WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

DATA BUOY COOPERATION PANEL

DBCP-28/ Doc. 10.2 rev. 2
(18-Sep-12)

TWENTY-EIGHTH SESSION

ITEM: 10.2

FREMANTLE, AUSTRALIA
2-6 OCTOBER 2012

ENGLISH ONLY

REPORT BY THE BUOY DATA MANAGEMENT CENTRES

(Submitted by Mr Jean Rolland (Météo-France) for SOC/DB and Mr Sylvain de Margerie (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 2011 – July 2012)
- B. JCOMM SOC for Drifting Buoys Report 2011 – 2012
- C. Recommendation 2 (JCOMM-4) – Marine Climate Data System (MCDS)

-A- DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

10.2.1 Mr Joe Linguanti (Canada) reported on the activities 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.

10.2.2 *[specific issues of interest to the Panel on RNODC/DB activities to be added here according to actual discussion during the Session]*

10.2.3 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 (France).

10.2.4 *[specific issues of interest to the Panel on SOC/DB activities to be added here according to actual discussion during the Session]*

10.2.5 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.

10.2.6 The Panel noted the outcome of the JCOMM-4 Session with regard to marine climatology, and in particular its decision through Recommendation 2 (JCOMM-4) (see Appendix C) to engage in the development of a new Marine Climate Data System (MCDS). In this context, the Commission has invited France and Canada, and other parties currently performing the functions of DACs and/or GDACs or similar (e.g. GCCs, Argo, OceanSITEs, GTSPP, GDP DAC) to participate in the discussions regarding the develoment of the MCDS strategy and implementation plan with a view to offering MCDS DAC or GDAC functions as appropriate. Meanwhile, the Commission approved the designation of the relevant French and Canadian centers as provisional GDAC for Drifting Buoys under JCOMM and IODE (GDAC-DB) to continue in their present roles of SOC/DB and RNODC/DB until the role of the MCDS GDACs is further clarified as a part of the MCDS strategy.

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Appendices: 3

APPENDIX A

REPORT OF THE IODE RESPONSIBLE NATIONAL OCEANOGRAPHIC DATA CENTRE (RNODC) FOR DRIFTING BUOYS (JULY 2011 – JUNE 2012)

Integrated Science Data Management (ISDM)
Sylvain.deMargerie@dfo-mpo.gc.ca

1. Introduction Historical Perspective

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 approximately 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 The Ad Hoc Task Team on Responsible National Ocean Data Centers (RNODCs) and Specialized Oceanography Data Centers (SOCs) met together with the RNODC and SOC for Drifting Buoys (DB) on the occasion of the first Marine Climate Data System Workshop (MCDS1; 28 Nov.-2 Dec. 2011, Hamburg, Germany). The MCDS report recommended that both the "RNODC/DB and SOC/DB become Global Data Assembly Centers for all drifting buoys" (MCDS-1 Final Report section 3.4.2). The Fourth JCOMM session (JCOMM-4/Doc. 7.2.7) further approved the designation of the relevant French (Meteo-France) and Canadian (ISDM) centers as provisional GDAC for Drifting Buoys under JCOMM and IODE (GDAC-DB) to continue in their present roles until the role of the MCDS GDACs is further clarified as a part of the MCDS strategy.

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 drifting and moored buoys. To distinguish between drifting 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 2011 to June 2012 ISDM archived 10,473,313 messages from 2537 platforms (approximately 15% fewer messages than for same period last year). Moored and drifting locations for the 12 month period are represented in Figure 1. Of the GTS messages processed, over 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 52 GB with 115 million drifting and moored records for the period December 1978 to June 2011 and growing at a rate of nearly 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 is in development. 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 data with custom products and map displays. These new products will enhance our support for DBCP Action Groups and other 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 Once the final BUFR templates for Drifting and Moored buoy platforms is finalized and adopted, ISDM will have to deal with several technical challenges in order to implement an operational process to merge the BUFR GTS into our existing processes.
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; clearly some work remains to ensure everyone can read and write BUFR to the GTS.

3.2.3 ISDM and SOC Meteo-France have developed an interchange format to allow us to compare the numbers of messages we each receive under various GTS Bulletin headers. Monthly exchanges of our GTS Bulletin statistics will allow us to identify GTS routing problems and verify we are each receiving all messages possible for our respective archives. An analysis of the July SOC and ISDM GTS reports has identified a number of potential routing problems that may be impacting ISDM's access to some moored buoys messages. ISDM is presently working with our contacts within the Canadian and American meteorological services to rectify the individual situations. (DBCP-XXVII D26/6.1.5 (5)) & D27/6.1.2 (iv)).

3.3 Update SVP Data Submission

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 2011 and will be updated again in 2012 with the most recent data submission from AOML (http://isdm.gc.ca/isdm-gdsi/drib-bder/svp-vcs/index-eng.asp).

4. Goals for 2012/2013

4.1 Process and update 2012 SVP submission from AOML.

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

4.3 Develop NetCDF data exchange products and enhance the use of THREDDS and OpenDAP data services.

4.4 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.

4.5 Work with JCOMMOPS and the international community to implement BUFR as the standard for GTS data transmission and exchange.

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 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 request. The ISDM web site (www.isdm.gc.ca) provides inventories and maps designed to help clients refine temporal and spatial criteria for custom offline requests. Last year ISDM received over 50 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). Where other services do not exist ISDM can provide specialized products before our normal monthly QC and archive update.

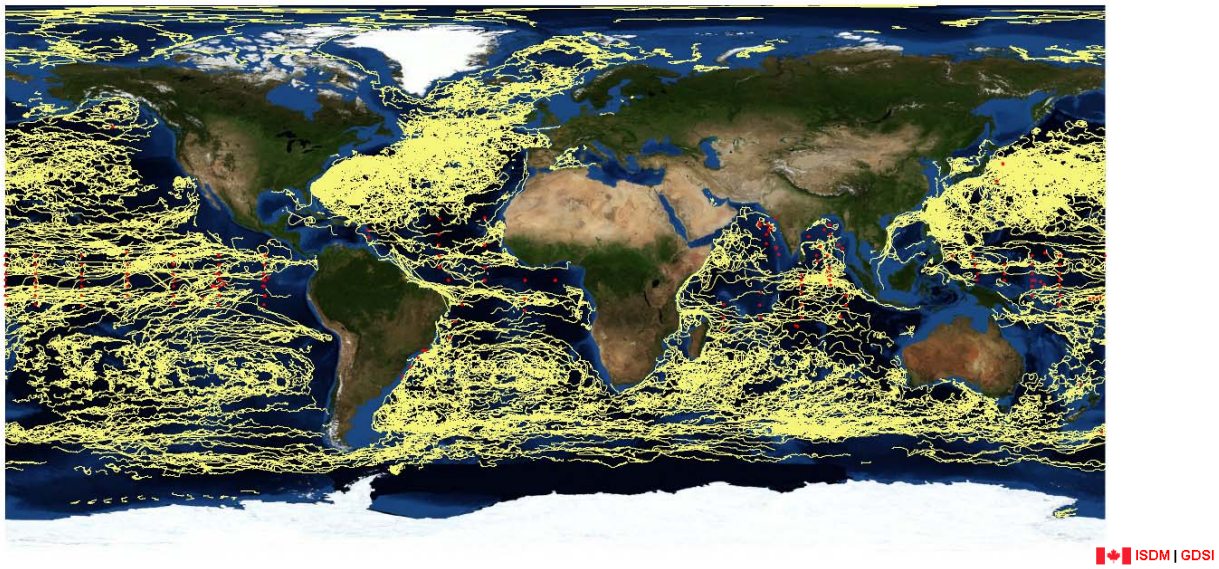


Figure 1
Track and Location Map (July 2011 to June 2012)

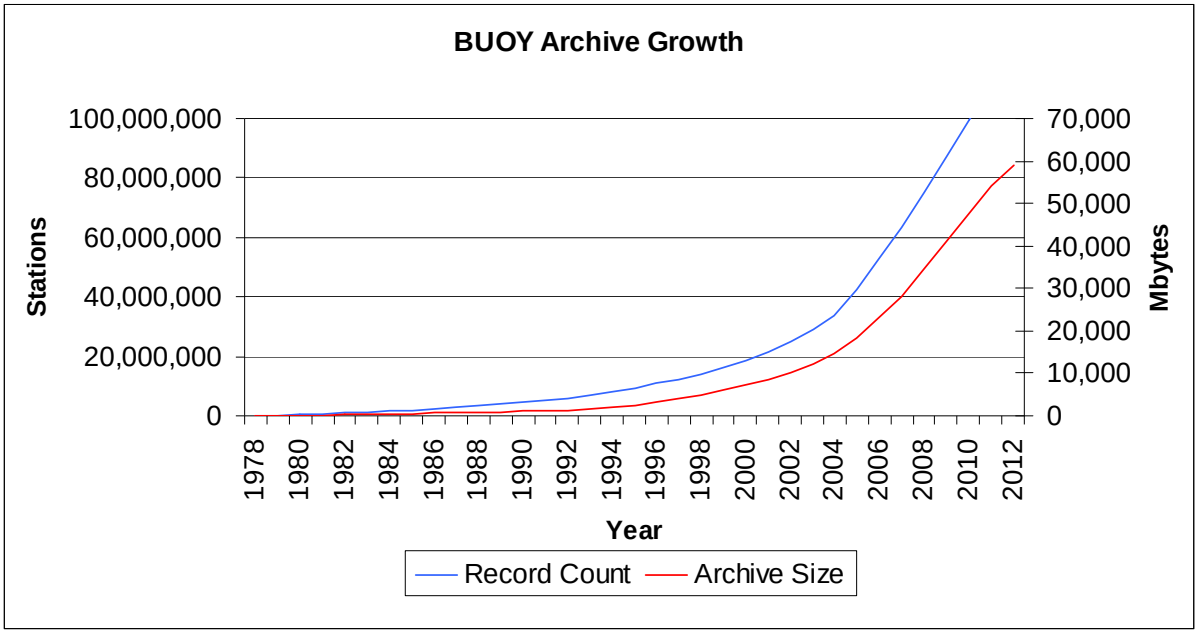


Figure 2
Buoy Archive Growth by Year

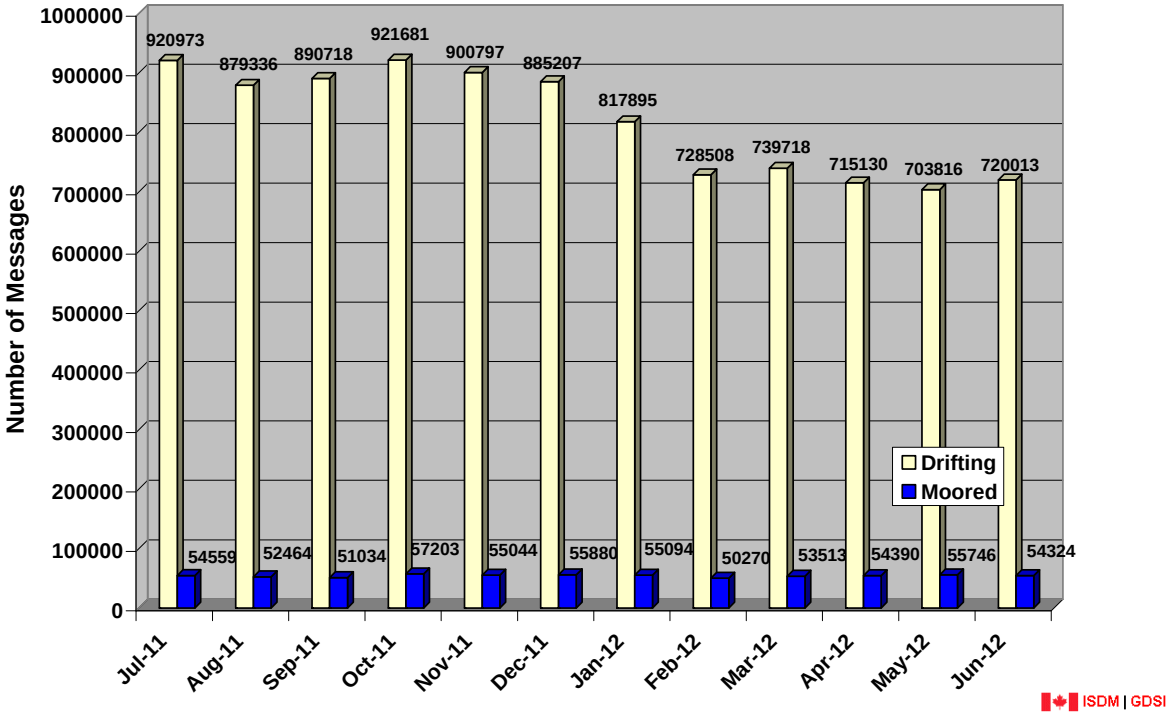


Figure 3
Number of Drifting and Moored Buoy Messages by Month

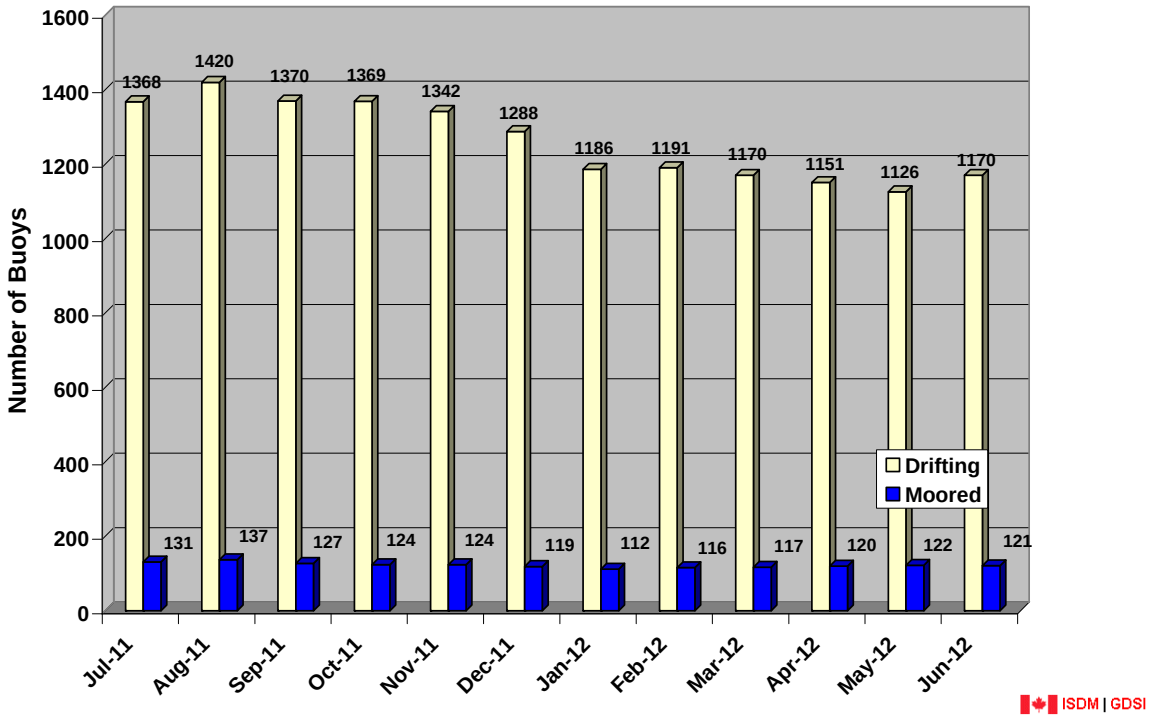
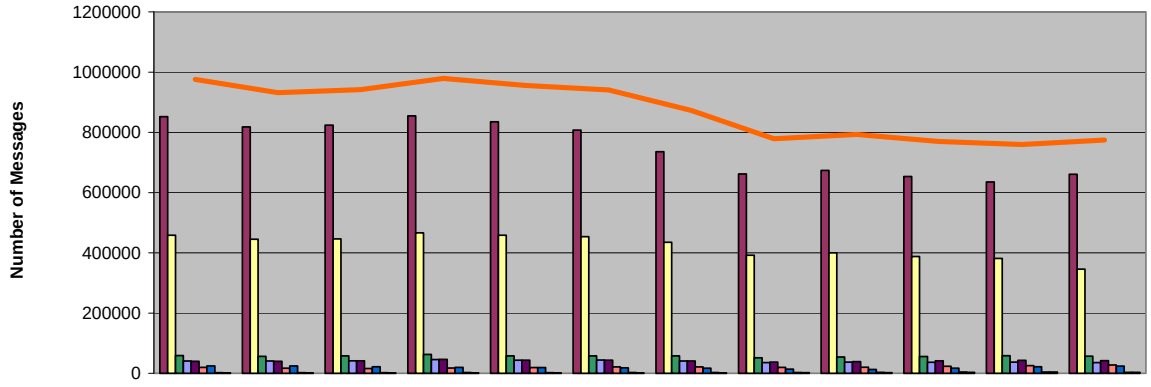


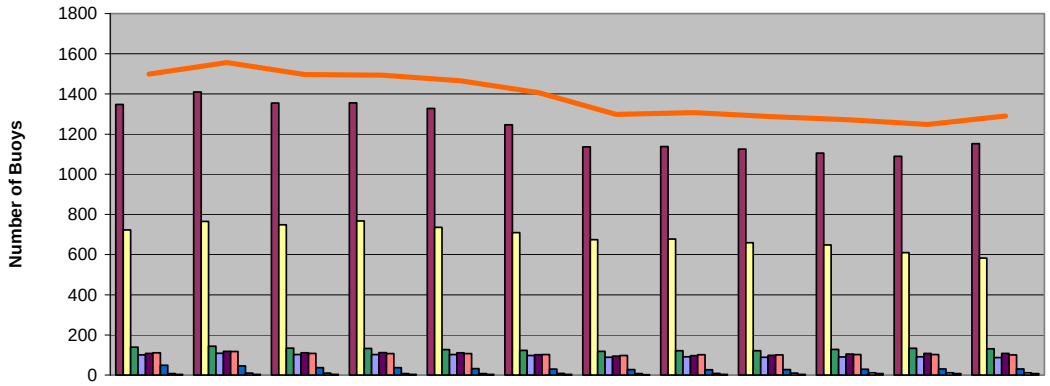
Figure 4
Number of Drifting and Moored Buoys by Month



	2011-07	2011-08	2011-09	2011-10	2011-11	2011-12	2012-01	2012-02	2012-03	2012-04	2012-05	2012-06
Surface Temp	852116	818535	824148	854863	835103	807592	735923	661661	673632	653575	635920	661324
Air Pressure	458881	445432	446392	466229	458850	453478	435083	392199	400328	387912	381660	345851
Air Temp	59133	56614	57664	62835	57614	57906	57540	51733	54308	55602	58703	57073
Rel Humidity	41018	40951	41782	45962	43917	44323	40958	36198	37179	36493	37254	35813
Wind Spd & Dir	40443	40447	41374	46338	43659	43601	40785	37587	38731	41415	42965	42205
Profiles	19918	16949	16065	17724	19002	21295	21152	19460	20394	22931	25345	27436
Surface Salinity	24919	24889	21586	19543	18992	18481	16972	14152	12652	17150	21769	23972
Wave Swell	1958	2375	2340	2698	2341	2654	2854	3020	3520	4219	4100	3715
Dew Temp	1379	1410	1573	1484	1294	1464	1320	1765	1829	3586	4288	3598
Total # of Msgs	975532	931800	941752	978884	955841	941087	872989	778778	793231	769520	759562	774337

ISDM | GDSI

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



	2011-07	2011-08	2011-09	2011-10	2011-11	2011-12	2012-01	2012-02	2012-03	2012-04	2012-05	2012-06
Surface Temp	1348	1410	1355	1356	1328	1246	1136	1138	1126	1106	1090	1152
Air Pressure	723	765	748	767	736	709	674	677	660	648	610	582
Air Temp	138	144	134	132	127	123	118	122	122	128	133	131
Rel Humidity	100	109	103	103	102	97	89	91	89	90	91	87
Wind Speed & Dir	108	118	111	112	111	101	94	96	98	105	108	108
SubSurface Profiles	111	117	108	107	107	102	97	101	100	102	102	100
Surface Salinity	49	45	37	37	32	30	28	26	27	29	31	31
Wave Swell	7	9	9	7	7	8	7	8	10	12	12	12
Dew Temp	3	3	3	3	3	3	2	3	3	7	7	7
Total # of Buoys	1499	1557	1497	1493	1466	1407	1298	1307	1287	1271	1248	1291

ISDM | GDSI

Figure 6
Number of Platforms Reporting Different Parameters by Month

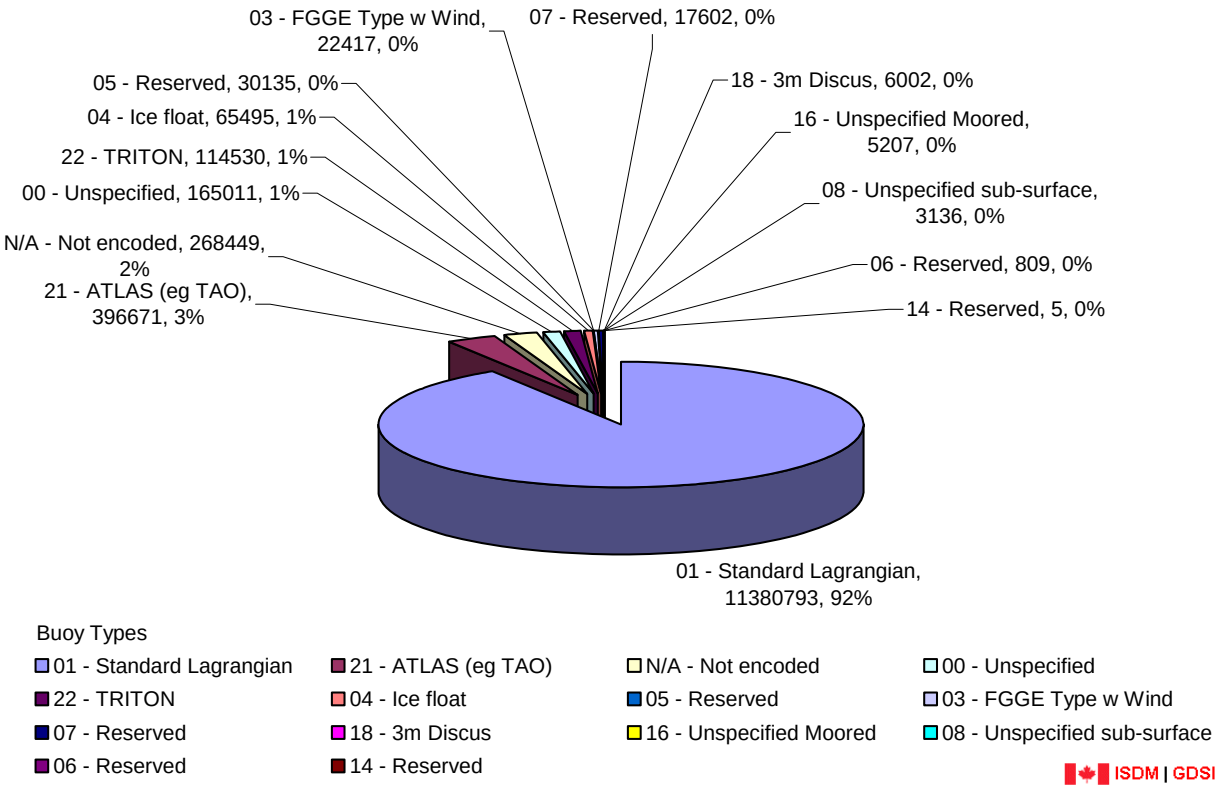


Figure 7
Reported Buoys Types (July 2010 to June 2011)

APPENDIX B

METEO FRANCE
Toujours un temps d'avance

REPORT OF THE JCOMM SPECIALIZED OCEANOGRAPHY CENTRE (SOC) FOR DRIFTING BUOYS REPORT 2011 – 2012

Météo France

SOC for Drifting Buoys Report
2011 – 2012

The Specialized Oceanographic Center (SOC) for Drifting Buoys has been run continuously during year 2011-2012. 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 being 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.

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 for pressure respectively for all BUOY reports (showing all buoys, moored buoys and Drifting Buoys) and SHIP reports, since January 2011.
- Figure 5 shows the time evolution of WAVEOB reports and sensors since January 2011.

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

- Figures 6a,b to 10a,b show these products for June 2012. "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.

Every 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 2012. Figure 11: Wind, Figure 12: Pressure, Figure 13: Air temperature, Figure 14: Sea surface temperature.

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).

The representatives of Meteo-France (for SOC/DB) and ISDM (for RNODC/DB) attented the first workshop for a new Marine Climate Data System (MCDS) organized by WMO in Hamburg in November 2011, in order to see how they could contribute to this system. An ad hoc group of the workshop discussed efforts to organize both existing entities plus NOAA's AOML/GDC into the MCDS structure. The following recommendations were agreed:

- the three organizations should become GDACs for all drifting buoy data;
- Meteo-France should serve as DAC and GDAC for real-time drifting buoy data;
- ISDM should serve as a GDAC for real-time and delayed-mode drifting buoy data;
- AOML should serve as GDAC for delayed-mode drifting buoy data.

Since, the organizations met through WebEx in May 2012 to discuss final implementation of the recommendations and GTS routing issues, metadata acquisition and exchange of value added data when occur. Most especially, the list of GTS bulletins containing BUOY messages, received at Meteo-France and ISDM have been compared.

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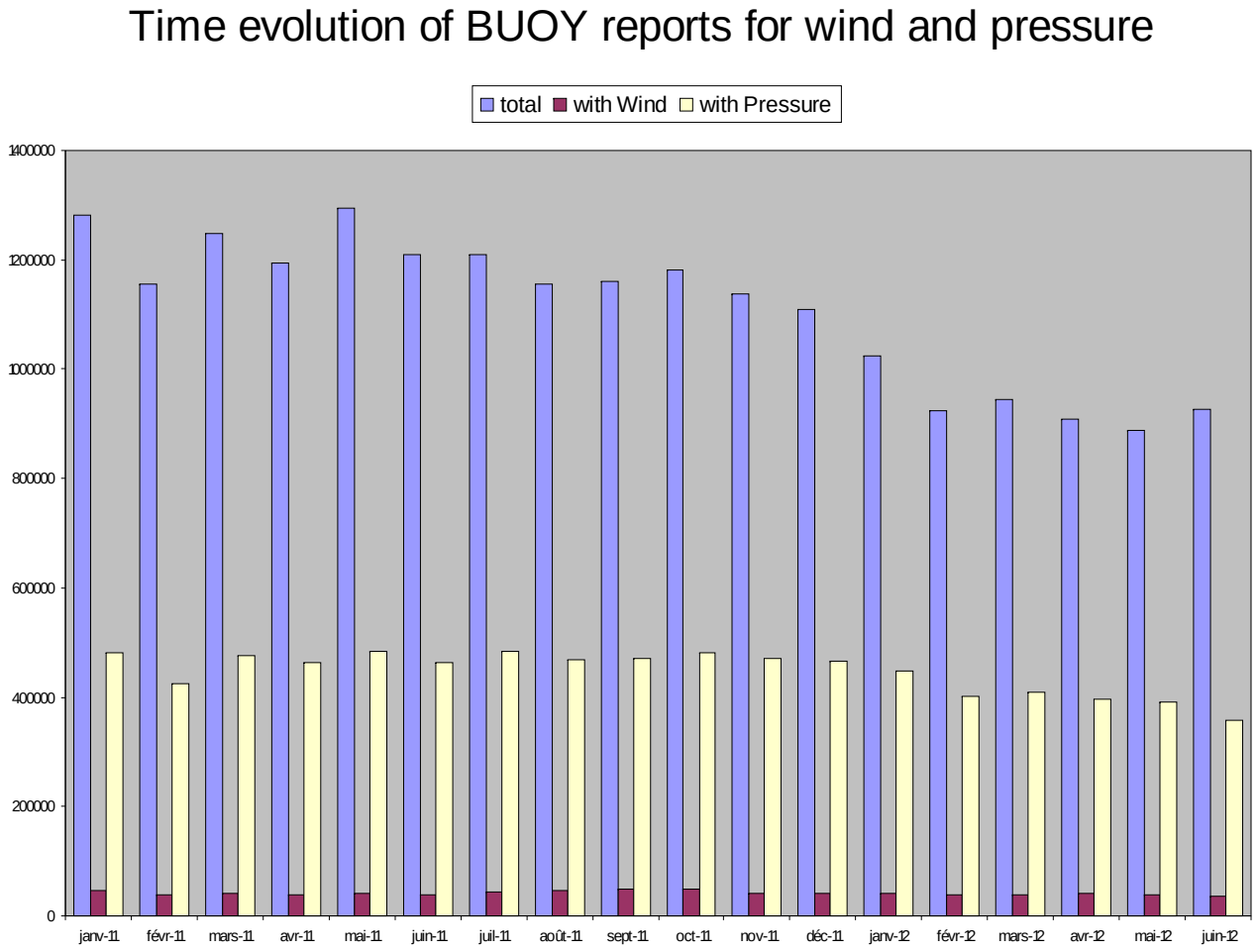

Figure 1: Time evolution of reports for wind and for pressure respectively for all BUOY reports since January 2011

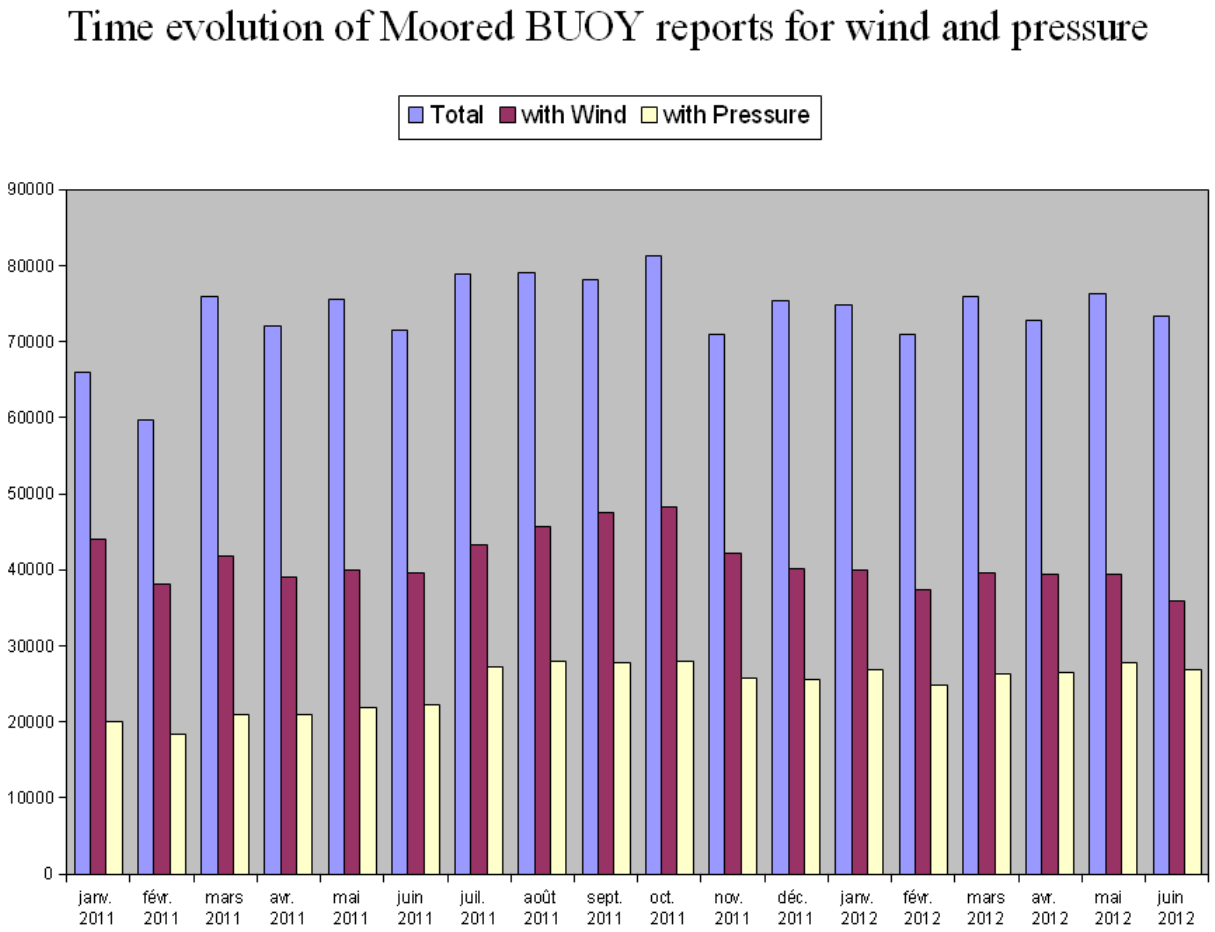

Figure 2: Time evolution of reports for wind and for pressure respectively for moored BUOY reports since January 2011

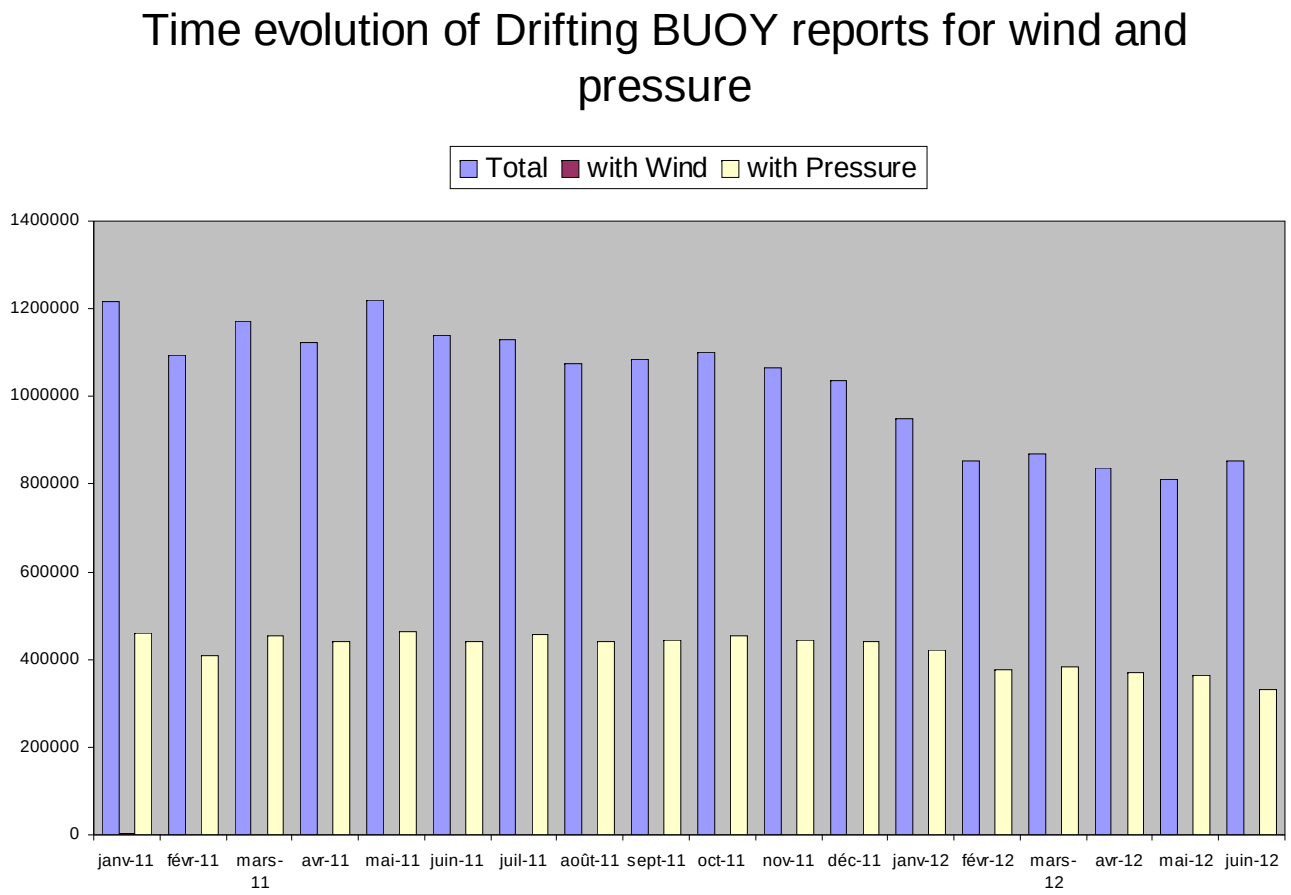

Figure 3: Time evolution of reports for wind and for pressure respectively for drifting BUOY reports since January 2011

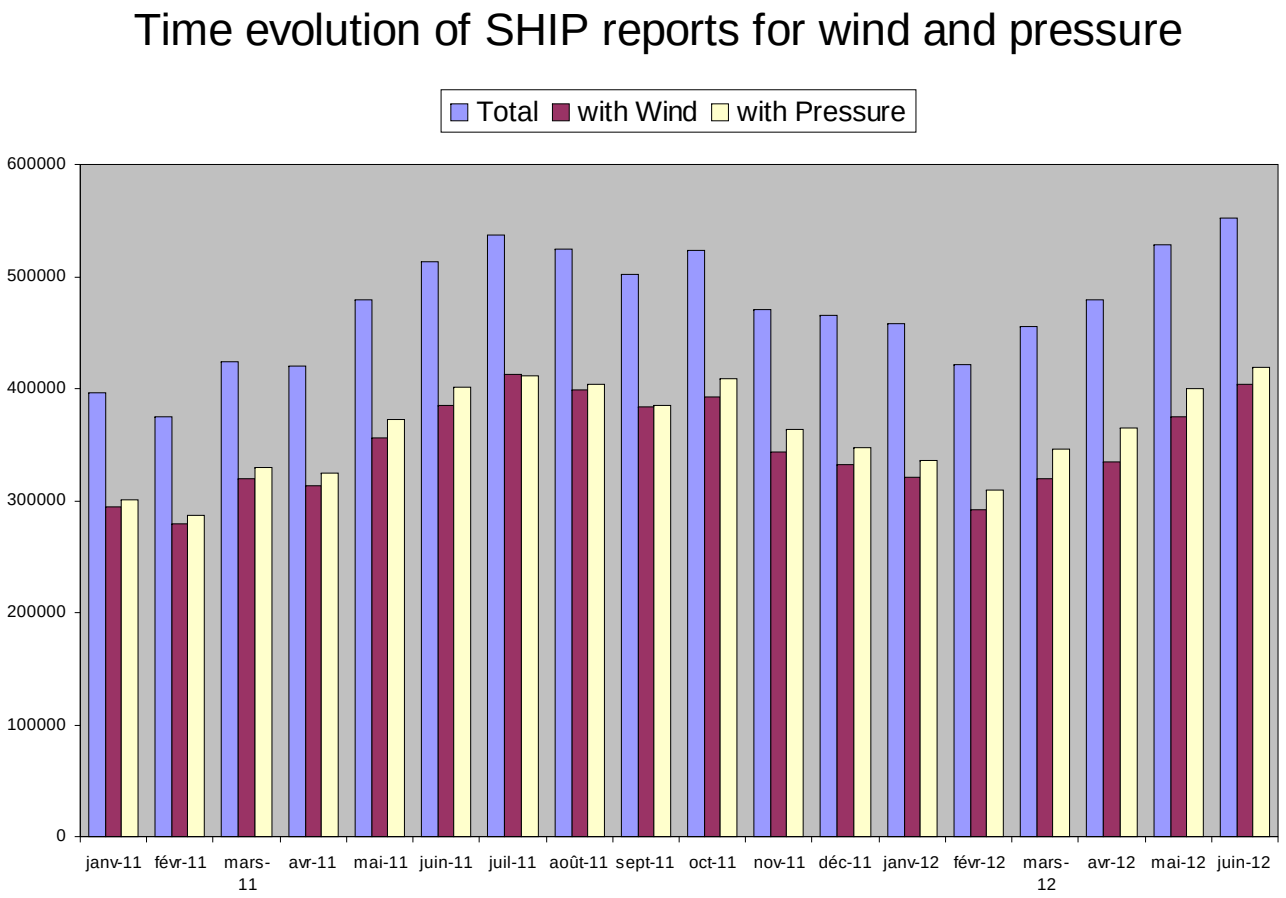

Figure 4: Time evolution of reports for wind and for pressure respectively for all SHIP reports, since January 2011

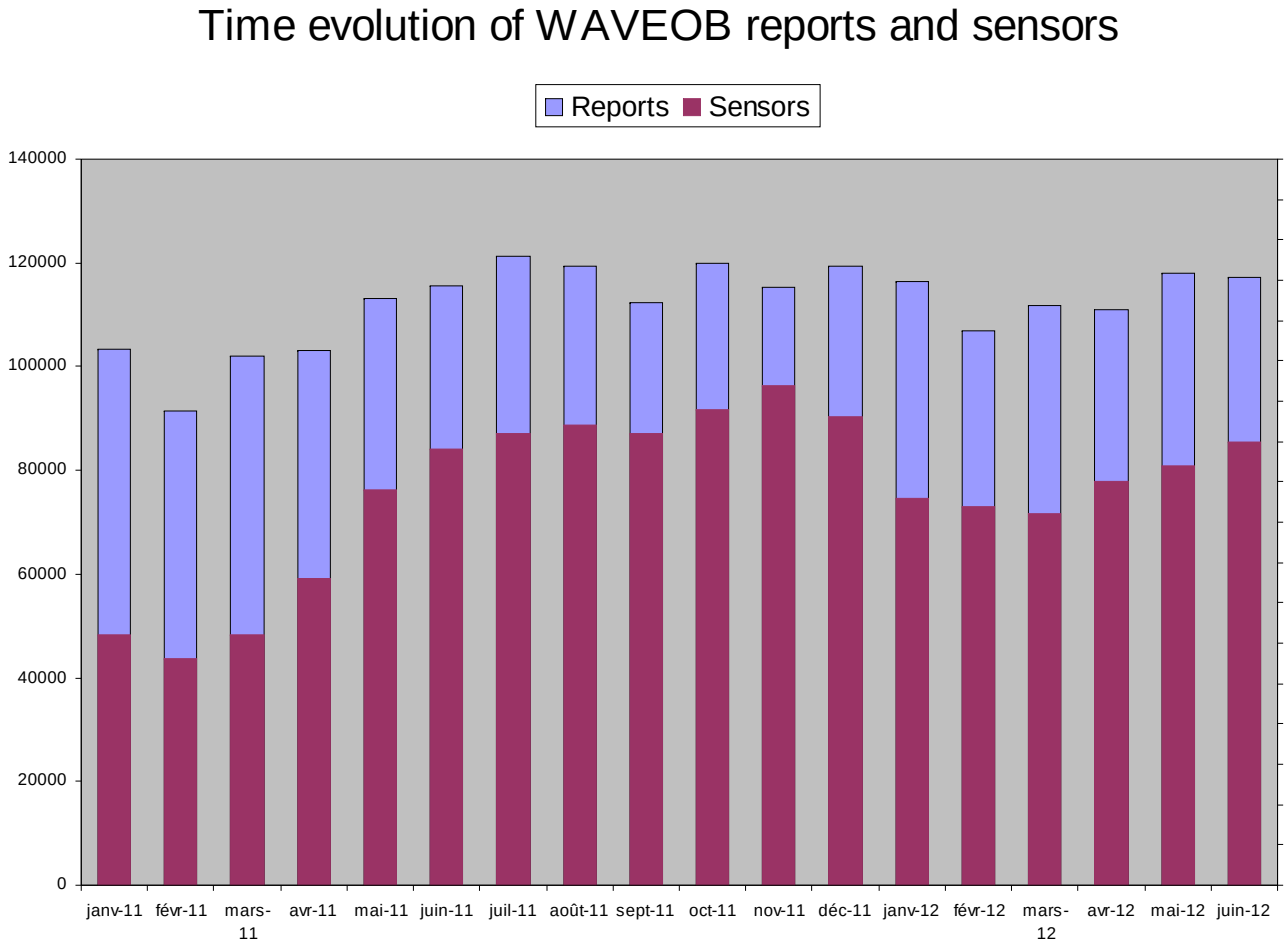

Figure 5: Time evolution of WAVEOB reports and sensors since January 2011

Carte de pointage des observations recues en juin 2012

Mapping position plot chart of data received during June 2012

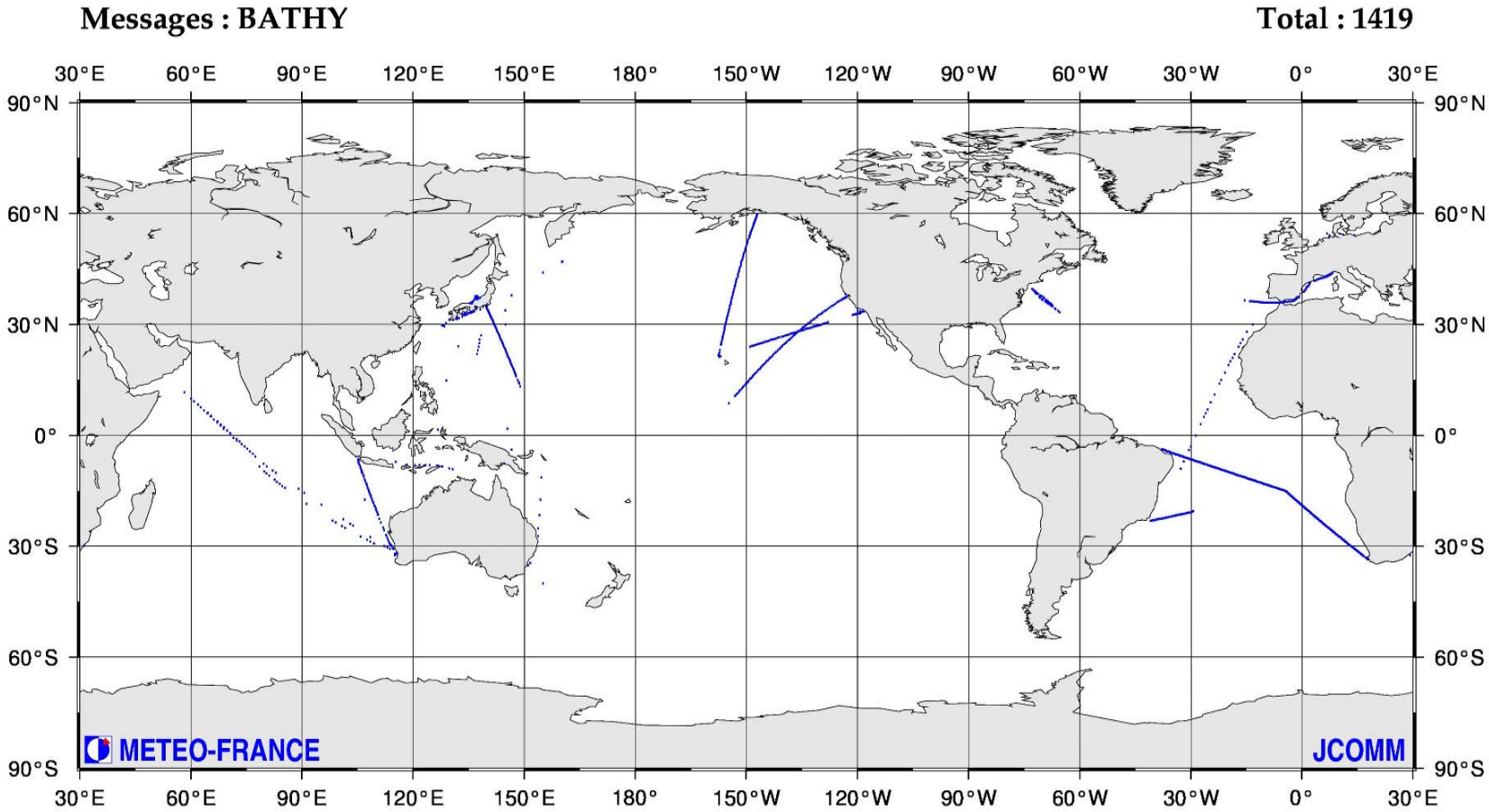

Figure 6a: Mapping position plot chart of BATHY reports, June 2012

Repartition par carre Marsden des observations recues en juin 2012

Marsden square distribution chart of data received during June 2012

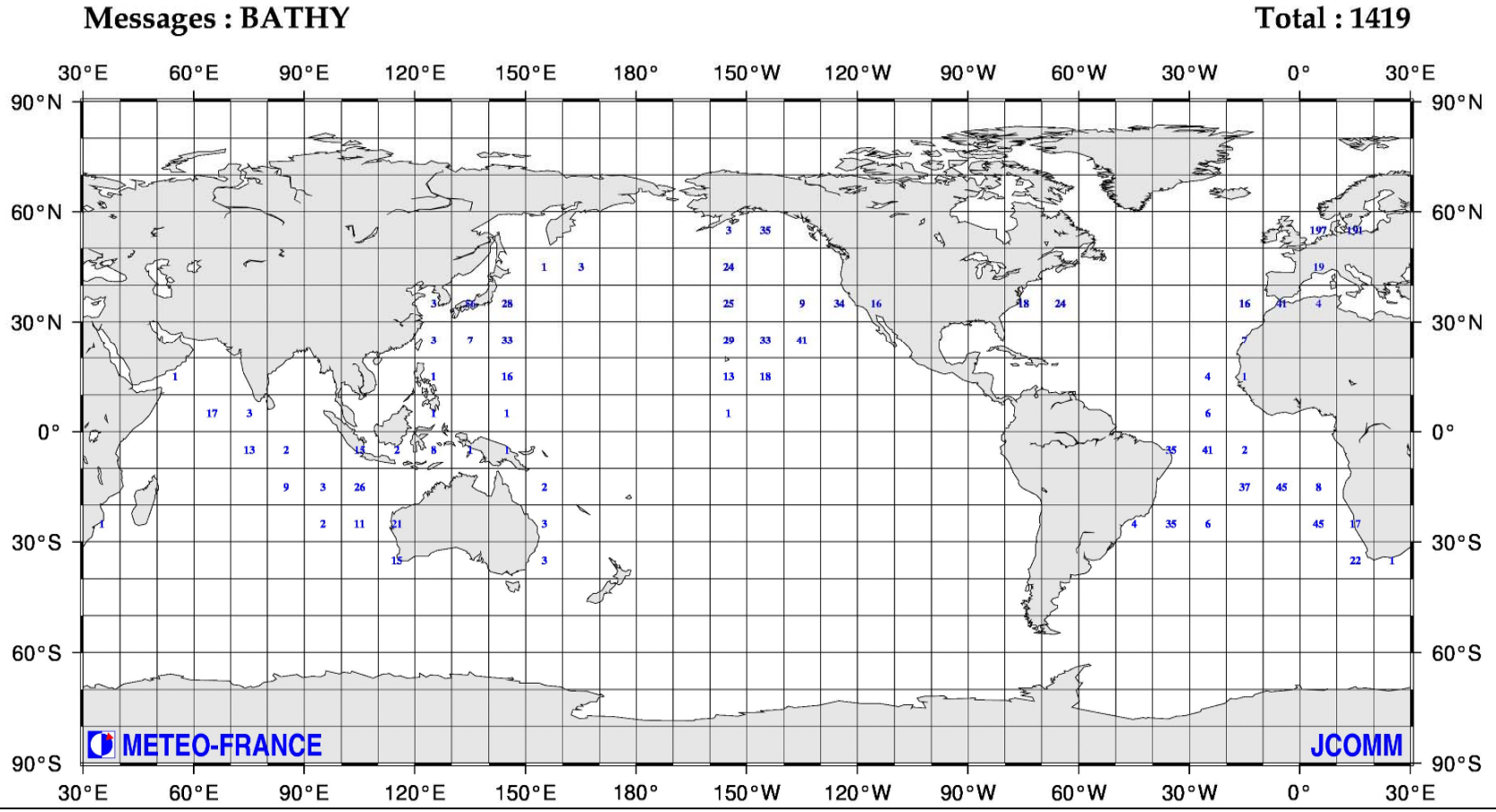

Figure 6b: Marsden square distribution of BATHY reports, June 2012

Carte de pointage des observations recues en juin 2012

Mapping position plot chart of data received during June 2012

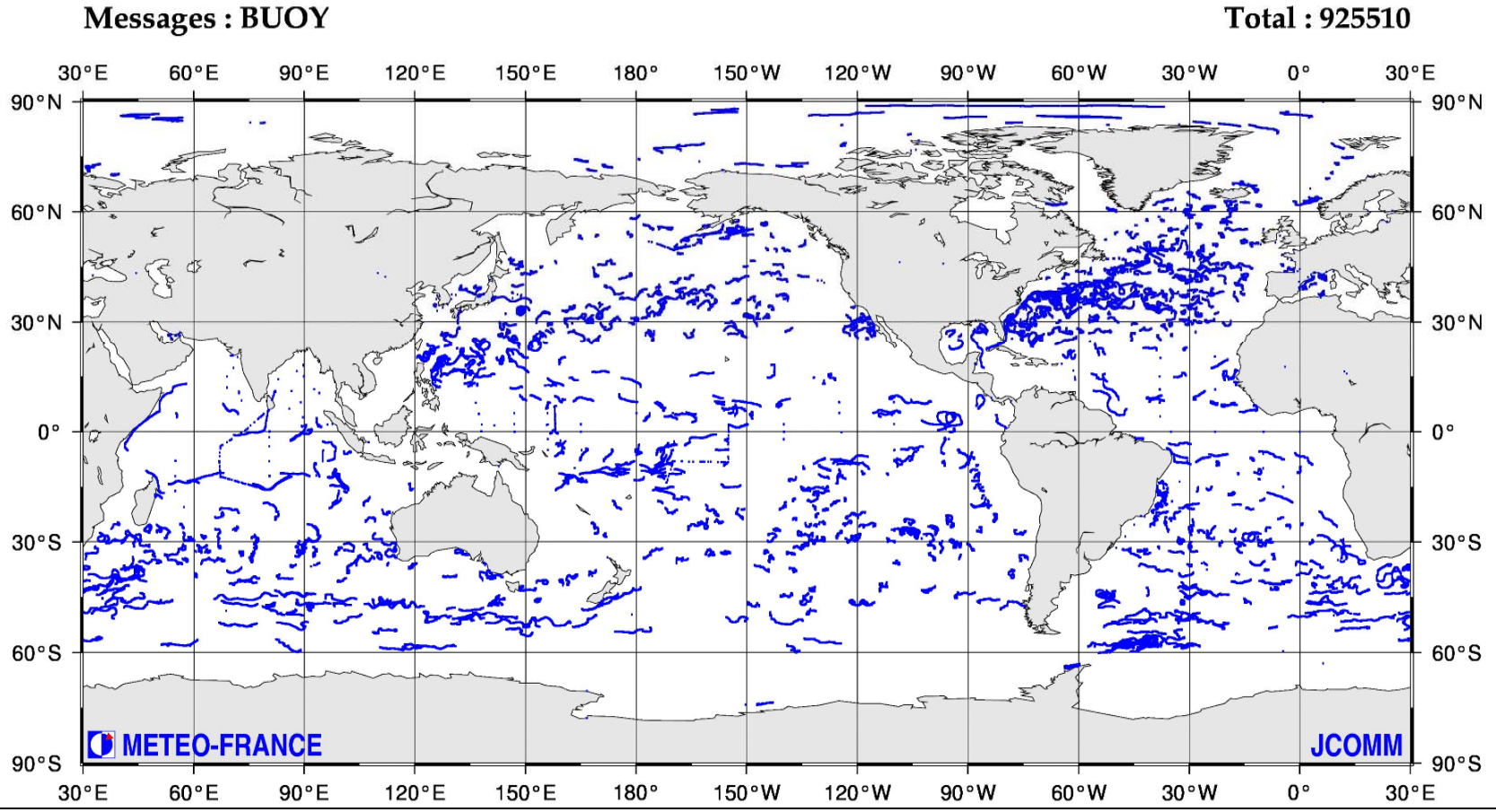

Figure 7a: Mapping position plot chart of BUOY reports, June 2012

Repartition par carre Marsden des observations recues en juin 2012

Marsden square distribution chart of data received during June 2012

Messages : BUOY **Total : 925510**

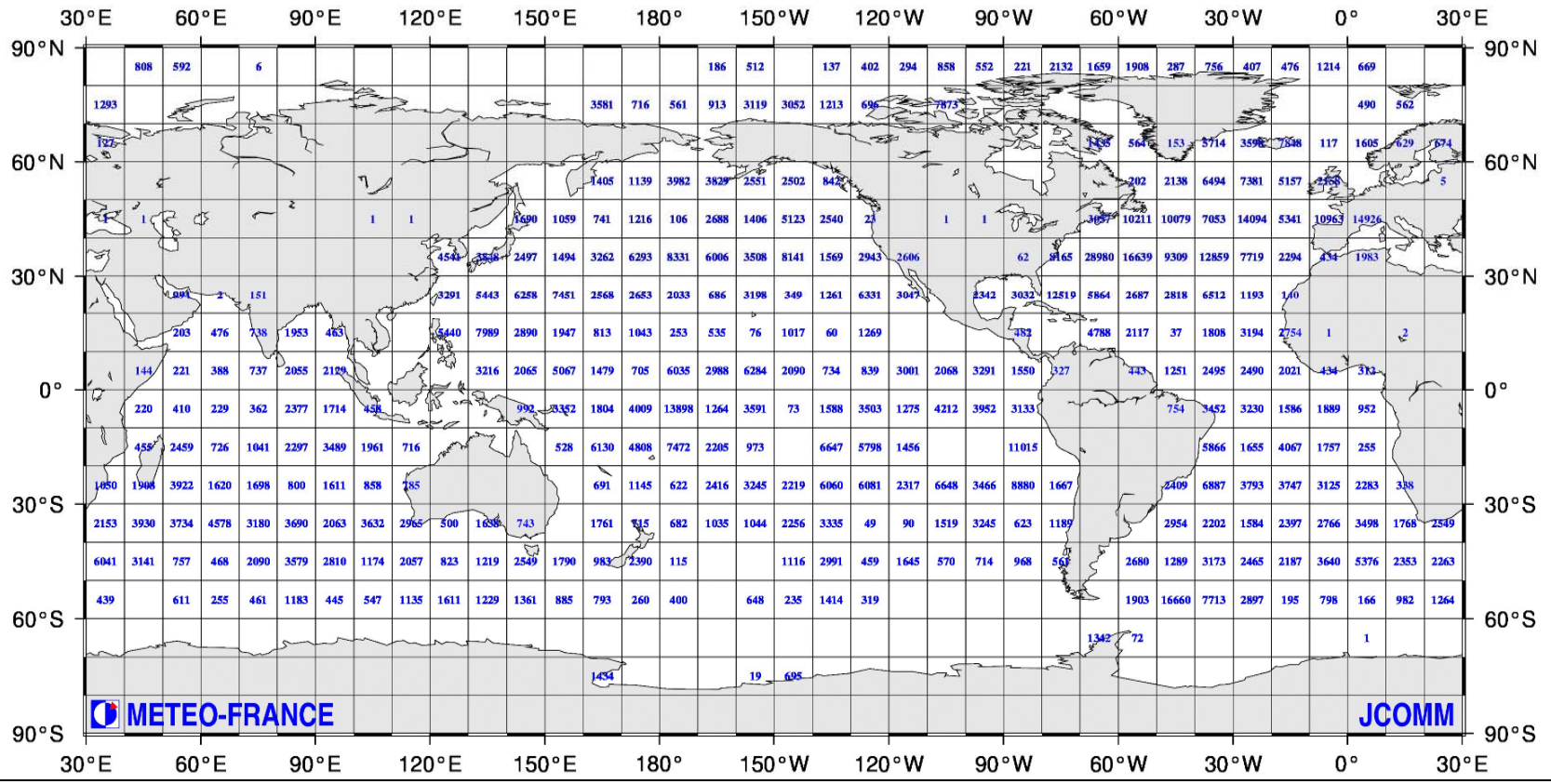

Figure 7b: Marsden square distribution of BUOY reports, June 2012

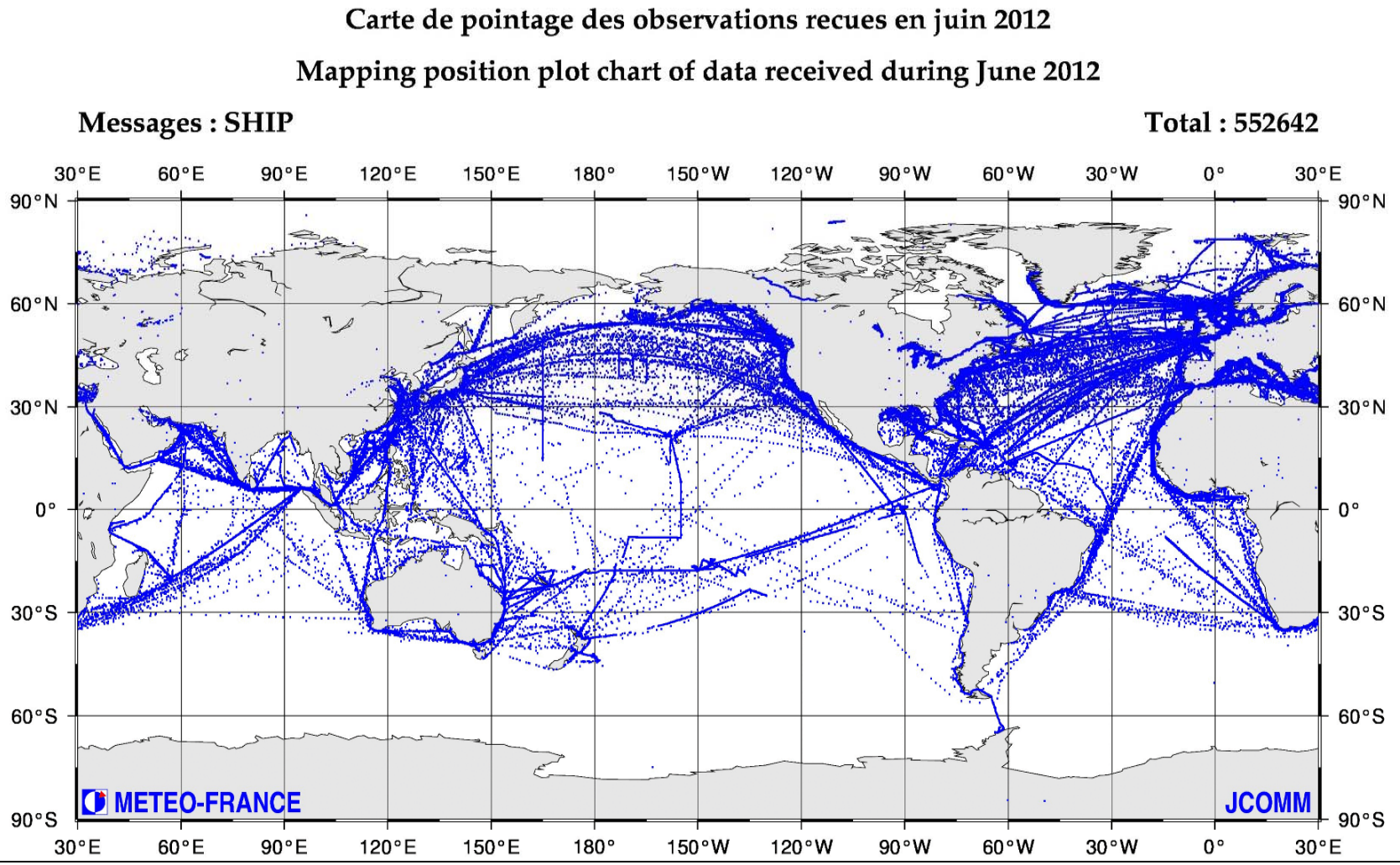

Figure 8a: Mapping position plot chart of SHIP reports, June 2012

Repartition par carre Marsden des observations recues en juin 2012

Marsden square distribution chart of data received during June 2012

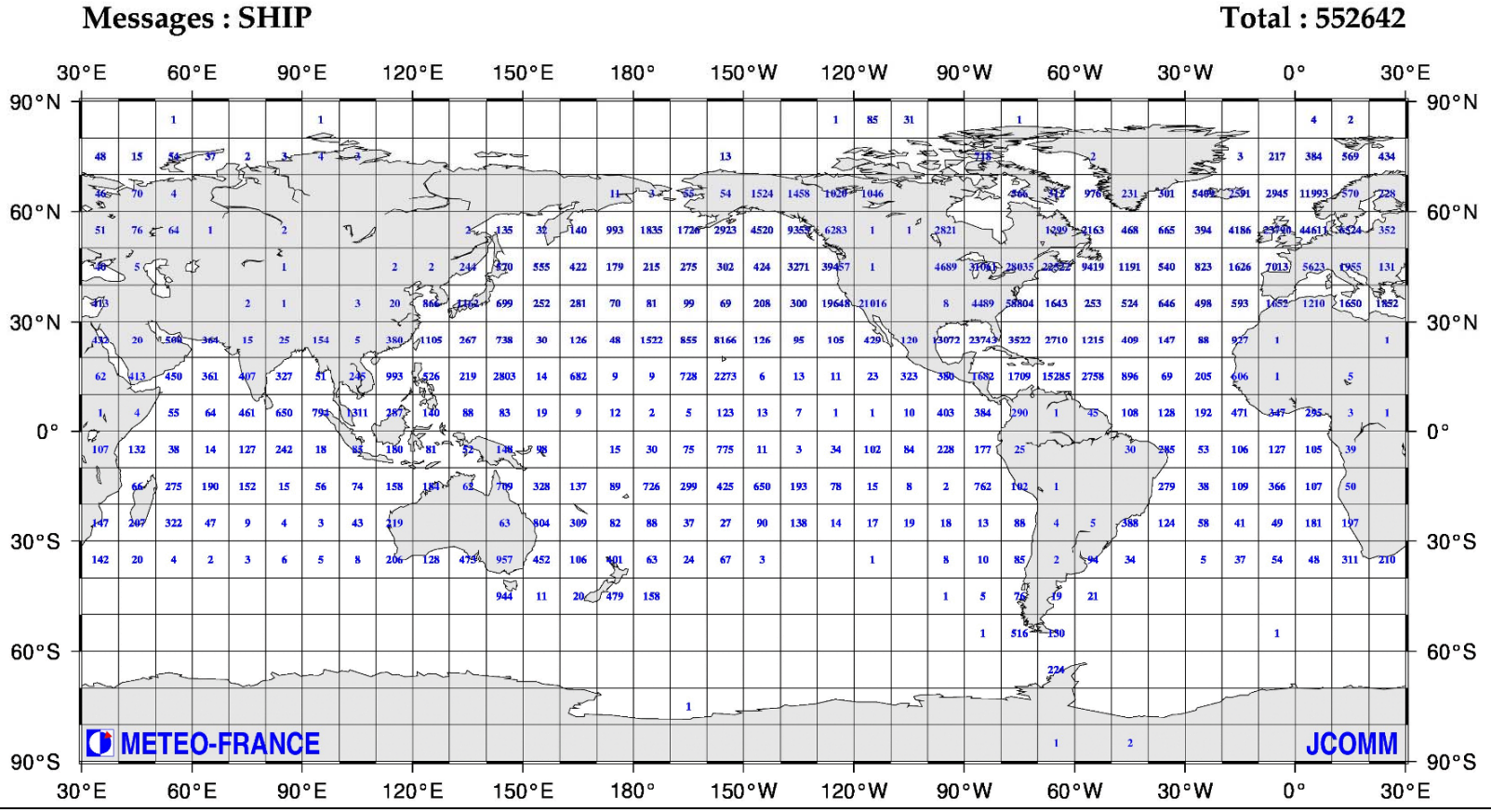

Figure 8b: Marsden square distribution of SHIP reports, June 2012

Carte de pointage des observations recues en juin 2012

Mapping position plot chart of data received during June 2012

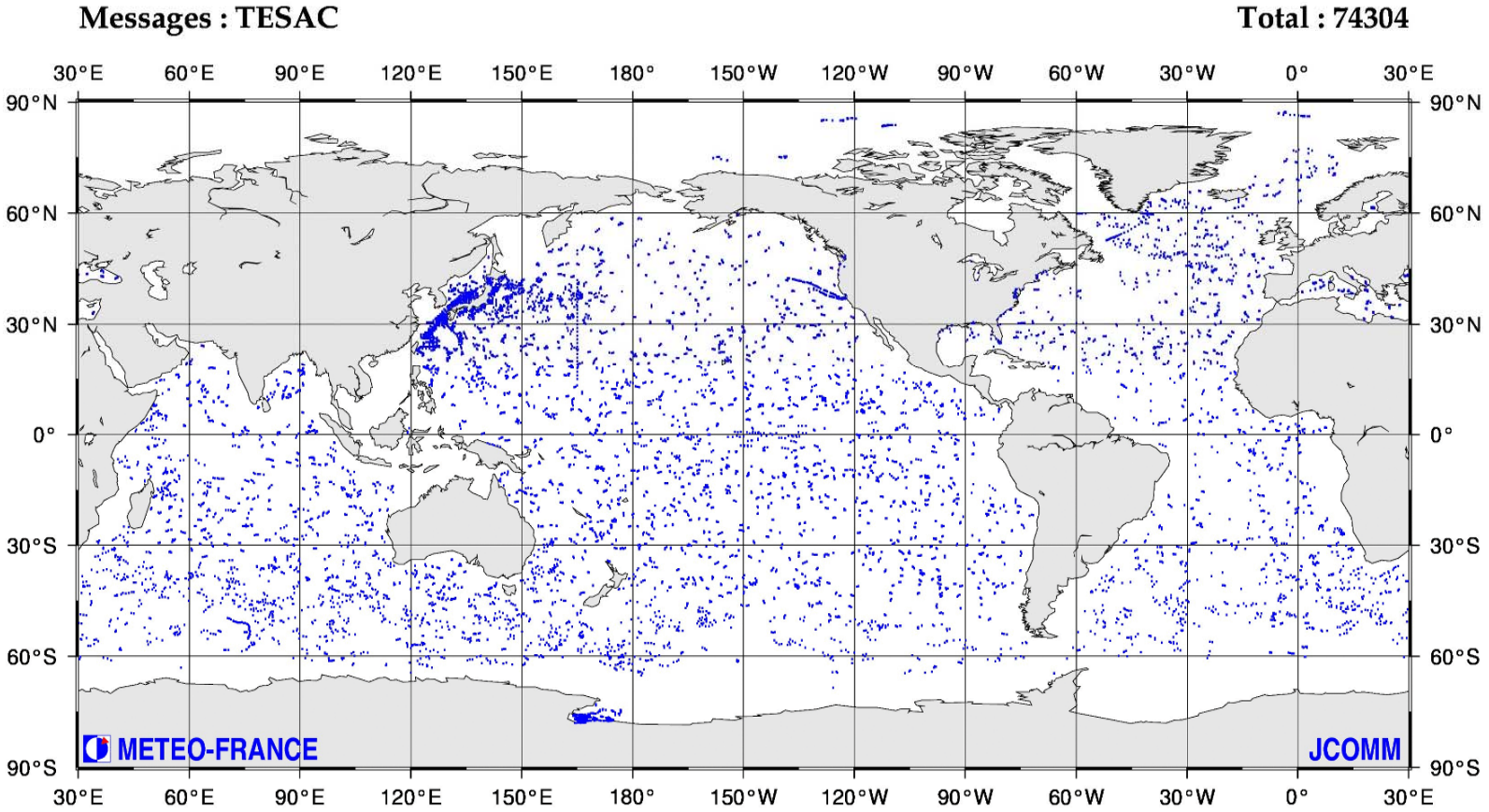

Figure 9a: Mapping position plot chart of TESAC reports, June 2012

Carte de pointage des observations recues en juin 2012

Mapping position plot chart of data received during June 2012

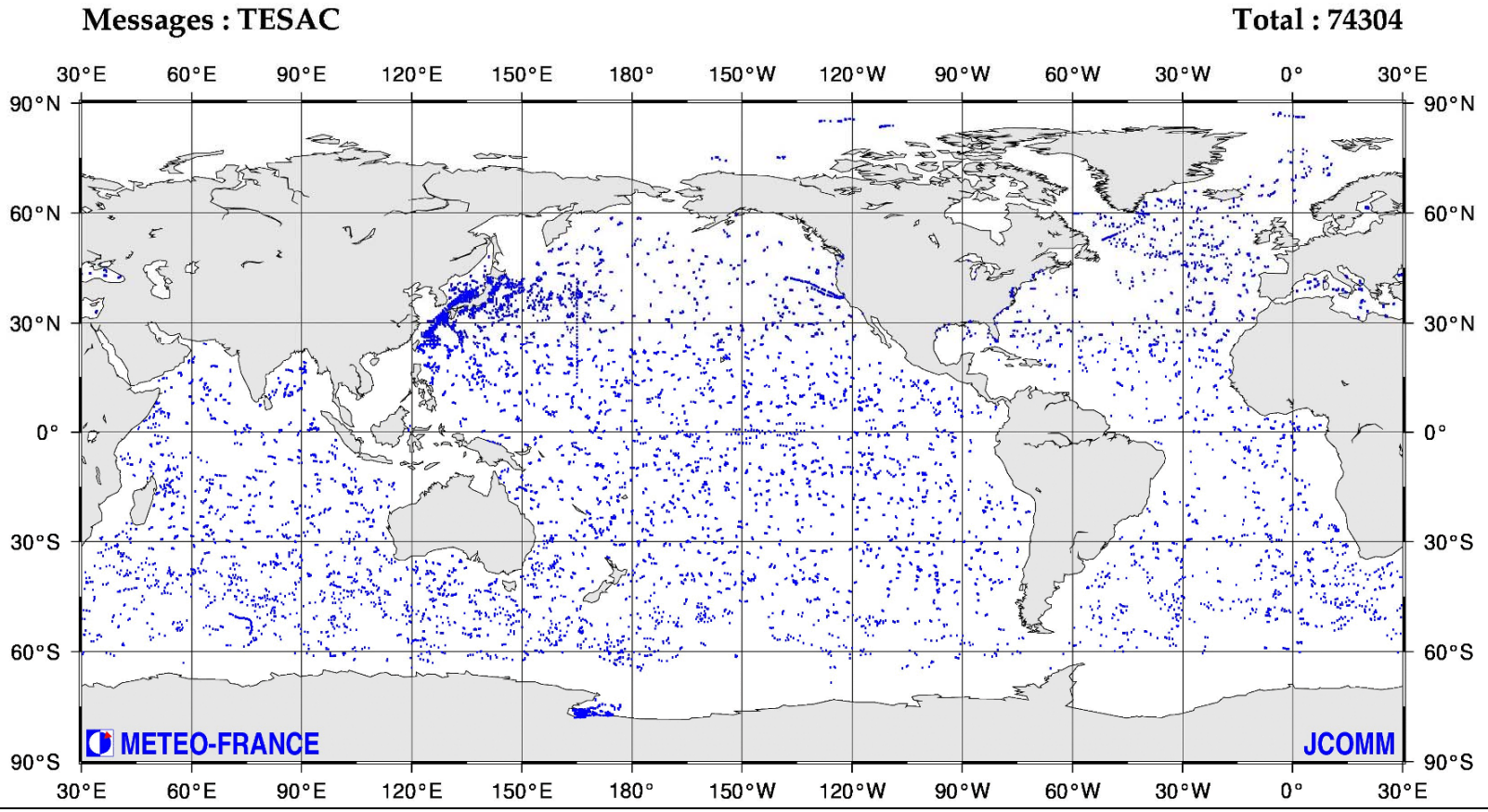

Figure 9b: Marsden square distribution of TESAC reports, June 2012

Carte de pointage des observations recues en juin 2012

Mapping position plot chart of data received during June 2012

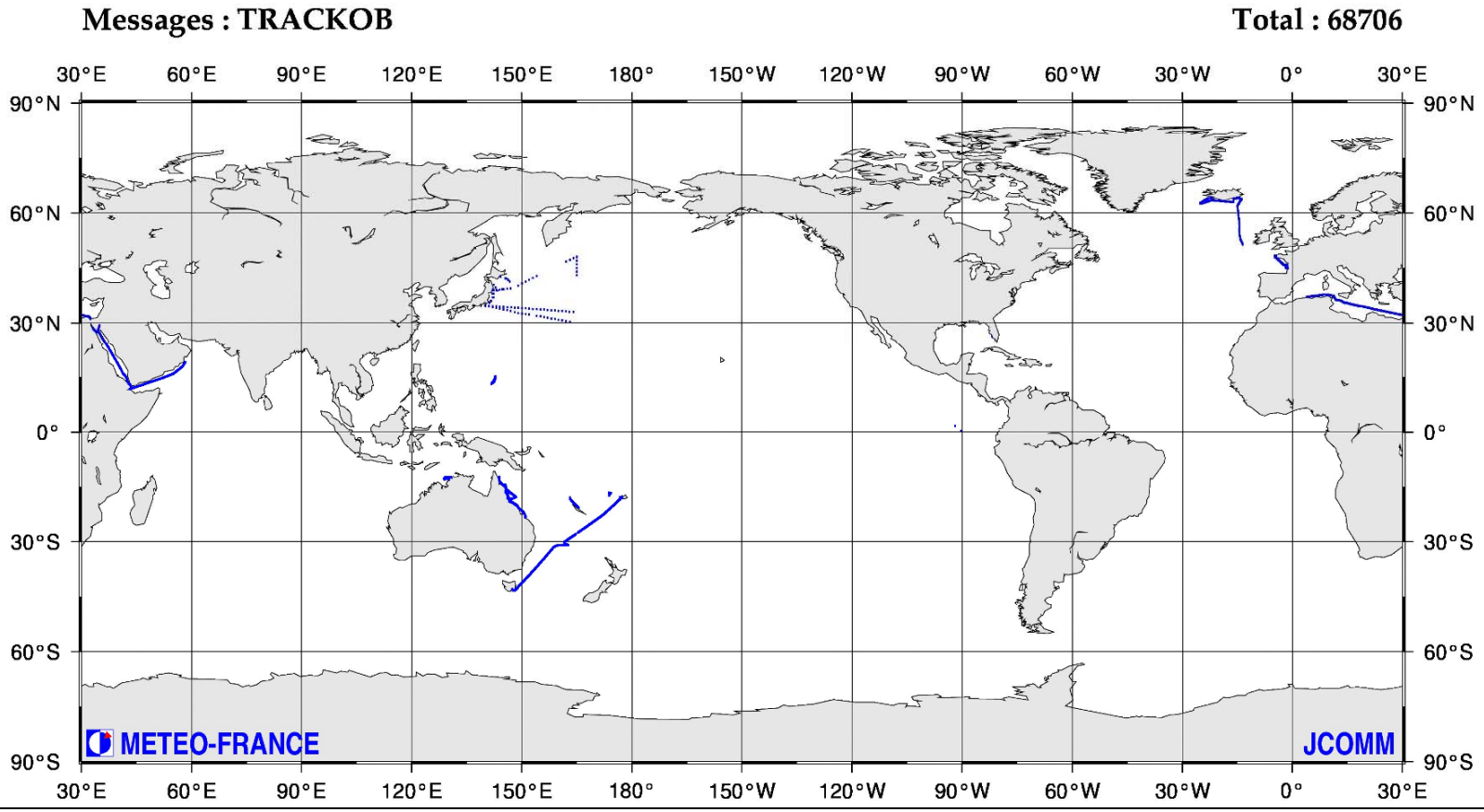

Figure 10a: Mapping position plot chart of TRACKOB reports, June 2012

Repartition par carre Marsden des observations recues en juin 2012

Marsden square distribution chart of data received during June 2012

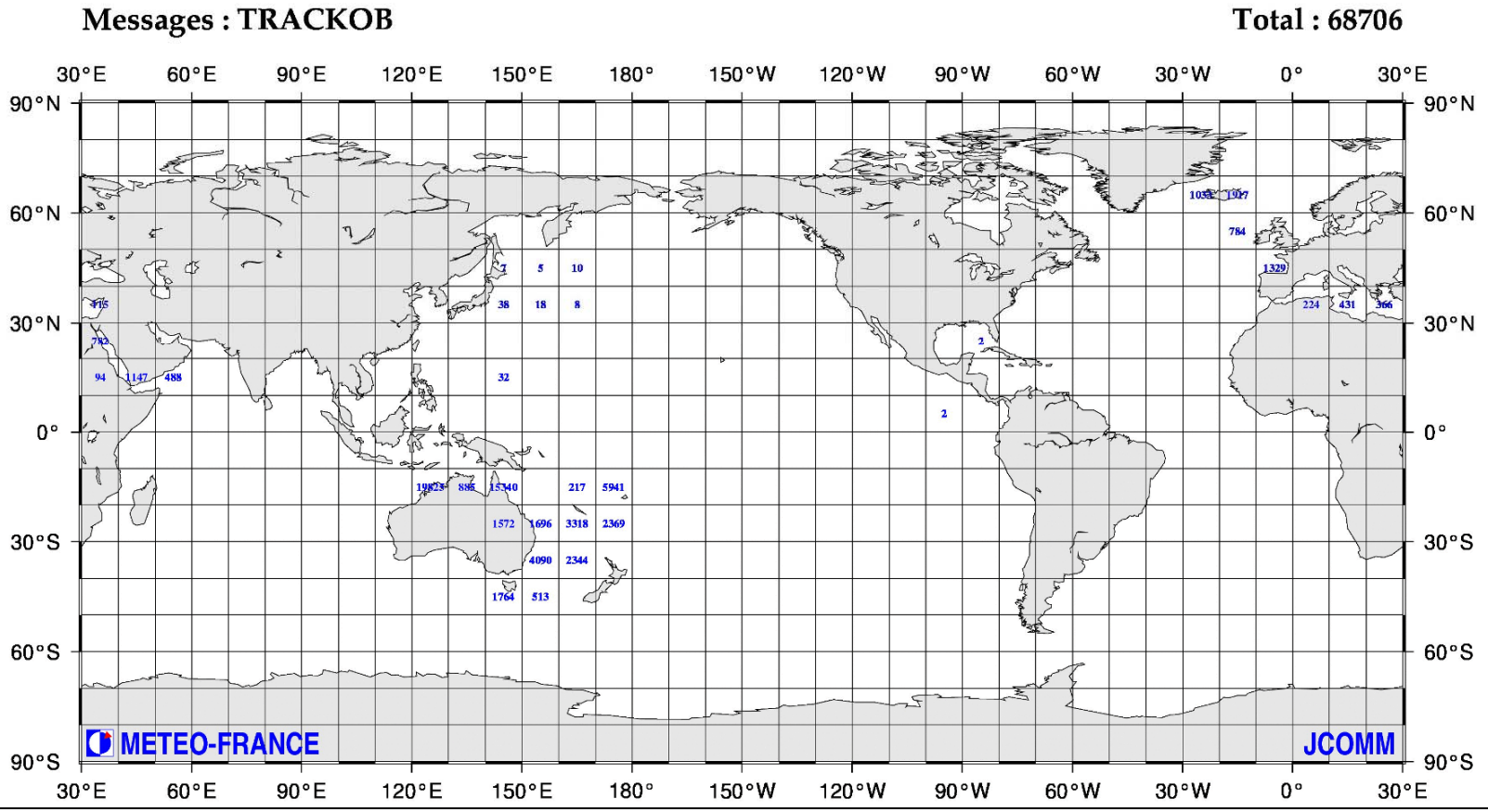

Figure 10b: Marsden square distribution of TRACKOB reports, June 2012

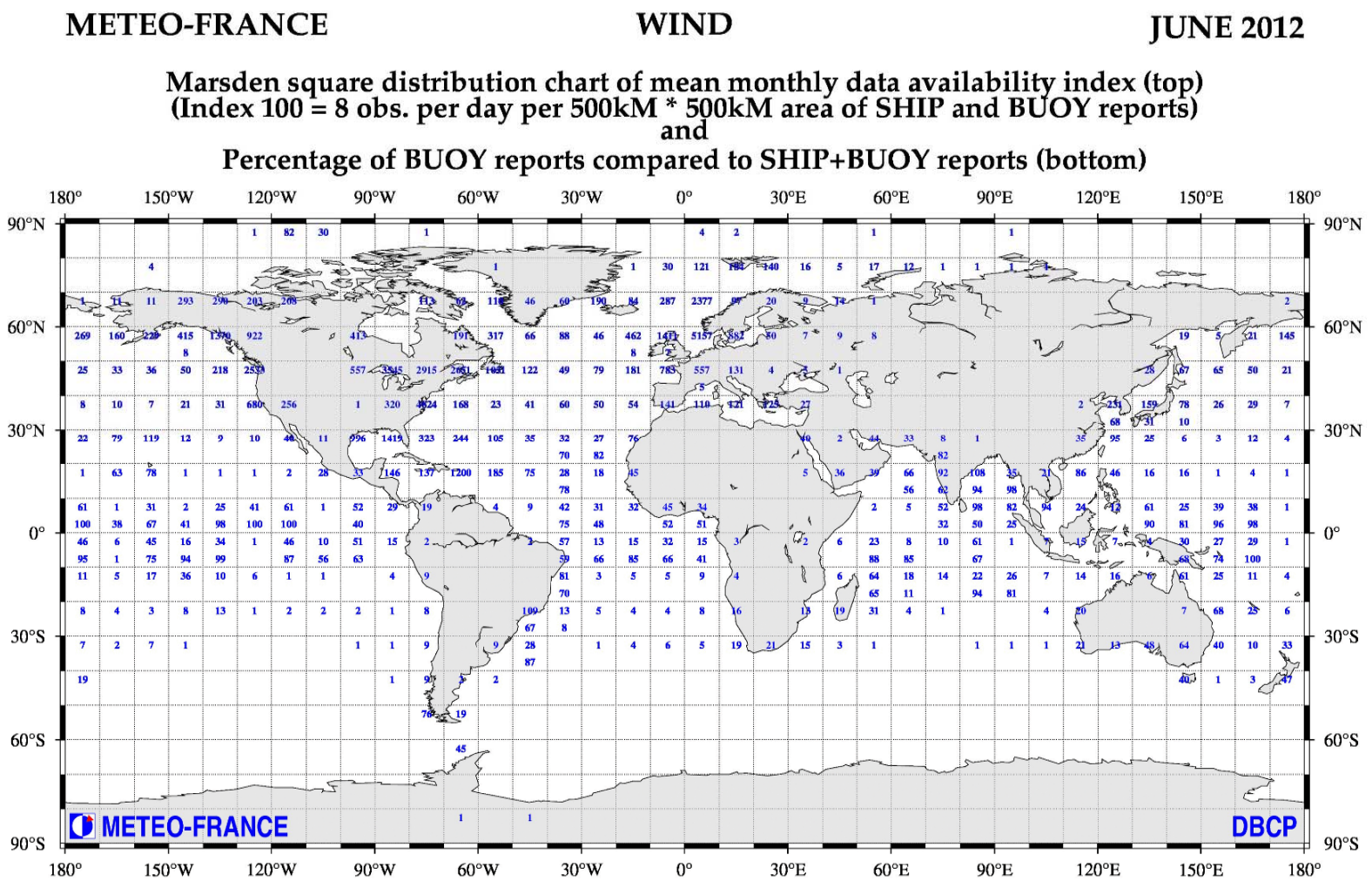

Figure 11: Marsden square distribution charts of mean monthly data availability (top) and percentage of BUOY reports compared to SHIP + BUOY reports (bottom) for surface wind, June 2012

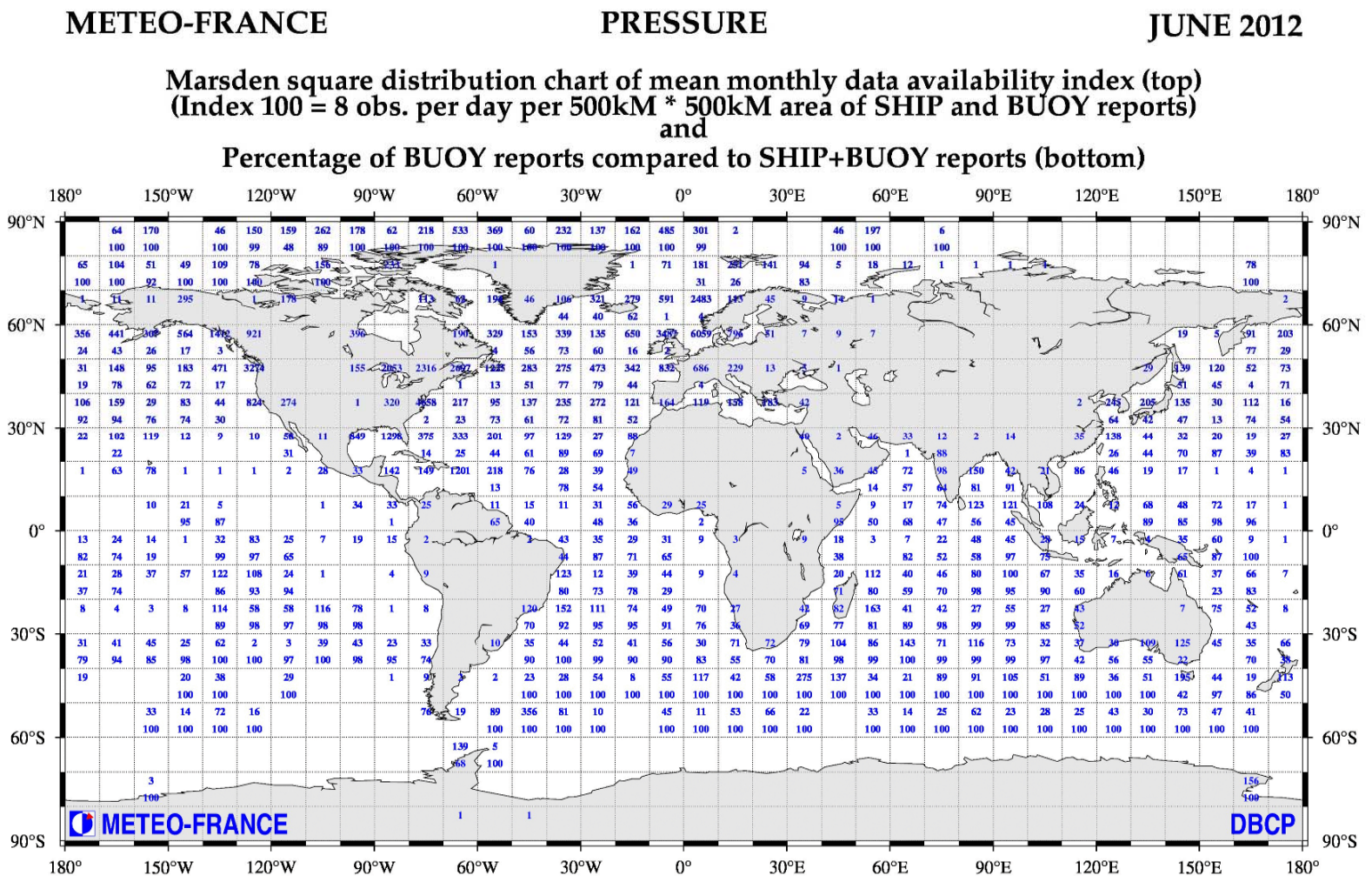

Figure 12: Marsden square distribution charts of mean monthly data availability (top) and percentage of BUOY reports compared to SHIP + BUOY reports (bottom) for sea level pressure, June 2012

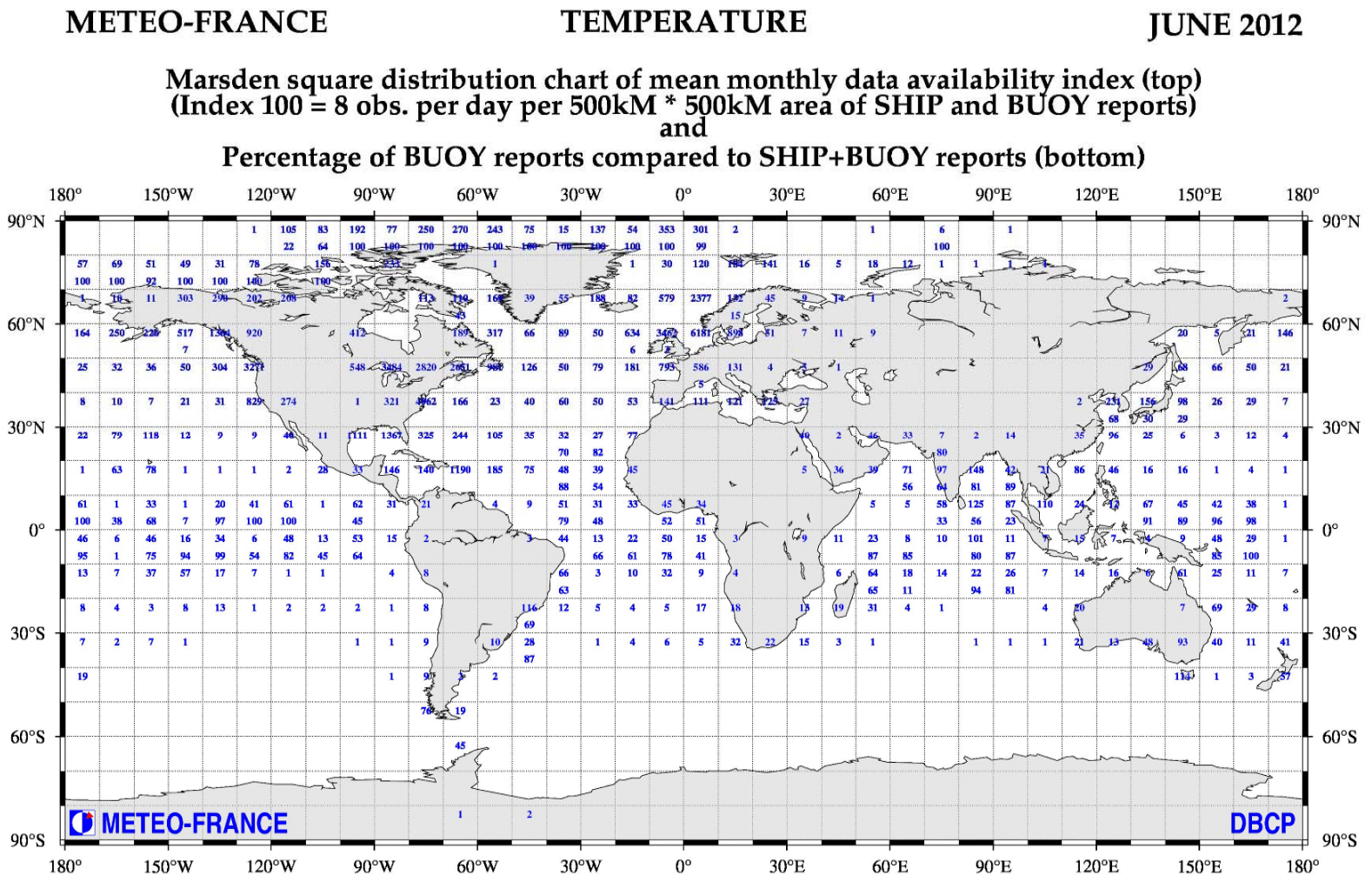

Figure 13: Marsden square distribution charts of mean monthly data availability (top) and percentage of BUOY reports compared to SHIP + BUOY reports (bottom) for surface air temperature, June 2012

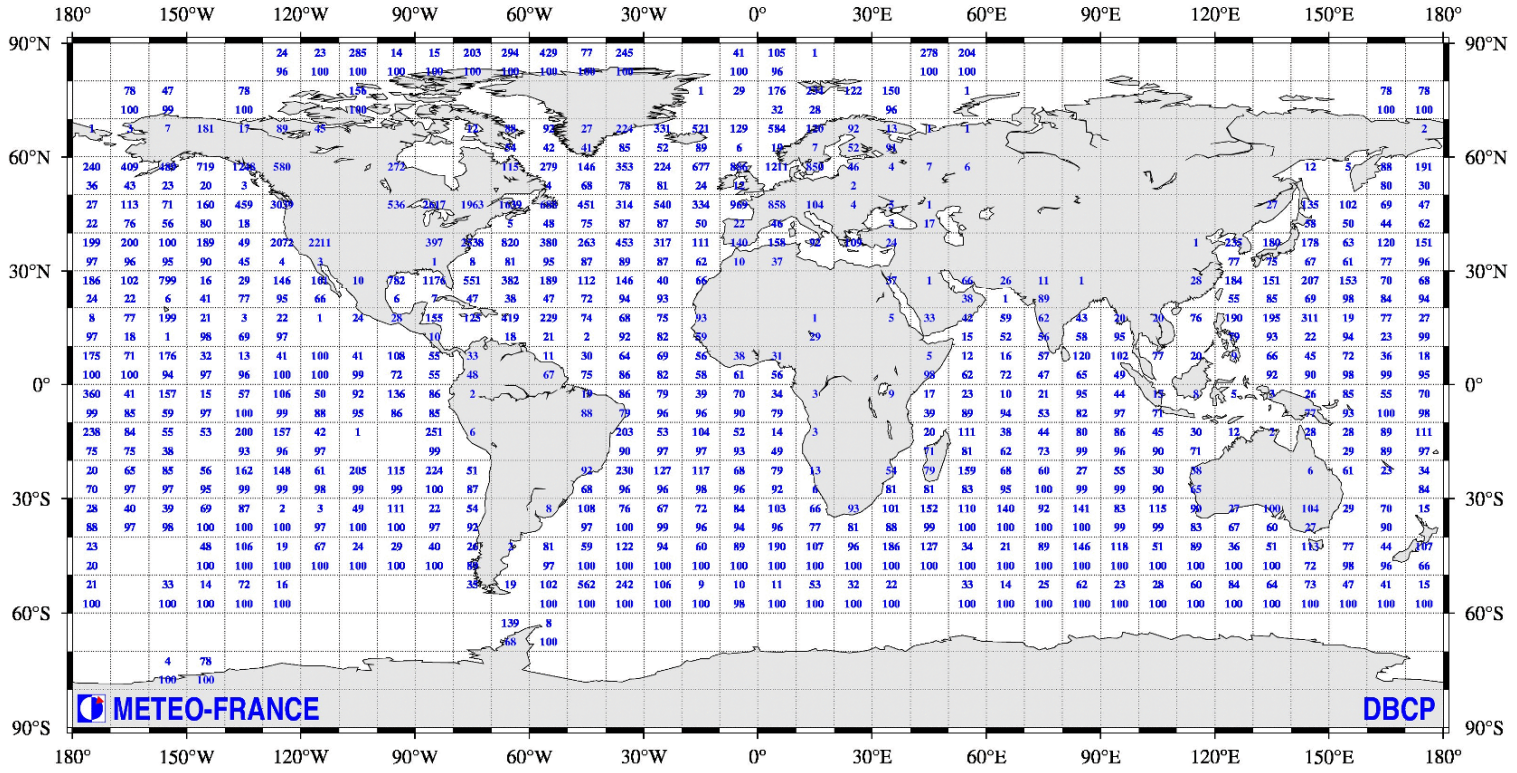

Figure 14: Marsden square distribution charts of mean monthly data availability (top) and percentage of BUOY reports compared to SHIP + BUOY reports (bottom) for sea surface temperature, June 2012

APPENDIX C

RECOMMENDATION 2 (JCOMM-4)

MARINE CLIMATE DATA SYSTEM (MCDS)

THE JOINT WMO-IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The JCOMM Terms of Reference, especially in relation to the development of standards and procedures regarding overall collection, management, exchanges and archival of high-quality marine-meteorological and oceanographic data, information and products, on which climate studies, predictions and services, as well as climate change impact and adaptation strategies, are based;

(2) Resolution 4.4/1 (Cg-XVI) – Marine Meteorology and Oceanography Programme;

(3) Resolution 11.3(1) (Cg-XVI) – Implementation of the WMO Integrated Global Observing System (WIGOS);

(4) The Final report of the workshop for a new Marine Climate Data System (MCDS) meeting, including the draft MCDS strategy in JCOMM MR#90;

(5) The summary report of the Twenty-First Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XXI);

Noting further:

(1) Chapter 5, Marine Climatological Summaries Scheme, Part I, Services for the high seas, of the WMO No. 558, Manual to Marine-Meteorological Services;

(2) Chapter 3, Marine Climatology, of the WMO No. 471, Guide to Marine-Meteorological Services;

(3) The Project Report, and Legacy Recommendations of the Pilot Project for the Integration of Marine-Meteorological and other Appropriate Oceanographic Observations into the WMO Integrated Global Observing System (WIGOS) (JCOMM/TR-No. 48);

(4) The proposal from China and Germany offering facilities for acting as WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOC), their statements of compliance and commitment, and readiness to operate as such as soon as possible;

Having considered:

(1) the need of Members/Member States for high quality marine meteorological and oceanographic historical data / metadata from the world oceans, to address the requirements of WMO and UNESCO/IOC programmes and co-sponsored programmes including climate monitoring, and the Global Framework for Climate Services (GFCS);

(2) The need to modernize the Marine Climatological Summaries Scheme (MCSS) to take into account the development of new observing systems and corresponding surface marine-meteorological data systems in recent years, new techniques for data management and quality control, and the current needs of end users for better statistical and graphical marine climatological products;

(3) The need to standardize and perform collection, quality control, state of the art bias corrections, the recording of historical surface marine-meteorological data and metadata, and agree on data exchange formats and protocols, in order to achieve delivery and use of coherent data sets;

(4) The similar need for the standardization of processing techniques including Quality Control, documentation, formats, exchange protocols in order to improve the use of subsurface ocean data in conjunction with marine-meteorological data;

(5) The need for modernization of management of surface drifter data, to rationalize the roles and functioning of the former IODE Responsible National Oceanography Centre for Drifting Buoys (RNODC/DB), the JCOMM Specialized Oceanography Centre for Drifting Buoys (SOC,/DB) the Global Drifter Programme (GDP) Data Assembly Centre (DAC), and the JCOMM Ocean Data Acquisition System (ODAS) Metadata Service (ODASMS) management of metadata for the surface drifters;

(6) The need for Members/Member States to exchange and share such data and metadata;

Recognizing:

(1) The cooperation that has been achieved between National Oceanographic Data Centres (NODCs) operating within IOC/IODE and data management activities of JCOMM;

(2) That an integrated Marine Climate Data System (MCDS), including routine and standardized collection of appropriate delayed-mode and historical marine-meteorological and oceanographic data and metadata, managed by a network of data centres facilitates fulfilling these requirements;

(3) The effectiveness of the JCOMM Marine Climatological Summaries Scheme (MCSS) for the collection and quality control of delayed-mode Voluntary Observing Ship (VOS) data through a network of (i) Contributing Members, (ii) Responsible Members, and (iii) two Global Collecting Centres (GCCs) operated by the UK and Germany for the Marine Climate Summaries Scheme (MCSS);

(4) The usefulness of the former IODE RNODC/DB operated by the Integrated Science Data Management (ISDM) of Canada, the GDP DAC operated by the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the National Oceanic and Atmospheric Administration (NOAA) of USA, the ODASMS operated by the NMDIS of the SOA of China, and the JCOMM SOC/DB operated by Météo-France, to collect, manage and make available historical drifting buoy data and metadata to end users;

(5) That the ISDM and the SOC/DB were requested by JCOMM-III to agree on complimentary functions to manage data from drifting buoys and that this activity should be done in cooperation with the GDP/DAC;

(6) That IODE-XXI had requested the JCOMM *ad hoc* Task team on RNODCs and SOCs to draft a Recommendation for JCOMM-IV, including Terms of Reference of centres that integrate RNODCs and SOCs and contribute to the IODE Ocean Data Portal (ODP), as well as background information;

(7) The existence of Data Acquisition/Assembly Centres (DACs) and Global Data Acquisition/Assembly Centres (GDACs) (which include some IODE NODCs operating in this context) specialized for specific ocean observing platform types;

(8) That the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) operated by the US NOAA and the US National Center for Atmospheric Research (NCAR) is widely used and trusted in the marine climate community;

(9) The expertise of Members/Member States with regard to marine meteorology and oceanography data management, as well as the dedicated facilities they operate;

(10) That Members/Member States could provide specialized facilities with substantial benefits to end users when integrated into the MCDS;

Recommends:

(1) Implementation of a modernized scheme for the management of surface marine climatological data in conjunction with ICOADS inside the MCDS;

(2) Implementation of a modernized scheme for the management of surface drifter data within the MCDS, replacing the former RNODC/DB and the SOC/DB;

(3) Establishment of a network of Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs) building on existing facilities as appropriate with the Terms of Reference in Annex 2, and adopt a mechanism for formal designation and withdrawal of CMOCs by WMO and IOC as detailed in Annex 3;

(4) That the ODASMS, and the SOC/DB be declared obsolete;

(5) That the National Marine Data and Information Service (NMDIS) of the China State Oceanic Administration (SOA) and the Deutscher Wetterdienst (DWD) undertake the functions of an CMOC on a trial basis and report on the results to JCOMM through the Management Committee;

Invites Members / Member States:

(1) To take advantage of the resources offered by the CMOCs once established;

(2) To contribute national resources towards the activities identified in the recommendations;

(3) To consider submitting applications for becoming a CMOC;

Requests:

(1) the Expert Team on Marine Climatology (ETMC), in close cooperation with IODE and other appropriate partners such as the ICSU World Data System, to develop, review and update t he MCDS strategy, implementation plan, designation criteria and performance indicators of CMOCs in the next two years for achieving the Vision for a new MCDS, based upon the res ults of the Workshop for a new Marine Climate Data System (MCDS1, 28 Nov.-2 Dec. 2011, Hamburg, Germany) and Ocean Data Portal technologies development;

(2) the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to facilitate implementation of this recommendation and provide appropriate technical advisory assistance to Members/Member States concerned as required, in the operations of CMOC.

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Annexes: 3

Annex 1 to draft Recommendation 7.2/1 (JCOMM-4)

VISION FOR A MARINE CLIMATE DATA SYSTEM IN 2020

JCOMM will strive to address the WMO and IOC applications requirements for appropriate marine-meteorological and oceanographic climatological data (met-ocean climate data), and particularly address those for long term climate monitoring (Global Climate Observing System – GCOS), seasonal to inter-annual climate forecasts, for the Global Framework for Climate Services (GFCS), and ocean climate requirements of the Global Ocean Observing System (GOOS).

To address those requirements, the Vision for a Marine Climate Data System (MCDS) is to formalize and coordinate the activities of existing systems, and address gaps to produce a dedicated WMO-IOC data system operational by 2020 in the view to have compiled coherent met-ocean climate datasets of known quality, extending beyond the GCOS Essential Climate Variables (ECVs). These will be of known quality collected from multiple sources to be served on a free and unrestricted basis to the end users through a global network of less than ten WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs) covering specific JCOMM data domains. Data, metadata and information will be fully interoperable with the WMO Information System (WIS) and the IOC/IODE Ocean Data Portal (ODP), will be compatible with, and contribute to the High Quality Global Data Management System for Climate (HQ-GDMSC) that is being developed by the WMO Commission for Climatology (CCl).

This system is expected to improve timescales for met-ocean climate data availability, facilitate the exchange of historical met-ocean climate data sets between countries, and thereby increase the amount of ocean observations eventually made available to the relevant end user applications. Furthermore, integrated data and metadata will be available containing comprehensive dataset information e.g. historic details on current and past data codes and formats.

The data management structure will be standardized, well defined and documented for existing and new data across JCOMM activities and state of the art marine climate and statistical products will be easily accessible.

The development of the MCDS requires using state of the art integrated and standardized international systems for the improved data and metadata-flow and management of a wide range of met-ocean climate data. This includes integrating collection, rescue, quality control, formatting, archiving, exchange, and access of *in situ* and satellite sources. This system will be based on improved quality management, documenting processes and procedures, using higher level quality control, added value data processing, including bias correction, and comparison of the observations with satellite and meteorological and oceanographic model gridded fields.

It is expected that the relevant data and associated metadata will be of known quality, and extend to products that satisfy the met-ocean climate data requirements for climate monitoring, forecasting, and services.

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Annex 2 to draft Recommendation 7.2/1 (JCOMM-4)

TERMS OF REFERENCE FOR WMO-IOC CENTRES FOR MARINE-METEOROLOGICAL AND OCEANOGRAPHIC CLIMATE DATA (CMOCs)

The Vision for a Marine Climate Data System (MCDS) is to formalize and coordinate the activities of existing systems, and address gaps to produce a dedicated WMO-IOC data system operational by 2020 in the view to have compiled coherent met-ocean climate datasets of known quality, extending beyond the Global Climate Observing System (GCOS) Essential Climate Variables (ECVs). These will be of known quality collected from multiple sources to be served on a free and unrestricted basis to the end users through a global network of less than ten WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs). Data, metadata and information will be fully interoperable with the WMO Information System (WIS) and the IOC/IODE Ocean Data Portal (ODP), will be compatible with, and contribute to the High Quality Global Data Management System for Climate (HQ-GDMSC) that is being developed by the WMO Commission for Climatology (CCl).

It will cover different and specific JCOMM data domains (e.g. marine meteorology, physical oceanography, historical period(s), geographical coverage, specific procedures applied to the data) and enhance international partnerships within a new JCOMM framework, taking full benefit of the existing network of IODE NODCs, in the best manner of harmonizing with the work of IODE NODCs. The primary objectives are to improve availability, recovery and archival of contemporary and historical data, metadata and products and obtain standardized quality of a high level in a more timely manner. This will ensure the long-term stability of the data management system, permit the sharing of responsibility and expertise, optimize resources and help prevent loss from technological failures. Groups of CMOCs will operate within a given data domain (e. g. global, regional, atmospheric, surface and sub-surface oceanic) and provide complimentary functions. To achieve maximum continuity, reliability and completeness of data, metadata and products, specialized CMOCs will be established that mirror the processes, data and metadata across the CMOC domain.

Governance for defining the functions and adoption of CMOC is proposed by JCOMM and endorsed by the WMO Executive Council and UNESCO/IOC Executive Council or Assembly.

To meet these requirements CMOCs must have the following:

Capabilities:

(a) Each Centre must have, or have access to, the necessary infrastructure, facilities, experience and staff required to fulfil the approved functions;

(b) Each Centre must have, or have access to, interoperability with the WMO Information System (WIS) and/or IOC/IODE ODP;

(c) Each Centre must be able to apply defined international standards applicable for Data and Quality Management;

(d) Mirroring CMOCs must be able to actively and reliably “mirror” (i.e. maintain mutually consistent) data, metadata, and products, as agreed within the CMOC network;

(e) A recognized authority (the JCOMM Data Management Coordination Group – DMCG) must assess each Centre, at least once every five years, to verify it meets the necessary capabilities and performance indicators as agreed by the Commission.

Corresponding functions:

(a) Each Centre must contribute to WMO and IOC Applications for example by rescuing, collecting, processing, archiving, sharing, distributing and mirroring worldwide marine-meteorological and oceanographic data and metadata documented in appropriate WMO and IOC publications;

(b) Each Centre must provide advice to Members/Member States internationally in response to enquiries regarding standards and best practices for example on data rescue, collection, processing, archival, and distribution of marine-meteorological and oceanographic data, metadata, and products;

(c) Each Centre must make datasets, and corresponding metadata, maintained as part of its scope available, and discoverable through the WIS and/or IOC/IODE ODP;

(d) All CMOC must communicate and liaise closely within the network; particularly on the development of quality processes and procedures, meeting on a regular basis;

(e) Each Centre must operate appropriate data processing and quality control procedures, and generate the required products within its scope;

(f) Following the procedures documented in appropriate WMO and IOC publications all Centres within the CMOC network must closely cooperate in the rescue, exchange, processing, and archival of marine-meteorological and oceanographic data, metadata, and products;

(g) Each centre will undertake its core defined functions and replicate data from other centres appropriate to its domain such that the set of data and products offered from the CMOC network is mutually consistent when accessed from any individual centre;

(h) Specialized CMOCs will mirror data, metadata, products and processes at defined time-scales; the method of mirroring will be agreed upon among mirroring centres;

(i) All kinds of data, metadata and processes managed within a CMOC domain will be subject to a stringent version control (e.g. Digital Object Identifier – DOI);

(j) Each Centre should report, on an annual basis, to the JCOMM Management Committee through the DMCG on the services offered to Members/Member States and the activities carried out. JCOMM in turn should keep the Executive Councils of the WMO and the UNESCO/IOC Assembly informed on the status and activities of the CMOC network as a whole, and propose changes, as required.

Data and Software Policy Requirements

A CMOC must make all the data, metadata, and products falling within the scope of the CMOC network freely and openly available to the international research community in a way consistent with WMO Resolution 40 (Cg-XII) and IOC Resolution IOC-XXII-6. Where applicable software should also be made open and freely available.

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Annex 3 to draft Recommendation 7.2/1 (JCOMM-4)

FORMAL DESIGNATION AND WITHDRAWAL OF WMO-IOC CENTRES FOR MARINE-METEOROLOGICAL AND OCEANOGRAPHIC CLIMATE DATA (CMOCS)

According to the Terms of Reference of WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs) as detailed in Annex 2, the mechanism for formal WMO and UNESCO/IOC appointment of a CMOC implies the following:

(a) Governance for defining the functions and adoption of each Centre is proposed by JCOMM and endorsed by the WMO Executive Council and UNESCO/IOC Assembly or Executive Council;
(b) The host of a candidate CMOC is required to produce a statement of compliance with requirements and commitment, list and demonstrate capabilities of the proposed Centre, state the scope of the data and/or products managed by the centre, state the formal commitment to host the Centre.

The following approach is recommended by JCOMM:

1. The host of the candidate CMOC will describe the extent to which it will be addressing requirements of scope, capabilities, functions and data and software policy of the proposed CMOC.
2. Once the host of the candidate CMOC has established that it meets the requirements to a sufficient extent, the IOC Action Addressee of the Country, or the Permanent Representative of the Country with WMO, as appropriate, writes to the IOC Executive Secretary or the WMO Secretary General respectively, to formally state the offer to host and operate the CMOC on behalf of the WMO and IOC, and to request that the Centre be added to the list of CMOCs. In doing so, the host of the candidate CMOC also provides a statement of requirements of scope, capabilities, functions and data and software policy as described in the CMOC Terms of Reference detailed in Annex 2. The letter should be copied to the appropriate JCOMM Co-President, and also to the relevant President of the WMO Regional Association or Chair of the IOC Regional Subsidiary Body in the case where the CMOC is only providing data corresponding to a specific geographic region.
3. The IOC or WMO Secretariat will then request the appropriate JCOMM Co-President to take action, in particular to request the Data Management Coordination Group (DMCG) to evaluate and verify compliance with requirements of the proposed Centre.
4. The DMCG evaluates the request and advises in writing (see 5 and 6) whether the CMOC application should be endorsed. The DMCG may wish to delegate this work to individuals and/or groups acting on its behalf (e.g. one of the component teams, depending on the nature of the proposed Centre), but any advice and proposal to JCOMM should still be assessed by and come through the DMCG. DMCG will also conduct reviews of performance and capabilities at the required intervals.
5. If endorsed by the DMCG, and depending on timing, the DMCG makes a recommendation to the JCOMM Management Committee (MAN), and invites them to provide further advice to JCOMM.
6. If not endorsed by the DMCG or MAN, the JCOMM Co-President should advise the candidates about areas where the candidate Centre can be improved to meet requirements. Candidates can reapply at a later date once changes have been made to meet these criteria.
7. If endorsed by MAN, a recommendation is passed to the next JCOMM Session, or depending on timing, directly to the WMO Executive Council and IOC Executive Council or Assembly following JCOMM consultation in writing.
8. If recommended by JCOMM, a Resolution is proposed to the WMO Executive Council and IOC Executive Council or Assembly for including the candidate in the list of CMOCs.

9. If the recommendation is approved by both the WMO Executive Councils and IOC Executive Council or Assembly, the candidate CMOC is listed in the appropriate WMO and IOC Manuals and Guides;

It is expected that this process, from submission of the CMOC proposal to the JCOMM Co-President, to formal approval by both WMO/IOC Executive Councils, may take from 6 months to 2 years.

At times it may be necessary for a Centre to be withdrawn from the CMOC role. The approach proposed by JCOMM is the following:

- The DMCG are to review each Centre for necessary capabilities and performance once every five years. If the review is favourable then the CMOC can continue its role as before. If the review is not favourable then the DMCG must insist improvements to be made and reviewed within one year. If the second review is still not favourable then the CMOC role will be withdrawn from the Centre through a recommendation by JCOMM and subsequent decision by the WMO Executive Council and IOC Assembly.
- If a Centre no longer wishes to carry out the functions of a CMOC the Expert Team on Marine Climatology (ETMC) and DMCG should be advised immediately.

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