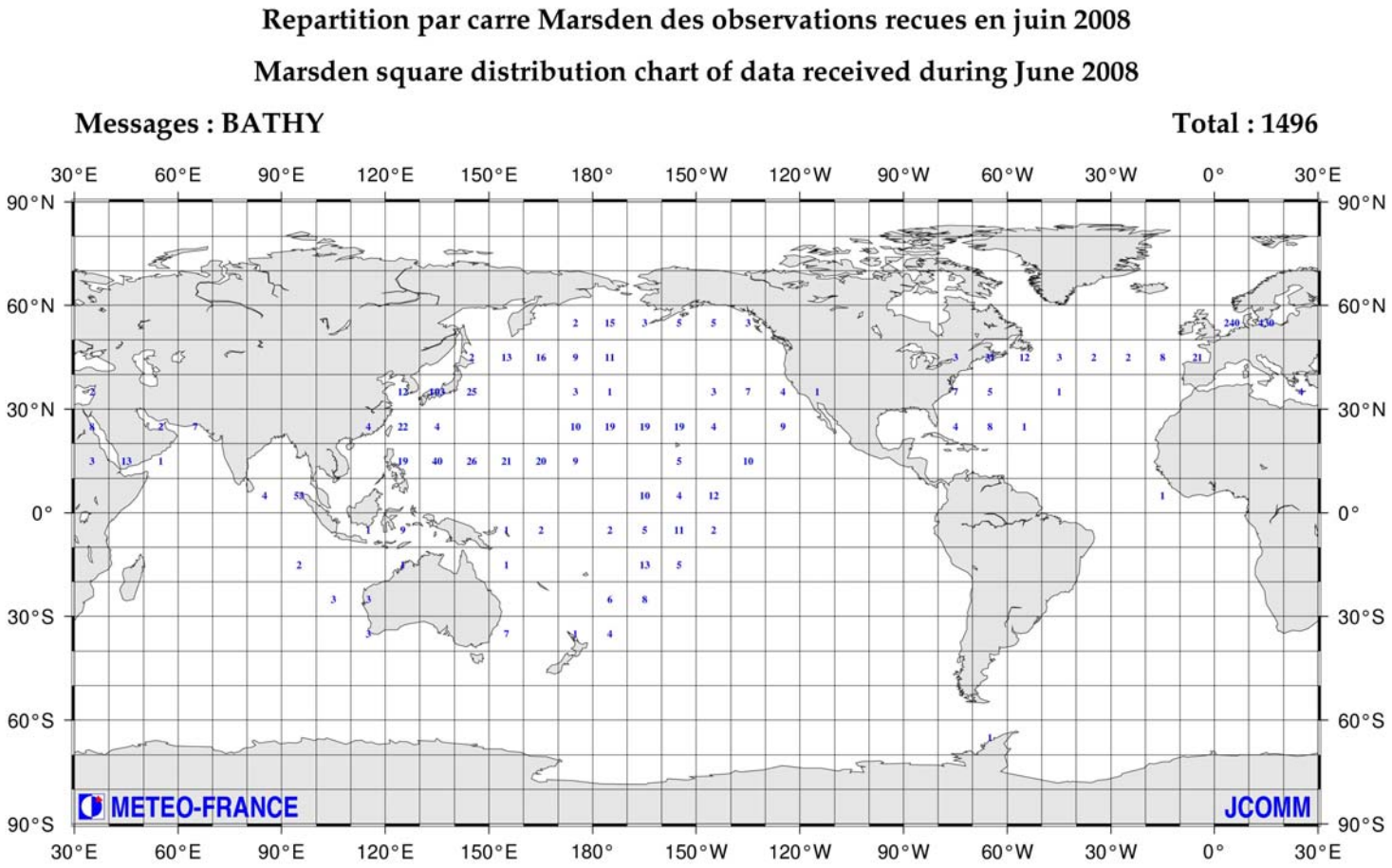

Figure 7a: Mapping position plot chart of data received during June 2008 (BUOY):

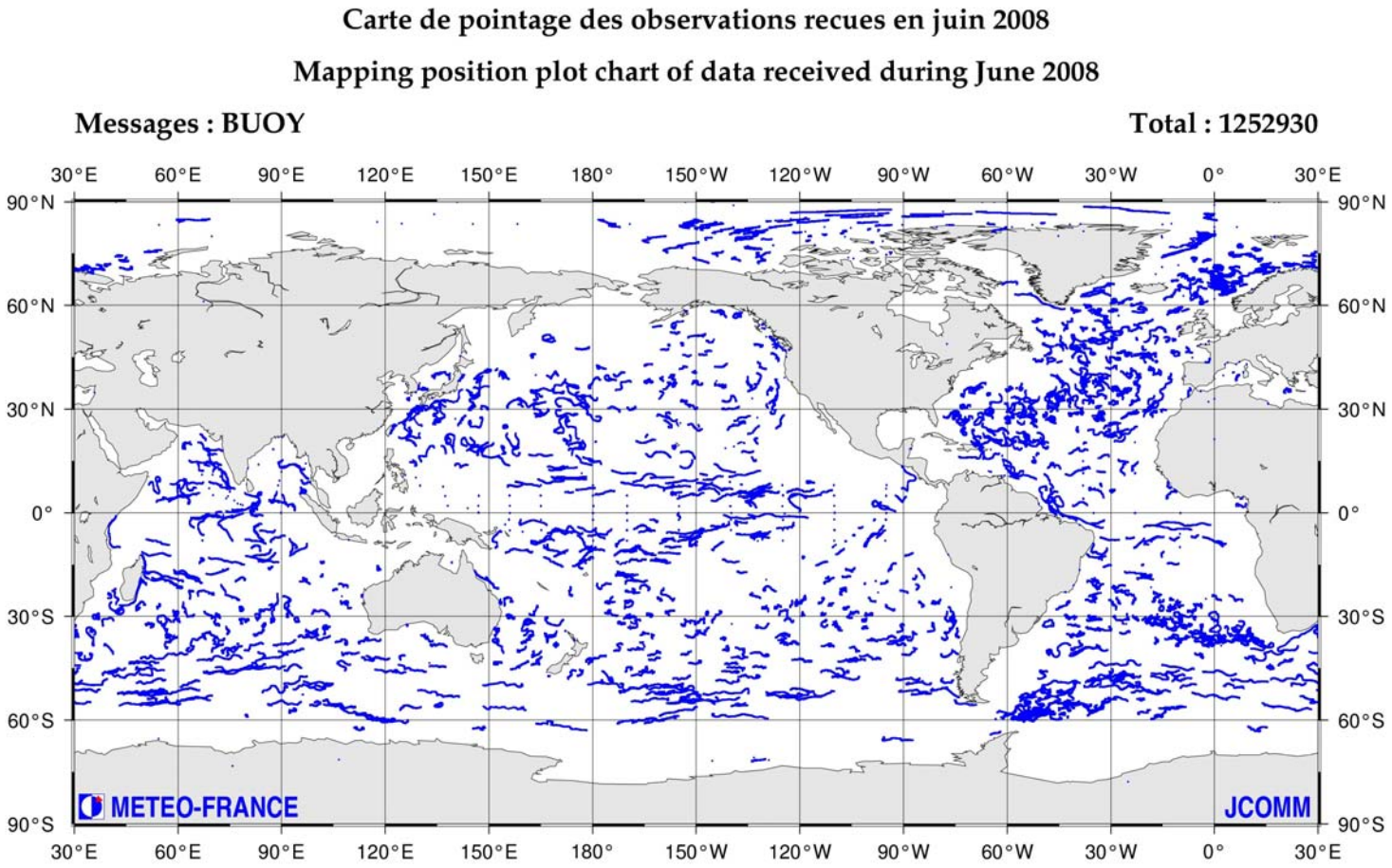

Figure 7b: Marsden square distribution chart of data received during June 2008 (BUOY):

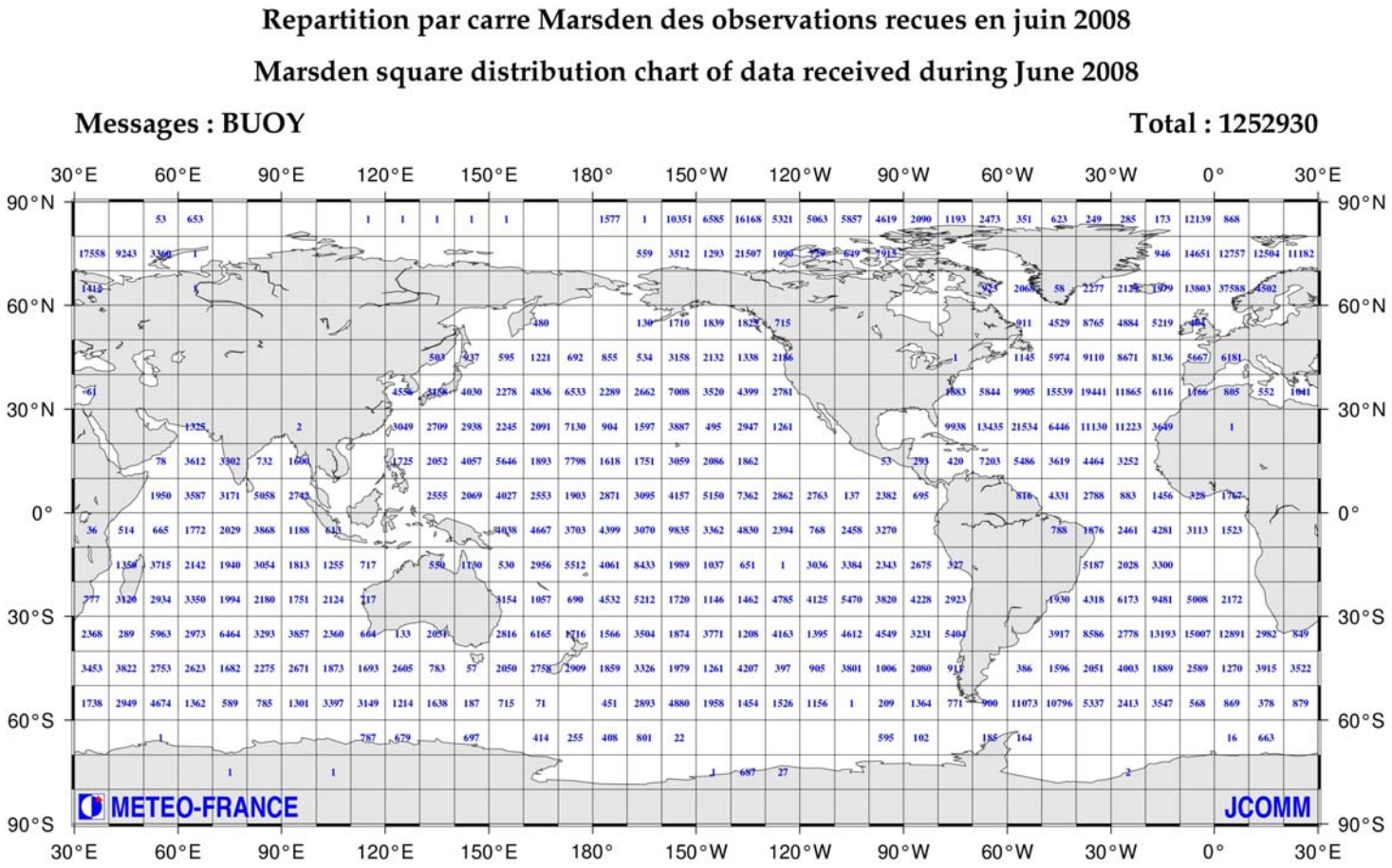

Figure 8a: Mapping position plot chart of data received during June 2008 (SHIP):

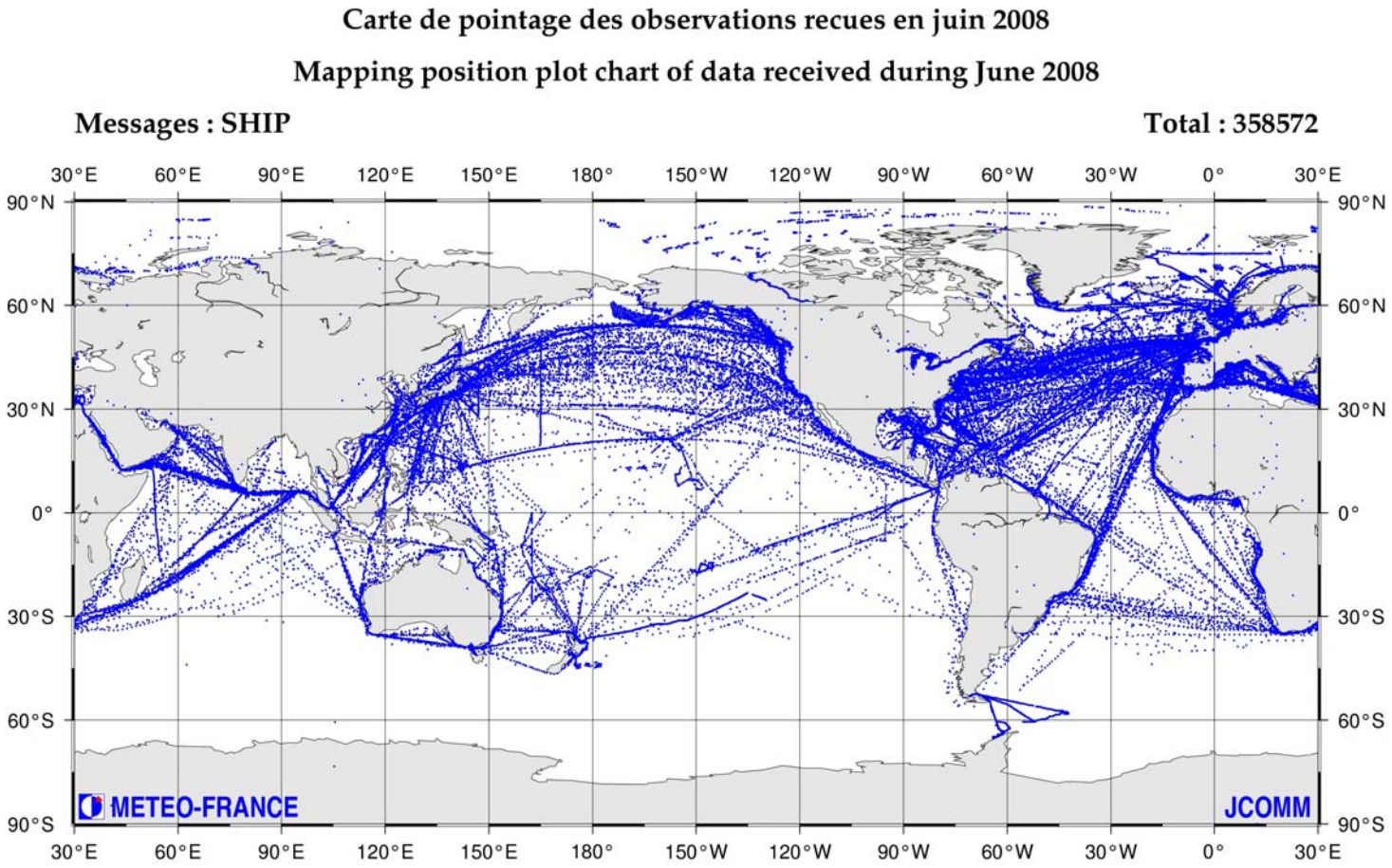

Figure 8b: Marsden square distribution chart of data received during June 2008 (SHIP):

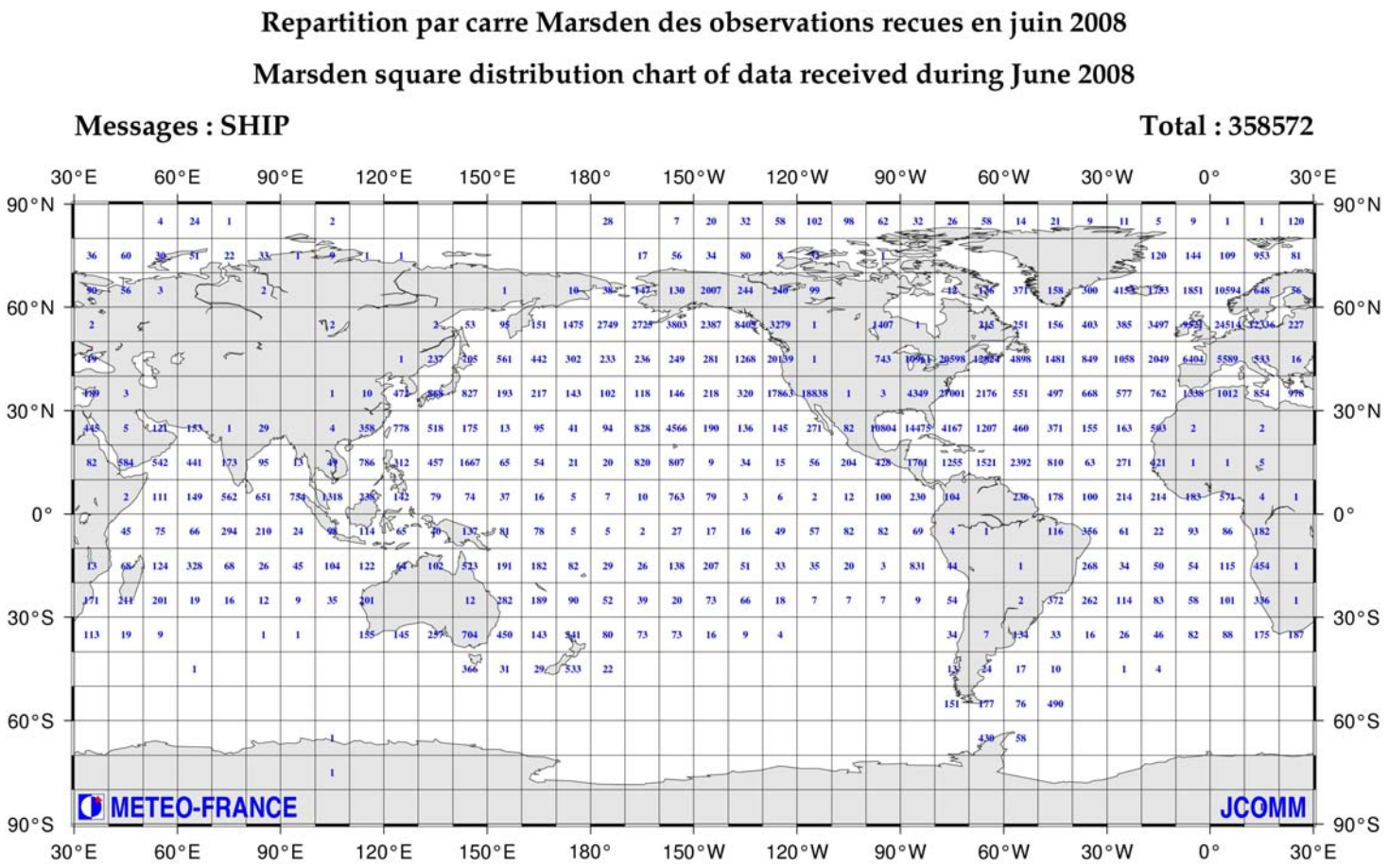

Figure 9a: Mapping position plot chart of data received during June 2008 (TESAC):

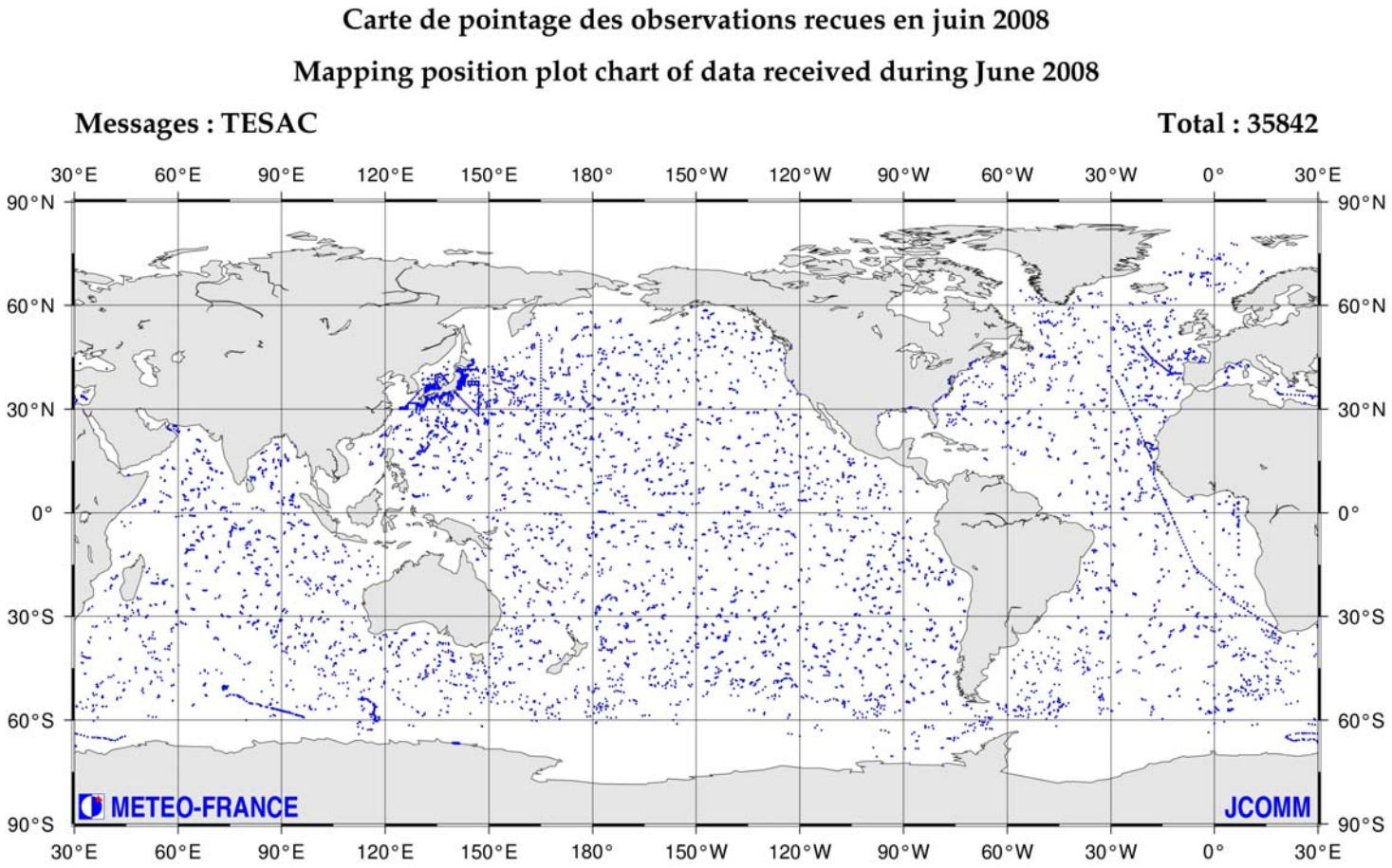

Figure 9b: Marsden square distribution chart of data received during June 2008 (TESAC):

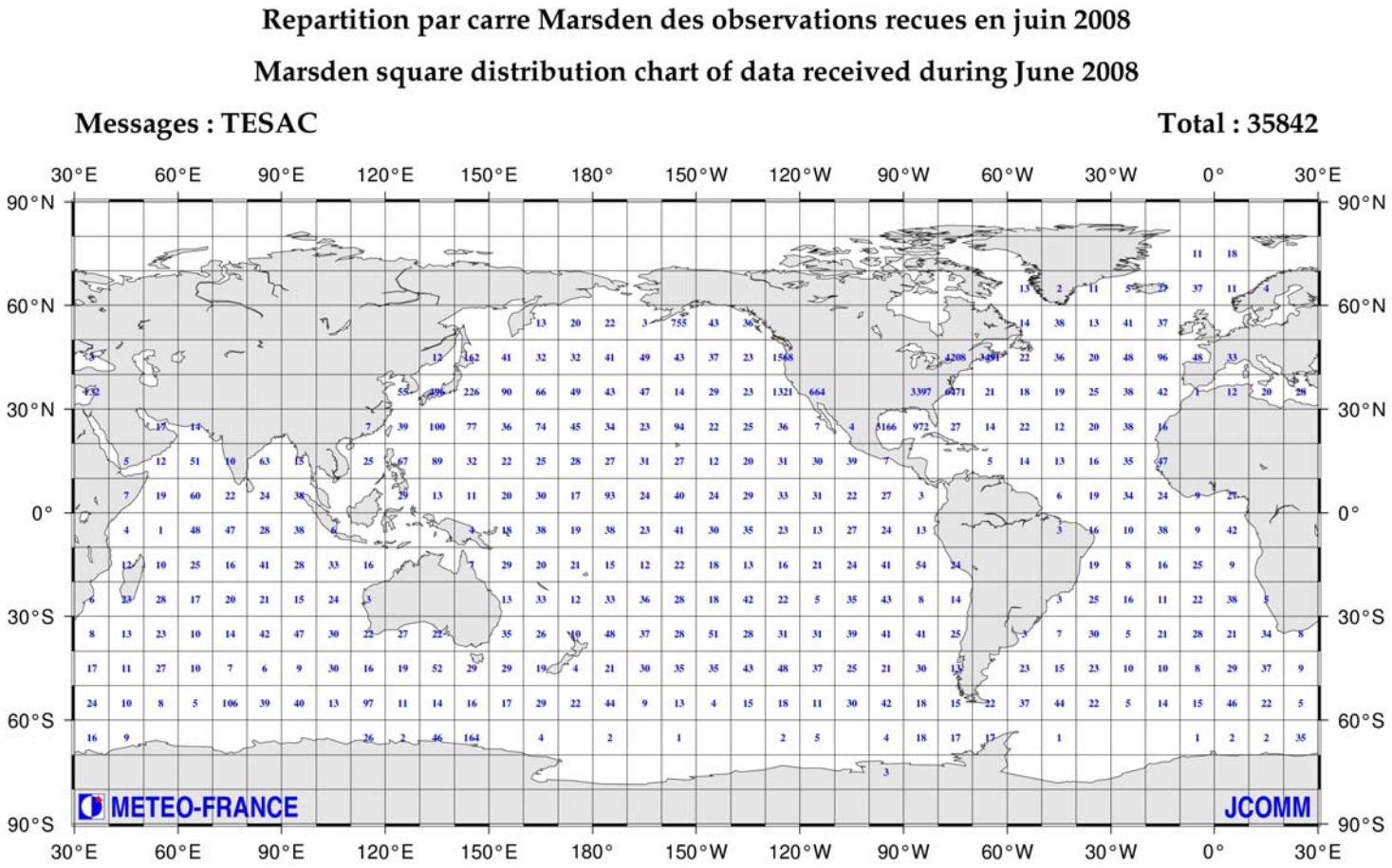

Figure 10a: Mapping position plot chart of data received during June 2008 (TRACKOB):

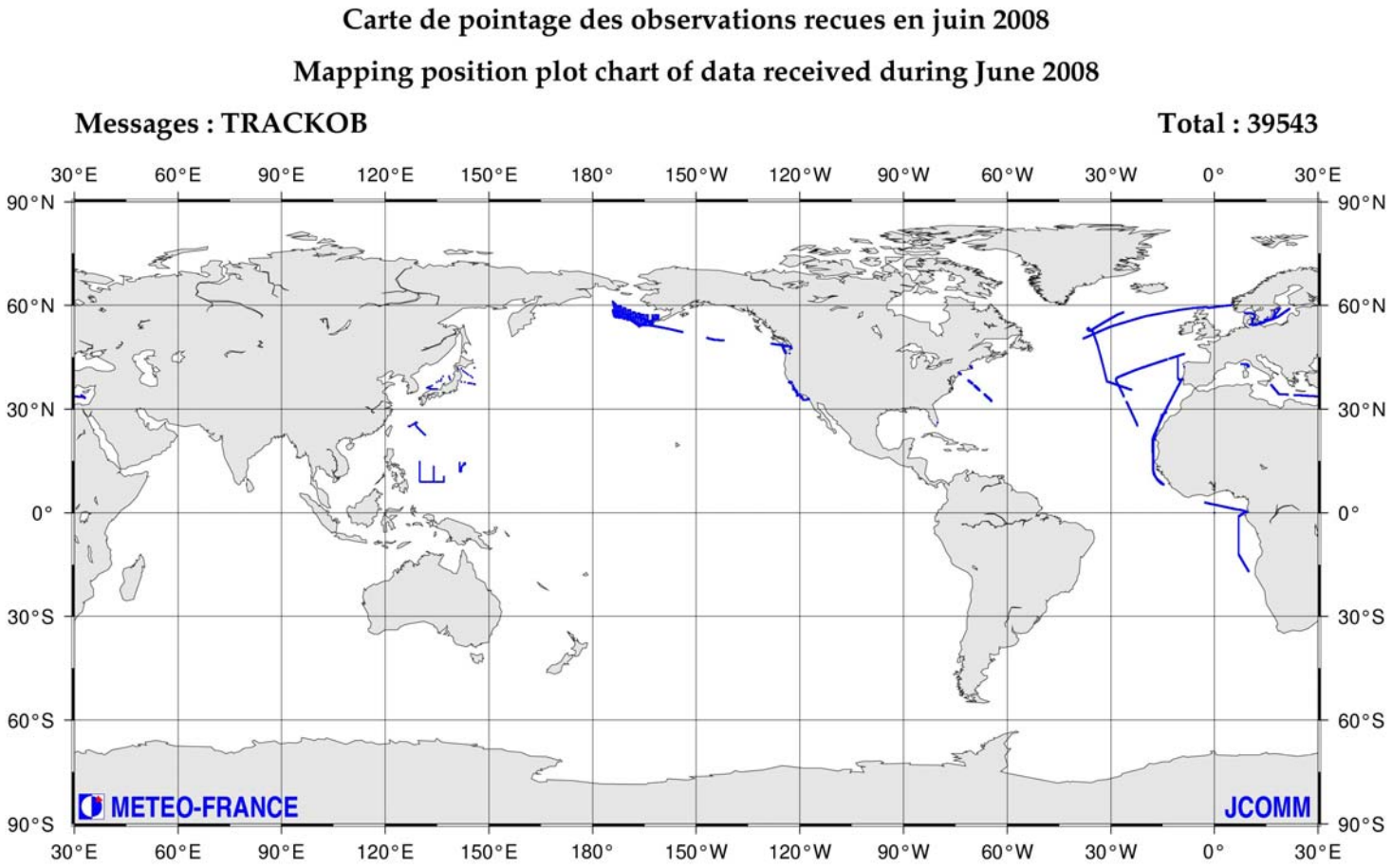

Figure 10b: Marsden square distribution chart of data received during June 2008 (TRACKOB):

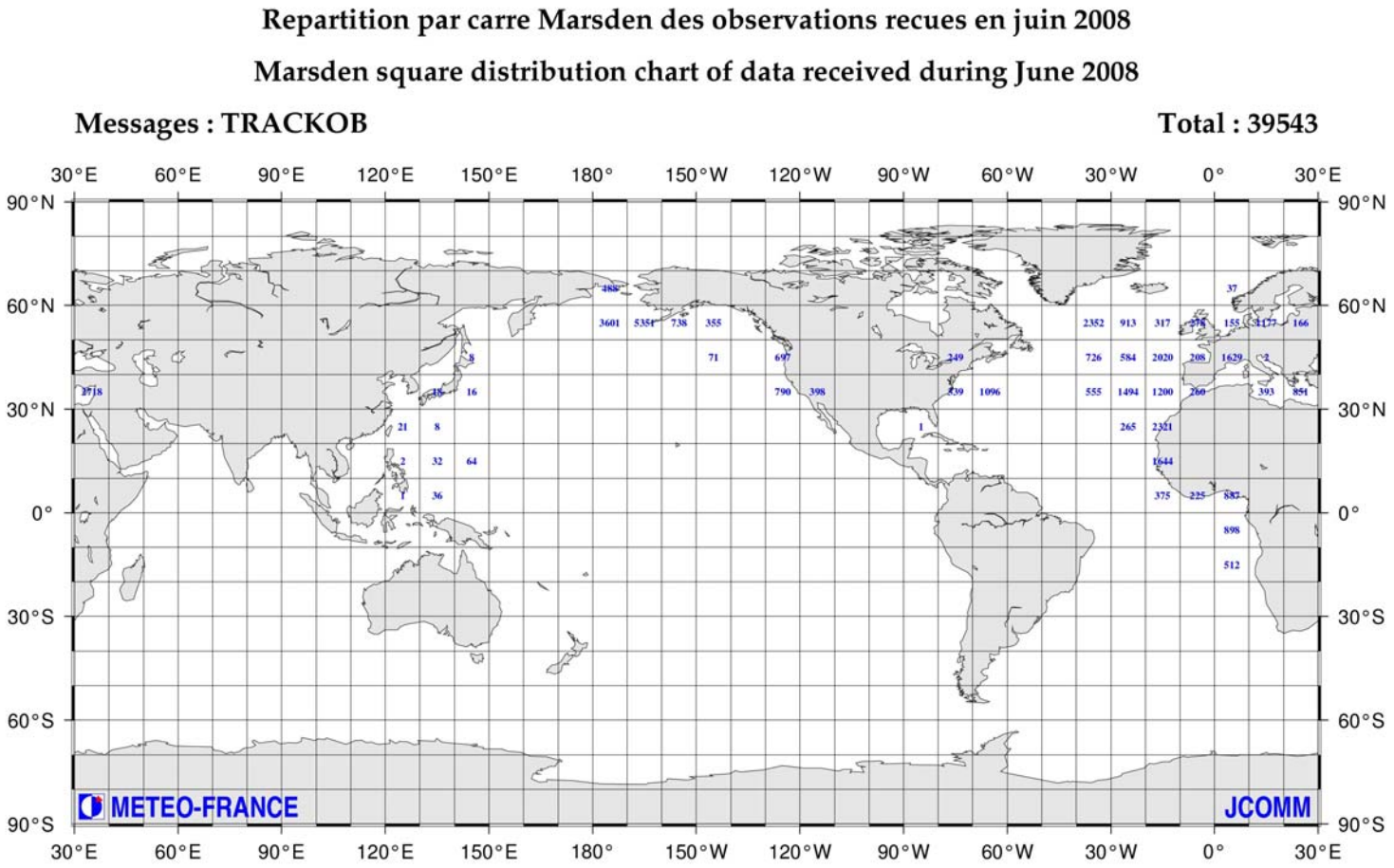

Figure 11: Data Availability Index Map for Wind, June 2008:

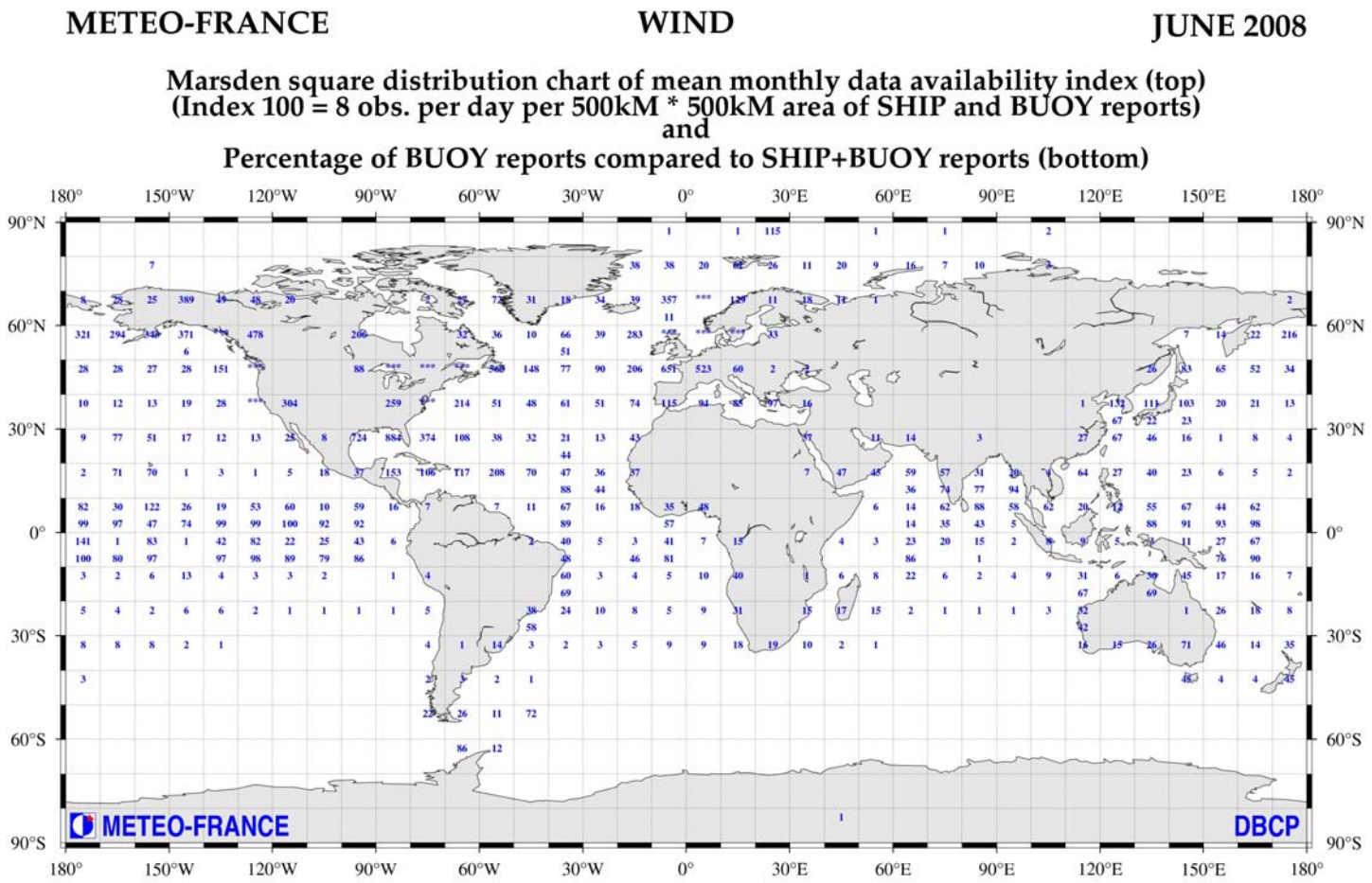

Figure 12: Data Availability Index Map for Air Pressure, June 2008

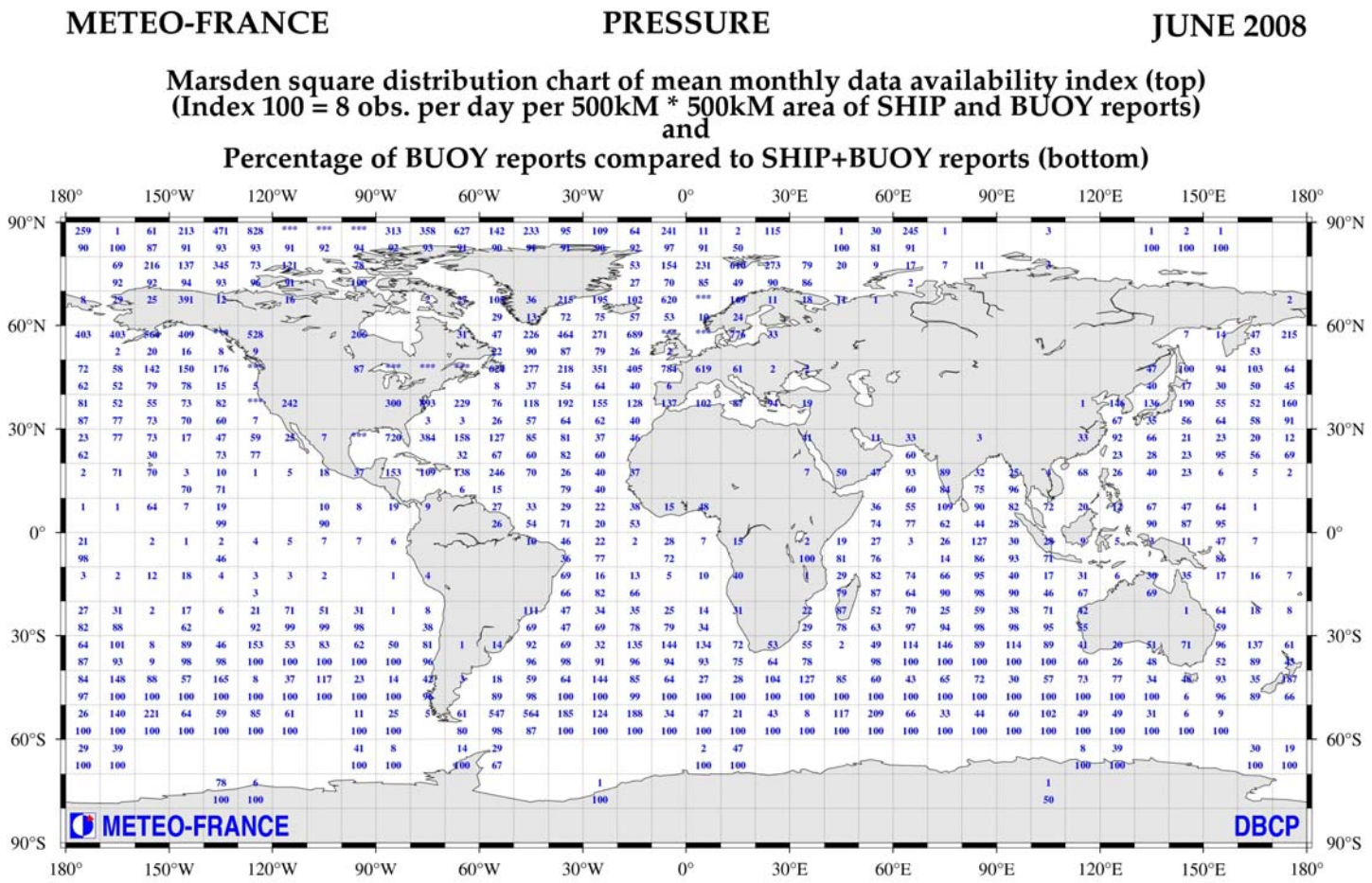

Figure 13: Data Availability Index Map for Air Temperature, June 2008

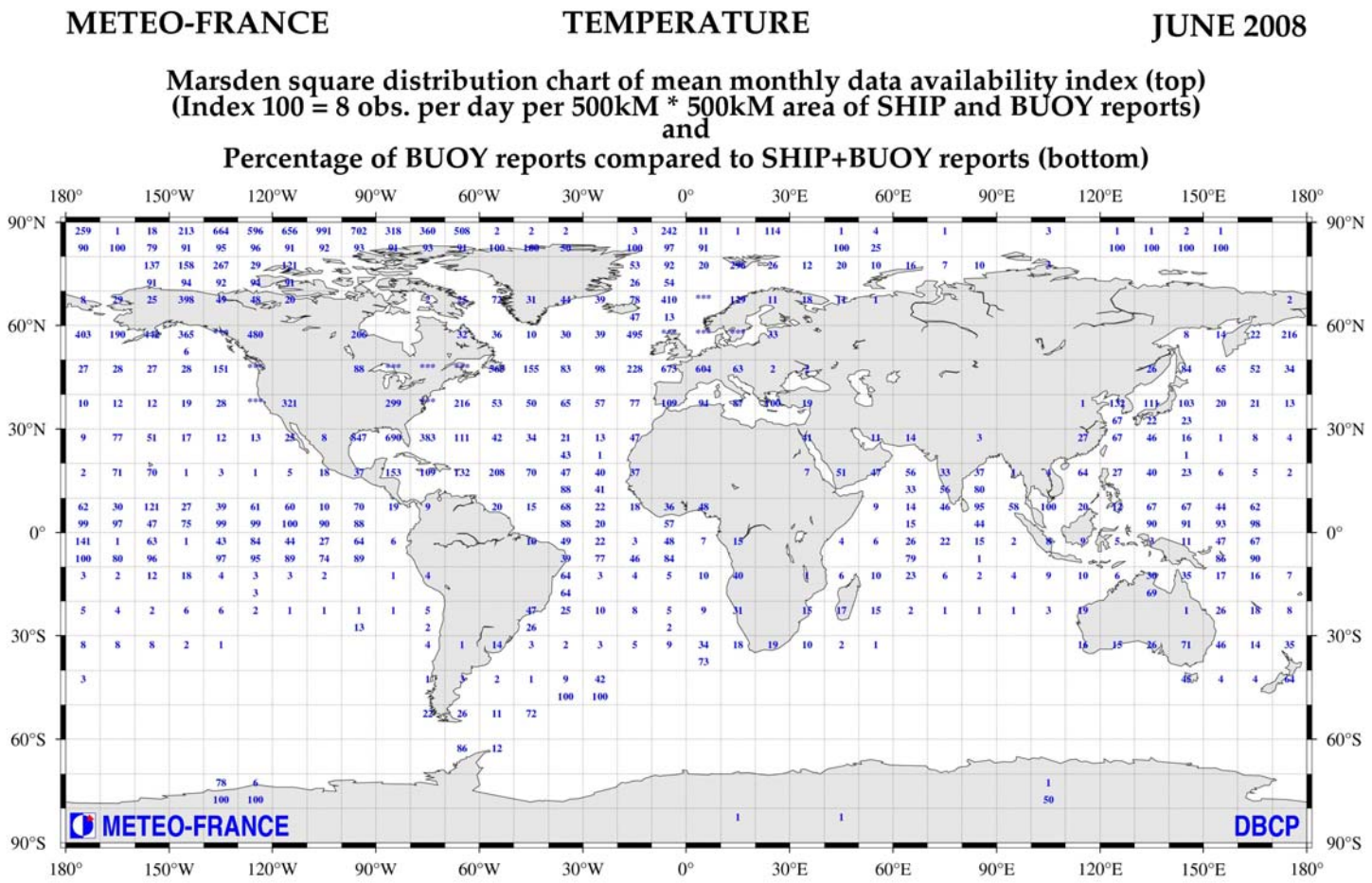

Figure 14: Data Availability Index Map for SST, June 2008