WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

DATA BUOY COOPERATION PANEL

DBCP-XXVII/Doc. 10.2 REV. 1
(2-Sep-11)

TWENTY-SEVENTH SESSION

ITEM: 10.2

GENEVA, SWITZERLAND
26-30 SEPTEMBER 2011

ENGLISH ONLY

REPORT BY THE 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 IODE RNODC for Drifting Buoys (August 2010 – July 2011);
- B. JCOMM SOC for Drifting Buoys Report 2010 – 2011.
- C. Report by the *ad hoc* Task Team on RNODC/DB & SOC/DB integration

-A- DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

10.2.1 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 Joe Linguanti (Canada) of DFO, presented the report.

10.2.2 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.

10.2.3 The Panel thanked both centres for their reports. The full reports are provided in Appendices A and B and will be included in the CD-ROM that will be distributed with the Session final report.

10.2.4 As noted at the previous DBCP Session, the two respective IODE and JCOMM centres are completely separate but provide similar functions. The Panel noted the discussions at the previous DBCP Session, and its request to the SOC/DB, and the RNODC/DB to collaborate in those developments as appropriate. It noted with interest that an *ad hoc* Task Team comprised of Bill Burnett (USA, leader of the team), Bruce Bradshow (ISDM, Canada, as RNODC/DB), Norio Baba (JODC, Japan, as IODE/RNODC), Jean Rolland (Meteo France as SOC/DB), Scott Woodruff (USA, ETMC Chair), and Sissy Iona (Greece, DMCG Chair) has been formed to address the issue. The Twenty-first Session of the IOC Committee on IODE (IODE-XXI, Liège, Belgium, 23-26 March 2011) approved the report by the JCOMM *ad hoc* Task Team for theRNODC-SOCs integration and requested the *ad hoc* Task Team to draft a Recommendation for JCOMM-IV, including ToR of such centres, as well as background information and requested the Chair of JCOMM DMCG to keep the Committee informed of progress on the integration of these centres. The report by the *ad hoc* Task Team is reproduced in Appendix C. A workshop was planned in Hamburg, Germany from 28 November to 2 December 2011 with representatives from the *ad hoc* Task Team, the RTMC, PIs, DACs and GDACs to discuss the vision for a future Marine Climate Data System (MCDS), including in particular the integration of RNODC/DB and SOC/DB, determine the Information Technology impacts for both Centres, and develop a timeline for achieving Initial Operational Capability (IOC) and Full Operational Capability (FOC).

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Appendices: 3

APPENDIX A

REPORT OF THE IODE RESPONSIBLE NATIONAL OCEANOGRAPHIC DATA CENTRE (RNODC) FOR DRIFTING BUOYS (AUGUST 2010 – JULY 2011)

Integrated Science Data Management (ISDM)
bruce.bradshaw@dfo-mpo.gc.ca

1. Introduction

1.1 Integrated Science Data Management (ISDM), previously the Marine Environmental Data Service (MEDS), of the Department of Fisheries and Oceans 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 and moored buoy messages reporting in Buoy Code and BUFR 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 online products and by a custom 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) and is currently growing at a rate of 1 million unique messages per month.

1.2 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 Chair 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.

1.3 ISDM is looking forward to participating in the Task Team on the Marine Climate Data System (TT-MCDS). Among other important initiatives, the Task Team will be looking at an improved integration of the RNODC-DB and the SOC-DB. More on the TT-MCDS terms of reference and the initial workshop (BSH Hamburg Germany, November 2010) is available on the JCOMM web site.

2. Overall annual statistics summary

2.1 All statistics, unless otherwise stated, refer to GTS data received in FM-18 XII BUOY Code, which includes both drifter and moored buoys. To distinguish between Drifters and Moored buoys in this report we use the WMO rule for allocating WMO numbers (A_1b_wnnn where nnn < 500 for moored buoys).

2.2 During the 12 month period from July 2010 to June 2011 ISDM archived 12,474,691 buoy messages from 2273 platforms (an eight percent increase from the same period last year). On average, each buoy is reporting 21.4 messages per day. Moored and drifting locations for the 12 month period are plotted in Figure 1. Of the GTS messages processed, 99% of the locations were quality flagged as good. The archives are normally updated in the second week of the month after an entire calendar month of data is assembled, merged, duplicates removed and quality control procedures and flags are applied. On average, it takes 27 days from the date of observation for the data to reach the archives and be ready for products and distribution. Access to the raw data before QC and archival is available by special request.

2.3 The size of the buoy archive is currently 50 GB with 105 million drifting and moored records for the period December 1978 to June 2011 and growing at a rate of 1 million unique records per month. The most recent month of data is available online with custom charts, inventories and map displays. All historical data in a variety of formats is freely available by request through the ISDM web site (ISDM.GC.CA).

3. Summary of work carried out during the year

3.1 Monthly Maps and Data Visualization using Google Earth

3.1.1 SVG maps by action group were discontinued in 2010 due to incompatibilities with Government of Canada web publishing guidelines. We now provide monthly Google Earth KML files immediately following archive updates that show all drifting buoy tracks and moored buoy locations. These new global Google Earth maps provide access to each buoys meta-data and links to online products and inventories as well as links to additional meta-data provided by JCOMMOPS. http://isdm.gc.ca/isdm-gdsi/drib-bder/KML/MonthlyKML-eng.htm

3.1.2 A more dynamic web mapping application that supports interactive user defined displays with robust products and meta-data was developed this summer. The new application is based on an ESRI web-mapping service with a PostGIS SQL backend. Once approved for deployment we will have the ability to provide online access to all data with custom products and map displays. These new products will enhanced our support for the DBCP Action Groups and user defined areas of interest.

3.2 Implementation of BUFR Processing Software

3.2.1 Drifting buoy data is now widely reported in both BUFR (Binary Universal Form for Data Representation) and BUOY Code formats. The ISDM BUFR decode software for both compressed and uncompressed BUFR formats has been tested and verified against the Buoy Code data stream.

3.2.2 Each month after the archives are updated a report is generated that summarizes the differences in WMO Buoy ID's, Bulletin Headers and message counts between the two data streams. Results are very encouraging so far; some work remains to ensure everyone can read and write BUFR to the GTS. Since Hester's departure from JCOMMOPS we have been waiting for the new technical coordinator to pick up the lead on rationalizing the differences between a few individual routing nodes. ISDM will be ready to switch from Buoy Code to BUFR as our primary data source once the community agrees to do so.

3.3 Update SVP Data Submission

3.3.1 Data collected and processed by the Atlantic Oceanographic and Meteorological Laboratory (AOML) under the Global Drifter Program formerly World Ocean Circulation Experiment - Surface Velocity Programme (WOCE-SVP) is available from ISDM by agreement with AOML. The collection currently covers the period 1979 to 2008 and will be updated in 2011 with the most recent data submission from AOML covering the period July 2007 to December 2010.
http://isdm.gc.ca/isdm-gdsi/drib-bder/svp-vcs/index-eng.asp

4. Goals for 2011/2012

4.1 Process and update 2007-2010 SVP submission from AOML.

4.1.1 Increase the functionality and availability of online inventories, data and visualization capabilities to support the DBCP and the individual Action Groups.

4.1.2 We look forward to working collaboratively with all participants in the TT-MCDS to modernize and enhance the delayed mode and realtime Marine-meteorological and Oceanographic systems and overall data management processes.

5. Data flow to ISDM

5.1 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 processed 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). After collecting the data for an entire calendar month several automatic and interactive processes are run to detect and resolve best versions of duplicate messages, flag erroneous data and run in-house quality control procedures to validate and flag individual measurements. Trained scientific personnel review displays of timeseries measurements, drift tracks and speed graphs. Flags are set according to the international QC flag definitions derived from IGOSS and JCOMM. Once completed, the data are merged into the archive and the website is updated.

5.2 With a monthly QC system, it takes anywhere between one and eight weeks for individual BUOY reports to be added to the archive. The average delay between reception and update is normally 27 days. ISDM continues to develop and enhance applications that improve processing systems and allow for more frequent updates and access to improved data and products.

6. Data distribution

6.1 Data is freely available online and by custom requests. The web site provides inventories and maps designed to help clients refine temporal and spatial criteria's for custom offline requests. Last year ISDM received over 75 requests for drifting buoy data. Requests come from universities, government organizations, private consulting companies and individuals.

6.2 A number of automated processes provide regular daily data distributions of raw 'off the wire' products to various clients including the US National Oceanographic Data Center (NODC) by FTP. Where other community services do not already exist ISDM can provide specialized products before the normal monthly QC and archive update.

7. GTS Routing Problems and Lost Data

7.1 Due to a GTS routing problem no messages from the Bulletin Header SSVX13 LFPW for the period of September 24 2009 to August 23 2010 were received at ISDM. Washington has kindly restored the routing rule to Montreal and we are receiving the bulletins once again without interruption. Meteo-France kindly provided us with a data file containing all of the missing data and the archives were updated in December 2010. This incident has highlighted that we need an

improved system to monitor the data flow from the GTS to ISDM. We are working with our partners to ensure we have the most complete and comprehensive archive of GTS data possible.

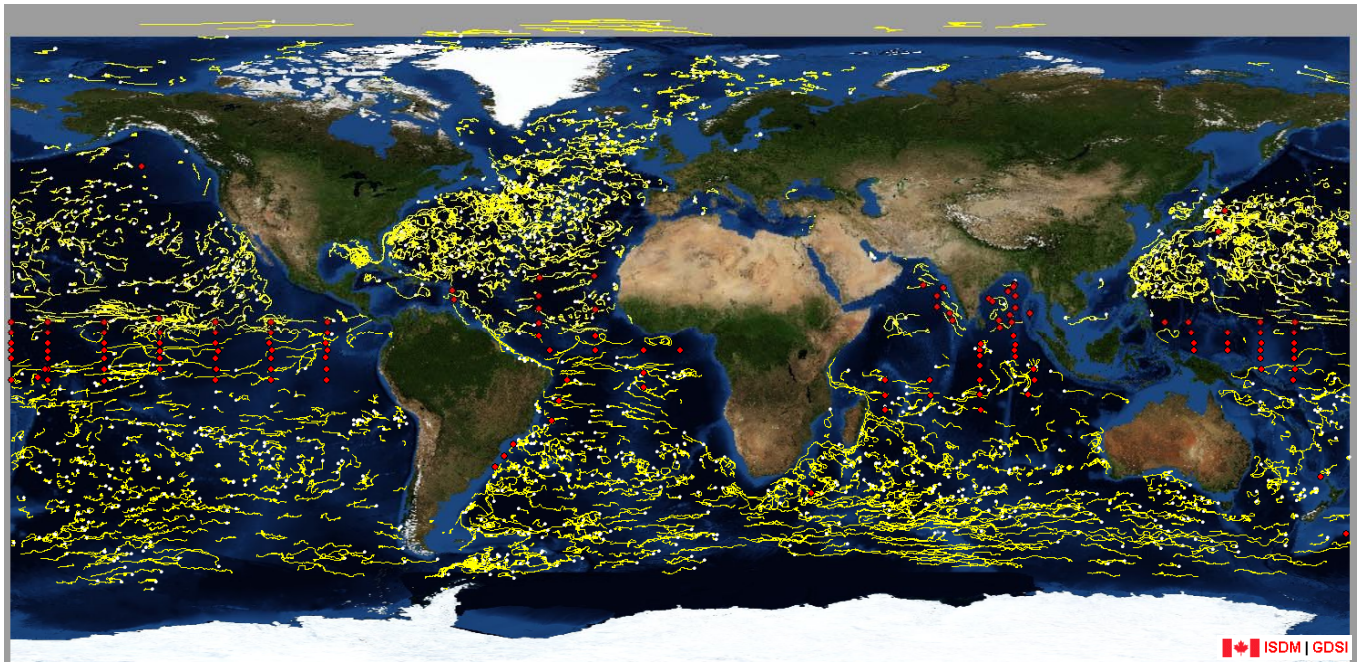


Figure 1
Track and Location Map (July 2010 to June 2011)

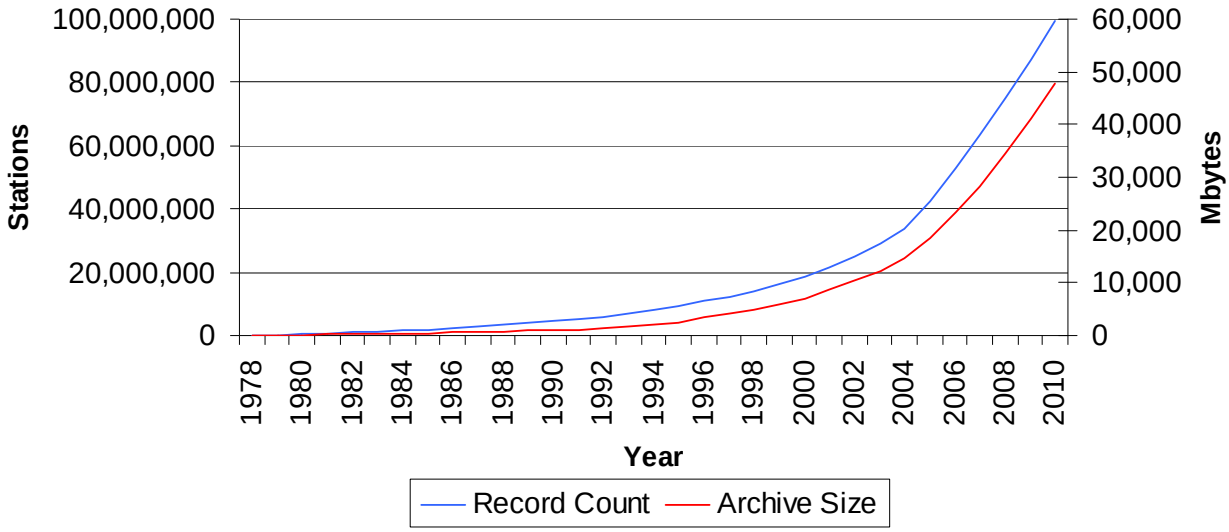


Figure 2
Buoy Archive Growth by Year

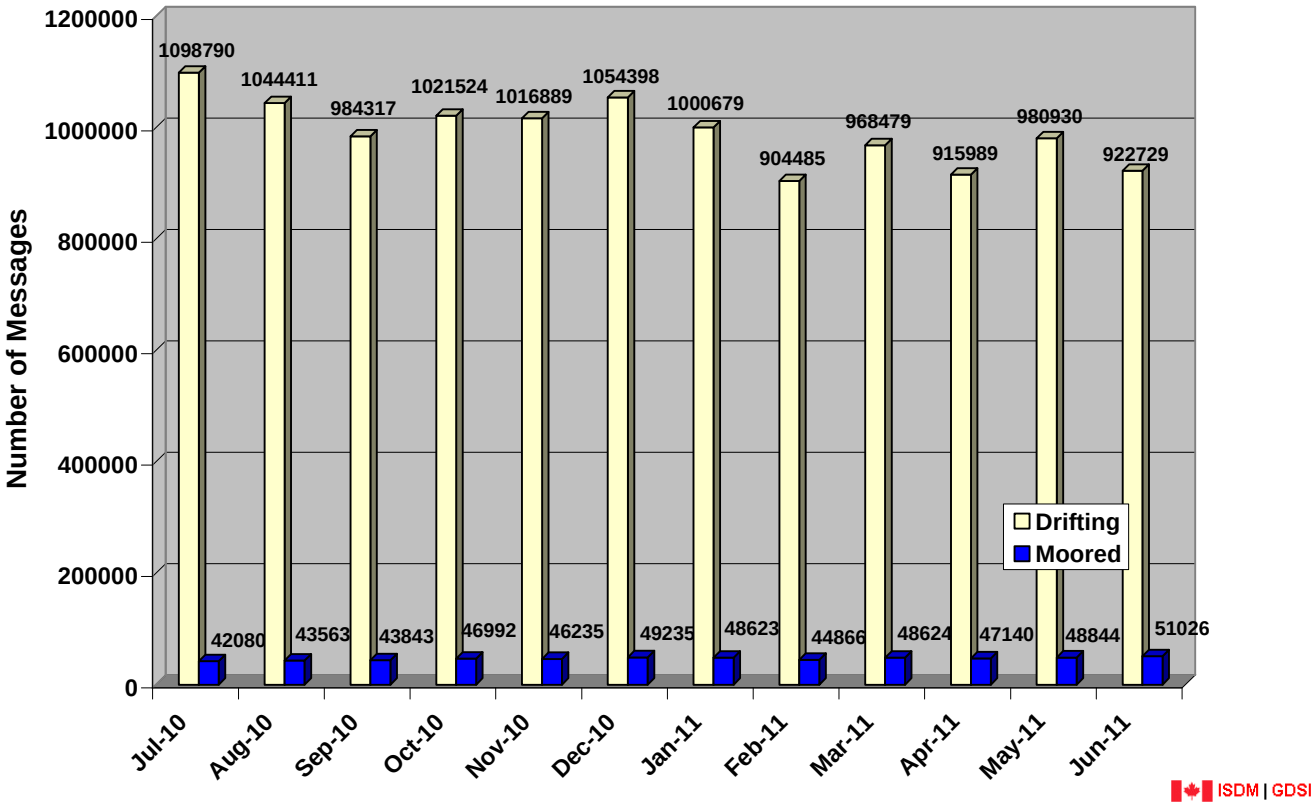


Figure 3
Number of Drifting and Moored Buoy Messages by Month

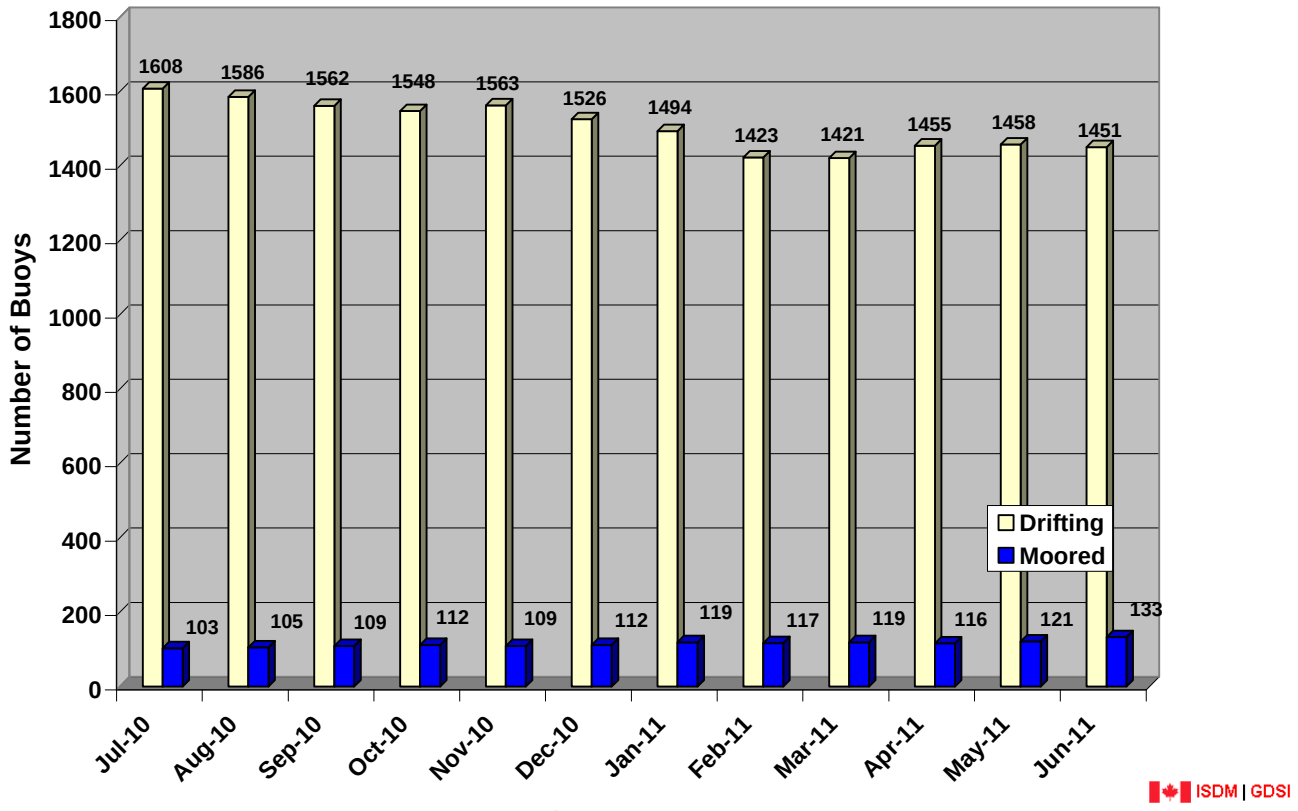
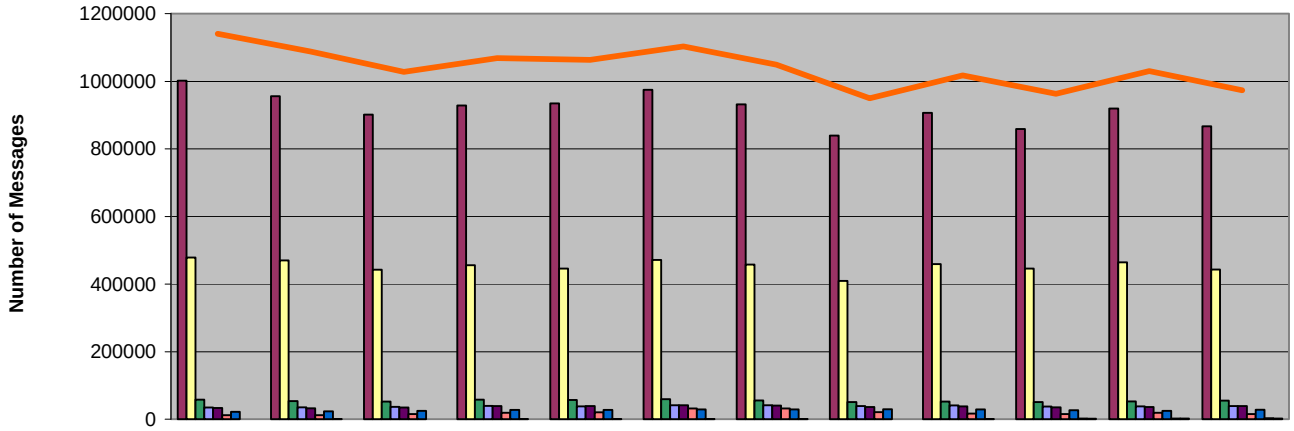


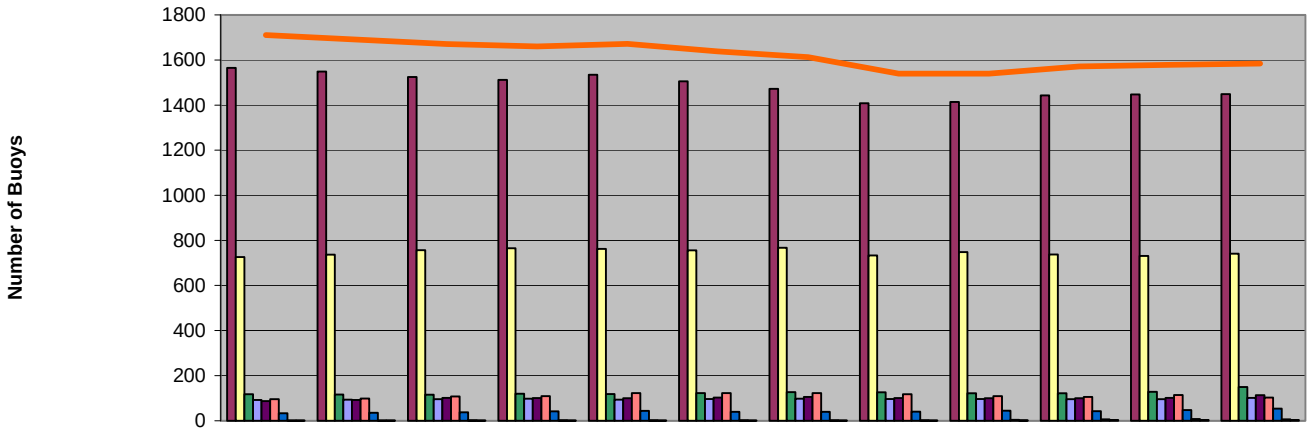
Figure 4
Number of Drifting and Moored Buoys by Month



	2010-07	2010-08	2010-09	2010-10	2010-11	2010-12	2011-01	2011-02	2011-03	2011-04	2011-05	2011-06
Surface Temp	1002059	955680	901936	928376	934676	975275	932163	839342	906463	858905	918873	867314
Air Pressure	478444	470089	442613	455447	445952	471114	457509	409110	459266	445605	464165	443295
Air Temp	58193	53281	52536	57559	57170	58986	55980	50815	51967	50736	52869	55184
Rel Humidity	34496	35608	36477	39313	38055	41277	41668	38977	41061	37572	37982	38841
Wind Spd & Dir	32827	32725	34737	39103	38948	41722	40375	35939	38290	35446	36134	38849
Profiles	11680	12105	15850	19337	20725	31753	31753	21348	16716	15465	19113	15465
Surface Salinity	21920	23323	24939	27320	27246	28973	28973	29807	28794	27148	24535	27892
Wave Swell	335	364	343	379	367	388	388	349	742	2317	2169	2591
Dew Temp	5	3	2	7	7	1	1	5	314	1391	1923	1842
Total # of Msgs	1140870	1087974	1028160	1068516	1063124	1103633	1049302	949351	1017103	963129	1029774	973755

ISDM | GDSI

Figure 5
Type and Number of Parameters Reported from all Platforms by Month



	2010-07	2010-08	2010-09	2010-10	2010-11	2010-12	2011-01	2011-02	2011-03	2011-04	2011-05	2011-06
Surface Temp	1565	1549	1525	1512	1534	1506	1472	1408	1414	1443	1448	1449
Air Pressure	726	736	757	765	762	756	767	733	748	738	731	741
Air Temp	117	116	115	120	118	123	127	126	122	122	128	149
Rel Humidity	92	93	95	97	93	96	97	96	96	95	95	102
Wind Spd & Dir	87	92	102	101	100	103	106	101	100	99	102	113
Profiles	95	98	108	109	123	123	123	117	109	106	114	103
Surface Salinity	33	35	37	41	43	39	39	40	44	42	48	54
Wave Swell	1	1	2	2	2	2	2	2	4	6	7	6
Dew Temp	1	1	1	1	1	1	1	1	2	3	3	3
Total # of Buoys	1711	1691	1671	1660	1672	1638	1613	1540	1540	1571	1579	1584

ISDM | GDSI

Figure 6
Number of Platforms Reporting Different Parameters by Month

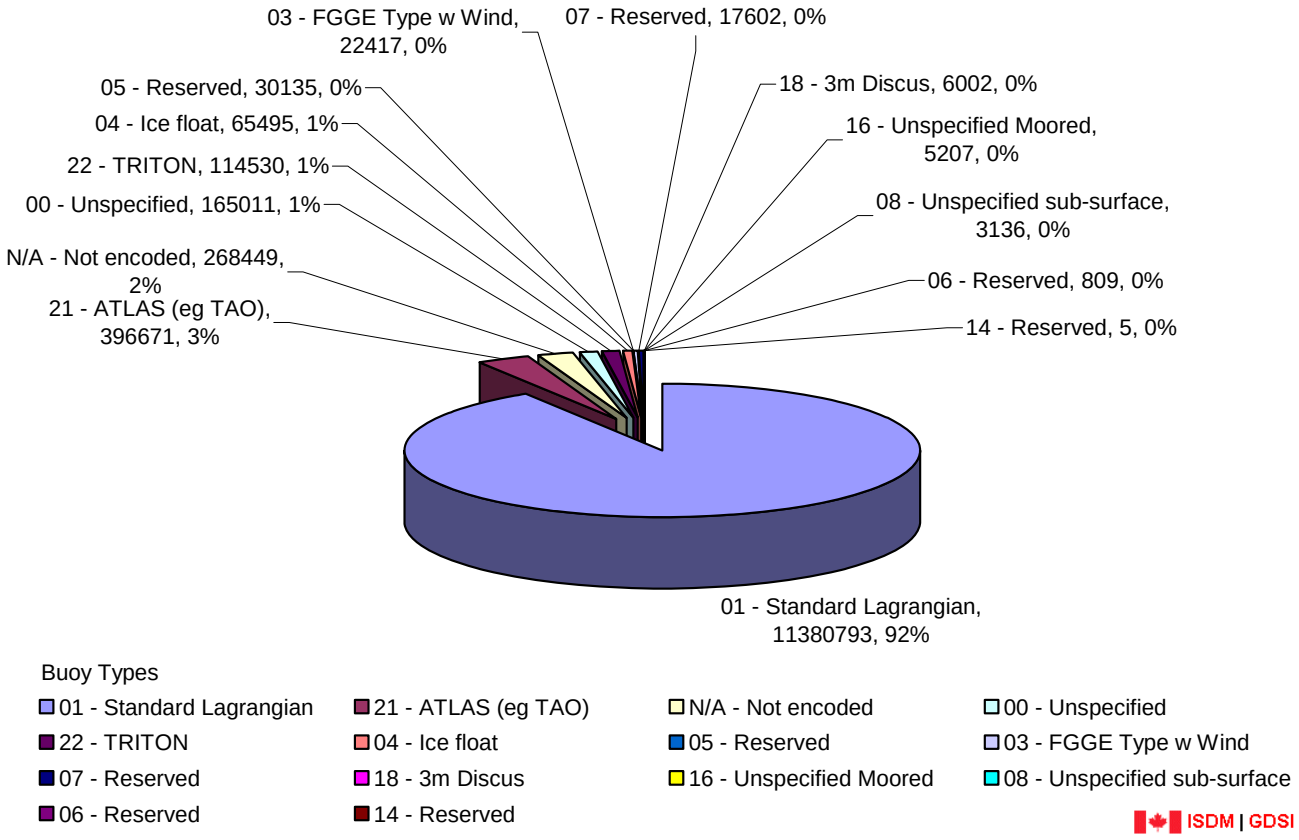


Figure 7
Reported Buoys Types (July 2010 to June 2011)

APPENDIX B

REPORT OF THE JCOMM SPECIALIZED OCEANOGRAPHY CENTRE (SOC) FOR DRIFTING BUOYS REPORT 2010 – 2011

Météo France

1. The Specialized Oceanographic Center (SOC) for Drifting Buoys has been running continuously during year 2010-2011. 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). The 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.

2. 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. detection of bad location, wrong acceleration and loss of drogue, sensor drift, etc) or when a modification seems needed (e.g. recalibrate or 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.

3. 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 found.

4. 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 for the last year.

- Figures 1, 2, 3 and 4 show the time evolution of reports for wind and pressure respectively, for all BUOY reports (showing all buoys, moored buoys and drifting buoys) and SHIP reports, since January 2010.
- Figure 5 shows the time evolution of WAVEOB reports and sensors since January 2010.

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

- Figures 6a,b to 10a,b show these products for June 2011. "a" stands for mapping position plot charts, and "b" for Marsden square distribution. Figures 6a and 6b for BATHY, Figures 7a and 7b for TESAC, Figures 8a and 8b for SHIP, Figures 9a and 9b for BUOY, and Figures 10a and 10b for TRACKOB.

6. 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 2011. Figure 11 for Wind, Figure 12 for Pressure, Figure 13 for Air temperature, Figure 14 for Sea surface temperature.

7. 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).

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FIGURE 1

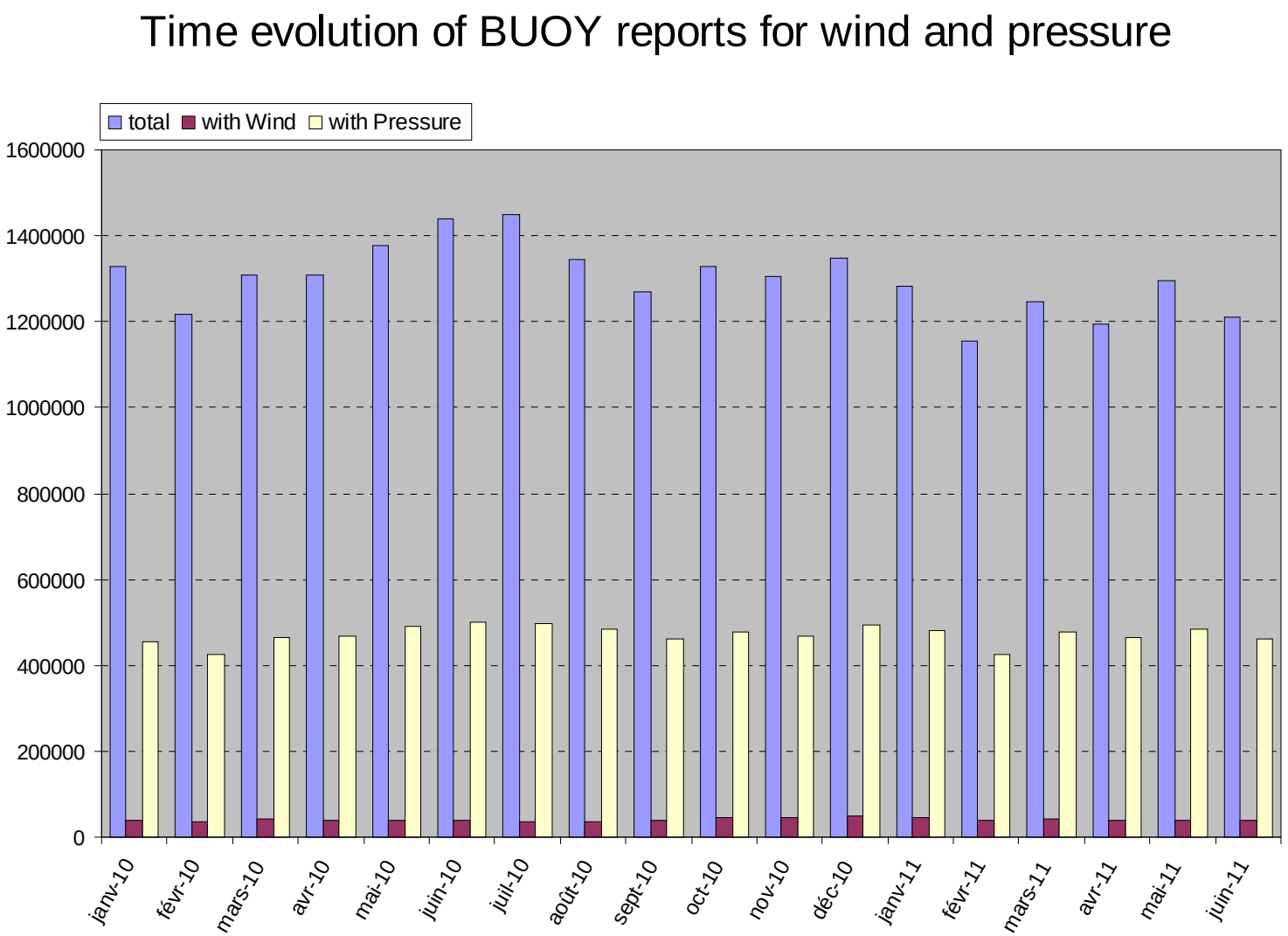

Time evolution of BUOY reports for wind and pressure
total
with Wind
with Pressure
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
janv-10
févr-10
mars-10
avr-10
mai-10
juin-10
juil-10
août-10
sept-10
oct-10
nov-10
déc-10
janv-11
févr-11
mars-11
avr-11
mai-11
juin-11

FIGURE 2

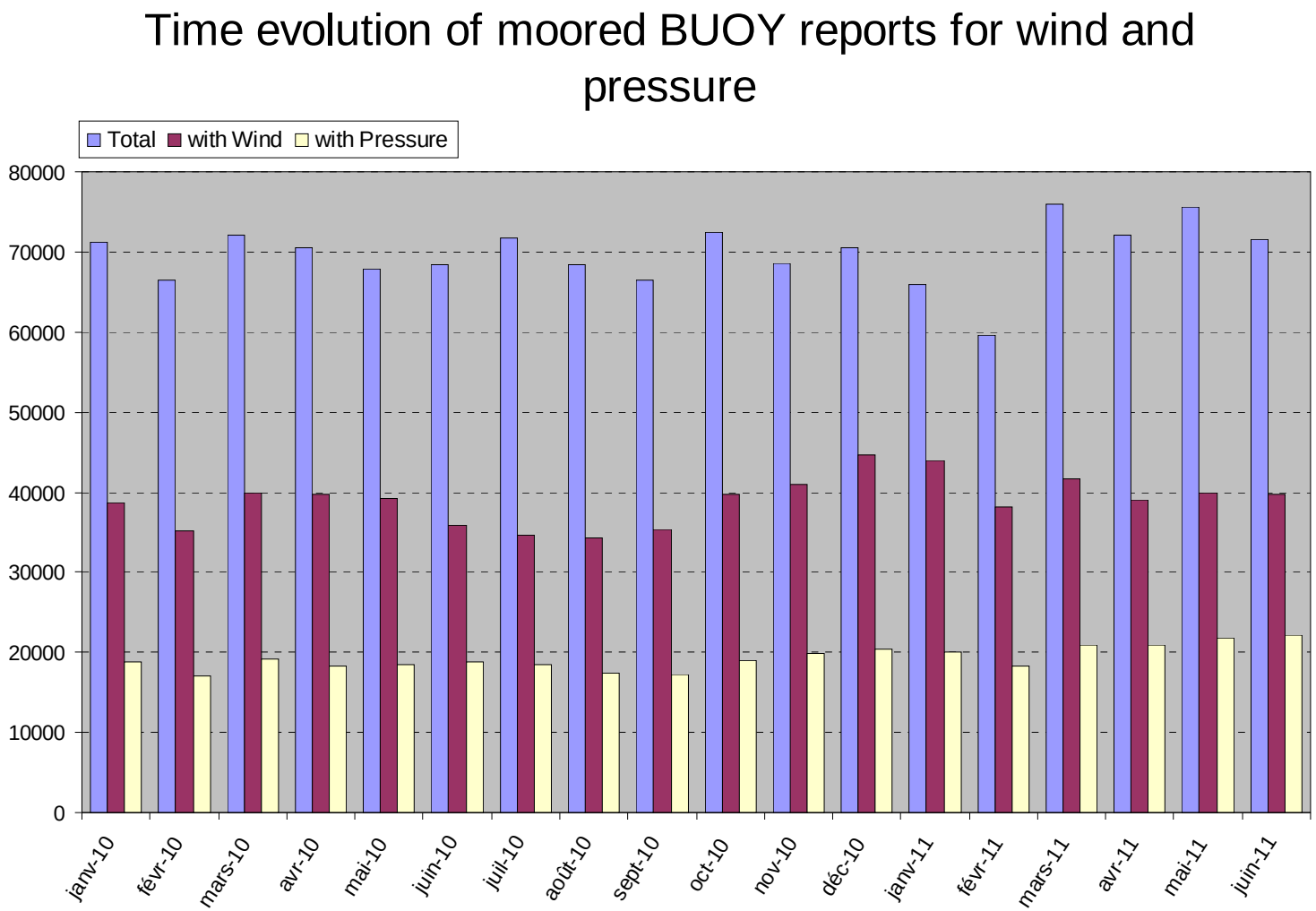

Time evolution of moored BUOY reports for wind and pressure
Total
with Wind
with Pressure
80000
70000
60000
50000
40000
30000
20000
10000
0
janv-10
févr-10
mars-10
avr-10
mai-10
juin-10
juil-10
août-10
sept-10
oct-10
nov-10
déc-10
janv-11
févr-11
mars-11
avr-11
mai-11
juin-11

FIGURE 3

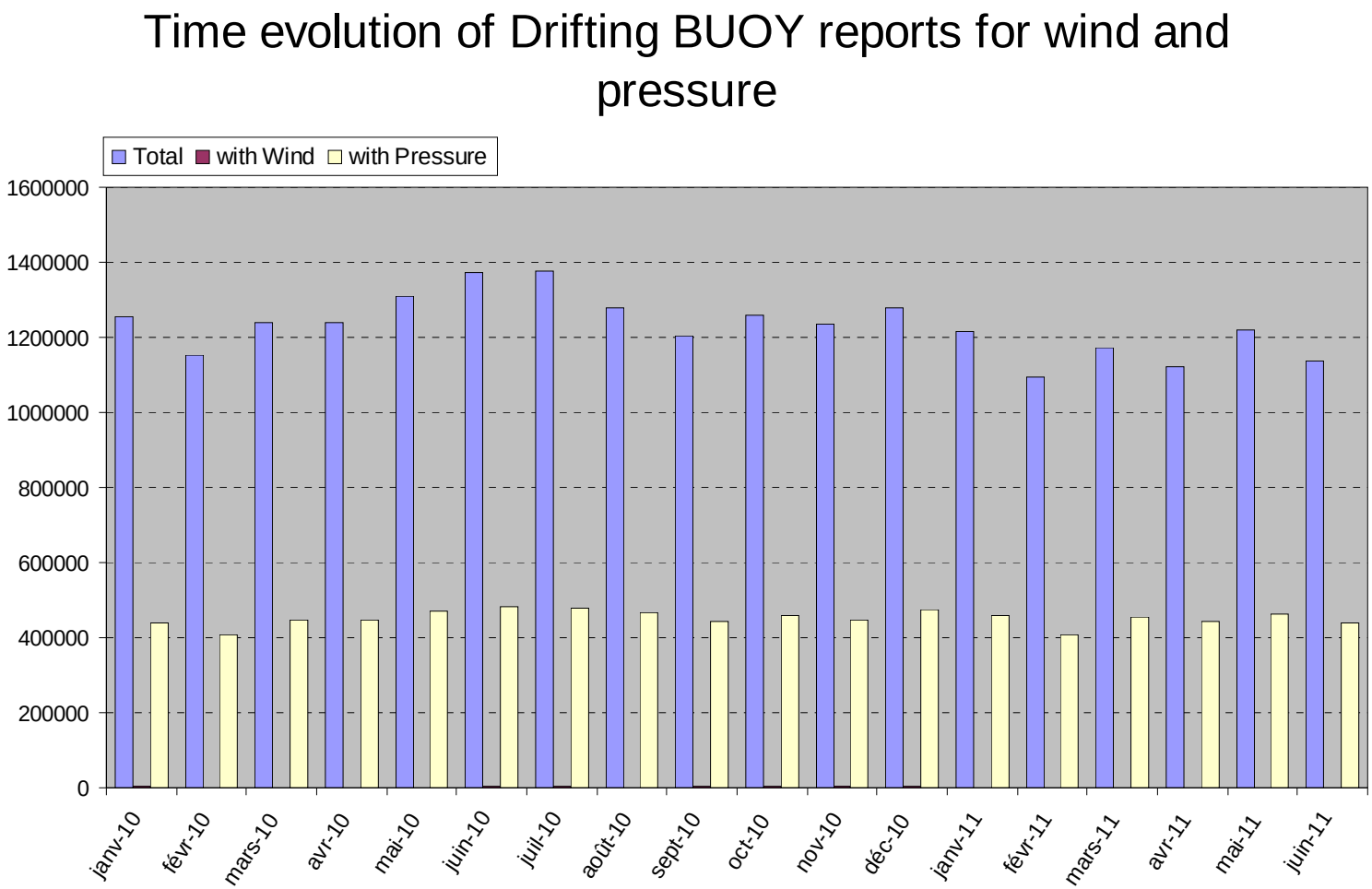

Time evolution of Drifting BUOY reports for wind and pressure
Total
with Wind
with Pressure
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
janv-10
févr-10
mars-10
avr-10
mai-10
juin-10
juil-10
août-10
sept-10
oct-10
nov-10
déc-10
janv-11
févr-11
mars-11
avr-11
mai-11
juin-11

FIGURE 4

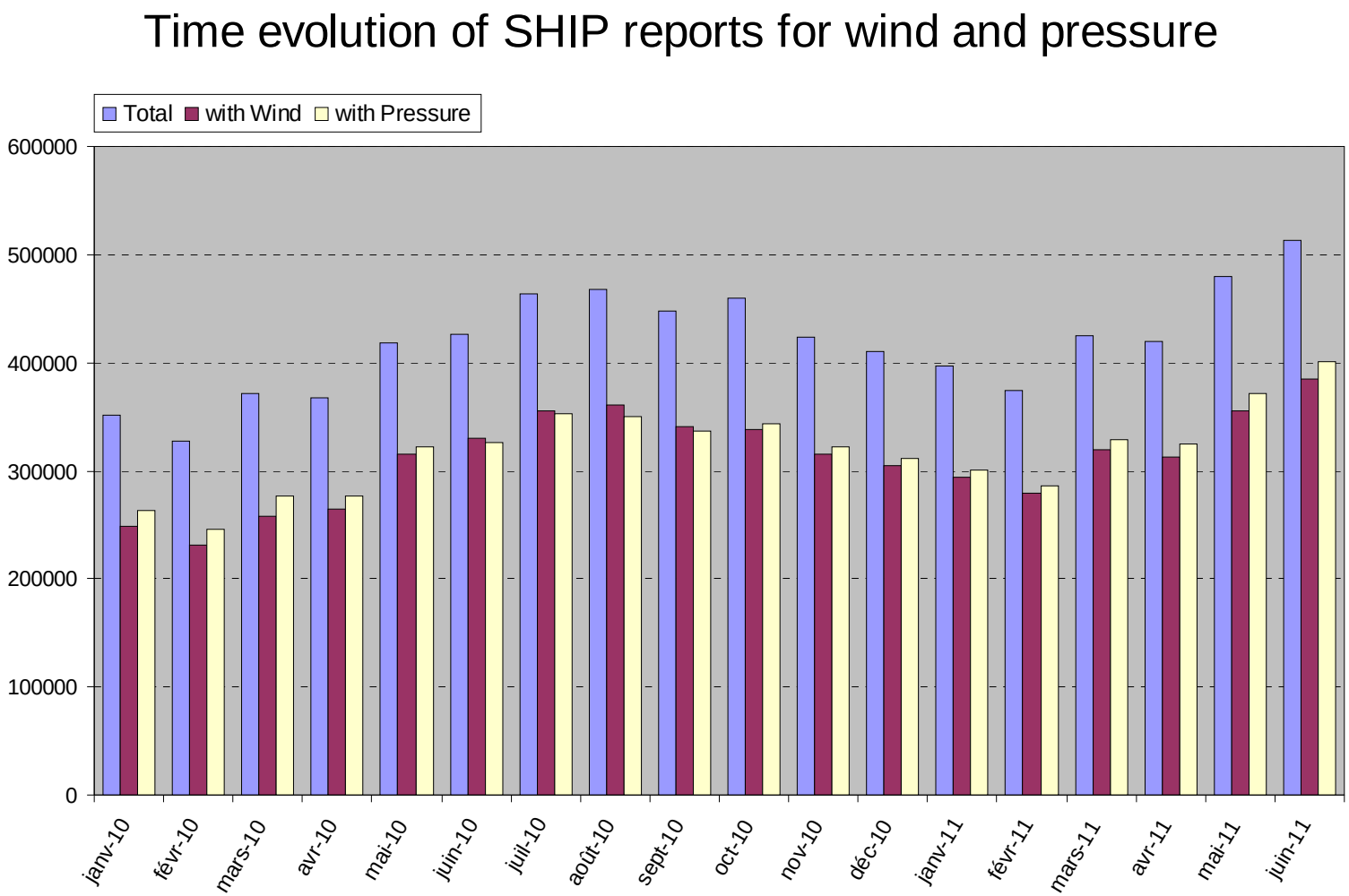

Time evolution of SHIP reports for wind and pressure
Total
with Wind
with Pressure
600000
500000
400000
300000
200000
100000
0
janv-10
févr-10
mars-10
avr-10
mai-10
juin-10
juil-10
août-10
sept-10
oct-10
nov-10
déc-10
janv-11
févr-11
mars-11
avr-11
mai-11
juin-11

FIGURE 5

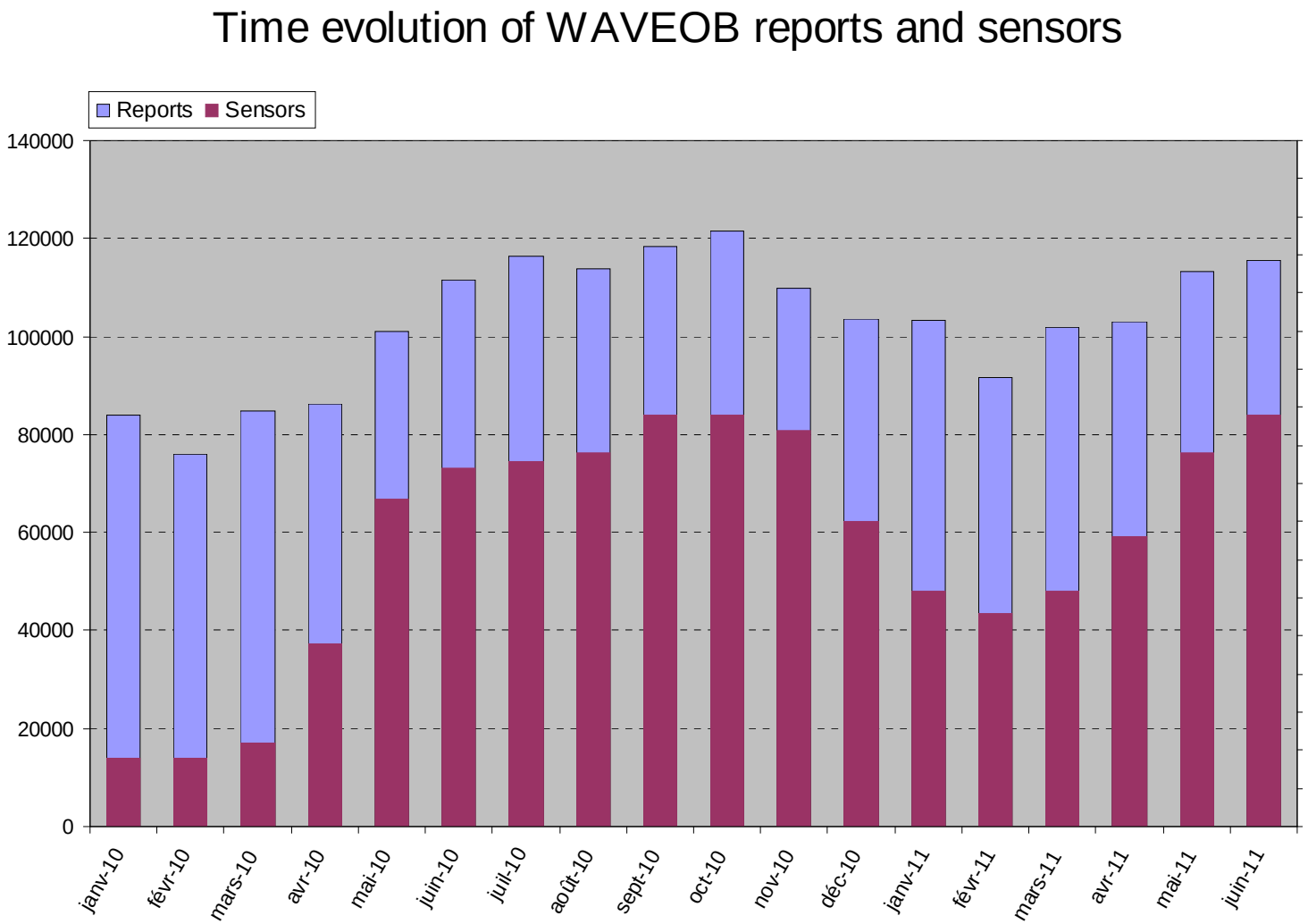

Time evolution of WAVEOB reports and sensors
Reports
Sensors
140000
120000
100000
80000
60000
40000
20000
0
janv-10
févr-10
mars-10
avr-10
mai-10
juin-10
juil-10
août-10
sept-10
oct-10
nov-10
déc-10
janv-11
févr-11
mars-11
avr-11
mai-11
juin-11

FIGURE 6A

Carte de pointage des observations recues en juin 2011

Mapping position plot chart of data received during June 2011

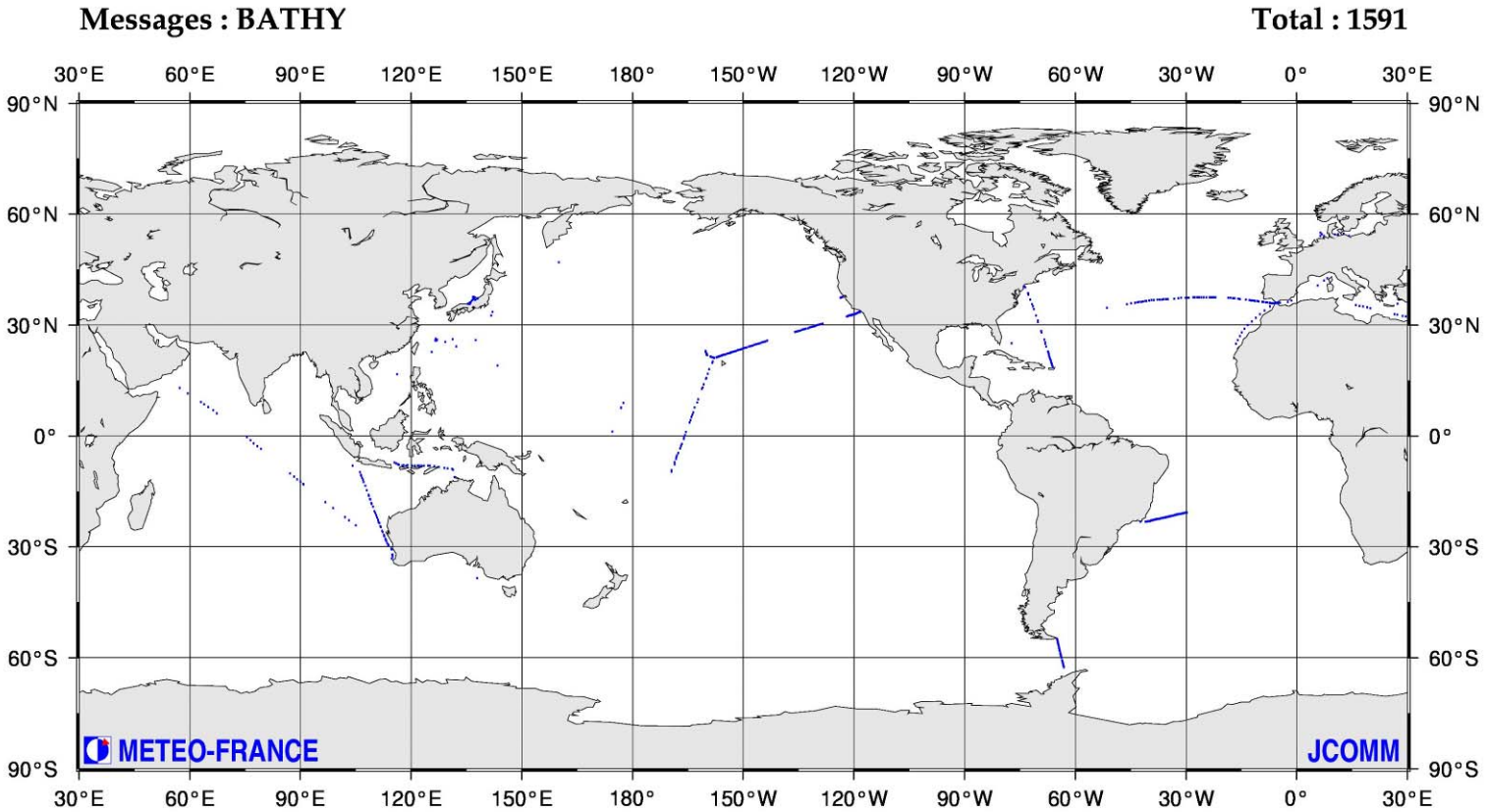


FIGURE 6B

Repartition par carre Marsden des observations recues en juin 2011

Marsden square distribution chart of data received during June 2011

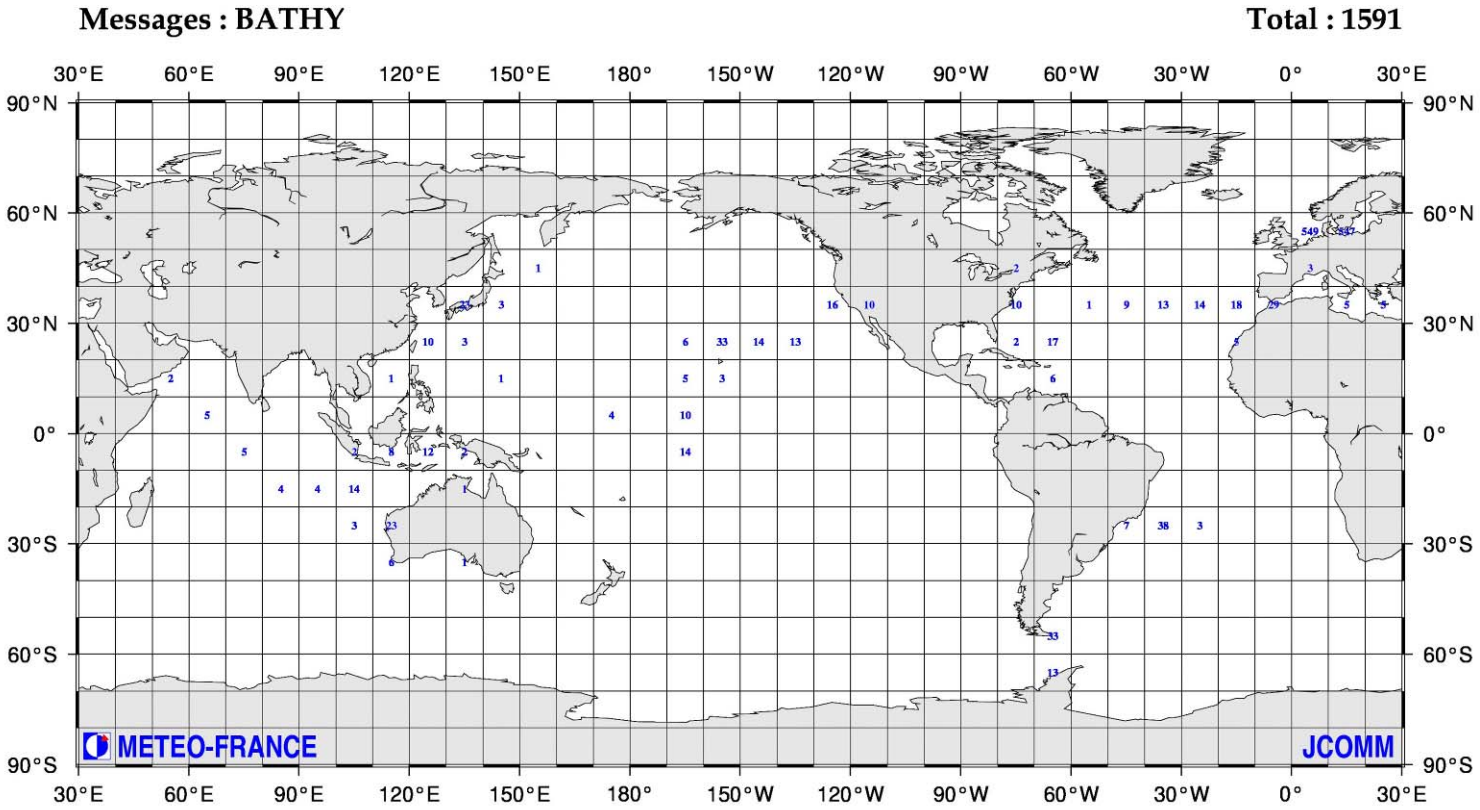


FIGURE 7A

Carte de pointage des observations recues en juin 2011

Mapping position plot chart of data received during June 2011

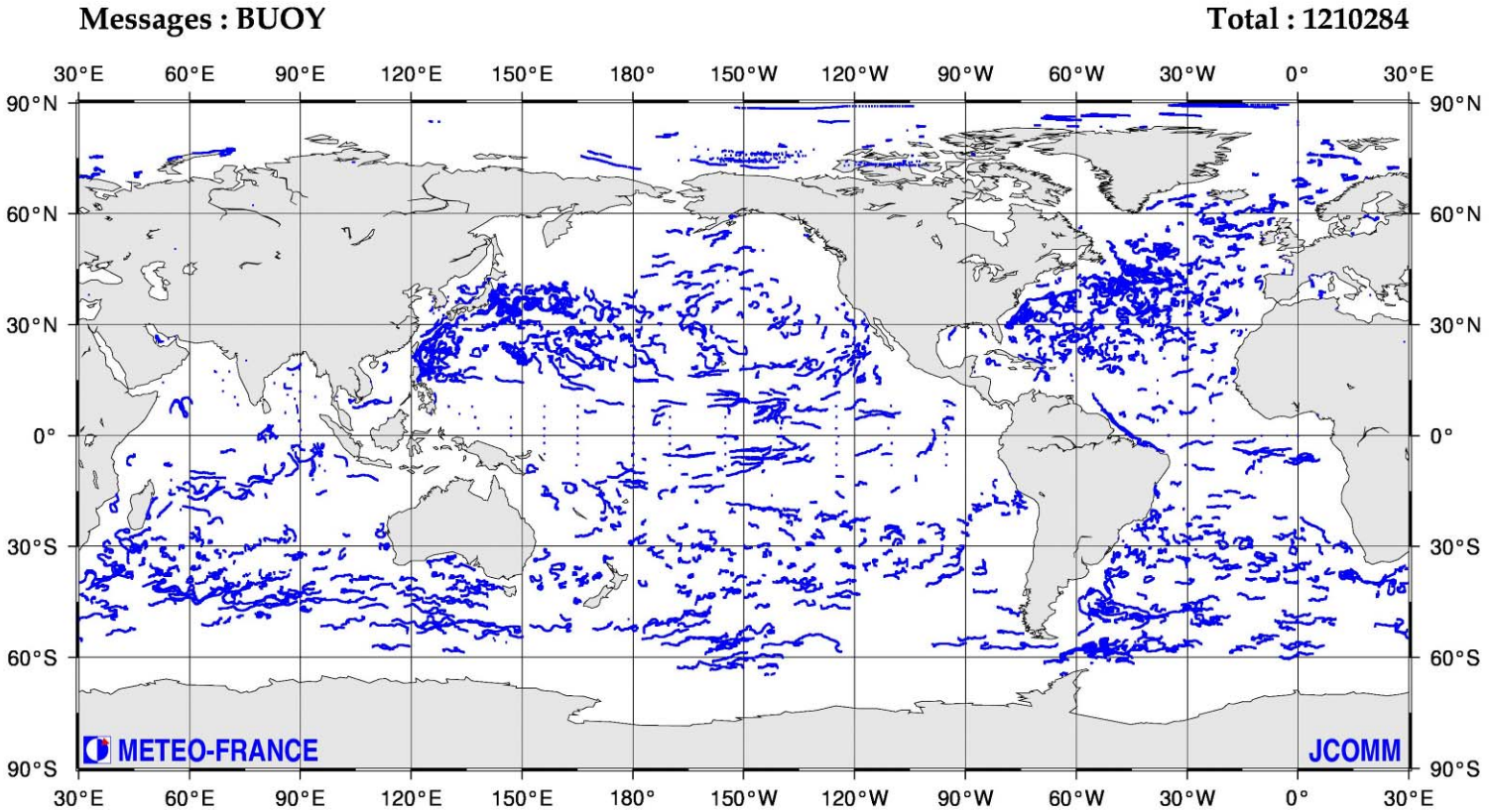


FIGURE 7B

Repartition par carre Marsden des observations recues en juin 2011

Marsden square distribution chart of data received during June 2011

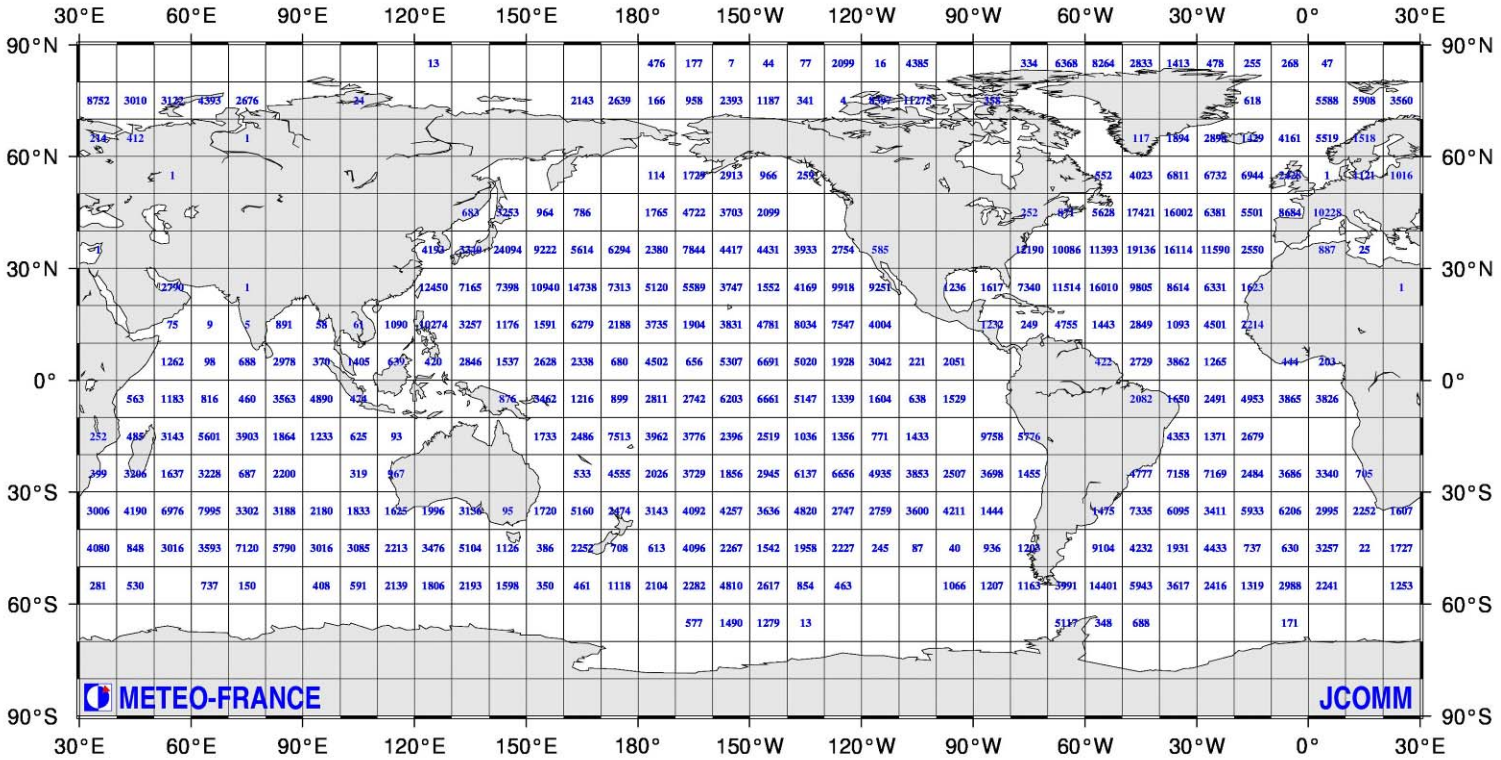


FIGURE 8A

Carte de pointage des observations recues en juin 2011

Mapping position plot chart of data received during June 2011

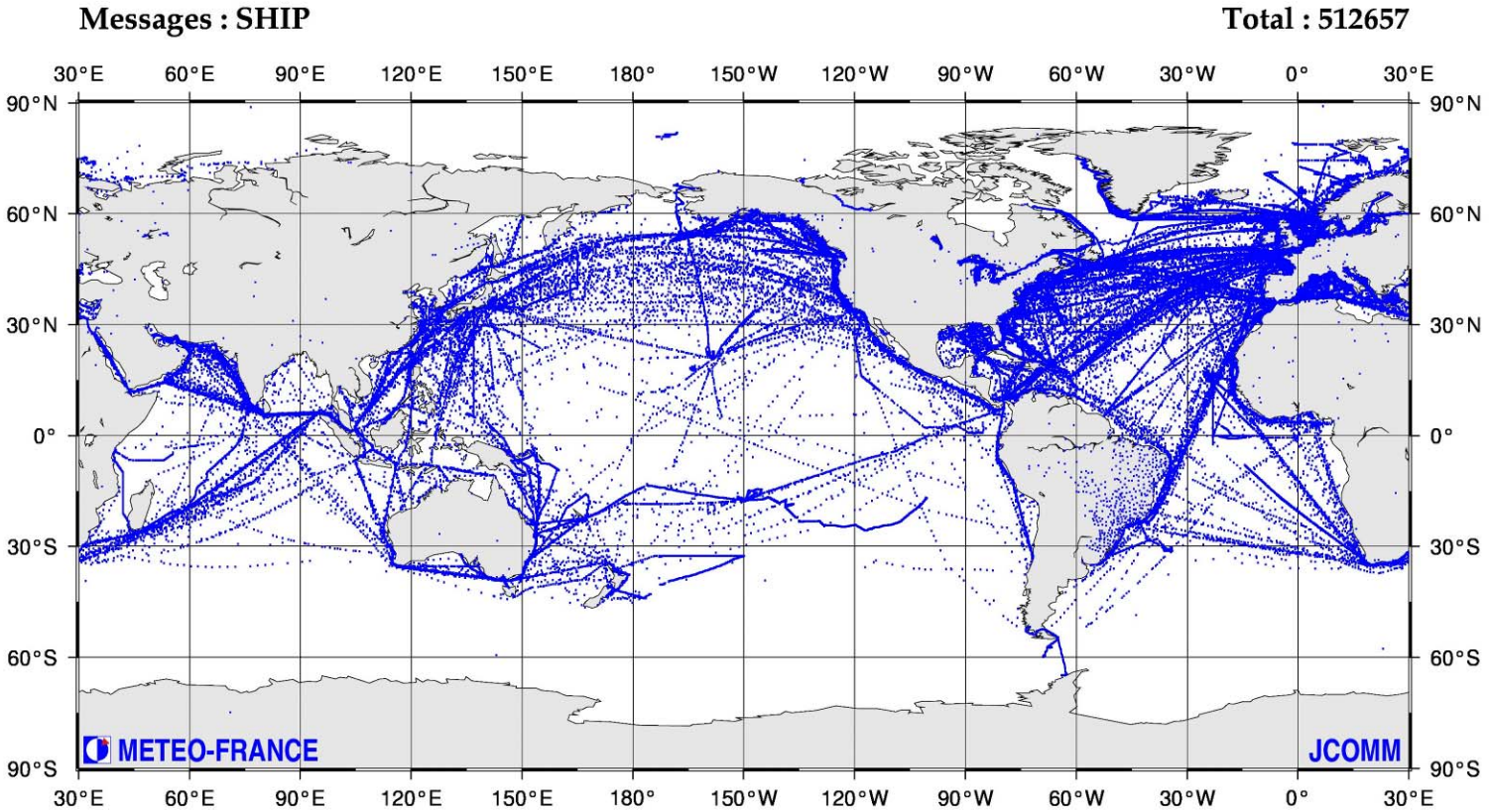


FIGURE 8B

Repartition par carre Marsden des observations recues en juin 2011

Marsden square distribution chart of data received during June 2011

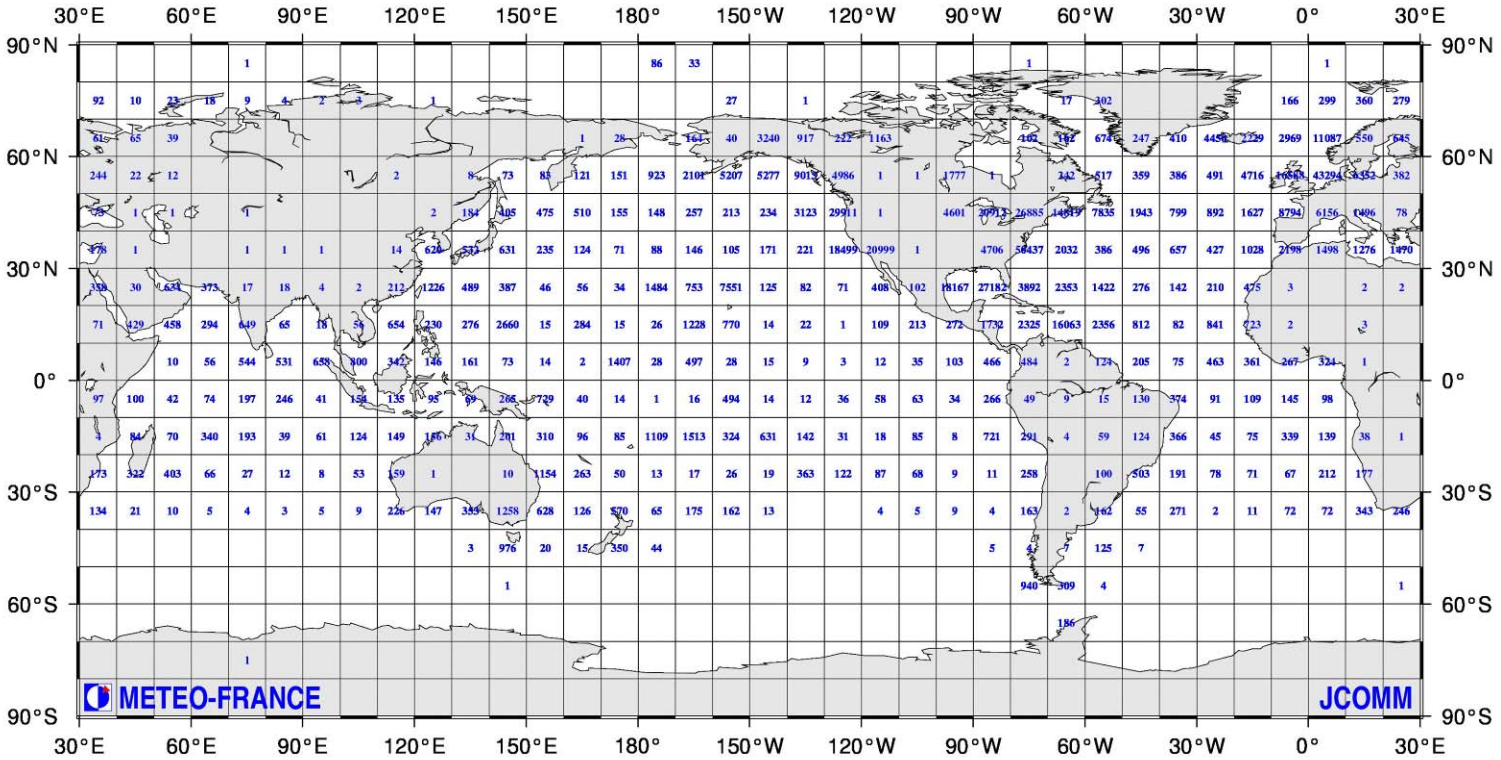


FIGURE 9A

Carte de pointage des observations recues en juin 2011

Mapping position plot chart of data received during June 2011

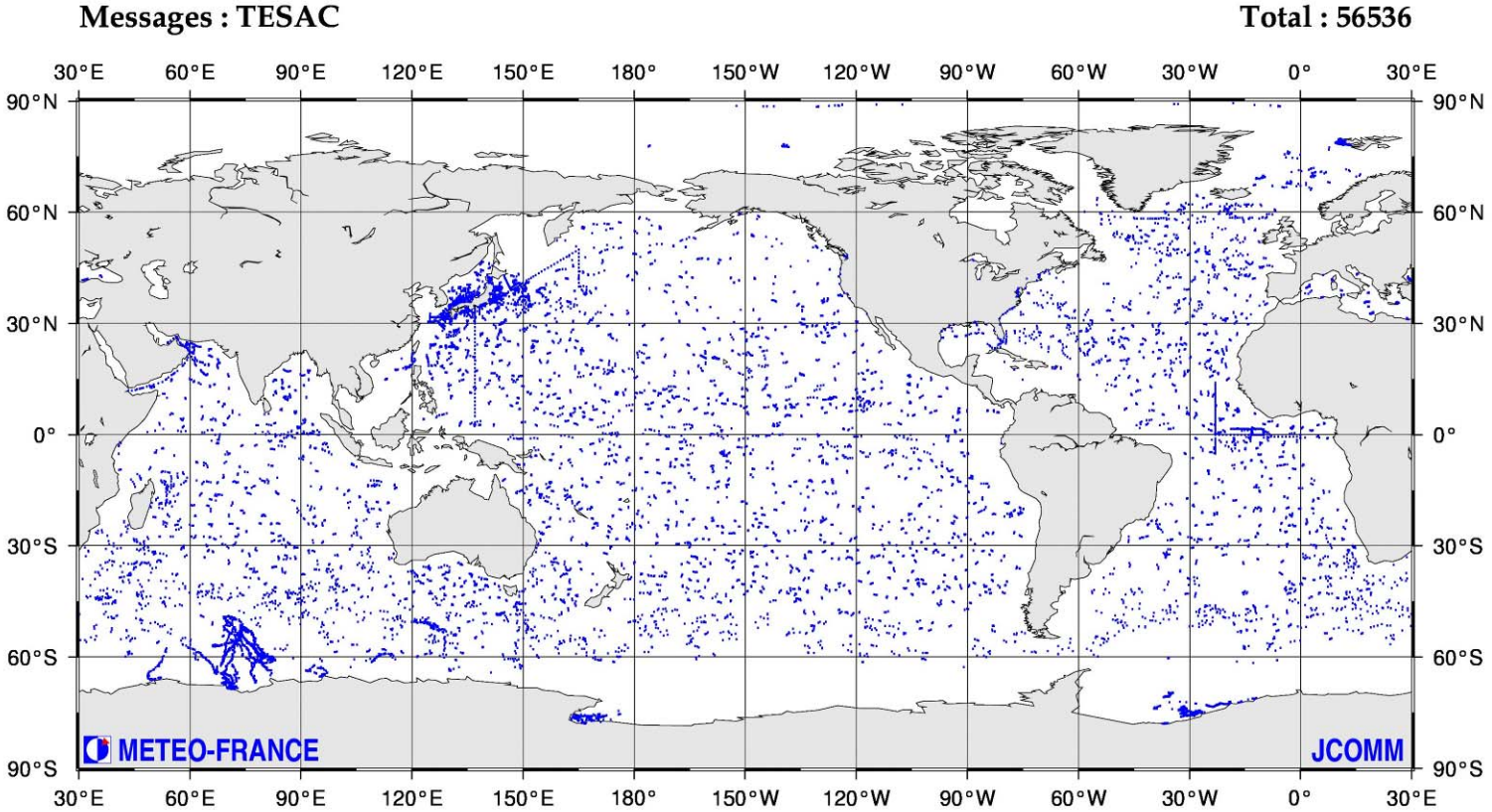


FIGURE 9B

Repartition par carre Marsden des observations recues en juin 2011

Marsden square distribution chart of data received during June 2011

Messages : TESAC **Total : 56536**

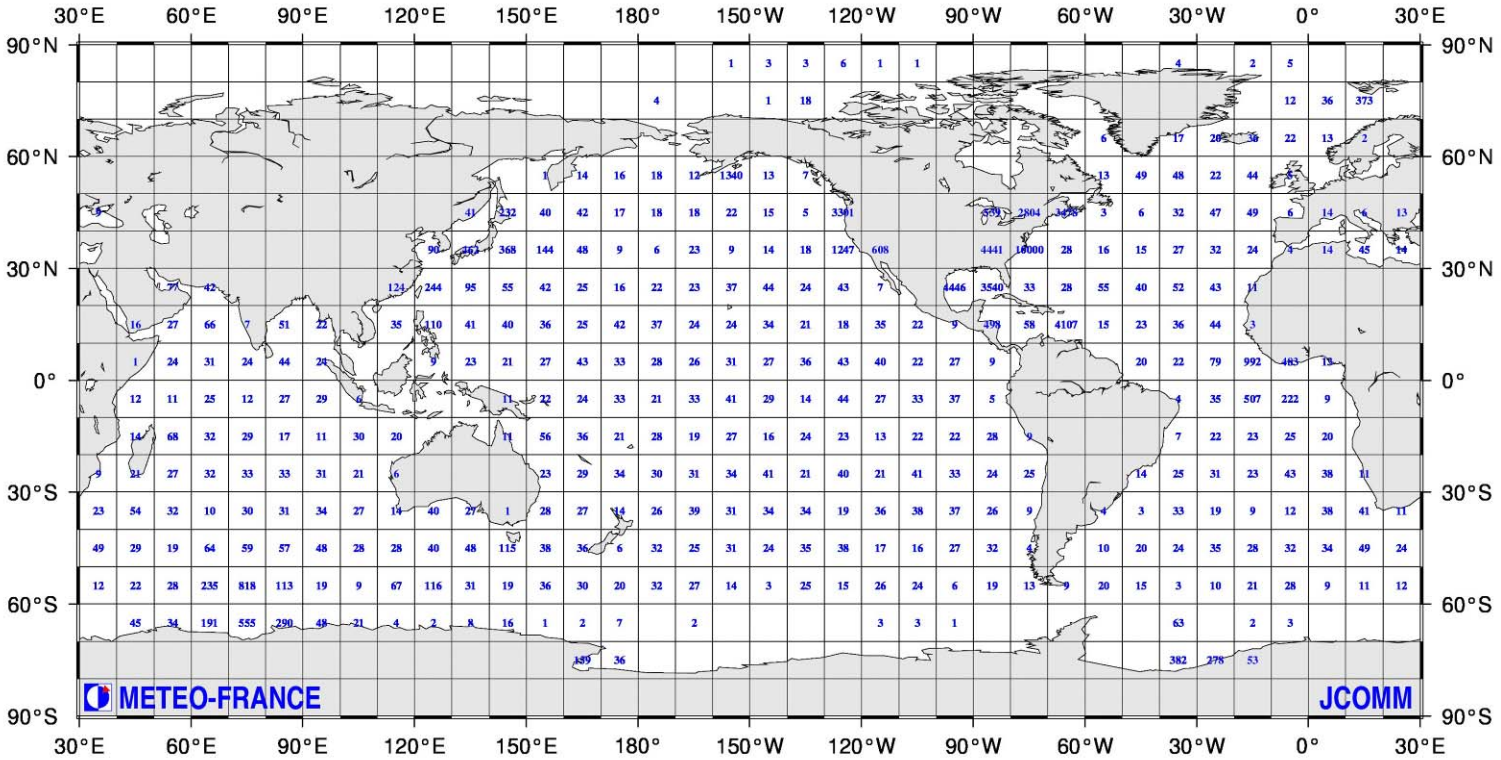


FIGURE 10A

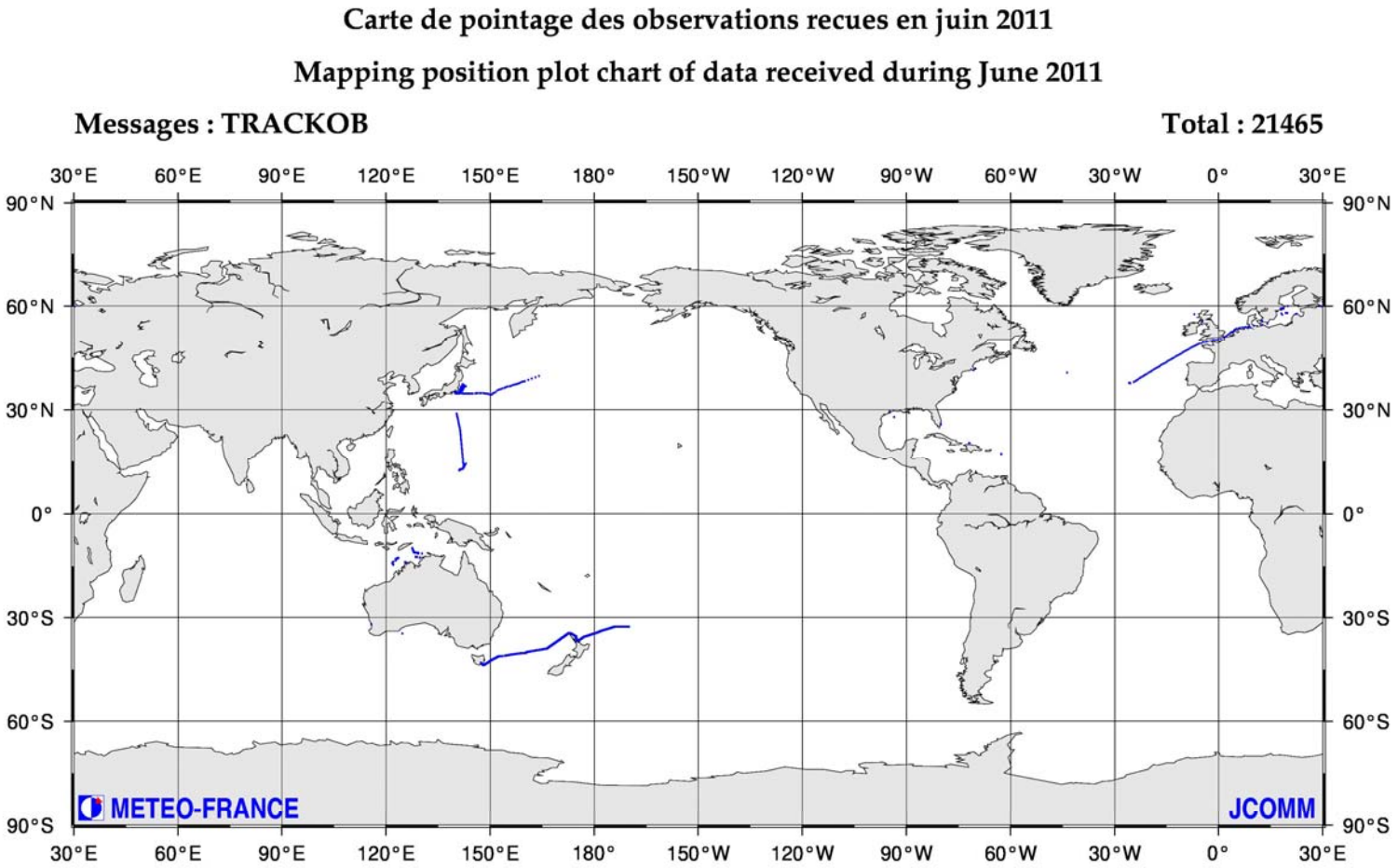

Carte de pointage des observations recues en juin 2011
Mapping position plot chart of data received during June 2011
Messages : TRACKOB
Total : 21465
30°E 60°E 90°E 120°E 150°E 180° 150°W 120°W 90°W 60°W 30°W 0° 30°E
90°N
60°N
30°N
0°
30°S
60°S
90°S
METEO-FRANCE
JCOMM

FIGURE 10B

Repartition par carre Marsden des observations recues en juin 2011

Marsden square distribution chart of data received during June 2011

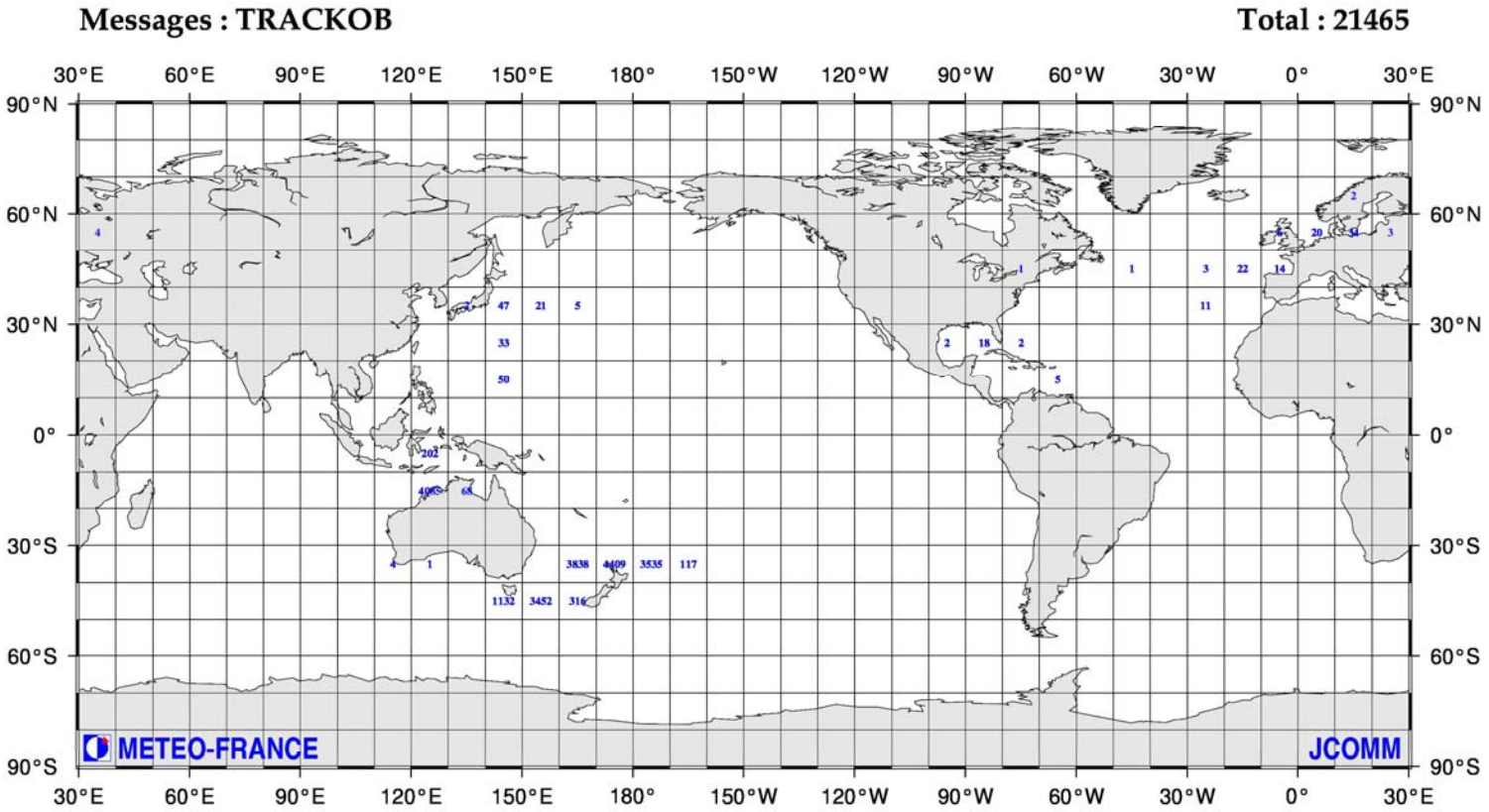


FIGURE 11

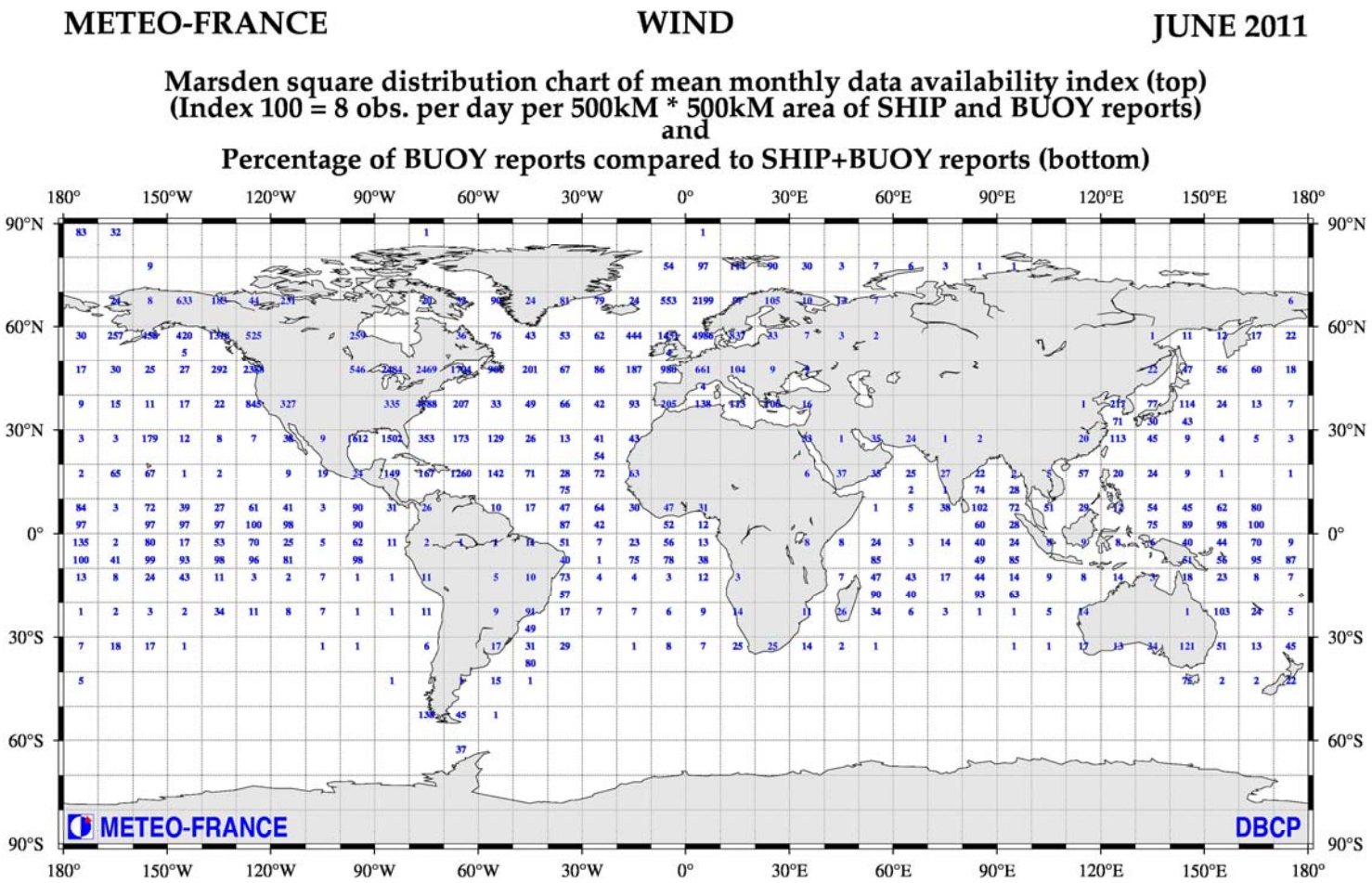

METEO-FRANCE
WIND
JUNE 2011
Marsden square distribution chart of mean monthly data availability index (top)
(Index 100 = 8 obs. per day per 500kM * 500kM area of SHIP and BUOY reports)
and
Percentage of BUOY reports compared to SHIP+BUOY reports (bottom)
180° 150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120°E 150°E 180°
90°N 60°N 30°N 0° 30°S 60°S 90°S
METEO-FRANCE
DBCP

FIGURE 12

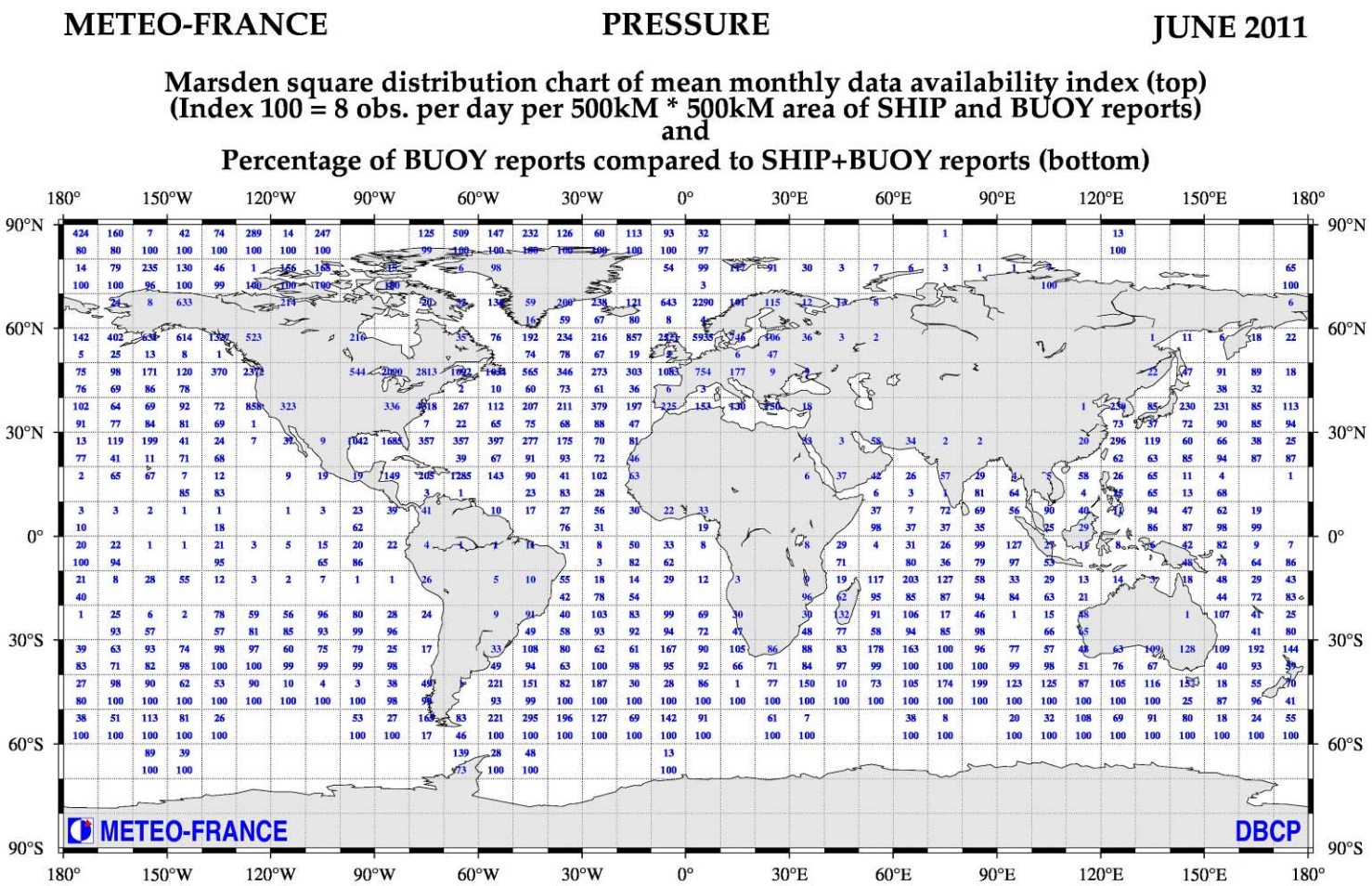

METEO-FRANCE
PRESSURE
JUNE 2011
Marsden square distribution chart of mean monthly data availability index (top)
(Index 100 = 8 obs. per day per 500kM * 500kM area of SHIP and BUOY reports)
and
Percentage of BUOY reports compared to SHIP+BUOY reports (bottom)
180° 150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120°E 150°E 180°
90°N 60°N 30°N 0° 30°S 60°S 90°S
METEO-FRANCE
DBCP

FIGURE 13

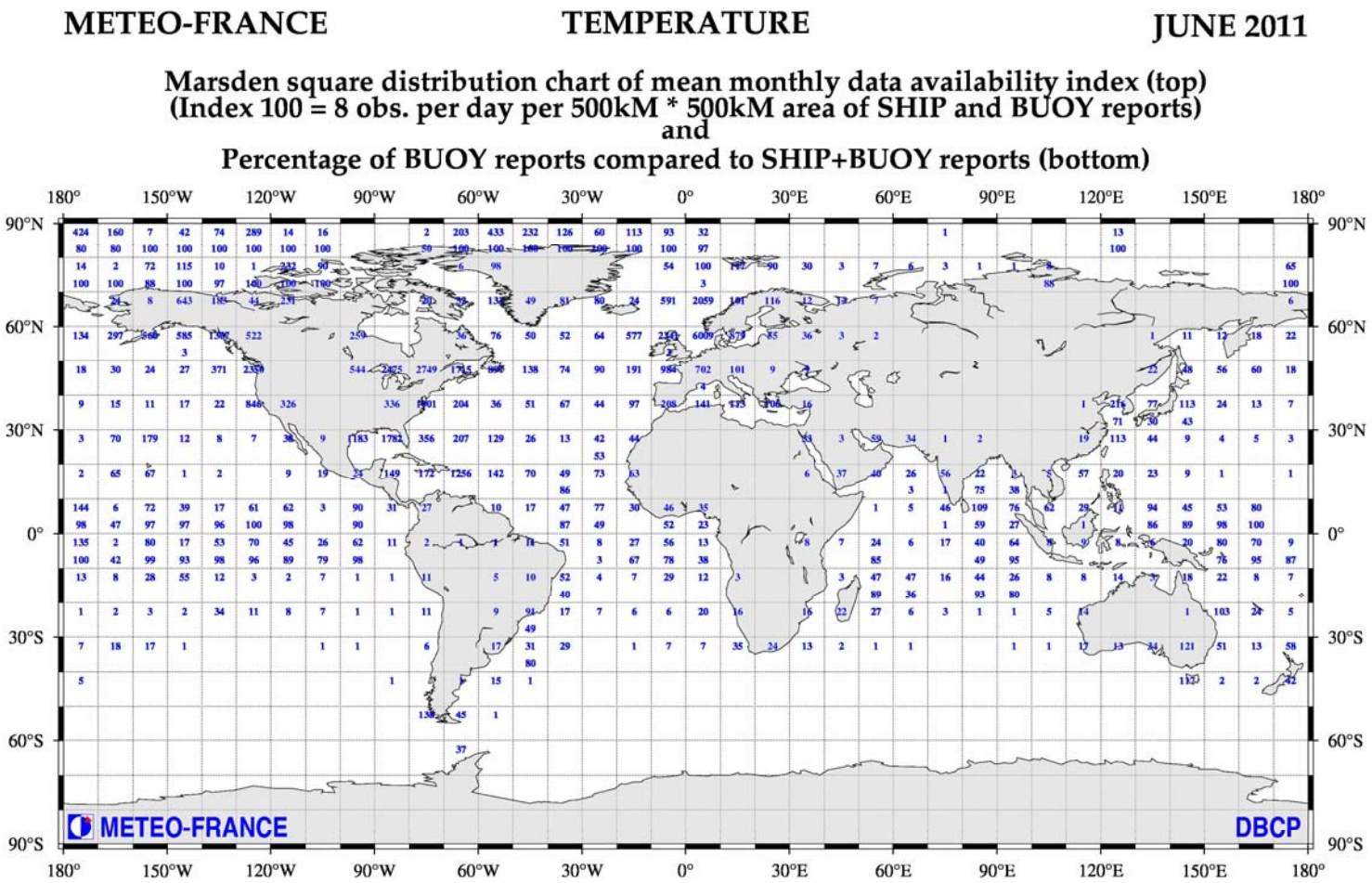
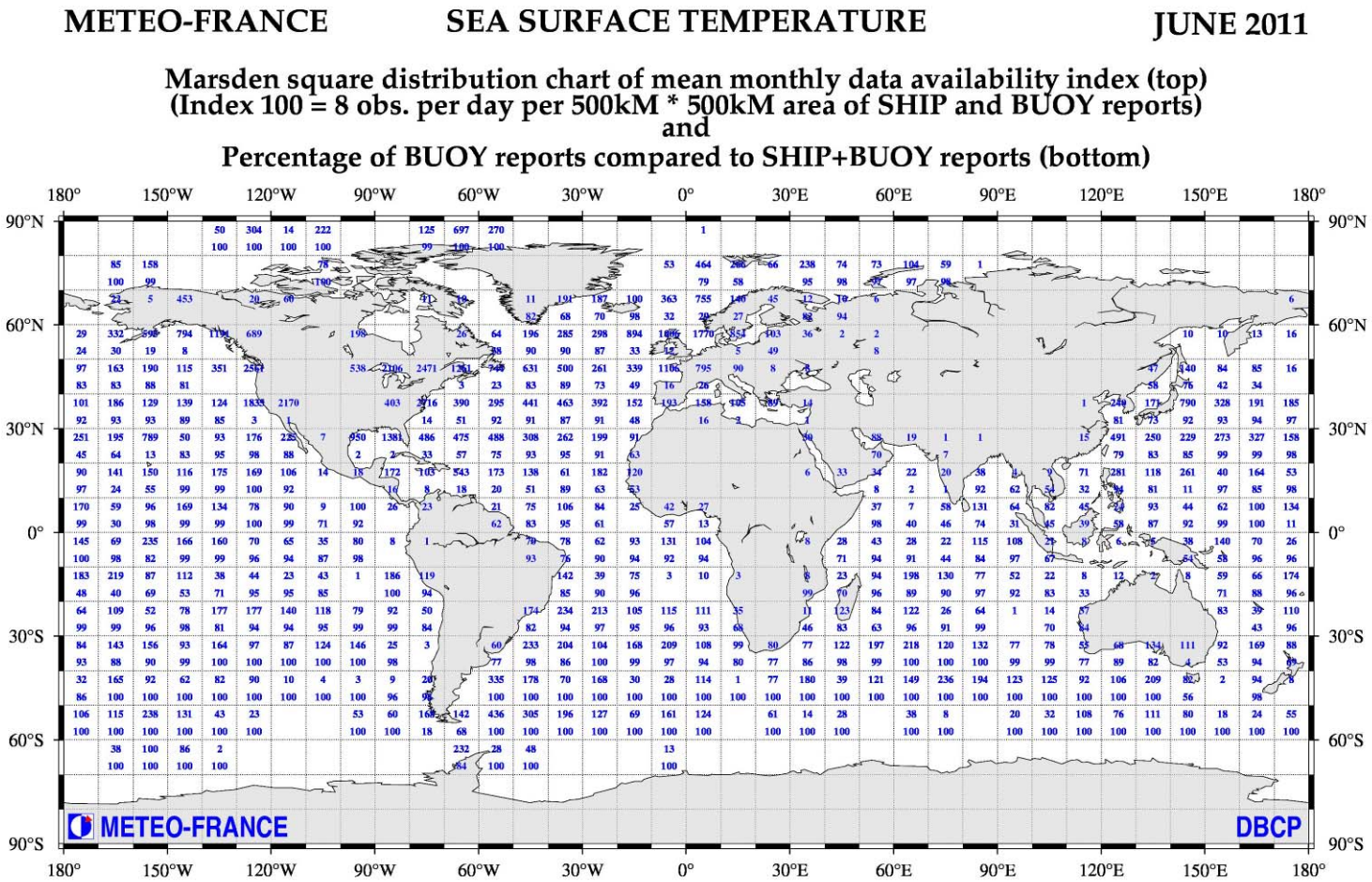

METEO-FRANCE
TEMPERATURE
JUNE 2011
Marsden square distribution chart of mean monthly data availability index (top)
(Index 100 = 8 obs. per day per 500kM * 500kM area of SHIP and BUOY reports)
and
Percentage of BUOY reports compared to SHIP+BUOY reports (bottom)
180° 150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120°E 150°E 180°
90°N 60°N 30°N 0° 30°S 60°S 90°S
METEO-FRANCE
DBCP

FIGURE 14


METEO-FRANCE SEA SURFACE TEMPERATURE JUNE 2011
Marsden square distribution chart of mean monthly data availability index (top)
(Index 100 = 8 obs. per day per 500kM * 500kM area of SHIP and BUOY reports)
and
Percentage of BUOY reports compared to SHIP+BUOY reports (bottom)
180° 150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120°E 150°E 180°
90°N 60°N 30°N 0° 30°S 60°S 90°S
METEO-FRANCE
DBCP

APPENDIX C

REPORT BY THE *AD HOC* TASK TEAM ON RESPONSIBLE NATIONAL OCEAN DATA CENTERS (RNODCs) AND SPECIALIZED OCEANOGRAPHY DATA CENTERS (SOCs)

1. Tasking:

Excerpt from JCOMM/DMCG-IV Report (Sec 8.1.3 (16)):

"Recommendation 5.8: The Group considered that the status of IODE Responsible National Oceanographic Data Centres (RNODCs), JCOMM Specialized Oceanography Data Centres (SOCs), and the VOSClim Real Time Monitoring Centre (RTMC) should be addressed. It would be beneficial to develop a proposal for integrating them into a single system of dedicated centres contributing to the ODP, and with specialized functions (archive, QC, monitoring, etc.)."

2. Assumptions:

- This proposal is not responsible for providing any funding recommendations that will impact RNODCs and SOCs, or the RTMC. However, the proposal recommends: (a) integrating these centres into a more unified system of (tentatively) "Global Data Assembly Centres" (GDACs); (b) updating each of their Terms of Reference (ToR) to accurately reflect present and any agreed new functions; and (c) closer interoperability (as appropriate) with the IODE/JCOMM Ocean Data Portal (ODP) and with the JCOMM in situ Observing Platform Support Centre (JCOMMOPS).
- Primarily, two drifting buoy data management centres will be discussed in this proposal – the RNODC for Drifting Buoys, operated by the Integrated Science Data Management (ISDM) of the Department of Fisheries and Oceans, Canada; and the SOC for Drifting Buoys, operated by Météo-France.
- The VOSClim Real Time Monitoring Centre (RTMC) will only be discussed secondarily, because no significant changes are proposed to the current VOSClim provision of monitoring information and data to NOAA's National Climatic Data Center.

Pursuant to a decision made at the 18th IODE Session in 2005, the formal system of RNODCs was abolished (Resolution IODE-XVIII.2; ref. IOC 2005). In response to this decision, for example, the Japan Oceanographic Data Center (JODC) transferred capacity building activities of RNODC WESTPAC on oceanographic data management to Ocean Data and Information Network (ODIN) projects of IODE in the WESTPAC region and JODC has maintained the resources and expertise of IGOSS, MARPOLMAN and ADCP in order to support international activities related to those data, such as GTSPP and CLIVAR etc.1

- However, the term "RNODC" continues to be recognized internationally and utilized by ISDM, and the important continuing functions of this (apparently) one remaining RNODC need to be smoothly transitioned into any agreed new unified system.

3. Definitions

- The RNODC for Drifting Buoys (RNODC/DB) at ISDM became an entity on behalf of the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological

1 The report from IODE-XIX (IOC, 2007) states: "At their February 2006 meeting the Officers had requested the former RNODCs to document the products and services that were provided by the RNODCs and to incorporate these, as relevant, in the terms of reference of the relevant ODINs. The following exceptions had been identified: RNODC for drifting buoys (Canada), JASIN (UK: to be closed), IGOSS (Japan, USA and Russia), MARPOLMON (Japan, USA and Russia), ADCP (Japan). The Officers had requested the centres that hosted the former RNODCs for drifting buoys (Canada), IGOSS (Japan, USA and Russia), MARPOLMON (Japan, USA and Russia) and ADCP (Japan) to continue their work until the next Session of IODE." However, the report from IODE-XX (IOC, 2009) does not appear to further address the issue of residual RNODC transition status.

Organization (WMO) in January 1986. To fulfill this role, ISDM acquires, processes, quality controls (QCs) and archives real-time BUOY (FM 18) messages reported over the Global Telecommunication System (GTS), as well as delayed mode data acquired from other sources. All data are made available to the international scientific community through online products, a web based request system or direct telephone and e-mail requests. We also note that the RNODC/DB also QCs, archives and makes available all moored buoy data reported in the BUOY code and BUFR (note: which code however does not include *all* open ocean or coastal moored buoys internationally, since e.g. the NOAA National Data Buoy Center still uses the SHIP FM 13 code to report some coastal moorings).

- The SOC for Drifting Buoys (SOC/DB) is made of Météo-France teams in Toulouse and Brest, France as well as teams involved in Coriolis, an inter-agency program lead by the French Research Institute for Exploration of the Sea (Ifremer). Ifremer is also in charge of delayed mode aspects, portal to external users, etc. Daily collection and archiving of buoy reports from the global ocean is performed by Météo-France. Météo-France operates QC procedures on drifting buoy data. Warning messages are sent to a mailing list when a problem appears (e.g., bad location detected, wrong acceleration and loss of drogue, sensor drift) or when a modification seems needed (i.e., to recalibrate or to remove a sensor from the GTS), via the JCOMMOPS interface.
- The UK Met Office operates the Real-Time Monitoring Centre (RTMC) for Voluntary Observing Ship (VOS) Climate (VOSClim) ships, and in this role continues to transfer VOSClim ships' observations and the associated co-located model data to the Data Assembly Centre (DAC) at the NOAA National Climatic Data Centre (NCDC).2

4. Background

The IOC's International Oceanographic Data and Information Exchange (IODE) was established in 1961 to enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products.

The main objectives of the IODE Programme are:

- To facilitate and promote the exchange of oceanographic data and information;
- To develop standards, formats and methods for the global exchange of oceanographic data and information;
- To assist Member States to acquire the necessary capacity to manage oceanographic data and information and become partners in the IODE network.

The IODE system forms a worldwide oriented network consisting of Designated National Agencies (DNAs), National Oceanographic Data Centres (NODCs), RNODCs (abolished formally by IODE-XVIII in 2005, as discussed above) and World Data Centres for Oceanography (WDCs). During 40 years, IOC Member States have established over 80 oceanographic data centres or DNAs. This network has been able to control the quality of, and archive of millions of ocean observations, and makes these available to Member States.

Worldwide marine meteorological and oceanographic communities are working in partnership under the umbrella of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), in order to respond to interdisciplinary requirements for met/ocean observations, data management and service products. JCOMM data are used for research and monitoring of ocean processes at global and intermediate scales. There is a need to support international science or service programmes with a variety of operational data services. For these

2 The Met Office also operates a Regional Specialized Meteorological Centre (RSMC), acting as WMO Commission for Basic Systems (CBS) Lead Centre for monitoring the quality of surface marine observations (routinely producing e.g. biannual quality reports as well as essential feedback to VOS operators regarding the quality of the data delivered by VOS ships).

reasons, Specialized Oceanographic Centres (SOC) fill an important element of JCOMM's data processing and services – by monitoring and archiving data and products of a regional or ocean basin scale of interest.

A "Data Type SOC" is a specialized centre which is established to collect and process data to a certain standard and deliver either quality controlled data sets or standard data or data information products to its users. The need for such a SOC is considered "permanent" since it is established to meet ongoing JCOMM requirements.

In 1988, the IOC-WMO put out a Guide to IGOSS (now JCOMM) Specialized Oceanographic Centers (SOCs) (IOC-WMO, 1988). Similarly, the network of RNODCs of the IODE system was described in the IOC Guide for Responsible National Oceanographic Data Centres (IOC, 1982). The RNODCs had a similar role and place in the IODE system to the SOCs role in the Joint IOC-WMO Integrated Global Ocean Services System (IGOSS). In some cases, when a RNODC and a corresponding SOC are involved in the same programme, the activities of both centres should be closely co-ordinated to maximize efficiency and minimize the users' task of obtaining similar data from two sources. When a corresponding RNODC exists, the SOC will submit the operational ocean data originating from the IOS (and other operational sources) to that RNODC in computer-compatible form. Formats and quality control procedures are specified for data exchange between JCOMM and IODE centres.

RNODCs operating in the IODE system have a primary responsibility to provide for the long term archival of oceanographic data and data products in the World Data Centres (note: eventually to be transitioned into a new World Data System, WDS). In contrast, SOCs have a primary responsibility to make data and data products available to users in an operational time frame.

Operational time frames range from a few hours to one month (30 days) depending on the parameter and process being monitored or studied. It was a goal of the JCOMM system to transfer the data from the JCOMM SOCs to the IODE RNODCs by the time the observation is no longer operational. Later on, the JCOMM system should be receiving non-operational data from other sources and should be able to provide more comprehensive data sets to users.

5. Proposal

While the 1988 recommendations for RNODCs and SOCs provided useful guidance for collaboration between the two centres, the increase in observations and new methods for supporting similar capabilities require new guidance. This proposal recommends a similar management scheme for drifting buoy data centres that successfully exists within Argo Float data centres and OceanSITES moored reference station data centres. The Global Temperature and Salinity Profile Program (GTSPP) will be referenced as a good example of the collaboration program between IODE data centers and SOCs. (Table 1).

Table 1. Current Data Management Centers for data from Argo, OceanSITES, drifting buoys, other coastal and open-ocean moored buoy systems, and GTSPP.

Program	***Summary***
Argo Program	An internationally coordinated activity directed at characterizing both the temperature and salinity structure of the mid- and upper- ocean and the advective field at mid-depth through deployment of autonomous profiling floats.The assembly of data in the Argo program is a distributed responsibility. In many cases, individual countries have established data Centres to handle the data collected by floats

	that their countries have contributed. In other cases, agencies within countries or groups of countries have also contributed floats to the Argo program but they make use of existing data processing Centres.
OceanSITES	OceanSITES is a worldwide system of long-term, deepwater reference stations measuring dozens of variables and monitoring the full depth of the ocean from air-sea interactions down to 5,000 meters. Since 1999, the international OceanSITES science team has shared both data and costs in order to capitalize on the enormous potential of these moorings. OceanSITES moorings are an integral part of the Global Ocean Observing System. They complement satellite imagery and ARGO float data by adding the dimensions of time and depth. The assembly of data in the OceanSITES program is a distributed responsibility. In many cases, individual countries have established data Centres to handle the data collected by moorings that their countries have contributed. In other cases, scientists or universities have also contributed moorings have also contributed moorings to the OceanSITES program but they make use of existing data processing Centres.
Drifting Buoy Centres	The management of the surface drifter data stream is relatively simple (but fragmented). The largest fraction of surface drifter data circulates on the GTS, the system operated by the WMO for broadcasting meteorological and oceanographic data to centres around the world. This distributed system has been promoted by the Data Buoy Cooperation Panel (DBCP) as a way to ensure widespread distribution of the observations. In recent years, some countries have provided internet access, in addition to distribution on the GTS, to the data collected by the buoys they operate. Data Centres capture all of the data from the GTS to hopefully ensure a complete (global) and long-term archive of the data and provide dissemination to users. We note however that the completeness of data receipts at different GTS centres has long been known to differ for operational and other reasons. Ideally therefore GTS receipts from different centres should be combined systematically to obtain the most complete and accurate data mixture possible.
Other Moored Buoy Centres	The management of data from moored buoy arrays presently appears to be the most fragmented, with near-coastal arrays (e.g. that operated by NOAA/NDBC around the US) possibly inherently less suitable for international management, owing to national coastal data management considerations and currently higher priorities within JCOMM and other international bodies for open-ocean observations. In contrast however, meteorological (and oceanographic) data from the tropical moored buoy arrays—specifically the Tropical Atmosphere Ocean/TRIangle Trans-Ocean buoy Network (TAO/TRITON) array in the Pacific, the Prediction and Research Moored Array in the Atlantic (PIRATA), and the Indian Ocean Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA)—are of critical importance to weather prediction and climate research applications. Presently data from these arrays (with some overlaps with OceanSITES) is managed separately at locations such as NOAA/NDBC, NOAA/PMEL, and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), also with possible management differences depending on whether a given installation is considered “research” or “operational.”

GTSPP	GTSPP is a cooperative international project promoted by IOC and WMO, aiming to develop and maintain a global ocean Temperature-Salinity resource. Making global measurements of ocean temperature and salinity (T-S) quickly and easily accessible to users is its primary goal. It uses the GTS to acquire near real-time data (BATHY/TESAC) handled by ISDM with cooperation of 4 GTS centers in Canada, US, Germany, and Japan. Historical data are acquired either from other NODCs or from cooperation projects. US NODC provides data processing service for historical data and maintenance of Continuously Managed Database. GTSPP clients can use data that are both up-to-date and of the highest quality from US NODC anytime. US NODC recently started data service of GTSPP by ODP.

The Ad Hoc Task Team recommends that the RNODC/DB and the SOC/DB develop a data management scheme similar to Argo and OceanSITES. These data are processed and distributed through a network involving different components that contribute to the overall data management system.

Figure 1 provides a visual summary of the data flow from either Argo or OceanSITES data management systems. The primary data flow is from the scientists or agencies who deploy the floats, to data centers who collect, qualify and processes the data to global data centers who serve as local distribution points on the Internet.

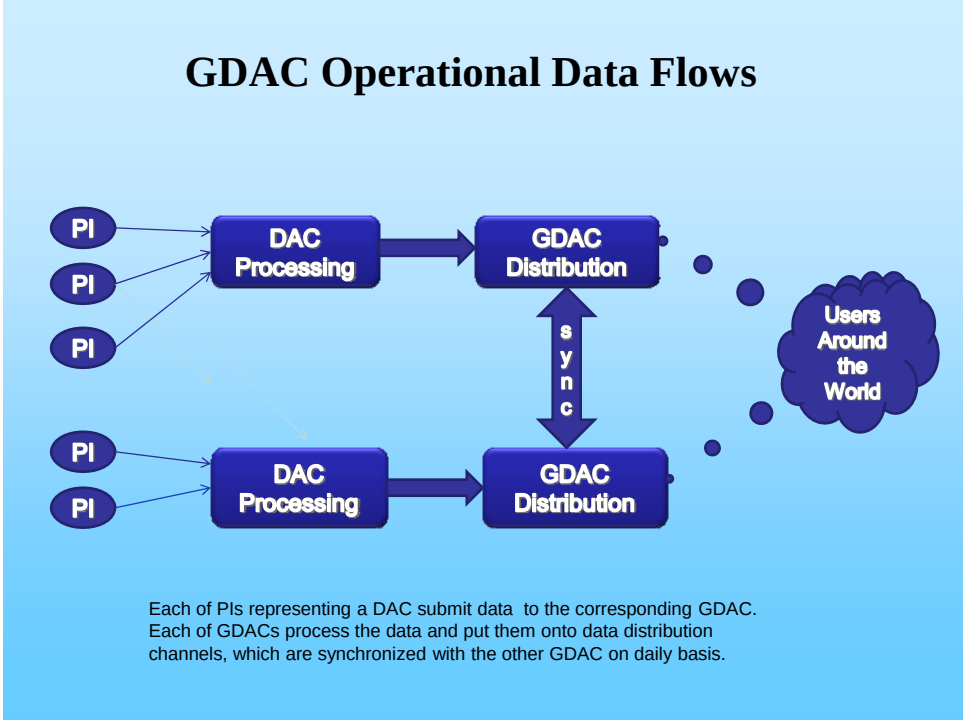


Figure 1. A visual summary of the data flow from either Argo or OceanSITES. While not shown on the figure, GDACS are also intended to serve as the regular pipeline to WDCs and/or NODCs for permanent data archival.

Expected main roles and functions of the Principle Investigator (PI), Data Assembly Centre (DAC) and Global Data Assembly Centre (GDAC) in the proposed data management scheme are listed below;

- The Principle Investigator (PI):
    - Maintains specific floats or platforms (one or more sites),
    - Determines what observations are released to the Global Telecommunications System (GTS),
    - Assures that the platform is available and provides reliable information,
    - Provides the DAC with the observations (data) in any format the DAC is willing to take, and the metadata necessary to serve as an Argo or OceanSITES platform, and
    - QCs post-recovery data according to agreed procedures.

- The Data Assembly Centre (DAC):
    - Sets up the "local" server according to the specifications approved by a data management group,
    - Guarantees data availability from the PI platforms,
    - Translates the data to the agreed upon format,
    - Quality Controls real-time data according to the minimum agreed procedures,
    - Provides the observations via the Global Telecommunications System (if requested by the PI),
    - Provides the data on a server for access by the GDACs
    - Organizes the data processing, formatting, data transfer and update with the PIs.

- The Global Data Assembly Centre (GDAC):
    - Provides the public, researchers, modelers, etc. with a virtual or centralized access to the data that are served by the DACs,
    - Ensures no data are excluded at the GDAC level, and full high-frequency data sets are available,
    - Keeps only the best version of the data. Additional products like interpolated data are separate optional sets,
    - Check all files daily using the "File Checker" software,
    - Maintains the Argo or OceanSITES catalogue, and
    - Synchronizes the catalogues with the second GDAC periodically (at least daily).
    - Responsible for permanent archive of the data.
    - Provides feedback to JCOMMOPS via Data Buoy Cooperation Panel Meetings.
    - Provide technical advice and support for QC and processing of drifting buoy data to DACs and PIs.
    - Will monitor circulation and data management status of drifting buoy data and will report to JCOMM/DMCG and provide advice to improve drifting buoy data circulation and management.

The Ad Hoc Task Team recommends that the RNODC/DB and SOC/DB become Global Data Assembly Centers for all drifting buoys – in a similar role that the Argo and OceanSITES GDACs server for their programs. Note that in both the Argo and OceanSITES case, GDACs serve as a DAC for some systems.

As drifting buoy GDACs, both agencies agree to manage the international archive of all surface drifter data – and synchronize the catalogues on a regular basis. Even though the National Centres keep master copies of both data and metadata for the drifters for which they are responsible, the GDACs are the source from which all users should obtain their data. By centralizing this function, users can be assured that they are receiving the most up-to-date versions and that the data they receive is the same as what all others would receive. The choice

of which GDAC server to access could be determined by its proximity to the user while attempting to alleviate the load put on either server. Having two redundant GDACs helps ensure that each of the two GDAC servers receive data directly from their DACs with the latest version of the drifter data and metadata. Both servers are updated simultaneously in order to ensure consistency between the two datasets. Each file is the responsibility of a single DAC (i.e., the data provider) who guarantees the quality and integrity of the data. One DAC is already responsible for most of these operations, the Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, FL. AOML formed the Global Drifter Program's Drifter Data Assembly Centre (DAC) to apply delayed mode quality control (QC) to the surface drifter data. Due to the change of GTS routing rule, a problem occurred at ISDM which causedsome data to not be received by the Center. For this problem, it is encouraged that other GTS centers exchange their received FM18 with ISDM as done in GTSPP. The RNODC/DB continues to receive and archive the real-time data and servers as a long-term archive for the delayed mode data.

6. Proposed Implementation

If this proposal is approved, the Ad Hoc Task Team recommends that representatives from the RNODC/DB and SOC/DB schedule a conference with representatives from this Task Team, PIs, DACs and GDACs to discuss the implementation of such a system, determine the Information Technology impacts for both Centres, and develop a timeline for achieving Initial Operational Capability (IOC) and Full Operational Capability (FOC).

SOC has real-time services and clients, generally operational up to 30 days. ISDM has different delayed mode services. AOML has other clients for the more refined SVP productsSuch differences should be considered at the conference when the implementation plan is discussed. The following arrangement could be additional arrangement for the discussion at the conference:

- SOC/DB will be a Real-Time GDAC for the data within 30 days.
- ISDM will be a Delayed Mode GDAC for the data 30 days passed and received from Real-time GDAC.
- AOML could be a special analyzed GDAC to assist other data centers including GDACs and other projects to develop special products and QC procedures/techniques.

It is also expected that an installation plan of ODP servers in the system will be discussed at the conference considering the capacities of the centers which will participate in the system.

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