WORKSHOP FOR A NEW MARINE CLIMATE DATA SYSTEM

(HAMBURG, GERMANY, 28 NOVEMBER – 2 DECEMBER 2011)

FINAL REPORT

JCOMM MEETING REPORT NO. 90

REVISION 1

MCDS1 GROUP PHOTO

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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NOTES

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Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

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C O N T E N T S

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EXECUTIVE SUMMARY

The workshop for a new Marine Climate Data System (MCDS) was held at the Deutscher Wetterdienst in Hamburg, Germany, from 28 November to 2 December 2011.

The main goals of the meeting were to discuss the vision for a new MCDS in the next 10 years to better address the WMO-IOC-UNEP-ICSU Global Climate Observing System (GCOS), Global Framework for Climate Services (GFCS), and the WMO-IOC-UNEP-ICSU Global Ocean Observing System (GOOS) marine-meteorological and ocean data requirements for climate monitoring, forecasting, and services, and starting by (i) a modernized Voluntary Observing Ship (VOS) delayed-mode data-flow, (ii) the establishment of a network of WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data (CMOCs) on the model of the trusted ICOADS, and (iii) the integration of the Responsible National Oceanographic Data Centre (RNODC) for Drifting Buoys (RNODC/DB) and the Specialized Oceanographic Centre (SOC) for Drifting Buoys (SOC/DB) to avoid duplication.

The workshop clarified the role of the IOC, and particularly the International Oceanographic Data and Information Exchange (IODE) in the MCDS, and agreed on a Vision for the MCDS to be submitted to JCOMM-IV for approval. It also agreed on a draft strategy, and initial implementation plan for the MCDS building on existing systems. The workshop further drafted two Recommendations to be submitted to the Fourth Session (JCOMM-IV) of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) for approval:

- A draft Recommendation on the MCDS and the establishment of CMOCs, with proposed CMOC Terms of Reference, and governance for their establishment;
- A Draft Recommendation on the collection of instrument/platform metadata.

The workshop welcomed the potential offers from China and USA to establish CMOCs, and proposed templates for statements of compliance and commitment to be submitted to JCOMM according to the proposed governance. It is expected that the two countries will submit Statements of Compliance and Commitment no later than 15 February 2012 to permit their evaluation by the Data Management Coordination Group, and the consideration of their formal establishment by JCOMM-IV. The workshop encouraged other Members/Member States to submit applications (by 15 February 2012 in case consideration by JCOMM-IV is sought).

The workshop agreed on general principles for the flow of marine-meteorological and oceanographic data within the MCDS, including the future establishment (or recognition of existing) of Data Acquisition Centres (DACs), Global Data Assembly Centres (GDACs), and CMOCs as an outcome of the Marine Climatological Summaries Scheme (MCSS) modernization. The workshop discussed the recommendations from the ad hoc Task Team on RNODC/DB and SOC/DB integration, and refined the data-flow proposal for drifting buoy data accordingly. The VOS data-flow was also discussed, and agreed upon. These shall be further discussed and elaborated as part of the MCDS strategy, implementation plan, and refinement of the MCDS dataflow.

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GENERAL SUMMARY OF THE WORK OF THE SESSION

1 OPENING AND WELCOME

1.1 Ms Gudrun Rosenhagen (DWD, Germany) welcomed the participants on behalf of the DWD and the government of Germany. Ms Sissy Iona (Greece), Chairperson of the JCOMM Data Management Coordination Group (DMCG) opened the workshop for a new Marine Climate Data System (MCDS) at 0900 hours on Monday, 28 November 2011, at the Deutscher Wetterdienst in Hamburg, Germany.

1.2 The WMO Secretariat representative welcomed the participants to the Session on behalf of the Secretary-General of WMO, Mr Michel Jarraud, and the Executive Secretary IOC, Dr Wendy Watson Wright.

1.3 The workshop recognized the rapidly developing Global Framework for Climate Services (GFCS), promoted by the WMO Fifteenth Congress (Cg-XV) as a priority activity of the WMO. A key goal of the GFCS will be to enable better management of the risks of climate variability and change and adaptation to climate change at all levels, through development and incorporation of science-based climate information and prediction into planning, policy and practice.

2 OPENING OF THE WORKSHOP

2.1 Adoption of the agenda

2.1.1 Ms Sissy Iona (HCMR/HNODC, Greece) introduced the Provisional Agenda, and invited the workshop to review it and adopt it. The workshop adopted the Agenda (*Annex I*).

2.2 Working arrangements

2.2.1 The Secretariat representative provided information on the working hours of the workshop and some practical arrangements for the workshop.

2.2.2 Participants were reminded that all working documents were made available through the JCOMM web site. Ms Sissy Iona invited all participants to introduce themselves briefly. The list of participants is available as *Annex II*.

3 NEW MARINE CLIMATE DATA SYSTEM

3.1 Background information, and rationale

3.1.1 The workshop recognized that the following climate related services have to be delivered to the industry and government users: (i) optimizing operations at sea (e.g. marine transport & ship routing, fishing operations); (ii) design of coastal and marine infrastructures (ports, ships, offshore platforms); (iii) assistance to the Tourism industry (e.g. wave & sea state “climate”); (iv) assistance to DRR authorities (e.g. thanks to marine climate information based on the monitoring of ocean related extreme events); (v) management of Sustained Coastal and Marine Ecosystem; and (vi) climate services based on products of operational ocean forecasting systems (e.g. Projected warming climate in Polar regions resulting in seasonally ice free Arctic ocean, and leading to the development of some climate service applications derived from the Global Maritime Distress and Safety System (GMDSS), the Marine Pollution Emergency Response Support System (MPERSS), and Search and Rescue (SAR) applications).

3.1.2 The workshop agreed that an efficient, high quality marine-meteorological and ocean data management system was required in order to be able to respond to those climate services

requirements, and particularly deliver the following products (i) High quality data for example for the initialization and validation of operational climate models; and (ii) marine climate information with statistics of occurrences of storm surges, Tsunami, extreme waves, sea-ice, etc.

3.1.3 The workshop recalled that the WMO Commission for Climatology (CCl) had stressed at its fifteenth Session (Antalya, Turkey, Feb. 2010) the importance of climate data in climate monitoring, research and applications, climate change and adaptation as well as in supporting the operation of the newly established Global Framework for Climate Services (GFCS). The CCl also had recognized that real opportunities exist for the improvement of climate data management in its various aspects including archiving, quality control, discovery and timely exchange amongst Members as well as with the end users. It had underlined that collaboration of Members is critical to ensure high quality, timely and accessible climate data from all possible sources encompassing land and marine data and including in-situ, space based and proxy data. The CCl had therefore recommended to work towards to the development of a high quality global climate data management system which will benefit from the progress made in implementing modern Climate Data Management Systems (CDMSs) and Climate Data Rescue (DARE) and the utilization of international standards for data representation, exchange and database models.

3.1.4 The workshop recognized that marine-meteorological and oceanographic climate data should contribute in an integrated way to the GFCS observations and monitoring pillar of the GFCS. The workshop agreed with the following elements to be considered as part of the MCDS vision and developments:

- Requirements for climate monitoring, forecasting, and services
- Standardized and integrated data-flow from multiple sources (real-time and delayed-mode) with enhanced data exchange and improved timescales
- Data rescue
- Improved quality management with higher level quality control, and value added products (bias correction, co-located Numerical Weather Prediction (NWP) and satellite data, Marine Climate Summaries (MCS) etc.)
- Fully documented system, including details on current and past data management practices (e.g. past data codes and formats)
- Coherent marine/ocean data sets of known quality with associated metadata archived and served through network of WMO-IOC Centres for Marine-meteorological and Oceanographic Climate data (CMOCs).
- Flexible user interface with full interoperability with the WMO Information System (WIS) and the Ocean Data Portal (ODP)
- Compatibility with & Contribution to the High Quality Global Data Management System for Climate (HQ-GDMSC) that is being developed by the CCl
- Homogenization of the terminologies used in the JCOMM marine climatology, and the ocean community (e.g. IODE).

3.1.5 The workshop agreed on the vision for a new Marine Climate Data System (MCDS) as reproduced in Annex V.

3.1.6 As a mean to agree on a strategy responding to the MCDS Vision, and advance a workplan responding to the strategy, the workshop recalled the establishment by the JCOMM Expert Team on Marine Climatology (ETMC) of a new Task Team on the Marine Climate Data System (TT-MCDS). The TT-MCDS replaces (i) the Cross Cutting DMPA-OPA Task Team on Delayed-Mode VOS Data (TT-DMVOS), and (ii) the DMPA/ETMC Task Team on Marine-meteorological and Oceanographic Climatological Summaries (TT-MOCS). The workshop proposed some changes to the Terms of Reference and Membership of the TT-MCDS. These are reproduced in Annex IV and shall be submitted to the ETMC for approval.

3.1.7 The workshop agreed that the MCDS should be developed in close cooperation between JCOMM and the IODE, that synergies should be sought, and invited the IODE to take joint

ownership of the MCDS with JCOMM, and the IODE officers to review the recommendations from the workshop.

3.2 Modernized VOS delayed-mode data-flow

3.2.1 The meeting discussed proposal from the Global Collecting Centres (GCCs) for a modernized VOS delayed-mode data-flow.

3.2.2 The workshop agreed that the Global Temperature and Salinity Profile Programme (GTSPP) experience in ocean data management can be useful when elaborating further the VOS data-flow (e.g. unique tag, reconciling real-tine and delayed-mode data).

3.2.3 After discussion, the meeting agreed with the overall VOS delayed-mode dataflow as described in Annex X.

3.2.3 The workshop agreed that the MCDS delayed-mode data-flow should be further elaborated as part of the MCDS strategy and implementation plan, to refine the Terms of Reference of the proposed component centres (e.g. Data Acquisition Centres – DACs, Global Data Assembly Centres – GDACs), as well as the governance for their establishment. Candidate DACs and GDACs will have to be identified, and consultation will be needed with existing MCSS Responsible Members (RMs) and Contributing Members (CMs) to identify the roles that they could play as part of the MCDS.

3.3 Establishment of a network of WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data (CMOCs)

3.3.1 The workshop recalled the discussions at the third Expert Team on Marine Climatology (ETMC) Session (ETMC-III, Melbourne, Australia, 8-12 February 2010), and the third International workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT-III, Frascati, Italy, 2-6 May 2011) regarding the proposal to establish a network of WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data (CMOCs) (see particularly paragraph 6.1.2, and Annex XI of JCOMM-MR-No. 70, ETMC-III final report). A refined proposal for establishing CMOCs was discussed as part of the strategy document for the MCDS. The workshop agreed that a candidate CMOC should follow the procedures described in the appropriate WMO and IOC Publications (those procedures are yet to be defined), and

(i) contribute to WMO and IOC Applications for example by rescuing, collecting, processing, controlling the quality, archiving, sharing,distributing, and mirroring worldwide marine-meteorological and oceanographic data, metadata and products according to procedures documented in relevant WMO and IOC Publications;
(ii) advise Members/Member States internationally on enquiries regarding standards and best practices for example on the rescue, collection, processing, quality control, archival, and distribution of marine-meteorological and oceanographic data, metadata, and products;
(iii) make data sets, and corresponding metadata, maintained as part of its scope available, and discoverable through the WIS and/or the Ocean Data Portal (ODP);
(iv) must communicate and liaise closely within the network; particularly on the development of quality processes and procedures, meeting on a regular basis
(v) operate appropriate data processing and quality control procedures, and generate the required products within its scope;
(vi) closely cooperate with the network of other CMOCs in the rescue, exchange, processing, and archival of Marine-meteorological and oceanographic data and metadata, such that the set of data and products offered from the CMOC network is mutually consistent when accessed from any individual Centre; and
(vii) should report, on an annual basis, to the JCOMM Management Committee 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 informed

on the status and activities of the CMOC network as a whole, and propose changes, as required.

3.3.2 The workshop agreed on draft Terms of Reference for the CMOCs to be submitted to JCOMM-IV for approval. The workshop further discussed and agreed on a process for the formal adoption and withdrawal of CMOCs. Both the proposed Terms of Reference and the process are part of the draft Recommendation on the MCDS to be submitted to JCOMM-IV (see Annexes 2 and 3 to the Recommendation respectively, as reproduced in Annex VII). The workshop further agreed on a template for CMOC statements of compliance, as reproduced in Annex VIII.

3.3.3 The workshop agreed that it would be appropriate and desirable that the International Comprehensive Ocean Atmosphere Data set (ICOADS) become a CMOC, and invited the USA to submit a Statement of Compliance no later than 15 February 2012.

3.3.4 The workshop also welcomed the proposal from China at the workshop that the functions of the ODAS Metadata Service (ODASMS) be integrated into a CMOC operated by the National Marine Data and Information Service (NMDIS) of the State Oceanic Administration (SOA) of China. The CMOC in China would manage not only metadata but also the corresponding data and products, and offer for example the following services:

- Strengthening and streamlining the development of JCOMM/ODASMS and improve its operational services to achieve direct access to all global marine-meteorological and oceanographic climate data, metadata, and related products via the CMOC network;
- Actively undertake the standardization, quality control and quality assessment of CMOCs data;
- Actively participate in the research and development of oceanographic and marine-meteorological products, and their related services;
- Provide technical training, and carry out capacity building activities for countries in the region.

3.3.5 The workshop invited China to submit a Statement of Compliance no later than 15 February 2012. The workshop encouraged Members/Member States to consider proposing CMOC facilities.

3.4 Follow up of the RNODC/DB and SOC/DB working group recommendations, and their contribution to the MCDS

3.4.1 The workshop reviewed the report from the *ad hoc* Task Team on Responsible National Ocean Data Centres (RNODCs) and Specialized Oceanography Data Centres (SOCs). The *ad hoc* Task Team was established by the fourth Session of the JCOMM Data Management Programme Area (Ostend, Belgium, 8-9 April 2010) and reviewed by the twenty-first Session of the IOC Committee on International Oceanographic data and Information Exchange (Liege, Belgium, 23-26 March 2011), which approved the recommendations from the *ad hoc* task team as detailed in the report from the *ad hoc* Task Team. The *ad hoc* Task Team was established on the principle that 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.).

3.4.2 The workshop recalled that the ISDM (Canada) and Météo France were respectively operating the RNODEC for drifting buoys (RNODC/DB) and the SOC for drifting buoys (SOC/DB). The workshop noted that the *ad hoc* Task Team had recommended that the RNODC/DB and the SOC/DB develop a data management scheme similar to Argo and the OCEAN Sustained Interdisciplinary Timeseries Environment observation System (OceanSITES). These data are processed and distributed through a network involving different components that contribute to the overall data management system. The *ad hoc* Task Team further recommended 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.

3.4.3 The ad hoc working group of the MCDS workshop met Tuesday 29 November 2011, and discussed efforts to organize existing entities (Météo-France, ISDM[1] Canada, and NOAA[2]'s AOML[3]) into the MCDS DAC and GDAC structure. A flow diagram reveals that the real-time data-flows from the drifting buoys through the Global Telecommunication System (GTS) to ISDM and directly to Météo France and AOML through Argo and Iridium service providers. All three entities process global data and thus act as GDACs. Météo-France focuses on the generation of derived products aimed at real time use. ISDM processes data in semi-real-time, applies MQC and then archives and makes available the QCed observations. AOML generate products on a yearly or twice yearly schedule, to produce derived products in a delayed-mode. AOML publish their delayed-mode data through various means including the web and also sends a copy to ISDM who mirrors these derived products on their web site.

3.4.4 After reviewing the data-flow through the principal organizations, the ad hoc working group focused on the functions of data providers, data acquisition centres, and global data assembly centres. The resulting discussion determined that all of the functions of the DAC and GDAC are being accomplished between the contributing organizations as noted in the previous paragraphs.

3.4.5 The workshop agreed with the following recommendations from the ad hoc working group:

- The former RNODC/DB (ISDM), the SOC/DB (Meteo-France), and AOML should become GDACs for all drifting buoy data.
- Meteo-France should serve as a DAC and GDAC for real-time drifting buoy data. They receive the real-time data from the communications services and generate value added products following quality control.
- ISDM should serve as a GDAC for the real-time drifting buoy data as they receive the GTS real-time feed and quality control the position, temperature, salinity, and pressure data from the GTS stream.
- AOML should also serve as the DAC and GDAC for all delayed-mode drifting buoy data. AOML receives all data from the communications center and the metadata from Principal Investigators and applies quality control in order to generate value-added products.
- ISDM should serve as a delayed-mode drifting buoy GDAC. ISDM receives the AOML delayed-mode data and data products at regular intervals and maintains the data at their site.

3.4.6 The above recommendations are intended to formalize existing functions and no major efforts are anticipated. However, the organizations should meet as soon as possible to discuss final implementation of these recommendations. Additionally, discussions concerning GTS routing issues, metadata acquisition, and the exchange of value added data should occur.

3.4.7 The workshop further discussed the proposal from Météo France for the integration of some other elements (e.g. VOS data) into the MCDS through a Real-Time DAC or GDAC for Surface Marine Observations. The details of the proposal are provided in Annex XI. The workshop agreed in principle with the proposal and invited Météo France to discuss the details with the TT-MCDS as part of the MCDS strategy and implementation plan.

3.4.8 The workshop discussed the implementation of such a system in order to determine the Information Technology impacts for both Centres, and develop a timeline for achieving Initial Operational Capability and Full Operational Capability.

3.5 Integration of the Ocean Data Acquisition System (ODAS) Metadata Service (ODASMS) into the MCDS

1 ISDM : Integrated Science Data Management of Canada
2 NOAA: US National Oceanic and Atmospheric Administration
3 AOML: NOAA Atlantic Oceanographic and Meteorological Laboratory

3.5.1 The workshop recalled that JCOMM-III recognized that metadata are important in a number of domains including climate applications and research (e.g. bias correction), and operational applications, permitting amongst other things to interpret the data correctly, ensure traceability to standards, enhance coherence of data records, and facilitate quality monitoring activities. JCOMM-III therefore stressed that its Members/Member States should routinely provide the metadata content on a routine basis and adopted Recommendation 3 (JCOMM-III) – Provision of ODAS and Water Temperature Metadata.

3.5.2 The workshop also recalled that ETMC-III had agreed to initiate a pilot study to investigate the current content of the Ocean Data Acquisition Systems (ODAS) Metadata Service (ODASMS[4]) and the Water Temperature Metadata (META-T) servers in terms of metadata available from operational observing platforms. Meanwhile the META-T Pilot Project was completed, and the ODASMS has delivered some useful metadata information but it lacked the links with adequate data, so it did not achieve the original aims.

3.5.3 Despite slow progress some very useful lessons have been derived from the META-T Pilot Project:

(i.) The concept of a single point of access to all JCOMM metadata that operates independently from the platform data management process is not sustainable, especially in a low funding environment.

(ii.) Organizing the metadata development effort around a geophysical variable, temperature in this case, was less effective than organizing around platforms.

(iii.) JCOMM is organized into panels that have common platforms and data processing systems. Exploiting this organizational infrastructure will likely be more effective, at least initially, than creating a separate metadata service that aims to integrate across panel activities and is developed independently. On the other hand, such cross-panel metadata services (e.g. ODASMS) may also still end up having important downstream integrating and permanent archive roles.

3.5.4 Amongst the META-T legacy recommendations, the workshop noted the following:

(i.) Recommendation to include as much metadata as is practically available at the time of GTS encoding in the BUFR[5] templates. The design of BUFR templates is of primary importance to the overall management and distribution of data and metadata;
(ii.) DMCG was invited to establish a JCOMM DMPA Task Team focused on exploring web based technologies and that could leverage the JCOMM DMPA Task Team on Table Driven Codes (TT-TDC) efforts and extend them with web-services that provide deeper functionality than the GTS can currently deliver.

3.5.5 While thanking China for its commitment to operate and maintain the ODASMS, the workshop agreed that taking the above META-T lessons learned into account, it would be preferable to eventually integrate the ODASMS within a CMOC, and invited China to consider submitting an application for a CMOC to that extent.

3.5.6 Prof. Shaohua Lin presented background information on the establishment of the ODASMS, as well as current status and future plans. She indicated that integrating the functions of the ODASMS into a CMOC would facilitate the evolution of the metadata service into a more robust and operational system.

3.5.7 The workshop agreed that the TT-MCDS should discuss the potential overlap between metadata management within DACs, GDACs, and CMOCs.

4 http://www.odas.org.cn/
5: FM 94–XIV BUFR - Binary universal form for the representation of meteorological data

3.5.8 The workshop reviewed and agreed on a draft Recommendation on metadata to be submitted to JCOMM-IV (***Annex XII***
).

3.6 Contribution of the GDACs, GTSPP, GOSUD to the MCDS

3.6.1 The workshop agreed that efforts should be made to achieve compatibility between the marine-meteorological data systems and the oceanographic data systems providing data of interest to climate monitoring, forecasting, and services. The concerned ocean data systems in particular include the following:

- The Global Ocean Surface Underway Data Pilot Project (GOSUD);
- The Global Temperature and Salinity Profile Programme (GTSPP);
- The Argo Data System;
- The OceanSITEs Data System.

3.6.2 The workshop noted that there are already much convergence between those ocean data systems, and agreed that the MCDS should be developed in such a way to ensure as much compatibility with them, so that they will be in a position to easily contribute to the MCDS.

3.7 Contribution from the IODE NODCs and former IODE RNODCs

3.7.1 The JCOMM/DMCG and IOC/IODE Co-Chair, Ms Sissy Iona (Greece), presented the International Oceanographic Data and Information Exchange (IODE) of the Intergovernmental Oceanographic Commission (IOC) of UNESCO focusing on the activities, functions and services which are interrelated with the components of the new Marine Climate Data System. IODE is global service oriented network of more than 80 National Oceanographic Data Centres (NODCs) and marine information management (library) infrastructures. It is serving the long-term archiving and exchange of oceanographic data and information on a global basis through its cooperation with the World Data Centres for Oceanography and relevant Projects. To facilitate and promote the exchange and dissemination of marine data and services the IODE is developing the Ocean data Portal through a network of interconnected NODCs providing seamless access to collections and inventories of marine data from these data centres. Furthermore to meet the interoperability requirements of the Ocean Data Portal, IODE is promoting the use of common standards related to ocean data management and exchange achieving thus interoperability with the WMO Information System (WIS) and contributing to the Group on Earth Observations (GEO)/Global Earth Observing System of Systems (GEOSS) through WIS.

3.7.2 In conclusion, Ms Iona pointed out that the IODE contribution is crucial for the success of the new system and this can be achieved through the IODE products, services , projects, and the joint IODE-DMCG ETDMP activities. As there are complementary data management activities, strong cooperation is needed to avoid duplication. Experience gained from GTSPP, GOSUD, WOD Projects should be used in the new system. In the framework of IODE response in the GFCS requirements, IODE should take the lead for the sub-surface data management issues in the MCDS. The Ocean Data and Information Network (ODIN) should be involved in the system. Finally, IODE could re-address the issue of the former RNODCs.

3.7.3 The workshop invited the IODE to take full ownership in the MCDS together with JCOMM. The workshop invited the IODE Officers to discuss the recommendations from this workshop in early 2012 before JCOMM-IV, and discuss synergies, and common actions (.e.g. IODE to recognize RNODC/DB as a GDAC), to be possibly reported and discussed at JCOMM-IV.

3.8 Longer-term scenarios for integrating other and new sources of data (e.g. tropical and coastal moored buoys, OceanSITES, Argo, satellite)

3.8.1 The workshop noted that the JCOMM Observing Systems Monitoring Center (OSMC) webpage provides a means to address the potential sources of data to integrate into the Marine

Climate Data System (MCDS). The types of data sets represented on the webpage are presented below.

DATA TYPE.	***No. PLATFORMS***	***STATUS***
Argo Floats	1000's	DACs and GDACs
Drifting Buoys	1000's	In work
CoastalStations (e.g. CMAN)	100's	None
Moored Buoys	100's	None
Satellite Data	10's.	None
OceanSITES	10's	DACs and GDACs

3.8.2 ARGO and OceanSITES have already been assigned Data Assembly Centers and Global Data Assembly Centers under their own data systems. It should be relatively easy to officially recognize these two efforts. The OceanSITES data set includes only a subset of the Global Tropical Moored Buoy Array (GTMBA) and the additional sixty to seventy-five buoys should be considered for inclusion. With the Drifting Buoy data set currently being addressed, the next most likely data set to be addressed is the moored buoy data. The additional buoys in the GTMBA could be added to this moored buoy data set.

3.8.3 The workshop recommended that a Task Team be organized to address the various issues associated with investigating the task of including the moored buoys in the MCDS, implementing the DAC and GDAC structure for moored buoys, and investigating how to implement the program. It is also recommended that when satellite data are considered, that satellite products, such as wind speed, sea surface height anomaly, and other satellite derived ocean surface parameters be addressed.

3.8.4 The workshop also recommended to investigate the benefits of possibly joining efforts between JCOMM, IODE, and the CCl for example in the view to eventually merge existing relevant Expert Teams into a joint Expert Team that would address the overall climate data management issues, including, land, upper air, marine-meteorological, and ocean.

3.8.5 The workshop invited NDBC, and the EuroGOOS Mediterranean Operational Oceanography Network (MOON) to investigate acting as a GDAC for moored buoys.

3.8.6 The workshop invited the ISDM and the NOAA National Data Buoy Center (NDBC) to investigate acting as GDAC for the Rigs and Platforms.

3.9 Assessment of future requirements for the Marine Climate Summaries

3.9.1 The Chair of the ETMC, Mr Scott Woodruff provided background information on tabular/graphic Marine Climatological Summaries (MCS) that are currently a documented legacy product of the Marine Climatological Summaries Scheme (MCSS). The workshop concurred with the following recommendations from Mr Woodruff:

a) While the form of the MCS products would continue to be standardized as documented in the *Manual on* and *Guide to Marine-Meteorological Services* (WMO–Nos. 558/471), their production by the Responsible Members would become optional under the MCSS.
b) Recommendation along these lines will be drafted for JCOMM-IV, suggesting development over the next intersession period of appropriate additional changes to WMO–Nos. 558/471.
c) That the proposed new Task Team on the Marine Climate Data System (TT-MCDS) will take over any residual commitments from the DMPA/ETMC Task Team on Marine-meteorological and Oceanographic Climatological Summaries (TT-MOCS), and propose further changes to the Technical Regulations as documented in WMO–Nos. 558/471 to JCOMM-V through the ETMC and in consultation with the Responsible Members.

d) In conjunction with above, WMO should ensure that current (and if possible any earlier available) editions of WMO–Nos. 558 and 471 documenting the MCS details, together with other historical aspects of the MCSS, be permanently archived, for future reference.

3.10 Draft Vision for 2020 for the future Marine Climate Data System (MCDS) to ultimately replace the existing MCSS

3.10.1 The workshop discussed and agreed on a vision for the MCDS in the next 10 years. The proposed vision is reproduced in Annex V.

3.11 Draft strategy for the realization of the Vision, to be submitted to JCOMM-IV

3.11.1 The workshop discussed and agreed on a draft Strategy for realizing the vision of the MCDS. The proposed draft strategy is reproduced in Annex VI. It will be submitted to JCOMM-IV for review. The Plan is to have the strategy approved by the Data Management Coordination Group (DMCG) at its fifth Session.

3.12 Initial Implementation Plan for the realization of the Strategy

3.12.1 The workshop discussed and agreed on an initial Implementation Plan for realizing the draft MCDS strategy. The proposed initial Implementation Plan is attached to the draft MCDS strategy (see Annex I of Annex VI).

3.12.2 The workshop agreed on a draft Recommendation on the MCDS to be submitted to JCOMM-IV for approval. The Recommendation is reproduced in Annex VII., and includes in particular the following elements:

1. JCOMM in close cooperation with IODE and other appropriate partners (such as the ICSU[6] World Data System – WDS) to develop a strategy and implementation plan for achieving the Vision for a new MCDS as described in Annex 1 to this Recommendation;
2. To implement a modernized scheme for the management of surface marine climatological data in conjunction with ICOADS inside the MCDS.
3. To implement a modernized data management scheme within the MCDS for surface drifter data replacing the RNODC/DB and the SOC/DB
4. To establish a network of CMOCs building on existing facilities as appropriate with the Terms of Reference (ToRs) in Annex 2, and adopt a mechanism for formal WMO and IOC/IODE designation of CMOCs where:
    (a) Governance for defining the functions and adoption of CMOC is proposed by JCOMM and endorsed by the WMO and UNESCO/IOC Executive Councils,
    (b) Candidate CMOCs will be required to produce a statement of compliance, list capabilities of the proposed centre, state the domain of the data and products managed and/or generated by the centre, state the formal commitment to voluntarily host the centre and demonstrate capability to JCOMM,
    (c) The process for establishing a new CMOC is described in Annex 3 to this Recommendation,
    (d) Following possible agreement by JCOMM, the WMO and UNESCO/IOC Executive Councils will be invited to accept and approve new CMOCs,
    (e) Terms of Reference of CMOC will become part of the WMO Guide to Marine-Meteorological Services (WMO No. 471),
5. To adopt the Terms of Reference of CMOC, including capabilities, and corresponding functions as given in the Annex 2 to this recommendation,
6. To Establish the ICOADS (USA) and the NMDIS (China) as CMOCs;
7. To encourage Members/Member States to offer CMOC facilities;
8. To declare the ODASMS, and the SOC/DB obsolete;

6 ICSU : International Council for Science

3.12.3 The workshop also agreed with the overall MCDS dataflow as described in Annex X.

4 CONCLUSION OF THE WORKSHOP

4.1 The workshop reviewed and agreed on the actions arising from this event. These are summarized in *Annex III*.

4.2 Ms Sissy Iona thanked all for participating and for their comments and support to the workshop, as well as the Secretariat. She stressed that the recommendations from the workshop will be brought to the attention of the fourth JCOMM Session (Yeosu, Rep. of Korea, May 2012). The participants thanked Germany for the great facilities and support provided for and during the workshop.

4.3 The workshop closed by 13:05 hours on Friday 2 December 2011.

ANNEX I

AGENDA

1 OPENING AND WELCOME

2 OPENING OF THE WORKSHOP

2.1 Adoption of the agenda

2.2 Working arrangements

3 NEW MARINE CLIMATE DATA SYSTEM

3.1 Background information, and rationale

3.2 Modernized VOS delayed-mode data-flow

3.3 Establishment of a network of WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data (CMOCs)

3.4 Follow up of the RNODC/DB and SOC/DB working group recommendations, and their contribution to the MCDS

3.5 Integration of the Ocean Data Acquisition System (ODAS) Metadata Service (ODASMS) into the MCDS

3.6 Contribution of the GDACs, GTSPP, GOSUD to the MCDS

3.7 Contribution from the IODE NODCs and former IODE RNODCs

3.8 Longer-term scenarios for integrating other and new sources of data (e.g. tropical and coastal moored buoys, OceanSITES, Argo, satellite)

3.9 Assessment of future requirements for the Marine Climate Summaries

3.10 Draft Vision for 2020 for the future Marine Climate Data System (MCDS) to ultimately replace the existing MCSS

3.11 Draft strategy for the realization of the Vision, to be submitted to JCOMM-IV

3.12 Initial Implementation Plan for the realization of the Strategy

3.13 **CONCLUSION OF THE WORKSHOP**

ANNEX II

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ANNEX III

ACTION ITEMS ARISING FROM THE WORKSHOP

No.	***Action item***	***By***	***Deadline***
1	To seek approval from ETMC on MCDS Vision, draft strategy, initial implementation plan, draft JCOMM-IV Recommendations on MCDS and Metadata, and the new proposed ToR of the TT-MCDS	S. Woodruff	11 Dec 2011
2	To complete changes to WMO 558, 471 for submission to JCOMM-IV	S. Woodruff, Secretariat	15 Dec. 2011
3	To submit the MCDS Vision to JCOMM-IV for approval	Secretariat	15 Dec. 2011
4	To submit the draft Strategy and initial Implementation Plan to JCOMM-IV for review and further guidance	Secretariat	15 Dec. 2011
5	To submit the draft Recommendation on MCDS to JCOMM-IV for approval	Secretariat	15 Dec. 2011
6	To submit the draft Recommendation on Metadata to JCOMM-IV for approval	Secretariat	15 Dec. 2011
7	To submit a statement of compliance and commitment for hosting a CMOC	USA & China and other Candidates	15 Feb. 2012
8	To consider adding CMOC review in the Terms of Reference of the DMCG	S. Iona, Secretariat	15 Dec. 2011
9	To further elaborate the MCDS delayed-mode data-flow as part of the MCDS strategy and implementation plan; in particular, to propose Terms of Reference for the different component centres (e.g. DACs, GDACs), as well as the governance for their establishment.	TT-MCDS	End 2012
10	To identify candidate DACs and GDACs, and consult with existing MCSS Responsible Members (RMs) and Contributing Members (CMs) to identify the roles that they could play as part of the MCDS	TT-MCDS, Secretariat	End 2012
11	To discuss the potential overlap between metadata management within DACs, GDACs, and CMOCs.	TT-MCDS	End 2012
12	To form a Task Team to address the various issues associated with investigating the task of including the moored buoys in the MCDS, implementing the DAC and GDAC structure for moored buoys, and investigating how to implement the program	TT-MCDS	End 2012
13	When satellite data are considered, that satellite products, such as wind speed, sea surface height anomaly, and other satellite derived ocean surface parameters should be addressed for contributing to the MCDS	DMCG, TT-SAT	End 2012
14	To investigate the benefits of possibly joining efforts between JCOMM, IODE, and the CCl for example in the view to eventually merge existing relevant Expert Teams into a joint Expert Team or Task Team that would address the overall climate data management issues, including, land, upper air, marine-meteorological, and ocean.	S. Iona, S. Woodruff, MAN, IODE Officers, CCl, Secretariat	End 2012
15	to investigate acting as a GDAC for moored buoys.	NDBC & MOON	End 2012
16	to investigate acting as GDAC for the Rigs and Platforms.	ISDM & NDBC	End 2012
17	to review, update, and approve the MCDS strategy and implementation plan	TT-MCDS, ETMC, DMCG	End 2012

18	to look at further details on the data-flows and QC for drifting buoys	Ad hoc group on RNODC/DB & SOC/DB integration	End 2012

ANNEX IV

PROPOSED NEW TERMS OF REFERENCE OF THE ETMC TASK TEAM ON THE MARINE CLIMATE DATA SYSTEM (MCDS)

The Task Team on the Marine Climate Data System (TT-MCDS) replaces (i) the Cross Cutting DMPA-OPA Task Team on Delayed-Mode VOS Data (TT-DMVOS), and (ii) the DMPA/ETMC Task Team on Marine-meteorological and Oceanographic Climatological Summaries (TT-MOCS).

The Task Team shall work during the period 2011 to 2020 on the following tasks:

1. Continue the work of the two TT-DMVOS and TT-MOCS Task Teams to realize the modernization of the Marine Climatological Summaries Scheme (MCSS);
2. Propose a Vision for 2020 for the future Marine Climate Data System (MCDS) to ultimately replace the existing MCSS;
3. Propose a Strategy for the realisation of the Vision, to be submitted to JCOMM Management Committee (MAN) through the Data Management Coordination Group (DMCG), taking into consideration the draft strategy that is provided as background document to JCOMM-IV..
4. Propose an Implementation Plan for the realisation of the Strategy to MAN through DMCG;
5. Guide and follow the development of the MCDS according to the Implementation Plan, and if necessary propose adjustments to the Implementation Plan;
6. Report regularly to the ETMC and ETDMP as appropriate;
7. Develop a MCDS website and actively promote the MCDS within the marine community.

Membership of the Task Team includes individuals from JCOMM and other partners (e.g. IODE, ICSU) with expertise in the field of marine-meteorological and oceanographic climate data:

- Nicola SCOTT (Co-Chairperson, and GCC UK)
- Gudrun ROSENHAGEN (Co-Chairperson, and GCC Germany)
- Sissy Iona (DMCG Chair, IODE Co-Chair)
- Julie FLETCHER (SOT/VOS)
- Shawn SMITH (SOT/SOOP)
- Graeme BALL (SOT)
- Eric FREEMAN (RM and VOSClim DAC)
- Elizabeth C. KENT (RM)
- Frits B. KOEK (RM)
- Hing-Yim MOK (RM)
- Svetlana SOMOVA (RM)
- Scott WOODRUFF (RM)
- Mizuho HOSHIMOTO (RM)
- Heike HAAR (GCC Germany)
- Bruce SUMNER (Associated Member, HMEI)
- Joel HOFFMAN (SOC/DB)
- Sylvain de MARGERIE (RNODC/DB)
- Shaohua LIN (ODASMS)
- Loic Petit de la VILLEON (GOSUD)
- Charles SUN (GTSPP)
- Bill BURNETT (OceanSITES)
- Norio BABA (member of ad hoc Task Team on RNODC/DB & SOC/DB integration)
- Colin PARRETT (VOSClim RTMC)
- Mukuria KIMANI (JCOMM DMCG, Kenya)
- ETDMP representative nominated by the Chair of ETDMP

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ANNEX V

PROPOSED VISION FOR THE MCDS

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 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 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, and 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 VI

DRAFT MCDS STRATEGY AND INITIAL IMPLEMENTATION PLAN

DRAFT JCOMM STRATEGY TO REALIZE THE VISION FOR A NEW MARINE CLIMATE DATA SYSTEM (MCDS)

VERSION 1.00
DECEMBER 2011

VERSION CONTROL

Version	***Date***	***Author***	***Comment***
0.01	27/7/2011	Secretariat	Outline of strategy
0.02	6/8/2011	S. Woodruff	Revision/Additions
0.03	7/9/2011	G. Rosenhagen & N. Scott	Revision/Additions
0.04	11/11/2011	E. Charpentier	Consistency with new DAC/GDAC/CMOC dataflow terminology
1.00	12/2011	MCDS workshop	New version reviewed by workshop

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NOTES

WMO DISCLAIMER

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

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EXECUTIVE SUMMARY

This document outlines a Strategy and Implementation Plan, as approved by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Expert Team on Marine Climatology, to realize the Vision by 2020 for a new Marine Climate Data System (MCDS) — replacing the legacy Marine Climatological Summaries Scheme (MCSS).

The MCDS will include the following elements:

- An integrated data-flow for the collection of marine-meteorological and oceanographic data and metadata, including real-time and delayed-mode data and metadata from *in situ* ocean observation platforms;
- Continued data rescue, and global sharing of historical records of marine-meteorological and oceanographic data archived worldwide;
- Quality Management, Higher Level Quality Control, bias correction, and comparison with satellite and meteorological and oceanographic model gridded fields to be applied to all MCDS archived data;
- Archival of the relevant data and metadata made available to end users on a free and unrestricted basis managed by a network of WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs). Data will be discoverable through the WMO Information System (WIS) and the IOC Ocean Data Portal (ODP);
- Realisation and provision of state of the art marine climate and statistical products via a flexible and interactive user interface.
- Well defined and documented data management structure for existing and new data within JCOMM.
- Much improved timescales for data availability, in particular, data originating from the Global Telecommunication System (GTS) GTS to be available by defined timescales.
- The storage and accessibility of a comprehensive data/metadata historic guide to JCOMM data, including details of past date codes/formats (decodes, dates used, any updates made), metadata regarding whole datasets etc.

This builds on continuing JCOMM efforts to modernize the MCSS—established in 1963—addressing identified issues, and taking into account new sources of historical marine-meteorological and oceanographic climate data, as well as state of the art data management techniques. The goal is to develop a standardized international data management system across JCOMM, integrating collection, rescue, quality control, formatting, archiving, exchange, and access—for marine-meteorological and oceanographic real-time and delayed-mode data and associated metadata of known quality, and products that satisfy the needs of WMO and IOC applications. In particular, ocean data requirements for long term climate monitoring, and climate services are to be addressed.

The compiled coherent data sets comply with the WMO Global Integrated Observing System (WIGOS) framework for quality management, data accessibility and being fully interoperable with the WMO Information System (WIS) and the IOC Ocean Data Portal (ODP).

The document describes the rationale and scope for the proposal, and provides detailed information on 9 key deliverables. This includes roles and responsibilities and a detailed implementation plan between 2011 and 2020, together with the list of the required resources.

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THE STRATEGY

1. Introduction and Vision

This document provides the strategy for realizing the Vision of a new Marine Climate Data System (MCDS) by 2020 that will address the requirements of WMO and IOC Applications for marine-meteorological and oceanographic climatological data.

Vision

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 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 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, and 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.

2. Background

The Marine Climatological Summaries Scheme (MCSS), established in 1963 (Resolution 35, Cg-IV), has as its primary objective the international exchange, quality control and archival of delayed-mode marine climatological data, in support of global climate studies and the provision of a range of marine climatological services. Eight Members/Member States (Germany; Hong Kong, China; India; Japan; Netherlands; Russian Federation; United Kingdom; and USA) were designated as

Responsible Members (RMs) to gather and process the data, including also data from other Contributing Members (CMs) worldwide; and to regularly publish Marine Climatological Summaries (MCS) for representative areas, in chart and/or tabular forms. Two Global Data Collecting Centres (GCCs) were established in 1993 in Germany and the United Kingdom to facilitate and enhance the flow and quality control of the data. Eventually all data are to be archived in the appropriate archives, including the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), a collection of all available surface marine observations dating from the late 1600s to present.

The MCSS has represented the core of the work of the Expert Team on Marine Climatology (ETMC) to date, and ties together two important functions:

(a.) Delayed-mode (DM) Voluntary Observing Ship (VOS) Data Management;
(b.) The production of the MCSS (tabular/graphical) Summaries (MCS).

Partly due to the longevity of the overall Scheme, the two separate functions, but particularly the data management component (a.), possess a variety of strengths. On the other hand, as JCOMM seeks to define a new, overall data management strategy, plus the establishment of new linkages between other WMO Commissions, including for Climatology (CCl) and Basic Systems (CBS), a review and restructuring of the MCSS is needed.

The Second Session of the JCOMM Data Management Coordination Group (DMCG-II, Geneva, Switzerland, 10-12 October 2006) and the Second session of the JCOMM Expert Team on Marine Climatology (ETMC-II, Geneva, Switzerland, 26-27 March 2007) acknowledged the need to modernize the current Marine Climatological Summaries Scheme (MCSS) and two task teams were established and commenced operations to investigate and initiate the work required:

The Task Team on Delayed-Mode Voluntary Observing Ship Data (TT-DMVOS): The Global Collecting Centres (GCCs) were identified as co-chairs of TT-DMVOS with a cross-cutting membership from both the JCOMM Observations Programme Area (OPA) and the Data Management Programme Area (DMPA), representing a new active area of collaboration. The TT-DMVOS considered the relationship between data available in real-time and that available in delayed-mode. User requirements for both data streams were considered, as well as some of the wider issues around the provision of data climate applications.

The Task Team on Marine-meteorological & Oceanographic Climatological Summaries (TT-MOCS): This task team was set up to improve the management of preparing marine climate summaries and to identify modern user requirements. A JCOMM questionnaire in 2005 provided information regarding the potential customer base and purposes of the MCS products. However, these justifications need to be more broadly agreed upon, to the extent that the MCS products will be managed and officially sanctioned by the ETMC and JCOMM, as opposed to produced and offered nationally. JCOMM also recommended that the ETMC explore how oceanographic and ice climatologies could be coordinated with the marine-meteorological data, so that the results could be viewed as an integrated product.

The Third Session of JCOMM (JCOMM-III, Marrakech, Morocco, 4-11 November 2009) noted with appreciation that a modernization of the MCSS had been initiated, and it endorsed the activities proposed by the DMCG and provided further guidance (see section 4.1 for details below).

The Third Session of the ETMC (ETMC-III, Melbourne, Australia, 8-12 February 2010) noted the substantial progress made by the TT-DMVOS with regard to the definition of the data-flow part of the modernization of the MCSS, including higher level quality control, and the use of co-located first guess field data from Numerical Weather Prediction (NWP), as well as satellite data. ETMC-III further proposed establishing a network of WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs). If formally appointed by JCOMM the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) could be integrated.

Following the MARCDAT-III workshop (Frascati, Italy, 2-6 May 2011), it was proposed to merge the two TT-DMVOS and the TT-MOCS into one single Task Team on the Marine Climate Data System (TT-MCDS)

The Vision for the new Marine Climate Data System (MCDS) was also proposed to and well received by the Third International Workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT-III, 2-6 May 2011, Frascati, Italy) taking into account the recommendations from the two Task Teams and the ETMC as well as lessons learned.

The Workshop for the new Marine Climate Data System (Hamburg, Germany, 28 November – 2 December 2011) reviewed the proposed Vision for the MCDS, and proposed a draft Strategy responding to this Vision, as well as an initial Implementation Plan.

The strategy is also to be reviewed by the JCOMM Expert Team on Marine Climatology (ETMC) and the IODE officers with the plan to submit the vision to JCOMM-IV for approval, and the strategy for review, assuming that the strategy and implementation plan will then be further refined.by the ETMC and the DMCG per JCOMM-IV guidance.

3. Rationale

The development of a new MCDS is essentially proposed to modernize the MCSS and address the following issues in order to better comply with current requirements of WMO and IOC Applications. Particularly those of the Global Framework for Climate Services (GFCS), the WMO-IOC-UNEP-ICSU Global Climate Observing System (GCOS), as well as the climate requirements of the WMO-IOC-UNEP-ICSU Global Ocean Observing System (GOOS) for well documented (with metadata), high quality, consistent, coherent, historical marine observation data sets.

There are a number of issues to be resolved in order to better address the requirements:

For historical reasons, the current MCSS is essentially dealing with Delayed-Mode Voluntary Observing Ship (VOS) Data (DMVOS). However, in the last thirty years, other sources of non-delayed-mode marine data such as data buoys, profiling floats, and satellites have become available, and specific Data Acquisition Centres (DACs) and Global Data Assembly Centres (GDACs) have been developed. Some coordination is required between these activities in order to provide an overall view on the current practices, and data formats used. The new MCDS should integrate all relevant observations.

The Marine Climate Summaries (MCS) as standardized decades ago through the MCSS are no longer produced by most of the Responsible Members, and the extent to which they are used is believed to be minor. Moreover there are now many new statistical and graphical products that better serve the end user needs. MCDS should take this into account and develop replacement MCS.

When JCOMM was established in 1999, the functions of the IODE Responsible Oceanographic Data Centre for Drifting Buoys (RNODC/DB) and those of the IGOSS[7] Specialized Oceanography Centre for Drifting Buoys (SOC/DB) overlapped and required action. These two functions contribute to the data collection, processing, quality control, and archiving of drifting buoy data, and are relevant to the MCDS. Although each Centre provides slightly different services, there are areas of duplication which need to be better integrated. The Global Drifter Programme (GDP) Data Assembly Centre (DAC) also provide functions that complement those of the RNODC/DB, and SOC/DB, and that would benefit from integration in the MCDS.

JCOMM-III recognized that metadata are important in a number of domains including climate applications and research (e.g. bias correction), permitting amongst other things the correct

7: IGOSS: WMO-IOC Integrated Global Ocean Services System (replaced by JCOMM in 1999)

interpretation of data, ensures traceability of standards, enhanced coherence of data records and facilitates quality monitoring activities. JCOMM-III therefore stressed that its Members/Member States should routinely provide metadata content on a routine basis and adopted Recommendation 7.1/1 (JCOMM-III) – Provision of ODAS (JCOMM Ocean Data Acquisition System) and Water Temperature Metadata. Metadata should be promptly submitted to the ODAS Metadata Service, however, in practice the Service is not working effectively because it is dedicated to metadata and lacks links with data. It would be preferable, and more effective if the ODAS Metadata Service (ODASMS) could be integrated into the MCDS, and the existing Centre operate as a CMOC to serve both data and metadata.

ICOADS is widely used and trusted internationally by marine climate data users. However, it has not yet been formally recognized by JCOMM and the parent Organizations, WMO and IOC. Becoming formally internationalized, as well as establishing similar centres in other countries that could replicate and augment their data, would facilitate the sharing of new international datasets ultimately aligning all (where possible) climate data types within JCOMM and standardizing the data management.

Because of modern practices in the marine climate community, it is now feasible to develop a set of individual marine reports that are adjusted (or corrected) in a manner that best represents our current state-of-the-art. For example the adjustments to ship data could include (but are not limited to) ship heating, Beaufort wind adjustments, height adjustment, adjustments for known instrument variations (e.g., bucket vs. intake SST), and improved Quality Assurance (QA) and Quality Control (QC) procedures (e.g. incorrect platform ID vs. type). The ETMC has developed a proposal for ICOADS to realize this, and there would be benefit for end user applications to include this into the proposed MCDS. To begin developing this work, the USA (NOAA[8], NCAR[9] and Florida State University) was recently funded by the NOAA Climate Program Office under a 3-year proposal (FY2011-13) to create an ICOADS Value-Added Database (IVAD).

Quality control procedures have dramatically improved in recent years but some standardization for higher-level quality control is needed, and the practices have to be documented. For example, it is now possible for quality monitoring purposes to compare ocean observation with co-located first guess field data from Numerical Weather Prediction (NWP), as well as satellite data.

4. Scope, proposal and deliverables

4.1 JCOMM guidance

This proposal follows the recommendations and guidance from JCOMM-III as reproduced below:

The Commission noted with appreciation that a modernization of the Marine Climatological Summaries Scheme (MCSS), originally established in 1963, had been initiated, and it endorsed the proposed activities as described at http://www.jcomm.info/MCSS-mod. In order to guide modernization efforts over the upcoming intersessional period, including exploring possibilities for interoperability, such as via the IMMA format, with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), the Commission requested the DMPA, through the ETMC, to undertake the following actions:

(a) With the Ship Observations Team (SOT), to continue to develop and agree on detailed proposals for the future international marine data-flow, including Higher Quality Control Standard (HQCS), as well as questions of format and QC interoperability;

8 NOAA: US National Oceanic and Atmospheric Administration
9 NCAR: US National Centre for Atmospheric Research

(b) To continue to consider:

(i) Making products more readily discoverable through product and services level metadata, and accessible through the use of modern web services technologies;

(ii) Integration of oceanographic and ice climatologies together with marine-meteorological information;

(c) Develop appropriate documents describing the modernization progress and amendments regarding the IMMT-III format and version V of Minimum Quality Control Standards to be proposed for the Manual on Marine-Meteorological Services and the Guide to Marine-Meteorological Services and to be implemented for all data collected as from 1 January 2011;

(d) To undertake the modernization, to continue to implement the revised data management scheme and the end user product development, and continue to review the value and effectiveness of these modernization steps.

4.2 The proposal

The modernization of the Marine Climatological Summaries Scheme (MCSS) will be fully integrated in to the new Marine Climate Data System (MCDS), and will be fully documented in the appropriate WMO and IOC Publications, e.g.:

- WMO No. 558 – Manual on Marine-Meteorological Services: Part I, Chapter 5 to be renamed to “Marine Climate Data System”, and corresponding annexes to be renamed, replaced, deleted, or new annexes added as needed;
- WMO No. 471 – Guide to Marine-Meteorological Services: Chapter 3 to be replaced and corresponding annexes to be renamed, replaced, deleted, or new annexes added as needed;

New elements will be added into the MCDS to consider those climate requirements which are not covered by the modernized MCSS, and in particular ocean data management as governed through the IODE.

In line with the vision detailed in section 1, the MCDS will include the following elements:

- An integrated data-flow for the collection of marine-meteorological and oceanographic data and metadata, including real-time and delayed-mode data and metadata from *in situ* ocean observation platforms;
- Continued data rescue, and global sharing of historical records of marine-meteorological and oceanographic data archived worldwide;
- Quality Management, Higher Level Quality Control, bias correction, and comparison with satellite and met./ocean model gridded fields to be applied to all MCDS archived data;
- Archival of the relevant data and metadata made available to end users on a free and unrestricted basis managed by a network of WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOC). Data will be discoverable through the WMO Information System (WIS) and the IOC Ocean Data Portal (ODP);
- Realisation and provision of state of the art marine climate and statistical products via a flexible and interactive user interface.
- Well defined and documented data management structure for existing and new data within JCOMM.
- Much improved timescales for data availability, in particular, data originating from the GTS to be available by defined timescales.

- The storage and accessibility of a comprehensive data/metadata historic guide to JCOMM data, including details of past date codes/formats (decodes, dates used, any updates made), metadata regarding whole datasets etc.

An implementation plan will be developed to respond to the strategy. The implementation plan will initially focus on sub-deliverables that can be easily achievable (e.g. VOS data-flow, former RNODC/DB and current SOC/DB integration, CMOC(s)). As draft implementation plan in proposed in Appendix I.

4.3 Deliverables

The proposal includes the following deliverables:

Deliverable 1 - Data-flow

Description:	An integrated and well structured data-flow to include not only delayed-mode VOS data but other sources of marine-meteorological and oceanographic data for use in climatological applications. This deliverable includes (i) a modernized VOS data-flow; (ii) the contribution of RNODC/DB and SOC/DB to the MCDS; and (iii) the contribution of the various specialized Data Acquisition Centres (DACs) and Global Data Assembly Centres (GDACs) (GMBA[10], Argo, OceanSITES[11], GOSUD[12], GTSPP[13], …) to the MCDS. The management of ocean data is realized in cooperation and synergy with the IODE. Existing and relevant data systems are listed in Annex E.
Implemented through:	GDACs, DACs
Tasks:	Define the data-flow template proposal, with details of generic roles and responsibilities. For all relevant data types use the data-flow template to display compliance with the proposed structure. Update relevant chapters of the WMO and IOC Publications, and relevant IOC Manuals and Guides to reflect new corresponding obligations of Members/Member States as well as guidance to them respectively.
Target dates:	2014 (Step#1, DMVOS, RNODC/DB & SOC/DB), then (Step#2, other ocean data, e.g. GOSUD[12], OceanSITEs[11], GLOSS[14], GTSPP[13], Argo)

Deliverable 2 – Quality Control

Description:	Update the Minimum Quality Control Standard (MQCS) for VOS data. Document quality control procedures used for other types of data, and then standardize, if needed, minimum QC procedures. Develop a Higher Level Quality Control for all types of appropriate marine-meteorological and oceanographic data.

10 GMBA: Global Moored Buoy Array
11 OceanSITEs: Ocean Sustained Interdisciplinary Timeseries Environment observation System
12 GOSUD: Global Ocean Surface Underway Data Pilot Project
13 GTSPP: Global Temperature and Salinity Profile Programme
14 GLOSS: Global Sea Level Observing System (JCOMM)

Implemented through: DACs, GDACs, CMOCs, and other partners (e.g. ICSU for the World Data System)

Tasks:
Propose an update of MQCS to JCOMM-IV (MQCS-7).
Refine the Higher Level Quality Control (HLQC) proposal, and document it (e.g. as new JCOMM Technical Report).
Update relevant chapters of the WMO and IOC Publication accordingly to reflect obligations of Members/Member States as well as guidance to them respectively.
Update or create new IOC Manual & Guide if needed

Target date: 2016

Deliverable 3 – Value added marine climate data

Description: The overall goal of the activity is to develop a set of individual marine reports that are adjusted (or corrected) in a manner that best represents our current state-of-the-art. This will include consideration of establishing interoperable *in situ* and satellite climatologies and products (e.g. SST data from GHRSST[15]). This links naturally with the WMO Information System, and the development of interoperability arrangements with WIS through WIGOS. For example, the adjustments could include (but are not limited to) ship heating, Beaufort wind adjustments, height adjustment, adjustments for known instrument variations (e.g., bucket vs. intake SST), improved QA/QC procedures (e.g. incorrect platform ID vs. type).

Implemented through: CMOCs, and other partners (e.g. ICSU for the World Data System)

Tasks:
Establish Pilot Project and Steering Team for value added ICOADS
Run Pilot Project for creation of a value-added ICOADS version (e.g., bias corrected), and make recommendations
Document procedures, and how the data should be interpreted through a new JCOMM Technical Report.

Target date: 2014 (first step)

Deliverable 4 – Data Exchange Protocols

Description: Agree on data collection and exchange protocols and formats (e.g. IMMA[16], netCDF)

Implemented through: GDACs, CMOCs

Tasks:
TT-MCDS to investigate requirements and possible options for a data exchange format(s).
Ensure selected format(s) is flexible enough to meet foreseeable future requirements
If needed, propose new format(s) to JCOMM
Develop software to convert historical formats into the new format(s) and make it freely available
Update relevant chapters of the WMO and IOC Publications to reflect new preferred format(s).

15 GHRSST: Group for High Resolution SST
16 IMMA: International Maritime Meteorological Archive

Target date: 2016

Deliverable 5 - Co-located data

Description: Consideration of the use of co-located model field, reanalysis of historical data, and satellite data for use within the Higher Quality Control Standard (HQCS) for in situ data

Implemented through: CMOCs

Tasks: Propose an ad-hoc task team to investigate requirements and feasibility.

Target date: 2016

Deliverable 6 - CMOC

Description: Development of a global network of WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data (CMOC) that are fully interoperable with the WMO Information System (WIS) and the IOC Ocean Data Portal (ODP), are 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). A candidate CMOC will follow the procedures described in the appropriate WMO and IOC Publications, and

(i) contribute to WMO and IOC Applications for example by rescuing, collecting, processing, quality control, archiving, sharing,distributing, and mirroring worldwide marine-meteorological and oceanographic data and metadata according to procedures documented in the appropriate WMO and IOC Publications;
(ii) advise Members/Member States internationally on enquiries regarding standards and best practices for example on the rescue, collection, processing, quality control, archival, distribution, and mirroring of marine-meteorological and oceanographic data, metadata, and products;
(iii) make data sets, and corresponding metadata, maintained as part of its scope available, and discoverable through the WIS;
(iv) must communicate and liaise closely within the network; particularly on the development of quality processes and procedures, meeting on a regular basis
(v) operate appropriate data processing and quality control procedures, and generate the required products within its scope;
(vi) closely cooperate with the network of other CMOC in the rescue, exchange, processing, and archival of marine-meteorological and oceanographic data and metadata, such that the set of data and products offered from the CMOC network is mutually consistent when accessed from any individual Centre; and
(vii) should report, on an annual basis, to the JCOMM Management Committee 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 informed on the status and activities of the CMOC network as a whole, and propose changes, as required.

Implemented through: CMOC(s)

Tasks: Agree on Terms of Reference for CMOC, governance and approval process for establishing new CMOC, content of statement of compliance.
Draft Recommendation to be submitted to JCOMM-IV for approval.
Candidate CMOC(s) to submit statements of compliance.

Candidate CMOCs to collaborate between themselves and share data.
Agree on data exchange protocols and formats.
Update relevant chapters of the WMO and IOC Publications, accordingly to reflect obligations of Members/Member States as well as guidance to them respectively.

Target date: 2012, 2016, 2020, …

Deliverable 7 - Metadata

Description: Integration of the ODAS Metadata Service (ODASMS) with the relevant data which can be realized through integrating the ODASMS into a CMOC. The storage and accessibility of a comprehensive metadata guide to JCOMM data (e.g. WMO Publication No. 47).

Implemented through: CMOC

Tasks: Agree on metadata collection and exchange format(s).
Investigate metadata rescue (e.g. buoy metadata)
Members to submit metadata together with their data submissions through GDACs or CMOC(s) (if no DAC/GDAC available for collecting the type of data).
Develop a easily accessible comprehensive metadata guide, including details of past date codes/formats (decodes, dates used, any updates made), metadata regarding whole datasets etc.
CMOC to include metadata management as part of their activities.
Update relevant chapters of the WMO No. 558, and 471, and IOC Manuals and Guides accordingly to reflect obligations of Members/Member States as well as guidance to them respectively.

Target date: Drifters and selected moorings (e.g. GMBA) 2014, ODAS 2016, Guide 2020

Deliverable 8 - Interoperability

Description: Full interoperability of MCDS with the WIS and ODP

Implemented through: GDACs, CMOC(s)

Tasks: CMOC(s) to develop or maintain interoperability with the WIS and ODP.
GDACs to develop interoperability with the WIS and ODP.
CMOC to possibly apply as WIS National Centres (NCs) or Data Collection and Production Centres (DCPCs).
Harmonization of the MCDS functionalities with the WIS and the other IOC data systems

Target date: 2014

Deliverable 9 - MCS

Description: Marine Climate Summaries (MCS)

Implemented through: TT-MCDS and ETMC (standards), and CMOCs (implementation)

Tasks: Define roles and responsibilities for producing MCSs (e.g. CMOC) on a minimal requirement basis.
Update relevant chapters of the WMO and IOC Publications (in particular WMO No. 558, and 471) accordingly to reflect obligations of Members/Member States as well as guidance to them respectively.

Target date: 2016

5. Roles and responsibilities

To develop the MCDS, an ETMC Task Team on MCDS is being established. Terms of Reference and membership of the Task Team are listed in Annex C. The Task Team will be required to coordinate with appropriate WMO and IOC bodies, and with the Expert Team on Marine Climatology (ETMC), as well as the centres implementing specific functions of the MCDS in particular.

Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)

- JCOMM will be invited to approve the recommendations (technical regulations, establishment of specific components contributing to the MCDS, governance) passed to it by the MCDS Task Team through the Expert Team on Marine Climatology (ETMC), the Data Management Coordination Group (DMCG), and the Management Committee (MAN). Those recommendations will then be passed to the WMO and IOC Executive Bodies for approval. Progress will be reported regularly to the ETMC, DMCG, and MAN.

- The JCOMM Observations Programme Area (OPA), its Coordination Group (OCG), and its Observations Panels, in collaboration with CBS, will assist in the development of best practices and standards, and ensure that the flow of real-time and delayed-mode observations will eventually be provided through the MCDS, the WIS and partner ocean data systems. This includes a collaboration with the Data Buoy Cooperation Panel (DBCP), the Ship Observations Team (SOT), the Global Sea Level Observing System (GLOSS), and the Ocean Sustained Interdisciplinary Timeseries Environment observation System (OceanSITES).
- JCOMM shall communicate on the benefits of the MCDS (e.g. through dedicated webpages, JCOMM Newsletter, communications during JCOMM meetings).

JCOMM Associated Programmes

- Ocean Observations Programmes associated to JCOMM such as Argo, IOCCP[17], and GO-SHIP will be invited to contribute to the MCDS.

IOC (of UNESCO) Committee for the International Oceanographic Data and Information Exchange (IODE)

- The IODE Committee will assist in the development of MCDS, in particular for standards (see list in Annex D), documentation, and accreditation process, for example through the joint IODE-JCOMM standards development and accreditation process[18]..

- The JCOMM-IODE Expert Team on Data Management Practices (ETDMP) will provide guidance for realizing interoperability of the MCDS with the Ocean Data Portal (ODP).

- The JCOMM-IODE Global Ocean Surface Underway Data Pilot Project (of IODE, JCOMM)

17 IOCCP: International Ocean Carbon Coordination Project (IOC)
18 : Ocean Data Standards (ODS) process - http://www.oceandatastandards.org/

(GOSUD) will be consulted, and invited to contribute its data to the MCDS.

- The JCOMM-IODE Global Temperature and Salinity Profile Programme (GTSPP) will be consulted, and invited to contribute its data to the MCDS.

- The IODE Global Oceanographic Data Archaeology and Rescue (GODAR) will be consulted, and invited to contribute to the MCDS

- IODE will assist to contribute ocean biological data of interest to climate application to the MCDS (e.g. Ocean Bio-Geographical Information System - OBIS).

WMO Commission for Basic Systems (CBS)

- CBS is responsible, in particular, for the cooperation with Members, other technical commissions and relevant bodies in the development and operation of the required integrated data systems in response to requirements of all WMO Programmes and opportunities provided by technological developments. The development of the WIS is undertaken in the framework of the CBS. Interoperability with the WIS being a key deliverable of the activity, consultation with the CBS will be required as appropriate.

WMO Commission for Climatology (CCl)

- A coordinated approach between JCOMM and the CCl to marine and environmental data and data management, including data rescue must be promoted as part of the MCDS developments. This includes collaborative development of required interoperability standards and systems for data exchange; collaboration on WIGOS, and GCOS/GOOS (to ensure best practices in observational systems serving the climate program); in developing climate indices and defining and monitoring extremes; and in capacity building and training. This can essentially be realized through linkages between the ETMC and the Open Panel of CCl Experts (OPACE) on Climate Data Management (OPACE-1), e.g. the Expert Team on Climate Database Management Systems (ET-CDBMS).
- High Quality Global Data Management System for Climate (HQ-GDMSC)

WMO Members and IOC Member States

In addition, building on existing systems, MCDS development will require coordination and contributions with/from WMO Members and IOC Member States, including:

- Data Acquisition Centres (DACs): Centres receiving data from various JCOMM data sources in agreed formats in delayed-mode and real-time
  (a) Delayed-mode DACs (DM-DAC) – Receiving data from a specific data source in delayed-mode, applying agreed MQC, investigating problems when required and forwarding of data to the appropriate GDAC
  (b) Real-time DACs (RT-DAC) – Existing GTS Centres receiving data from all real-time sources

- Global Data Assembly Centres (GDACs): Selected centres combining data of all streams from their appropriate DAC. Their role is to establish a unique, complete dataset (including metadata), perform agreed quality checks and forward the data and metadata with flags to the CMOC in agreed formats. Data from both, delayed-mode and real-time should be compared and linked. It is mandatory that the GDACs are registered as WIS DCPCs.

- JCOMM Centres for Marine-meteorological and Oceanographic Climate Data (CMOC): All data (original and QCed) and metadata received from GDACs are forwarded to the suitable CMOC. CMOC acts as a mirroring network of data stores, applying HQCS, making datasets available to the user interface and advising member/members states when

appropriate (see CMOC Terms of Reference for further information). Data and metadata are stored in line with defined JCOMM standards to ensure data integrity and universal interoperability.

- JCOMM improved data access: Universal data acess system for searching, downloading, displaying and analysis of JCOMM data and products. It provides a flexible tool with variable privileges for all users to manipulate the data. In particular, the tool must allow:
    - Interactive searching by element, time, location, geographical feature, data type
    - Fast and easy downloading into various codes and formats
    - Interactive displays – maps, tables – allowing GIS layering
    - Versatile analysis to generate and visualise standardised and bespoke climatological products and statistics in suitable forms

- ICOADS which is managed by the USA will be invited to contribute to the MCDS as a CMOC;

- The operators of the various ocean data centres, DACs and GDACs concerned:

    - Canada (GTSPP, RNODC/DB)
    - France (Argo GDAC, SOC/DB, GOSUD)
    - USA (Argo GDAC, OceanSITEs, GTSPP, GOSUD)
    - UK (PSMSL[19])
    - European projects such as SeaDataNet, and MyOcean

- The ODASMS which is operated by China will be invited to consider enhancing the service and integrating it within a CMOC;

- Other potential actors

6. Data and software policy

All components of the MCDS must make all the data, metadata, and products falling within the scope of the MCDS freely and openly available to the international community in a way consistent with:

(a) WMO Resolution 40[20] (Cg-XII) - WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities;

(b) Resolution IOC-XXII-6[21] - IOC Oceanographic Data Exchange Policy;

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.

7. Quality Management

19 PSMSL: Permanent Service for Mean Sea Level

20 : Full text of the Resolution can be found at http://www.wmo.int/pages/about/Resolution40_en.html . The Resolution in particular states that "as a fundamental principle of WMO, and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted (non-discriminatory and without charge) international exchange of meteorological and related data and products."

21 : Full text of the resolution can be found at http://www.ioc-goos.org/ioc-xxii-6 . The Resolution is particularly promoting the timely, free and unrestricted access to all data, associated metadata and products.

The MCDS is planning to include appropriate Quality Management (QM) for all of its deliverables. By promoting standards, documenting them as part of appropriate WMO and IOC Publications, as well as documenting its procedures, the MCDS will ensure that the required data quality standards are met and sustained for all WMO and IOC programme requirements.

The goal is to facilitate improved data management including collection of relevant delayed-mode data, data rescue, data processing, and quality control, value adding, archival, data exchange and data retrieval capabilities.

The MCDS is therefore promoting the development and implementation of Quality Management Systems (QMS) for each of its components, in compliance with the WMO and IOC quality policies, including the WMO Quality Management Framework (QMF). It is recommended to compile at the national level, regulatory documentation produced in a way consistent with the eight Quality Management Principles[22] developed under ISO Technical Committee 176 (TC176): User / customers focus, Leadership, Involvement of people, Process approach, System approach to management, Continual improvements, Factual approach for decision making, and Mutually beneficial supplier relationships. This may lead in some instances to the certification of such QMS related to the relevant MCDS data and products. ISO 9001 certification will not be mandatory, as some of the meteorological and / or oceanographic centres contributing to the MCDS might wish to comply with other standards than ISO.

8. Capacity development

The use of the IODE OceanTeacher and a dedicated MCDS website for sharing this documentation is something to be considered.

In a way consistent with the WMO and IOC strategies for Capacity Building, training materials about MCDS will shared using modern technology such as e-learning, e.g through the IODE project office, and WMO Regional Training Centres.

CMOCs can be a mechanism used for assisting developing countries in rescuing their data, and developing their own capacities for the management of ocean climate data.

9. Standards, protocols and formats

If necessary, the MCDS will require the updating of existing standards and the development of new ones as described in the table in Annex D.

10. Implementation plan

The detailed initial implementation plan responding to this strategy, with proposed steps for each deliverable, actors and deadlines is provided in Annex A.

11. Resources

The table in Annex B provides some information on the preliminary resources required to develop and operate the future MCDS.

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22: http://www.iso.org/iso/iso9000-14000/understand/qmp.html

ANNEX A

INITIAL IMPLEMENTATION PLAN

Note: It is recommended to merge the workplan of the former TT-DMVOS into this implementation plan.

No.	*Deliverable*	*Action*	*By*	*Deadline*	*Comment*
	All	Agree on ToR for the new TT-MCDS	TT-MCDS	08/2011	
	1	Data-flow proposal / DMVOS : Refine the proposal, with roles and responsibilities of the different actors	GCCs	11/2011	
	1	Data-flow proposal / Buoy data: Refine the proposal, with roles and responsibilities of the different actors	ISDM, AOML, Météo France	11/2011	
	1	Data-flow proposal / DMVOS: Agree on data collection and exchange protocols and formats	GCCs, RMs, CMs	11/2011	New version, IMMT Decide on the need for future/new data exchange format(s)
		Data-flow proposal / Buoy data: Agree on data collection and exchange protocols and formats	ISDM, AOML, Météo France	TBD	
	1	Data-flow proposal / DMVOS: Make proposal for the updating relevant chapters of relevant WMO Publications to reflect new corresponding obligations of Members/Member States as well as guidance to them respectively.	GCCs & ETMC	11/2011	To be submitted to JCOMM-IV
		Data-flow proposal / Buoy data: Make proposal for the updating of relevant chapters of relevant WMO Publications to reflect new corresponding obligations of Members/Member States as well as guidance to them respectively.	DBCP & ETMC	2014	
	1	Data-flow proposal / Ocean data[23]: Refine the proposal, with roles and responsibilities of the different actors	DMCG in coop. with IODE	2015	
	1	Data-flow proposal / Ocean data[23]: Agree on data collection and exchange protocols and formats	ETDMP	2015	New data exchange format(s)
	1	Data-flow proposal / Ocean data[23]: Propose updating relevant chapters of the IOC Manuals and Guides to reflect new corresponding obligations of Members/Member States	ETDMP	2013	To be submitted to IODE-22

23 Ocean Data refers to ocean observations such as from Argo profling floats, OceanSITEs, GOSUD, GTSPP, GLOSS

		as well as guidance to them respectively.			
	7	Clarify the legacy of ODASMS within MCDS	NMDIS	2012 ?	
	6	Candidates to submit statement(s) of compliance for CMOC (e.g. ICOADS, China)	Candidate CMOC	TBD	For consideration by JCOMM-IV, Statements of Compliance need to be submitted by candidates no later than March 2012
	All	Organize MCDS preparatory workshop	ETMC, TT-DMVOS, TT-MOCS, Secretariat	11/2011	Done
	All	Propose draft Recommendation to JCOMM-IV on MCDS	ETMC	11/2011	
	All	Compile required changes to WMO No. 558, and 471 for modernized VOS data-flow, and draft JCOMM-IV Recommendation	ETMC, Secretariat	12/2011	
	All	Approve JCOMM-IV Recommendations regarding MCDS	JCOMM-IV	5/2012	
	All	Propose draft Recommendation to subsequent JCOMM session on MCDS	ETMC	JCOMM-V:2017	
	All	Compile required changes to relevant WMO and IOC Publications for MCDS for submission to subsequence JCOMM and IODE Sessions	Secretariat	JCOMM-V:2017 IODE-22:2013	
	2	Propose new version of the MQCS if necessary	GCCs	2012	For JCOMM-IV
	2	Refine the HLQC proposal, and propose updating chapters of the relevant WMO and IOC Publications accordingly to reflect obligations of Members/Member States as well as guidance to them respectively	GDACs, CMOCs	2016	
	3	Establish Pilot Project and Steering Team for value added ICOADS	ETMC	01/2012	
	3	Run Pilot Project for creation of a value-added ICOADS version (e.g., bias corrected), and make recommendations	PP Steering Team	2020	
	3	Value added marine climate data: Document procedures, and how the data should be interpreted through a new JCOMM Technical Report.	ETMC	2020	
	4	Propose a new ad hoc task team for Data Exchange Protocols.	ETDMP	2012	
	5	Propose a new ad hoc task team for use of model field and satellite data with the HQCS.	ETMC	2013	
	6	Make proposal for Terms of Reference for CMOC, governance and approval process for establishing new CMOC, content of statement of compliance.	Workshop MCDS, ETMC	11/2011	
	6	Candidate CMOC(s) to develop synchronized data	Candidate	2012,	

		holdings, with harmonized quality management, .	CMOC	and ongoing	
	6	CMOC: Agree on data exchange protocols and formats	CMOC, TT-MCDS, ETMC	2014	
	6	CMOC: Update relevant chapters of the relevant chapters of WMO and IOC Publications accordingly to reflect obligations of Members/Member States as well as guidance to them respectively	TT-MCDS, ETMC, ETDMP	TBD	
	7	Agree on metadata collection and exchange format(s).	ODASMS, CMOC(s)	2016	
	7	Members to submit metadata together with their data submissions through DACs, GDACs or CMOC(s).	Members/Member States	2016, then ongoing	
	7	CMOC(s) to include metadata management as part of their activities.	CMOC	2016	
	7	Metadata: Update relevant chapters of the WMO and IOC Publications accordingly to reflect obligations of Members/Member States as well as guidance to them respectively.	TT-MCDS, ETMC, ETDMP	2016	
	8	CMOC to develop interoperability with the WIS and ODP, and possibly apply as WIS NCs or DCPCs..	CMOC	2014	
	8	GDACs to develop interoperability with the WIS and ODP, and possibly apply as WIS NCs or DCPCs.	GDACs	2014	
	9	Agree on some minimum requirements for the production of MCSs.	CMOC, ETMC, ETDMP	2016	
	9	Define roles and responsibilities for producing MCSs (e.g. CMOC).	CMOC, ETMC, ETDMP	2016	
	9	MCS: Update relevant chapters of the WMO and IOC Publications accordingly to reflect obligations of Members/Member States as well as guidance to them respectively.	CMOC, ETMC, ETDMP	2016	

ANNEX B

RESOURCES

The table below provides some information on the resources required to develop and operate the future MCDS.

Coordination of the overall activities will be made by email, but face to face meetings of experts will still be required although the financial resources required for the following activities cannot be estimated at this point. WMO and IOC Secretariats will strive to identify appropriate resources to be committed in support of these developments. This table will be refined as the implementation of the MCDS progresses.

No.	***Activity***	***Year(s)***	***Supported by (examples)***	***Comment***
	MCDS kick-off workshop, Nov./Dec. 2011	2011	WMO	
	ETMC-IV Session, 2012	2012	WMO	Some other sources of funding to be found; or participants to attend self funded
	TT MCDS workshop, 2014	2014	TBD	In conjunction with ETMC-V or other event
	ETMC-V Session, 2014	2014	WMO	Some other sources of funding to be found; or participants to attend self funded
	ETMC-VI Session, 2016	2016	TBD	
	TT-MCDS workshop, 2018	2018	TBD	In conjunction with ETMC-VI or other event
	ETMC-VII Session, 2018	2018	TBD	
	Deliverable 1 - Data-flow / DMVOS (Step 1)	2012	UK, Germany	
	Deliverable 1 - Data-flow / DMVOS (Step 2)	2012-2016	UK, Germany	
	Deliverable 1 – Data-flow / RNODC/DB & SOC/DB	2012	Canada, France	
	Deliverable 1 – Data-flow / GDACs – Argo	2012-2020	France, USA	
	Deliverable 1 – Data-flow / GDACs – OceanSITES	2012-2016	France, USA	
	Deliverable 1 – Data-flow / GDACs – GOSUD	2012-2016	France, USA	
	Deliverable 1 – Data-flow / GDACs – GTSPP	2012-2020	USA, Canada	
	Deliverable 1 – Data-flow / GDACs – GLOSS	2012-2016	UK, USA	
	Deliverable 2 – Quality Control	2012-2016	UK, Germany	
	Deliverable 3 – Value added marine climate data	2012-2020	USA	
	Deliverable 4 – Data Exchange Protocols	2011-2016	TBD	
	Deliverable 5 – Co-located data	2012-2016	UK, Germany, USA	
	Deliverable 6 – CMOC / ICOADS	2012	USA	
	Deliverable 6 – CMOC / Other ?	2012-2020	Members/Member States	
	Deliverable 7 – CMOC / China	2012 – 2016	China	ODASMS to be integrated
	Deliverable 8 – Interoperability	2012-2014	Members/Member States operating	

			CMOC	
	Deliverable 9 – MCS	2012-2016	Members/Member States operating CMOC	

ANNEX C

TERMS OF REFERENCE AND MEMBERSHIP OF THE ETMC TASK TEAM ON THE MARINE CLIMATE DATA SYSTEM (MCDS)

The Task Team on the Marine Climate Data System (TT-MCDS) replaces (i) the Cross Cutting DMPA-OPA Task Team on Delayed-Mode VOS Data (TT-DMVOS), and (ii) the DMPA/ETMC Task Team on Marine-meteorological and Oceanographic Climatological Summaries (TT-MOCS).

The Task Team shall work during the period 2011 to 2020 on the following tasks:

8. Continue the work of the two TT-DMVOS and TT-MOCS Task Teams to realize the modernization of the Marine Climatological Summaries Scheme (MCSS);
9. Propose a Vision for 2020 for the future Marine Climate Data System (MCDS) to ultimately replace the existing MCSS;
10. Propose a Strategy for the realisation of the Vision, to be submitted to JCOMM Management Committee (MAN) through the Data Management Coordination Group (DMCG), taking into consideration the draft strategy that is provided as background document to JCOMM-IV..
11. Propose an Implementation Plan for the realisation of the Strategy to MAN through DMCG;
12. Guide and follow the development of the MCDS according to the Implementation Plan, and if necessary propose adjustments to the Implementation Plan;
13. Report regularly to the ETMC and ETDMP as appropriate;
14. Develop a MCDS website and actively promote the MCDS within the marine community.

Membership of the Task Team includes individuals from JCOMM and other partners (e.g. IODE, ICSU) with expertise in the field of marine-meteorological and oceanographic climate data:

- Nicola SCOTT (Co-Chairperson, and GCC UK)
- Gudrun ROSENHAGEN (Co-Chairperson, and GCC Germany)
- Sissy Iona (DMCG Chair, IODE Co-Chair)
- Julie FLETCHER (SOT/VOS)
- Shawn SMITH (SOT/SOOP)
- Graeme BALL (SOT)
- Eric FREEMAN (RM and VOSClim DAC)
- Elizabeth C. KENT (RM)
- Frits B. KOEK (RM)
- Hing-Yim MOK (RM)
- Svetlana SOMOVA (RM)
- Scott WOODRUFF (RM)
- Mizuho HOSHIMOTO (RM)
- Heike HAAR (GCC Germany)
- Bruce SUMNER (Associated Member, HMEI)
- Joel HOFFMAN (SOC/DB)
- Sylvain de MARGERIE (RNODC/DB)
- Shaohua LIN (ODASMS)
- Loic Petit de la VILLEON (GOSUD)
- Charles SUN (GTSPP)
- Bill BURNETT (OceanSITES)
- Norio BABA (member of ad hoc Task Team on RNODC/DB & SOC/DB integration)
- Colin PARRETT (VOSClim RTMC)
- Mukuria KIMANI (JCOMM DMCG, Kenya)
- ETDMP representative nominated by the Chair of ETDMP

ANNEX D

MARINE CLIMATE DATA SYSTEM (MCDS) STANDARDS

This table provides a list of standards required to operate the MCDS, and provides information on current versions, purpose and scope, where these standards are published, what MCDS components should be using them, responsible bodies for maintaining them, and target dates for the implementation of new versions.

Standards	***Current Version (date)***	***Description***	***Published in***	***Relevant components***	***Body responsible***	***Target date for new version(s)***
MCDS	n/a	This standards provides for the overall Technical Regulations of the MCDS, and its components.	WMO 558, 471	All	JCOMM[24]	2016, 2020
IMMT	IV (2009)	The International Marine-Meteorological Tape (IMMT) format is used for the collection of delayed-mode VOS data, including appropriate observations, metadata, and quality control fields.	WMO 558, 471	GCCs, RMs, CMs, then DACs, GDACs	JCOMM[24]	2012, 2016, 2020
MQCS	VI (2009)	Minimum Quality Control Standard (MQCS) is used for the quality control of delayed-mode VOS data.	WMO 558, 471	GCCs, RMs, CMs, then DACs, GDACs	JCOMM[24]	2012, 2016, 2020
HQCS	n/a	This standard provides for Higher Level Quality Control (HQCS) of appropriate delayed-mode marine-meteorological data.	WMO 471	GCCs, RMs, CMs, then GDACs, CMOCs	JCOMM[24]	2012, 2016, 2020
IMMA		The International Maritime Meteorological Archive (IMMA) data format is used for the archival and distribution of marine-meteorological and oceanographic data at ICOADS (present), and CMOC (future)	WMO 471	ICOADS, then CMOC	USA then JCOMM[24]	2016, 2020
MCS	(1963?)	This provides for a standardization of Marine Climate Summaries (MCS) as produced by CMOC.	WMO 471	CMOC	JCOMM[24]	2016, 2020
ODAS metadata	(1999)	This standard provides for a format for the collection and exchange of Ocean Data Acquisition Systems (ODAS) metadata	WMO 471	CMOC	JCOMM[24]	2016, 2020

24: Formats developed and recommended by the ETMC

ANNEX E

Data types potentially contributing to the Marine Climate Data System (MCDS)

(9 Nov. 2011)

Note: the list of potential contributors is not exhaustive, and other candidate centres can be added if applicable. The exact roles of DACs and GDACs still need to be refined.

Data type	*Panel*	*Effort*[i]	*Existing RT source*	*Existing DM source*	*DAC*	*GDAC*	*CMOC*
VOS	VOSP[ii]	Underway/2012	GTS/FM-13 SHIP GTS/FM-94 BUFR	PMOs[iii]	RT[iv]: GCCs[v] DM[vi]: RMs[vii]	GCCs[v]/IMMT	ICOADS[viii] NODCs[ix]
Surface underway T&S	GOSUD[x]	Moderate	GTS/FM-62 TRACKOB GTS/FM-94 BUFR	GOSUD[x] PIs	GOSUD[x] Participants	GOSUD GDAC[xi]/netCDF	ICOADS[viii] WDCs[xii] WOA[xiii] ? WOD[xiv] NODCs[ix]
Upper Ocean T&S	GTSPP[xv]	Moderate	GTS/FM-63 BATHY	GTSPP[xv] PIs	RT[iv]: ISDM[xvi] DM[vi]: GTSPP[xv] DACs	US-NODC/ netCDF	WDCs[xii] , WOA[xiii] WOD[xiv] NODCs[ix]
Argo	AST[xvii]	Moderate	GTS/FM-64 TESAC GTS/FM-94 BUFR Argo/NetCDF	Argo PIs	Argo national DACs[xviii] ARCs[xix]	Argo GDACs[xx]/netCDF Argo GADR[xxi]	WDCs[xii] , WOA[xiii] WOD[xiv] NODCs[ix]
Drifters	DBCP[xxii]/GDP[xxiii]	Underway/2012	GTS/FM-18 BUOY GTS/FM-94 BUFR	Service Argos	RT[iv]: SOC/DB[xxiv] DM[vi]: GDP[xxiii] DAC[xxv] & SOC/DB[xxiv]	RNODC/DB[xxvi] (Canada)	ICOADS[viii] NODCs[ix], WOD[xiv] (th. chains only)
Meteorological Moored Buoys	DBCP[xxii]	To be discussed	GTS/FM-13 SHIP GTS/FM-94 BUFR	NMHSs[xxvii]	To be decided	To be decided	ICOADS[viii] NODCs[ix] ?
Global Tropical Moored Buoys Array (GTMBA)	DBCP[xxii]/TIP[xxviii]	Moderate	Surface data & T profiles GTS/FM-18 BUOY GTS/FM-94 BUFR	Sub-surface data TAO[xxix] PIs	???	TAO GDACs[xxx]	ICOADS[viii] WDCs[xii] WOA[xiii] WOD[xiv] NODCs[ix]
Ocean Reference Sites	OceanSITEs[xxxi]	Moderate	GTS/FM-18 BUOY GTS/FM-94 BUFR	OceanSITEs[xxxi] PIs	DACs	OceanSITEs[xxxi] GDACs[xxxii]/netCDF	ICOADS[viii] WDCs[xii] WOA[xiii] WOD[xiv] NODCs[ix]
Tide gauges	GLOSS[xxxiii]	To be discussed		GLOSS[xxxiii] PIs	National Centres	- DM[vi]: PSMSL[xxxiv] & UHSLC[xxxv] JASL[xxxvi]	ICOADS[viii] ? NODCs[ix] ?

Data type	*Panel*	*Effort*[i]	*Existing RT source*	*Existing DM source*	*DAC*	*GDAC*	*CMOC*
						- RT[iv]: VLIZ[xxxvii] & UHSLC[xxxv] - HF[xxxviii]: BODC[xxxix] & UHSLC[xxxv] - GNSS[xl]: TIGA[xli]	
Tsunameters	DBCP[xxii]/ITP[xlii]	To be discussed	GTS/FM-94 BUFR FTP/FM-94 BUFR	USA (15sec data by FTP)	Regional Tsunami Watch Centres (input from Australia, Chile, Russia, Thailand, USA) India/FTP	NDBC provides global visual interface	ICOADS[viii] ? NODCs[ix]
Gliders	None	Important	Miscellaneous	Miscellaneous	To be discussed	To be discussed	NODCs[ix] WOD[xiv]
High Resolution SST data from satellites	GHRSST[xliii]	Moderate	Space agencies GTS/Multiple sources for *in situ* data	Space agencies	RDACs[xliv]	GHRSST GDAC[xlv] GHRSST LTSRF[xlvi]	WDCs[xii], NODCs[ix]

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i: Effort needed to have the considered data contribute to the MCDS
ii: VOSP: Ship Observations Team (SOT) Voluntary Observing Ship's Scheme (VOS) Panel
iii: PMOs: Port Meteorological Officers
iv: RT: Real-Time
v: GCCs: Marine Climatological Summaries Scheme (MCSS) Global Collecting Centres (UK, Germany)
vi: DM: Delayed Mode
vii: RMs: Marine Climatological Summaries Scheme (MCSS) Responsible Members (Germany, Hong Kong-China, India, Japan, Netherlands, Russia, UK, USA)
viii: ICOADS: International Comprehensive Ocean-Atmosphere Data set (NOAA & NCAR, USA)
ix: NODCs: International Oceanographic Data and Information Exchange (IODE) National Oceanographic Data Centres
x: GOSUD: Global Ocean Surface Underway Data Project
xi: GOSUD GDAC: Global Data Assembly Centre (Coriolis, France)
xii: WDCs: World Data Centres for Oceanography (National Oceanographic Data Centres of USA, Russia, China)
xiii: WOA: World Ocean Atlas (National Oceanographic Data Centre, USA)
xiv: WOD: World Ocean Database (National Oceanographic Data Centre, USA)
xv: GTSPP: Global Temperature and Salinity Profile Programme
xvi: ISDM: Integrated Science Data Management (Canada)
xvii: AST: Argo Steering Team
xviii: Argo DACs: Data Assembly Centres
xix: ARCs: Argo Regional Centres
xx: Argo GDACs: Global Data Assembly Centres: FNMOC (USA) and Coriolis (France)
xxi: GADR: Global Argo Data Repository (National Oceanographic Data Centre, USA)
xxii: DBCP: Data Buoy Cooperation Panel
xxiii: GDP: Global Drifter Programme
xxiv: SOC/DB: JCOMM Specialized Oceanography Centre for Drifting Buoys (Météo France)

[xxv]: GDP DAC: Global Drifter Programme (GDP) Drifter Data Assembly Centre (NOAA/AOML, USA)
[xxvi]: RNODC/DB: JCOMM-IODE Responsible Oceanography Data Centre for Drifting Buoys (ISDM, Canada)
[xxvii]: NMHSs: National Meteorological and Hydrological Services
[xxviii]: TIP: Tropical Moored Buoy Implementation Panel
[xxix]: TAO: Tropical Atmosphere Ocean Array of moored buoys
[xxx]: TAO GDACs: NDBC (USA) for TAO, PMEL (USA) for ATLAS & sub-surface sites in PIRATA & RAMA, JAMSTEC (Japan) for TRITON and sub-su (India) for 3 subsurface sites in RAMA, FIO (China) for the Bai Long and sub-surface mooring in RAMA. PMEL collects all real time data and most and delivers them from PMEL web site, http://www.pmel.noaa.gov/tao/disdel/disdel.html. NDBC, JAMSTEC, NIO and FIO each have their own data which they operate. PMEL's QC procedures are available at http://www.pmel.noaa.gov/tao/proj_over/qc.html. The other data centers have adopt data formats are available including ASCII and NetCDF.
[xxxi]: OceanSITEs: OCEAN Sustained Interdisciplinary Timeseries Environment observation System
[xxxii]: OceanSITEs GDACs: Global Data Assembly Centree (Coriolis-France, and NOAA/NDBC-USA)
[xxxiii]: GLOSS: Global Sea Level Observing System
[xxxiv]: PSMSL: Permanent Service for Mean Sea Level (National Oceanography Centre, Liverpool, UK) – receiving mean delayed mode monthly QC'ed da
[xxxv]: UHSLC: University of Hawaii Sea Level Centre (USA) - The UHSLC together with the BODC (UK) are receiving higher frequency (hourly or bet GLOSS. The UHSLC together with VLIZ (Belgium) are collecting real-time sea level data via the GTS
[xxxvi]: JASL: UHSLC (USA) Joint Archive for Sea Level
[xxxvii]: VLIZ: Flanders Marine Institute (Belgium) – The VLIZ together with the UHSLC (USA) is collecting real-time sea level data via the GTS
[xxxviii]: HF: High Frequency data
[xxxix]: BODC: British Ocean Data Centre (UK) – The BODC together with the UHSLC (USA) are receiving higher frequency (hourly or better; delayed mod
[xl]: GNSS: Geo-Referenced station using Global Navigation Satellite System (e.g. GPS)
[xli]: TIGA: Continuous GNSS/GPS data to Tide Gauge Benchmark Monitoring data centre
[xlii]: ITP: International Tsunameter Partnership
[xliii]: GHRSST: Group for High Resolution SST
[xliv]: RDACs: GHRSST Regional Data Assembly Centres
[xlv]: GDAC: GHRSST Global Data Assembly Centre (NASA, USA)
[xlvi]: LTSRF: GHRSST Long Term Stewardship and Reanalysis Facility (US NODC)

ANNEX F

ACRONYMS

CBS	Commission for Basic Systems (WMO)
CCl	Commission for Climatology (WMO)
Cg	Congress (WMO)
CLIMAR	International Workshops on Advances in Marine Climatology (JCOMM)
CM	Contributing Member (MCSS)
CMOC	Centre for Marine-meteorological and Oceanographic Climate Data (JCOMM)
DCPC	WIS Data Collection and Production Centres
ETMC	Expert Team on Marine Climatology (JCOMM)
DAC	Data Acquisition Centre
DBCP	Data Buoy Cooperation Panel (JCOMM)
DM	Data Management
DMCG	Data Management Coordination Group (JCOMM)
DMPA	Data Management Programme Area (JCOMM)
DMVOS	Delayed-Mode VOS Data
ECV	Essential Climate Variable
ETDMP	Expert Team on Data Management Practices (JCOMM/IODE)
ETMC	Expert Team on Marine Climatology (JCOMM)
GCC	Global Collecting Centre (MCSS)
GCOS	Global Climate Observing System (WMO-IOC-UNEP-ICSU)
GDAC	Global Data Assembly Centre
GDP	Global Drifter Programme
GFCS	Global Framework for Climate Services
GHRSST	Group for High Resolution SST
GLOSS	Global Sea Level Observing System (JCOMM)
GMBA	Global Moored Buoy Array
GODAR	Global Oceanographic Data Archaeology and Rescue (IODE)
GOOS	Global Ocean Observing System (IOC-WMO-UNEP-ICSU)
GOSUD	Global Ocean Surface Underway Data Pilot Project (of IODE, JCOMM) (JCOMM/IODE)
GTS	Global Telecommunication System (WMO)
GTSPP	Global Temperature and Salinity Profile Programme (JCOMM/IODE)
HLQC	Higher Level Quality Control
HQCS	Higher Quality Control Standard
HQ-GDMSC	High Quality Global Data Management System for Climate
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA)
ICSU	International Council for Science
IEC	International Electrotechnical Commission
IGOSS	WMO-IOC Integrated Global Ocean Services System (replaced by JCOMM in 1999)
IMMA	International Maritime Meteorological Archive
IMMT	International Marine-Meteorological Tape
IOC	Intergovernmental Oceanographic Commission of UNESCO
IOCCP	International Ocean Carbon Coordination Project (IOC)
IODE	International Oceanographic Data and Information Exchange (IOC)
ISO	International Organization for Standardization
IVAD	ICOADS Value-Added Database
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
MAN	Management Committee (JCOMM)
MARCDAT	International Workshop on Advances in the Use of Historical Marine Climate Data (JCOMM)
MCDS	Marine Climate Data System
MCS	Marine Climate Summaries

MCSS	Marine Climatological Summaries Scheme
NC	WIS National Centre
NCAR	National Center for Atmospheric Research (USA)
NMHS	National Meteorological and Hydrological Service
MQCS	Minimum quality Control Standard
NOAA	National Oceanic and Atmospheric Administration (USA)
NWP	Numerical Weather Prediction
OBIS	Ocean Bio-Geographical Information System (IODE)
OceanSITES	OCEAN Sustained Interdisciplinary Timeseries Environment observation System
OCG	Observations Coordination Group (JCOMM)
ODAS	Ocean Data Acquisition Systems
ODASMS	ODAS Metadata Service (JCOMM)
ODP	Ocean Data Portal (IODE)
OPA	Observations Programme Area (JCOMM)
OPACE	Open Panel of CCl Experts
QA	Quality Assurance
QC	Quality Control
QMF	WMO Quality Management Framework
RA	WMO Regional Association
RC	Receiving Centre
RM	Responsible Member (MCSS)
RT	Real Time
RNODC	Responsible Oceanographic Data Centre (IODE)
RNODC/DB	RNODC for Drifting Buoys
RT-RC	Real-time Receiving Centre
SOC	Specialized Oceanography Centre (JCOMM)
SOC/DB	SOC for Drifting Buoys
SOT	Ship Observations Team (JCOMM)
SST	Sea Surface Temperature
ToR	Terms of Reference
TT-DMVOS	Task Team on Delayed-Mode VOS Data (JCOMM)
TT-MCDS	Task Team on Marine Climate Data System (ETMC)
TT-MOCS	Task Team on Marine-meteorological & Oceanographic Climatological Summaries (ETMC)
UNEP	United Nations Environment Programme
UNESCO	United National Educational, Scientific and Cultural Organization
VOS	Voluntary Observing Ship Scheme
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization (UN)

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ANNEX VII

PROPOSED JCOMM-IV RECOMMENDATION ON MCDS

DRAFT RECOMMENDATION

Rec. xxx (JCOMM-IV) — 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 Third Session of the JCOMM Expert Team on Marine Climatology (JCOMM/MR-No. 70);
5. The final Report of the Fourth Session of the JCOMM Data Management Coordination Group (JCOMM/MR No- 71);
6. The final Report of the Twenty-Sixth Session of the Data Buoy Cooperation Panel (DBCP) (JCOMM/MR No. 79);
7. The final report of the Eighth Session of the JCOMM Management Committee (JCOMM/MR-No. 83);
8. The final report of the Sixth Session of the JCOMM Ship Observations Team (SOT) (JCOMM/MR-No. 84);
9. The Final report of the workshop for a new Marine Climate Data System (MCDS) meeting, including the draft MCDS strategy in JCOMM MR#90;
10. The summary report of the Twenty-First Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XXI);

Noting further:

(1) The relevant sections of the WMO No. 558, Manual to Marine-Meteorological Services;

(2) The relevant sections 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 USA offering facilities for acting as WMO-IOC Centres for Marine-Meteorological and Oceanographic Climate Data (CMOC), their statements of compliance and commitment, and their successful evaluation by JCOMM according to the proposed process;

Having considered:

1. Members/Member States need for high quality marine meteorology and oceanographic historical data and 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 proposal from the National Marine Data & Information Service (NMDIS) of the State Oceanic Administration (SOA) of China to integrate the functions of the ODASMS as part of the CMOC proposed by China;
7. 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 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 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. JCOMM in close cooperation with IODE and other appropriate partners (such as the ICSU World Data System) to develop a strategy and implementation plan for achieving the Vision

for a new MCDS as described in Annex 1 to this Recommendation;

2. To implement a modernized scheme for the management of surface marine climatological data in conjunction with ICOADS inside the MCDS;
3. To implement a modernized data management scheme within the MCDS for surface drifter data replacing the RNODC/DB and the SOC/DB;
4. To establish 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 WMO and IOC/IODE designation of CMOCs where:
    (a) Governance for defining the functions and adoption of CMOC is proposed by JCOMM and endorsed by the WMO and UNESCO/IOC Executive Councils,
    (b) Candidate CMOCs will be required to produce a statement of compliance, list capabilities of the proposed centre, state the domain of the data and products managed and/or generated by the centre, state the formal commitment to voluntarily host the centre and demonstrate capability to JCOMM,
    (c) The process for establishing a new CMOC is described in Annex 3 to this Recommendation,
    (d) Following possible agreement by JCOMM, the WMO and UNESCO/IOC Executive Councils will be invited to accept and approve new CMOCs,
    (e) Terms of Reference of CMOC will become part of the WMO Guide to Marine-Meteorological Services (WMO No. 471);
5. To adopt the Terms of Reference of CMOCs, including capabilities, and corresponding functions as given in the Annex 2 to this recommendation;
6. To Establish the ICOADS (USA) and the NMDIS of SOA (China) as CMOCs;
7. To encourage Members/Member States to offer CMOC facilities;
8. To declare the ODASMS, and the SOC/DB obsolete;

Invites:

1. Members/Member States to consider taking advantage of the resources offered by the NOAA-NCAR organizations managing ICOADS in the USA dedicated to the surface marine-meteorological data, and by the NMDIS of SOA in China;
2. Members/Member States to contribute national resources towards the activities identified in the recommendations;
3. Members/Member States to consider submitting applications for becoming a CMOC;

Requests 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.

Annex 1 to Recommendation xxx (JCOMM-IV)

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 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 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, and 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 Recommendation xxx (JCOMM-IV)

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 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 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 comprise of different JCOMM data domains and enhance international partnerships within a new JCOMM framework. 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 and UNESCO/IOC Executive Council.

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 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 every five years, to verify it meets the necessary capabilities and performance.

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 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 informed on the status and activities of the CMOC network as a whole, and propose changes, as required.

Data and Software Policy Requirements

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 Recommendation xxx (JCOMM-IV)

FORMAL APPOINTMENT & 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), the mechanism for formal WMO and UNESCO/IOC appointment of CMOC implies the following:

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

The approach proposed by JCOMM is the following:

- The candidate CMOC evaluates the extent to which it will be addressing the CMOC requirements in terms of capabilities and functions as described in the CMOC Terms of Reference.
- Once the candidate CMOC believes 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 respectivel to formally state the commitment to voluntarily 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 candidate CMOC also provides a statement of compliance and commitment in terms of CMOC capabilities and corresponding functions as described in the CMOC Terms of Reference. The candidate CMOC will indicate to what extent it will meet these requirements. The domain of the data and/or products managed by the centre as part of the CMOC activities is also provided. The letter should be copied to the appropriate JCOMM Co-President, and also to the relevant President of the WMO Regional Association in the case where the CMOC is only providing data corresponding to a specific region..
- The IOC or WMO Secretariat requests the appropriate JCOMM Co-President to take action, in particular to requests the Data Management Coordination Group (DMCG) to evaluate and verify the capabilities of the proposed Centre.
- The DMCG evaluates the request and advises in writing whether the candidate CMOC 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.
- If endorsed by the DMCG, and depending on timing, the latter makes a recommendation to the JCOMM Management Committee (MAN), and invites them to provide further advice to JCOMM.
- If not endorsed by the DMCG or MAN, the JCOMM Co-President should advise the candidates about areas where the Centre can be improved to meet requirements. Candidates can reapply at a later date once changes have been made to meet these criteria.
- If endorsed by MAN, a recommendation is passed to the next JCOMM Session, or depending on timing directly to the WMO and IOC Executive Councils following JCOMM consultation in writing.
- If recommended by JCOMM, a Resolution is proposed to the WMO and IOC Executive Councils for including the candidate in the list of CMOCs.

- If the Resolution is approved by both the WMO and IOC Executive Councils, 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 to 12 months.

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 every five years. If endorsed the CMOC can continue its role as before. If the review is not endorsed the DMCG must insist improvements to be made and reviewed within a year. If compliance to standards is still not met the CMOC role will be withdrawn from the Centre.
- If a Centre no longer wishes to carry out the functions of a CMOC the Expert Team on Marine Climatology (ETMC) & DMCG should be advised immediately.
- The proposed decision of withdrawal of a CMOC shall then be submitted to the WMO and IOC Executive Councils.

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ANNEX VIII

DRAFT TEMPLATE FOR THE FORMAL STATEMENT OF COMPLIANCE AND COMMITMENT TO VOLUNTARILY HOST A CENTRE FOR MARINE-METEOROLOGICAL AND OCEANOGRAPHIC CLIMATE DATA (CMOC)[25]

From : The IOC Action Addressee of the host Member State, or the Permanent Representative of the host Member with WMO
To: Executive Secretary of IOC, or the Secretary General of WMO as appropriate

CC:

Co-Presidents of JCOMM
Permanent Representative of the host Member with the WMO, or IOC Action Addressee of the host Member State as appropriate
President of the WMO Regional Association where the host Member is located (if applicable)

Appendix A: Statement of compliance and commitment for the WMO-IOC Centre for Marine-meteorological and Oceanographic Climate Data at <Agency>
Appendix B: Introduction to <Program_Name>
Appendix C: Proposed domain for the operations of the CMOC (i.e. regional/global, type of data, period) as part of the <Program_Name> Capabilities and corresponding functions, and relationship to existing activities
Appendix D: List of key management and technical personnel

Subject: Establishment of the Centre for Marine-Meteorological and Oceanographic Climate Data at <Agency>, <Member/Member_State>

Dear <WMO-IOC_Rep>,

I refer to [draft] Recommendation XXX (JCOMM-IV) of the Fourth Session of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) (Republic of Korea, May 2012), approved by [to be submitted to] the WMO Executive Council at its Sixty-Fourth session (Geneva, Switzerland, June 2012) through Resolution XXX (EC-LXIV) establishing WMO-IOC Centre for Marine-meteorological and Oceanographic Climate Data (CMOCs).

I also refer to <Member/Member_State>'s offer made during <Event> to host a CMOC; and to the informal discussions with the WMO and IOC Secretariats to assist in the preparation for the establishment of a CMOC at <Agency>, <Member/Member_State>. These discussions in particular permitted to fully understand the rationale for establishing a CMOC at <Agency>, and provided an insight of requirements and format for the organization of relevant activities and services.

I would like to reaffirm <Member/Member_State>'s willingness and commitment to establish a [mirrored] CMOC at <Agency> in order to provide assistance to WMO Members and IOC Member States in accessing high quality marine meteorology and oceanographic historical data and metadata from the world oceans.

We expect that this will permit 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), and in turn result in improved final products and services delivered by concerned Members/Member States. I am therefore pleased to offer this CMOC function within the <Program_Name>, in <Agency>.

25 : Parts highlighted in yellow have to be completed/replaced by the Director of the candidate CMOC.

In this context, we have reviewed our capabilities and functions with regard to the Terms of Reference of CMOCs, and I am pleased to inform you that we believe that the <Program_Name> at <Agency> meets all of the requirements. In the Appendices A, B, C, and D you will find a statement of compliance and commitment for the CMOC capabilities and corresponding functions, as well as the suite of instrument expertise offered in this context.

I would therefore be grateful if you could take appropriate steps through JCOMM in order for the <Program_Name> at <Agency> to be eventually listed as a CMOC and operate as such on behalf of the WMO and IOC. We look forward to a fruitful cooperation with other CMOCs and components of the Marine Climate Data System (MCDS) through the activities of the future CMOC and JCOMM.

Yours sincerely,

<Director_Name>
Director, <Program_Name>

Explanation of fields (for information, not part of the letter):

Field	Meaning
<WMO-IOC_Rep>	WMO Secretary General or IOC Executive Secretary as appropriate
<JCOMM Co-Presidents>	Names of JCOMM Co-Presidents
<Member/Member_State>	Name of the Member or Member State offering to host the CMOC
<Event>	Name of the event where the host country made an offer to host a CMOC
<Region>	Name of the region where the CMOC will be located
<Agency>	Name of the agency or agencies where the candidate host is located
<WMO_RA>	Name of the WMO Regional Association where the candidate CMOC is located (e.g. RA-I for Africa)
<Program_Name>	Name of the centre(s) or programme that is offering hosting the CMOC
<DCPC_Name>	WIS Data Collection and Production Centre (DCPC) through which the data and metadata of the CMOC are visible.
<Director_Name>	Name of the director of the centre(s) offering hosting the CMOC

Things that are optional for a CMOC are indicated in [brackets] in this template.

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APPENDIX A

STATEMENT OF COMPLIANCE AND COMMITMENT FOR THE WMO-IOC CENTRE FOR MARINE-METEOROLOGICAL AND OCEANOGRAPHIC CLIMATE DATA AT <AGENCY>

Note: This template is provided as an example and can be modified as appropriate in line with the actual proposal from the candidate CMOC.

1. INTRODUCTION

Include here a short description of the <Program_Name> and its mission.

The <Program_Name> is committed to provide for the following capabilities on a long term basis and undertake the following functions in order to act as a WMO-IOC Centre for Marine-meteorological and Oceanographic Climate Data (CMOC) [mirrored with other CMOCs].

The main responsibilities of <Program_Name> are detailed in Appendix B.

1. LIST OF CAPABILITIES

Infrastructure (item a26)

The infrastructure and facilities in place at <Program_Name> permit to perform the functions required for a CMOC, i.e. long-term processing, quality control (QC), data accessibility, and archival of marine-meteorological and/or oceanographic data and metadata, gathered under the common requirements of WMO and UNESCO/IOC marine-related programmes and co-sponsored programmes[, as well as the production of statistical products based on those data].

See section 3 below and Appendix C for the domain of operations of the centre.

Staff resources (item a[26])

Qualified managerial and technical staff with the necessary experience is made available by the <Program_Name> in order for the CMOC to fulfill its functions.

Include here a statement about <Program_Name> policy with regard to employed staff, its recruitment, qualification, and qualification accreditation

A list of key management and technical personnel is provided in Appendix D.

Interoperability (item b[26])

<Program_Name> is committed to provide full interoperability with the WMO Information System (WIS) and/or the IOC/IODE Ocean Data Portal (ODP).

Quality Management (item c[26])

<Program_Name> is committed to develop and maintain the required data Quality Control procedures and data processing for relevant27 data, and generating climatological products, as standardized within the CMOC network.

Provide details here about established quality assurance procedures at <Program_Name>, i.e. quality management systems, certification, accreditation, audit, and management review.

26: Relevant item of the capabilities part of the annex to the CMOC Terms of Reference
27: Data and products managed within the stated CMOC scope (Appendix C) are referred as “relevant”

[Mirroring with other CMOCs (item d[26])]

[<Program_Name> is committed to develop and maintain the required IT infrastructure, protocols, data services, and human resources to permit the mirroring of its relevant[27] data, metadata, products, and processes with other mirroring CMOCs.]
[Please describe the nature of the mirroring activity, which shall be consistent with the other Mirroring CMOCs.]

Verification of capabilities and performances (Item (e[26])

<Program_Name> will allow an authority designated by JCOMM to assess the CMOC and verify its capabilities and performance at least every five years.

2. CORRESPONDING FUNCTIONS

Contribution to WMO and IOC Applications (item a28)

<Program_Name> is committed to [rescuing,] [collecting,] processing, archiving, sharing and distributing worldwide relevant[27] marine-meteorological and/or oceanographic data and metadata according to procedures documented in appropriate WMO and IOC Publications.

Advice to other Members/Member States (item b[28])

Within the CMOC domain of operations, the <Program_Name> is committed to devote some resources for rendering the following services to other Members/Member States for capacity building purposes, including reviewing the requests from those countries, and replying favorably on a case by case basis, regarding activities related to marine climatology, e.g.

- Advising on data collection, data processing, quality control, bias correction, data rescue, archiving techniques
- Advising on data formats and data exchange protocols
- Advising on marine climatological products, including climatological summaries, and statistical products.

Guidance materials will also be developed for possible JCOMM training events. The CMOC will play a pro-active role in producing, reviewing, and updating relevant[27] documentation through JCOMM.

Interoperability (item c[28])

<Program_Name> will operate (or make necessary developments to operate) as a WIS National Centre (NC) or Data Collection or Production Centre (DCPC) or provide appropriate description via ODP for the relevant[27] data sets.

Quality Management (item d[28,] e[4])

<Program_Name> is committed to operate the required data Quality Control procedures and data processing for relevant[27] data, and to generate climatological products, as standardized within the CMOC network.

Cooperation with other CMOCs (item f[28])

28 : Relevant item of the corresponding functions part of the annex to the CMOC Terms of Reference

In accordance with the procedures described in appropriate WMO and IOC Publications, the <Program_Name> is committed to cooperate with other CMOCs regarding the rescue, exchange, processing, and archival of relevant[27] marine-meteorological and related oceanographic data and metadata; and to coordinate its activities with them in order to [mirror,] maintain, and serve mutually consistent relevant[27] historical data sets (data, metadata, products).

Core functions (item g[28])

<Program_Name> will undertake its core defined functions and replicate data from other centres appropriate to its domain of operations such that the set of data and products offered from the CMOC network is mutually consistent when accessed from any individual centre.

[Mirroring with other centres (item h[28])]

[<Program_Name> will mirror data, metadata, products and processes at defined time-scales, with other CMOCs according to methods and procedures agreed upon.]

Versioning (item i[28])

<Program_Name> will undertake stringent version control (e.g. DOI) for all kinds of data, metadata and processes managed within its core functions.

Reporting (item j[28])

<Program_Name> is committed to submit a written report to the JCOMM Management Committee through the Data Management Coordination Group (DMCG) on an annual basis, on the services offered to Members/Member States and the activities carried out.

3. SUITE OF DATA MANAGEMENT EXPERTISE OFFERED

The Domain of the marine-meteorological and oceanographic data and products managed and/or generated by the centre as part of its Capabilities and corresponding functions include the following:

- A1
- A2
- …

4. DATA AND SOFTWARE POLICY REQUIREMENTS

<Program_Name> is committed to make all the relevant[27] data, metadata, and products freely and openly available to the international research community in a way consistent with WMO Resolution 40 (Cg-XII) and IOC Resolution XXII-6.

<Program_Name> will make the following software available openly and freely:

- S1
- S2

_____

APPENDIX B

INTRODUCTION TO <PROGRAM_NAME>

Provide here information about the centre, its affiliation, and mission.

APPENDIX C

Proposed domain for the operations of the CMOC (i.e. regional/global, type of data, period) as part of the <Program_Name> Capabilities and corresponding functions, and relationship to existing activities

As part of the CMOC capabilities and corresponding functions, the facilities and infrastructure available at <Program_Name> permit the generation and provision of the following marine-meteorological and oceanographic data, metadata and products:

[Please provide text here describing the scope of the centre, including for example description of products, historical period, geographical coverage, Specific procedures applied to data (digitization, quality control, bias correction, mirroring with other CMOC(s), etc.]

[Please also provide a short text concerning the existing national and international activities that are similar in nature to the activities of the proposed CMOC, and how they complement or duplicate those other activities]

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APPENDIX D

LIST OF KEY MANAGEMENT AND TECHNICAL PERSONNEL

No	Name	Title/Role	Education	Expertise	Depar
1					
2					
3					
n					

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ANNEX IX

PROPOSED MCDS DATAFLOW

The JCOMM Marine Climate Data System (MCDS) provides routine and standardised collection of real time and delayed-mode and historical climatological data and metadata. It includes both marine-meteorological and oceanographic data available through a network of CMOCs, promoting the sharing, collecting, recording, mirroring, and exchange of data and metadata for all types of users.

1. **JCOMM Data Source:** Data originating from various platforms and sources providing meteorological and/or oceanographic observations manually or automatically in real-time (GTS) and/or delayed-mode.

2. **JCOMM Data Acquisition Centres (DAC)**: Centres receiving data from various JCOMM data sources in agreed formats in delayed-mode and real-time

(a) Delayed-mode Receiving Centres (DM-DAC) – Receiving data from a specific data source in delayed-mode, applying agreed Minimum Quality Control (MQC), investigating problems when required and forwarding of data to the appropriate GDAC

(b) Real-time Receiving Centres (RT-DAC) – Existing GTS Centres receiving data from all real-time sources

3. **JCOMM Global Data Assembly Centre (GDAC**): Selected centres combining data of all streams from their appropriate DAC. Their role is to establish a unique, complete dataset (including metadata), perform agreed quality checks and forward the data and metadata with flags to the CMOC in agreed formats. Data from both, delayed-mode and real-time should be compared and linked. It is mandatory that the GDACs are registered as WMO Information System (WIS) Data Collection and Production Centres (DCPCs).

4. **JCOMM Centres for Marine-Meteorological and Oceanographic Climate Data (CMOCs)**: All data (original and QCed) and metadata received from GDACs are forwarded to the suitable CMOC. CMOC acts as a network of data centres, applying HQCS, making datasets available to the user interface and advising member/members states when appropriate (see CMOC Terms of Reference for further information). Data and metadata are stored in line with defined JCOMM standards to ensure data integrity and universal interoperability.

5. **JCOMM User Interface**: Universal user interface for searching, downloading, displaying and analysis of JCOMM data and products. It provides a flexible tool with variable privileges for all users to manipulate the data.

In particular, the tool must allow:

- Interactive searching by element, time, location, geographical feature, data type
- Fast and easy downloading into various codes and formats
- Interactive displays – maps, tables – allowing GIS layering
- Versatile analysis to generate and visualise standardised and bespoke climatological products and statistics in suitable forms

The roles of the proposed MCDS component centres are further detailed in Table 1.

FIGURE 1

JCOMM Marine Climate Data System (MCDS)

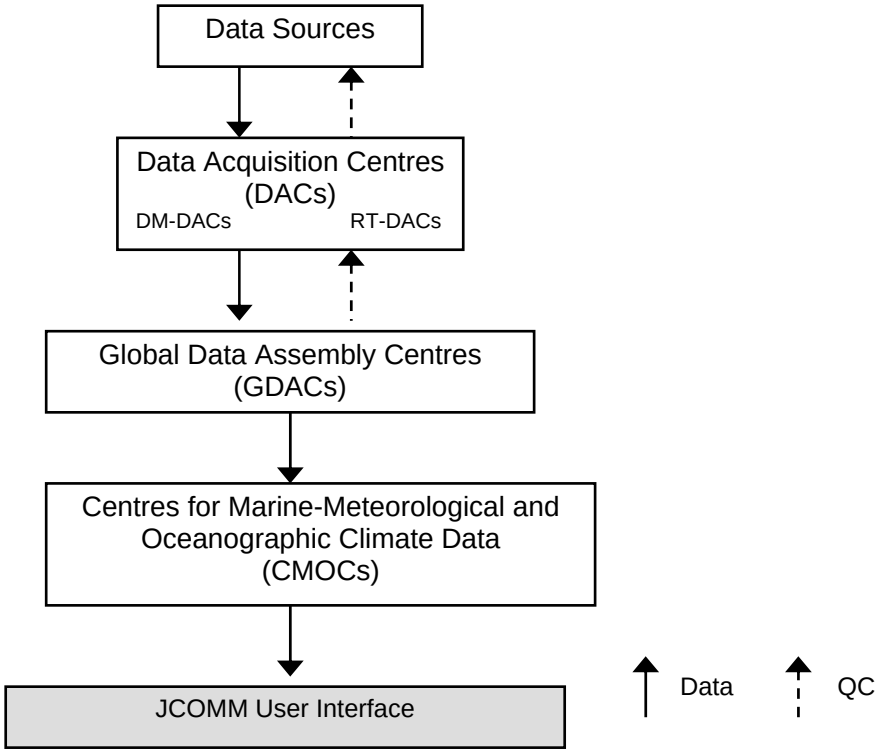


TABLE 1

Marine Climate Data System (MCDS), roles of specialized centres (draft)						
04/11/2011)						
	Sources	**DAC**	**GDAC**	**CMOC**	**Other**	**Comment**
Current examples	RT (GTS, netCDF)	DM-DACs (e.g.CMs)	GCCs	NODCs and NCDCs (if applicable)		
	DM (IMMT, netCDF)_	SOC/DB	RNODC/DB	WDCs		
	Metadata: JCOMMOPS, Pub47	GDP DAC ODASMS	Argo GDACs	WOD/WOA lCOADS		
		Coriolis RT-RCs	OceanSITES GDACs			
			GTSPP			
			GOSUD			
Data types (specific platform types, all, value added)	Observation platform	Observation platform	Observation platform(s)	Many obs. platforms		"Many obs. Platforms" to be discussed and defined for the MCDS, noting that longstanding divisions of responsibility have been established, e.g. among the World Data Centres (WDCs) between Oceanography and Meteorology.
Produce data & metadata	x					
Collect RT		x				
Collect DM		x				
Collect metadata		x				
Minimum QC (MQC)		x	x			
Format data for DACs (e.g. IMMT)		x	x			
Produce co-located data		x	x			
Format data for GDAC		x	x			
Combine data, metadata, QC flags, co-located (specific platform type)			x			
Produce Discovery Metadata			x			
Higher Level QC (HQC)			x	x		
Combine data, metadata, QC flags, co-located (many platform types)				x		
Mirror with other similar centres				x		
Data (and metadata) rescue					GODAR	
Format data (and metadata?) for specialized access				x		
Format data (and metadata) for archival (e.g. IMMA) and for open access (e.g. netCDF)				x		
Added value & bias correction				x		
Produce marine climate summaries				x		
Long term archive				x		Probably NODC/NCDCs and WDCs (now operating within the new World Data System, WDS), provide internationally the most formal long-term archival, probably with national variations outside of the WDS though. In USA e.g. NOAA has a formal role and houses WDCs

ANNEX X

PROPOSED MODERNIZED VOS DELAYED-MODE DATA-FLOW

(Version 3, 25th October 2011)

1. **Data Sources - VOS Data:** Platforms providing meteorological and/or oceanographic observations manually or automatically in real-time (Global Telecommunication System – GTS) and delayed-mode (e.g. Voluntary Observing Ships – VOS –, rigs, buoys).

2. **VOS Data Acquisition Centres (DACs)**

(a) **VOS Delayed-Mode DAC (DM-DAC)** (Contributing Members (CMs)): The VOS DM-DACs are responsible for:

1. collecting all Delayed Mode (DM) VOS data from their recruited vessels ideally on a monthly basis
2. applying at least Minimum Quality Control (MQC) to these data
3. forwarding MQC-checked data to the VOS Global Data Assembly Centres (GDACs) on a monthly basis in agreed JCOMM format.
4. investigating problems identified and reported by the VOS GDACs
5. informing VOS (and/or Port Meteorological Officers – PMO) of identified problems

(b) **GTS-DAC:** Existing GTS Centres receiving data from all real-time (RT) sources.

3. **VOS Global Data Assembly Centres (VOS GDACs)**: The VOS GDACs are responsible for the data management of both delayed-mode data received from VOS DM-DACs and all GTS data from GTS-DACs.

(a) Specific responsibilities for delayed-mode data:

1. ensuring MQC is applied
2. notifying the respective VOS DM-DAC of any systematic data problems identified, and resolving issues where possible

(b) Specific responsibilities GTS-data:

1. assembling all of the GTS data from GTS-DACs with Quality Control (QC)-flags, if available
2. convert the data in agreed transfer format of DM data
3. resolving duplications within and among the RT datastreams
4. applying MQC

(c) Responsibilities for the combined data base:

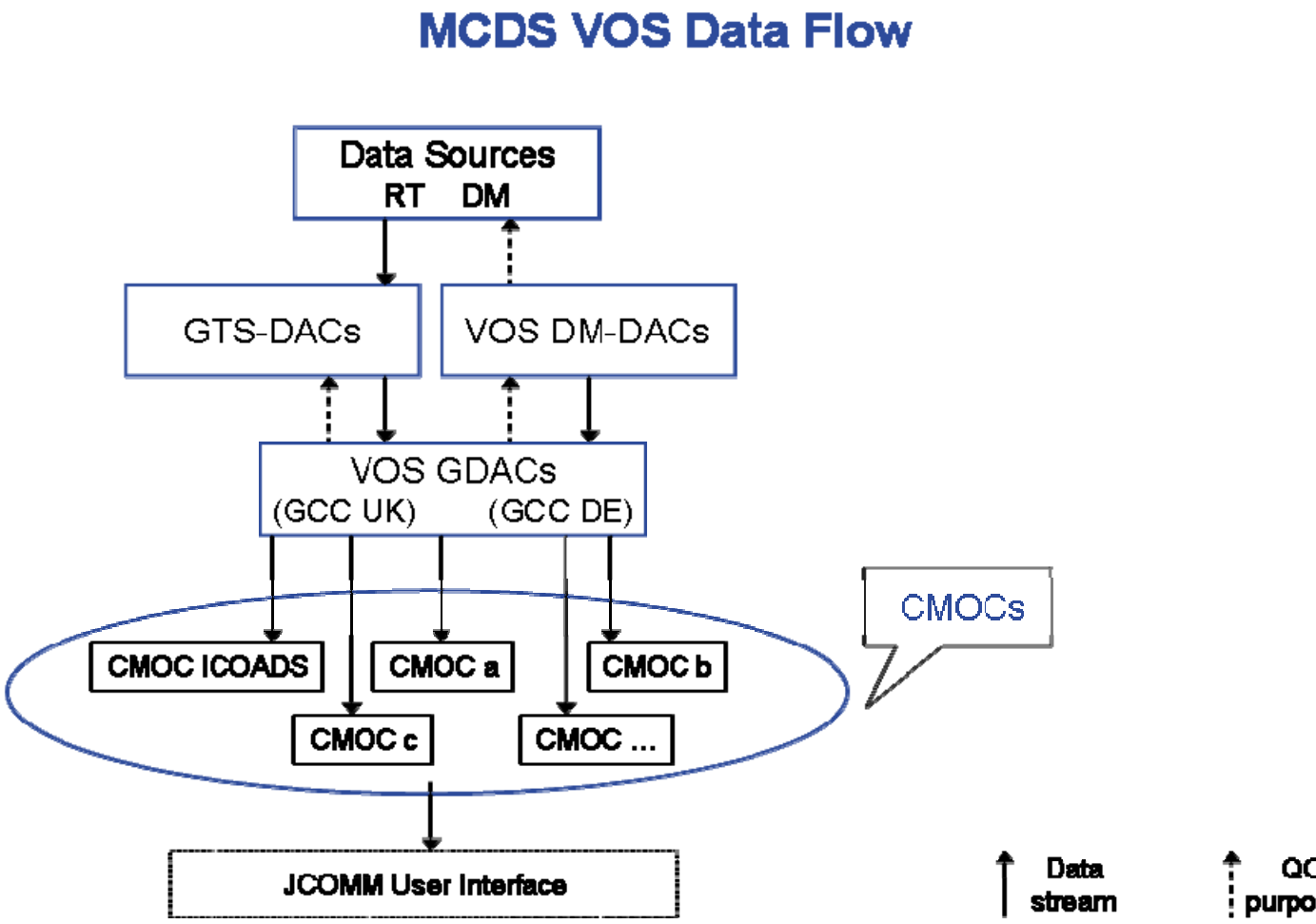
1. comparing GTS and delayed-mode data records and feed back to VOS DM-DACs
2. identifying and flagging/linking of duplicates of real-time and delayed-mode data
3. providing all data (both original and quality controlled) centrally accessible by the WMO Information System (WIS) and/or the IODE Ocean Data Portal (ODP) monthly in agreed JCOMM formats.
4. forward dataset discovery metadata to WIS and/or the ODP.

4. **JCOMM CMOCs:** All data (original and Quality Controlled) and metadata received from VOS GDACs are forwarded to the suitable CMOC. The candidate CMOC acts as a network of data centres, applying Higher Level Quality Control Standard (HQCS), making datasets available to the user interface and advising members/member states when appropriate (see CMOC Terms of Reference for further information). Data and metadata are stored in line with defined JCOMM standards to ensure data integrity and *universal* interoperability.

5. **JCOMM User Interface**: Universal user interface, building on or formalizing existing systems, for searching, downloading, displaying and analysis of JCOMM data and products. It provides a flexible tool with variable privileges for all users to manipulate the data. In particular the tool must allow:

Interactive searching by element, time, location, geographical feature, data type
Fast and easy downloading into various codes and formats
Interactive displays – maps, tables – allowing GIS layering
Versatile analysis to generate and visualise standardised and bespoke climatological products and statistics in suitable forms.

FIGURE 2


MCDS VOS Data Flow
Data Sources
RT DM
GTS-DACs
VOS DM-DACs
VOS GDACs
(GCC UK) (GCC DE)
CMOCs
CMOC ICOADS
CMOC a
CMOC b
CMOC c
CMOC ...
JCOMM User Interface
Data stream
QC purpo

ANNEX XI

MÉTÉO FRANCE PROPOSAL FOR A JCOMM REAL-TIME DATA ACQUISITION CENTRE (RT-DAC) FOR SURFACE MARINE OBSERVATIONS

For many years, Meteo-France has been archiving all GTS data received from drifting and buoys, moored buoys, and then since 2002, from all Voluntary Observing Ships, from the whole world.

Co-located model outputs from three global models - ECMWF and Meteo-France for the atmosphere and SST, Mercator for SST and SSS - are added to the observation data. Considered as being Value Added Data, they serve to the real time monitoring. Quality control tools, mainly composed of blacklists of dubious data – when far from model outputs - and graphs of differences between observations and model outputs over the past two weeks, are updated every day and made available onto the Web.

Since 2003, Meteo-France has also been computing surface current data deduced from drifting buoy tracks on a weekly basis, for buoys which are supposed having their drogue still attached (automatic detection). These surface current data are certainly less accurate than those computed by AOML in delayed-mode but they serve to Mercator, for instance, to validate their products in “real time”. Co-located wind and wind stress data from ECMWF at the time and location of the observations are part of product. They serve to compute the Ekman component of the measured current and help in the drogue presence detection.

Endly, Meteo-France developed an online VOS metadata database allowing VOS operators to enter their metadata themselves through a Web interface. Metadata for European rigs and other platforms (e.g. light vessels) are also gathered through this way. Operators (PIs) may also submit their Pub47 to Meteo-France who updates the database. Endly, the database is fed by Pub47 metadata provided by non-European VOS to WMO. Thanks to that, the database is permanently updated. A Pub47 file containing all VOS metadata is updated every day on a public FTP site. In parallel, the confidential MASK/REAL cross-reference list is provided to JCOMMOPS for European VOS having their callsign masked by a unique identifier.

The increase of the quality of real time data – work performed by Meteo-France -, contributes to improve the availability and the quality of Delayed-Mode data - e.g. in identifying potential problems at their source in advance. Meteo-France proposes MCDS considers these activities as being relevant for the system, through a real-time multi-platform (G)DAC for instance. RTMC, operated by the Met Office, has a similar function for the VOS.

Meteo-France activities would include GTS dataflow monitoring for surface marine observations. This is an important task to consider, most especially in the context of the migration to BUFR:

- Exchange of lists of bulletins received with other centres,
- Identification of missing bulletins (received elsewhere),
- Identification of quality network of which the data should be sent onto the GTS if they are not – monitoring of the data of these new networks after the GTS transmission starts,
- Monitoring of the presence/absence of new data (e.g. VOSClim data) and metadata to be sent in real time

Impact on MCDS strategy:

- Vanishing of the SOC/DB or conversion into a Real Time (G)DAC for drifting buoys,
- Establishing a Meteo-France Real Time (G)DAC for all Surface Marine Observations. This would include the drifting buoys indeed,
- Considering the global VOS Metadata Database within these (G)DAC activities.

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ANNEX XII

DRAFT RECOMMENDATION 7/??? (JCOMM-IV)

PROVISION OF OCEAN INSTRUMENT/PLATFORM METADATA

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

Noting:

(1) Recommendation 3 (JCOMM-III) – Provision of ocean data acquisition system and water temperature metadata
(2) The Abridged Final Report with Resolutions and Recommendations of the Third Session of the Joint WMO/IOC Commission for Oceanography and Marine Meteorology (WMO-No. 1049), general summary, paragraphs 5.2.10, 6.1.5, 6.1.11.4, 6.2.5, 7.1.5, 7.2, 7.4, 10.1.7, 10.2.7
(3) Resolution 24 (Cg-XVI) – Marine Meteorology and Oceanography Programme,
(4) Resolution 50 (Cg-XVI) – Implementation of the WMO Integrated Global Observing System (WIGOS),
(5) The final report of the third meeting of the JCOMM Expert Team on Marine Climatology (JCOMM/MR-No. 70),
(6) The final report of the fourth session of the JCOMM Data Management Programme Area Coordination Group (JCOMM/MR-No. 71),
(7) The final report of the Eighth Session of the JCOMM Management Committee (JCOMM/MR-No. 83),
(8) Recommendation ??? (JCOMM-IV) – Marine Climate Data System (MCDS)

Considering:

(1) The importance of instrument and platform metadata in a number of domains including climate applications and research (for example, bias correction), and operational applications, permitting amongst other things to interpret the data correctly, ensure traceability to standards, enhance coherence of data records, and facilitate quality monitoring activities,

(2) That China has fully developed an Ocean Data Acquisition System (ODAS) Metadata Service (ODASMS) for assembling, preserving and disseminating metadata on ODAS platforms,

(3) That there is a number of systems in place that are collecting metadata from ocean observing platforms (e.g. WMO Publication No. 47, European Directory for Initial Ocean and Observing Systems – EDIOS maintained by the SeaDataNet infrastructure) that can contribute metadata to the MCDS;

(4) The Development of the JCOMM Marine Climate Data System (MCDS), including WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data (CMOCs), providing an integrated data-flow for the collection of marine-meteorological and oceanographic climate data, including metadata from in situ ocean observation platforms;

(5) That metadata systems require the active involvement of all Members/Member States which operate such platforms and equipment to provide updated metadata in a routine fashion,

Recommends:

(1) Members/Member States to record and provide through the appropriate mechanisms, including CMOCs – once established – on a routine basis required metadata about ocean instruments and observing platforms that they operate;

(2) China to eventually integrate the functions of the ODASMS into a CMOC – once established;

(3) The JCOMM *in situ* Observation Programme Support Centre (JCOMMOPS) to routinely contact platform operators so that the metadata are being submitted to the relevant CMOC(s) (e.g. China), including for operational platforms and for historical ones;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC, to assist Members/Member States, as necessary, in the submission of metadata to the CMOCs.

This Recommendation replaces Recommendation 3 (JCOMM-III), which becomes obsolete.

ANNEX XIII

ACRONYM LIST

ACRE	Atmospheric Circulation Reconstructions over the Earth
AES	Advanced Encryption Standard
AIS	Automatic Identification System
AMSA	Arctic Marine Shipping Assessment
AOPC	Atmospheric Observation Panel for Climate
AOML	Atlantic Oceanographic and Meteorological Laboratory (of NOAA, USA)
Argo	International profiling float programme
ASAP	As soon as possible
ASAP	Automated Shipboard Aerological Programme
AWS	Automatic Weather Station
BOM	Bureau of Meteorology (Australia)
BUFR	Binary Universal Form for the Representation of meteorological data
CAS	WMO Commission for Atmospheric Sciences
CB	Capacity-Building
CBS	WMO Commission for Basic Systems
CCl	WMO Commission for Climatology
CDI	SeaDataNET Common Data Index
CDMS	Climate Data Management System
CEOS	Committee on Earth Observations Satellites
Cg	WMO Congress
CIMO	WMO Commission for Instruments and Methods of Observation
CLIMAR	JCOMM Workshops on Advances in Marine Climatology
CM	MCSS Contributing Member
CMDP	NOAA Climate Data Modernization Program (USA)
CMM	Former WMO Commission for Marine Meteorology (now JCOMM)
CMOC	WMO-IOC Centres for Marine-meteorological and Oceanographic Climate Data
CONOPS	WIGOS Concept of Operations
CWP	Community White Papers
DAC	Data Acquisition Centre
DARE	Climate Data Rescue
DBCP	Data Buoy Cooperation Panel
DCPC	Data Collection and Production Centre (of WIS)
DMAC	IOOS Data Management and Communications (USA)
DMCG	JCOMM Data Management Coordination Group
DMPA	JCOMM Data Management Programme Area
DRR	Disaster Risk Reduction
DWD	Deutscher Wetterdienst (Germany)
E2E	End-to-End Data Management
E2EDM	End-to-End Data Management Pilot Project
EC	Executive Council
ECMWF	European Centre for Medium Range Weather Forecasts
EECRA	Extended Edited Cloud Report Archive
ENCODE	Ship masking scheme whereby a unique, non-repeating identifier is used; the identifier is derived from encrypting elements in the message, e.g. callsign + latitude + longitude
ESA	European Space Agency
E-SURFMAR	EUMETNET Surface Marine programme
ETCCDI	Joint CCl-CLIVAR-JCOMM Expert Team on Climate Change Detection and Indices
ET-CDBMS	Expert Team on Climate Database Management Systems
ETDMP	JCOMM-IODE Expert Team on Data Management Practices
ETMC	JCOMM Expert Team on Marine Climatology

ETMSS	JCOMM Expert Team on Maritime Safety Services
ETSI	JCOMM Expert Team on Sea-Ice
ETWS	JCOMM Expert Team on Wind Waves and Storm Surges
EUMETNET	Network of European Meteorological Services
FAQ	Frequently Asked Questions
FTP	File Transfer Protocol
GAW	Global Atmosphere Watch
GCC	MCSS Global Collecting Centre
GCC-DM	Delayed-mode GCC
GCC-RT	Real-time GCC
GCOS	WMO-IOC-UNEP-ICSU Global Climate Observing System
GCOS-IP	GCOS Implementation Plan in Support of the UNFCCC
GDAC	Global Data Assembly Centre
GDSIDB	Global Digital Sea Ice Data Bank
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GFCS	Global Framework for Climate Services
GHRSST	Group for High Resolution SST
GISC	Global Information System Centres (of WIS)
GMDSS	Global Maritime Distress and Safety System
GODAE	Global Ocean Data Assimilation Experiment
GODAR	Global Oceanographic Data Archaeology and Rescue
GOOS	WMO-IOC-UNEP-ICSU Global Ocean Observing System
GOS	WMO Global Observing System
GOSUD	Global Ocean Surface Underway Data Pilot Project
GPS	Global Positioning System
GTMBA	Global Tropical Moored Buoy Array
GTS	Global Telecommunication System
GTSPP	Global Temperature and Salinity Profile Programme
HISKLIM	HIStorical CLIMate (the Netherlands)
HQC	Higher-level QC
HQCS	Higher Quality Control Standard
HQ-GDMSC	High Quality Global Data Management System for Climate
ICES	International Council for the Exploration of the Sea
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA)
ICSU	International Council for Science
IMMA	International Maritime Meteorological Archive
IMMT	International Maritime Meteorological Tape
IMO	International Maritime Organization
IMOS	Integrated Marine Observing System (Australia)
IOC	Intergovernmental Oceanographic Commission of UNESCO
IOCCP	IOC International Ocean Carbon Coordination Project
IODE	International Oceanographic Data and Information Exchange (of IOC)
IP	Implementation Plan
IP	Intersessional Period
IPET-DRC	CBS Inter Programme Expert Team on Data Representation and Codes
ISDM	Integrated Science Data Management (Canada)
ISO	International Organization for Standardization
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM *in situ* Observing Programme Support Centre
JMA	Japan Meteorological Agency
LDCs	Least Developed Countries
LDP	ODP Light Data Provider
M&G	Manual and Guides
MAN	JCOMM Management Committee

MARCDAT	International workshop on Advances in the Use of Historical Marine Climate Data
MASK	Ship masking scheme whereby a unique, repeating identifier is used; the masking identifier is assigned by the NMS that recruited the ship
MCDS	Marine Climate Data System (of JCOMM)
MCP	Marine Community Profile
MCS	Marine Climatological Summary
MCSS	Marine Climatological Summaries Scheme (JCOMM)
META-T	Water Temperature Metadata Pilot Project
MQCS	Minimum Quality Control Standard
MOON	EuroGOOS Mediterranean Operational Oceanography Network
MPERSS	Marine Pollution Emergency Response Support System
MSC	Maritime Safety Committee (of IMO)
MSI	Maritime Safety Information
NCDC	NOAA National Climatic Data Center (USA)
NCEP	NOAA National Centers for Environmental Prediction (USA)
NDBC	NOAA National Data Buoy Center (USA)
NetCDF	Network Common Data Form
NMDIS	National Marine Data and Information Service (China)
NMHS	National Meteorological and Hydrographic Service
NOAA	National Oceanic and Atmospheric Administration (USA)
NOC	National Oceanography Centre (UK)
NODC	IODE National Oceanographic Data Centre
NWP	Numerical Weather Prediction
OBIS	Ocean Bio-geographical Information System
OceanSITES	OCEAN Sustained Interdisciplinary Timeseries Environment observation System
OCG	JCOMM Observations Coordination Group
ODAS	Ocean Data Acquisition System
ODASMS	ODAS Metadata Service (operated by China for JCOMM)
ODIN	IOC Ocean Data and Information Network
ODP	UNESCO/IOC-IODE Ocean Data Portal
ODS	IODE-JCOMM Ocean Data Standards Pilot Project
ODV	Ocean Data View
OGC	Open Geospatial Consortium
OOPC	Ocean Observations Panel for Climate
OPA	JCOMM Observations Programme Area
OPACE	Open Panels of CCl Experts
OPAG	Open Programme Area Group
OSMC	JCOMM Observing Systems Monitoring Centre
OT	OceanTeacher
OWDIP	Ocean Wave Data and Information Portal
PA	Programme Area (of JCOMM)
PDF	Portable Document Format
PP-WET	DBCP/ETWS Pilot Project for Wave measurement Evaluation and Testing
PSMSL	Permanent Service for Mean Sea Level
Pub. 47	WMO-No. 47 (WMO, 1955)
QA	Quality Assurance
QC	Quality Control
QMF	WMO Quality Management Framework
QMS	Quality Management System
R/V	Research Vessel
RA	WMO Regional Association
REAL	Ship masking scheme whereby the Official ITU callsign of the ship is used (i.e. unmasked)
RECLAIM	RECovery of Logbooks And International Marine data
RIHMI-WDC	Russian Research Institute of Hydrometeorological Information

RM	MCSS Responsible Member
RMIC	WMO-IOC Regional Marine Instrument Centre
RNODC	IODE Responsible National Oceanographic Data Centre
RNODC/DB	RNODC for Drifting Buoys
RRR	Rolling Review of Requirements
RTMC	VOSClim Real Time Monitoring Centre
SAR	Search and Rescue
SCG	JCOMM Services Coordination Group
SDN	SeaDataNet
SeaDataNet	Pan-European infrastructure for Ocean and Marine Data Management
SFSPA	JCOMM Services and Forecasting Systems Programme Area
SHIP	Ship masking scheme whereby a non-unique identifier is used; the callsign is unilaterally replaced by the letters “SHIP”
SOA	State Oceanic Administration (China)
SOC	JCOMM Specialized Oceanography Centre
SOC/DB	SOC for Drifting Buoys
SOT	JCOMM Ship Observations Team
SPA	JCOMM Services Programme Area
SSS	Sea Surface Salinity
SST	Sea Surface Temperature
TDC	Table Driven Code
ToR	Terms of Reference
TT-DMVOS	SOT/ETMC Task Team on Delayed-Mode VOS Data (now merged into TT-MCDS)
TT-MCDS	ETMC Task Team for the Marine Climate Data System
TT-MOCS	ETMC Task Team on Marine-meteorological and Oceanographic Climatological Summaries (now merged into TT-MCDS)
TT-TDC	DMPA Task Team on Table Driven Codes
UNFCCC	United Nations Framework Convention on Climate Change
VCP	Voluntary Cooperation Programme
VOS	Voluntary Observing Ship
VOSClim	VOS Climate Project
WCC	World Climate Conference
WCRP	World Climate Research Programme
WDC	ICSU World Data Centre (the system of WDCs is now suprseeded by the WDS)
WDS	ICSU World Data System
WDIP	WIGOS “Test of Concept” Development and Implementation Plan
WG	Working Group
WGNE	CAS Working Group on Numerical Experimentation
WG-SP	GCOS AOPC/OOPC Working Group on Surface Pressure
WG-SST/SIAOPC/OOPC	Working Group on Sea-Surface Temperature and Sea-Ice
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
WOA	World Ocean Atlas
WOD	World Ocean Database
XBT	Expendable Bathythermograph
XML	Extensible Markup Language