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WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

EXPERT TEAM ON MARINE CLIMATOLOGY (SIXTH SESSION)

National Oceanography Centre, Southampton, UK

19-21 July 2016

REPORT

JCOMM Meeting Report No. 133

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NOTES

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C O N T E N T S

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EXPERT TEAM ON MARINE CLIMATOLOGY (SIXTH SESSION)

1. ORGANIZATION OF THE SESSION

The sixth session of the JCOMM Expert Team on Marine Climatology (ETMC-6) was opened by Mr Eric Freeman (USA), Chair of the Expert Team at 1400 hours on Tuesday, 19 July 2016, at the National Oceanography Centre (NOC) Southampton, UK. The Chair welcomed all participants and invited the Team to focus on development of Marine Climate Data System (MCDS) and associated regulatory materials, infrastructures, governance, etc. Mr Freeman thanked David Berry (UK) and NOC for excellent organization and hosting of the Fourth International Workshop on the Advances in the Use of Historical Marine Climate Data (MARCDAT-IV) and Sixth Session of the JCOMM Expert Team on Marine Climatology.

Dr Long Jiang, representative of WMO secretariat, stressed that rewriting of the marine climatology chapters of the WMO Manual on and Guide to Marine Meteorological Services, No. 558 and 471 is a key deliverable to the upcoming JCOMM-5 session, planned October 2017 in Indonesia. He thanked all experts attending ETMC-6, and contributors to the rewriting.

The Team went through round table introductions and adopted the agenda for the Session on the basis of the provisional agenda prepared by the secretariats. The Team agreed on its working hours and other practical arrangements. The documentation was introduced by the secretariat. The meeting was conducted in English.

2. JCOMM ASPECTS AND REPORTS

2.1 Report by the ETMC Chairperson

The Chairperson, Eric Freeman (USA) presented an overview of the activities of the ETMC since its fifth session (ETMC-5, Geneva, Switzerland, 22-25 June 2015). In continuing development work of the new Marine Climate Data System (MCDS), focus is now being shifted to the implementation phase of the MCDS. During the intercessional period, work undertaken included:

- Updates to Marine Climatology Chapters of WMO Publication Nos. 471 and 558.
- Assistance in organizing the Fourth Workshop on the Advances in the Uses of Historical
- Marine Climate Data (MARCDAT-IV), Southampton, UK, 18-22 July 2016.
- Review of invitation letter to become a GDAC in the MCDS (drafted initially for ARGO).
- Assuring representation of ETMC at the following meetings:

- Inter-programme Expert Team on the Climate Data Modernization Programme (IPET-CDMP, TBC),
- Sixth Session of the JCOMM Data Management Coordination Group (DMCG), Oostende, Belgium, 27-28 June 2016.

- ETMC review and response to the questionnaire on the Review of IOC's Role and Involvement in the IHO-IOC General Bathymetric Chart of the Oceans (GEBCO) Project.

The Team recognized with much appreciation, the efforts of the ETMC Vice-Chair, Lydia Gates, in representing the ETMC at the meetings mentioned above. Additionally, Dr. Gates represented JCOMM and ETMC in presenting oral and poster information on the new MCDS at the following meetings:

- Ocean Sciences 2016, New Orleans, Louisiana on 21-26 February 2016.
- MARCDAT-IV, Southampton, UK, 18-22 July 2016.

The Chairperson also recalled some issues that will have to be resolved by the Team, including:

- Major losses of delayed-mode International Maritime Meteorological Tape (IMMT) data flows from Automatic Weather Stations (AWS) on ships that are not being properly retrieved and provided to the GCCs or any other archive, as noted at the Eighth Session of the JCOMM Ship Observation Team (SOT-8);

- Call-sign masking continues to be a problem; and

- Full transition to FM-94 BUFR table driven code continues to progress, and is moving much faster now. Concerns in the community are still expressed regarding preservation of originally reported data. Ship-to-shore formats produced by E-SURFMAR are being considered for replacement of FM-13 SHIP code and FM-18 BUOY code.

Mr. Freeman provided the following guidance to the Team regarding priority activities that relate to marine climatology:

- Working towards to full Implementation of the MCDS vision by 2020 and by the continued collaboration of ETMC, Task Team on the MCDS (TT-MCDS) and the JCOMM Data Management Coordination Group (DMCG);

- Finalizing the JCOMM Marine Climatology website in support of implementing the MCDS.

- Progress towards resolving the outstanding callsign masking issues including implementation of callsign encryption;

- Data preservation issues relating to migration of real-time transmission to FM-94 BUFR;

- Addressing the loss of IMMT data from TurboWin e-logbooks from AWS. Propose new data flows and better ways to avoid loss;

- Completion of the Marine Climatology chapters of the WMO Manual on (WMO Publication No. 558) and Guide to (WMO Publication No. 471) Marine Meteorological Services by 2015; and

- Close interactions with the new CMOC/China to provide guidance in data rescue and buoy data/metadata integration.

The ET was urged to continue rewriting of the marine climatology chapters of 558 and 471, to ensure timely delivery for JCOMM-5 to be approved, and coordinate with Neal Moodie (ETMSS chair) on the timeline. The Team requested the secretariat to follow up on the availability of Mr Etienne Charpentier for his responsible parts in the documents. Regarding the work of TT-MOWIS, the ET requested chair to coordinate with TT-MOWIS to clarify integration requirements to WIS, and keep abreast of the guidance document to be prepared by TT-MOWIS.

2.2 JCOMM Management Committee and Data Management Coordination Group guidance

The WMO secretariat submitted a report on the outcomes of Seventeenth World Meteorological Congress (Cg-17, May-June 2015, Geneva, Switzerland) that are highly relevant to the work of ETMC, including the WIGOS pre-operational phase (2016-2019) and WMO Climate Data Policy.

The WIGOS Pre-operational Phase Priorities (2016-2019):

- National WIGOS implementation
- WIGOS **Regulatory Material**, complemented with necessary guidance material
- The WIGOS **Information Resource (WIR),** with special emphasis on the operational deployment of the **OSCAR/Surface** database
- Development and implementation of the **WIGOS Data Quality Monitoring System (WDQMS)**
- Regional WIGOS Centres(RWCs)

WIGOS implementation is to ensure maximum usefulness of WIGOS observations, which are accompanied by adequate metadata, including mandatory, conditional and optional metadata.

WIGOS Data Quality Monitoring System provides three functions in quality monitoring, equality evaluation, and incident management. WDQMS will offer better availability and higher quality of observational data to users, with rapid detection of problems on the exchanged observational data, and quick identification of actions to solve those highlighted issues.

WMO Climate Data Policy

The Secretariat reported that Cg-17 through its resolution 60 urged Members to strengthen their commitment to the free and unrestricted exchange of GFCS relevant data and products, and to make sure of the WIS for the exchange of GFCS relevant data and products among Members.

JCOMM Data Management Coordination Group

The sixth session of JCOMM Data Management Coordination Group (DMCG-6) took place from 27 to 28 June, 2016, at the International Oceanographic Data and Information Exchange of the Intergovernmental Oceanographic Commission (IODE/IOC), Ostend, Belgium.

The DMCG appreciated the work of ETMC in the development of Marine Climate Data System (MCDS), in particular the rewriting of marine climatology chapters of the Manual on and Guide to Marine Meteorological Services WMO No.558 and 471.

DMCG made the following recommendation regarding work of ETMC:

1) Continue working on the rewriting and to make sure the texts will be ready before JCOMM-5 (October 2017) for approval, in consultation with ETMSS on the timeline.
2) Follow up on the establishment of CMOCs of ICOADS and WOD, and designation of GDSIDB as GDAC or CMOC.
3) Coordinate with the cross cutting Task Team for Integrated Marine Meteorological and Oceanographic Services within WIS (TT-MOWIS) to clarify integration requirements to WIS
4) Incorporate MARCDAT-4 recommendations for MCDS as appropriate.

3. MARINE CLIMATE DATA SYSTEM (MCDS)TOP PRIORITY

3.1 Review of MCDS developments, data and metadata, and WIGOS, platform data

The chairperson introduced development of MCDS.

CMOC-China

A future meeting/workshop with CMOC-China is scheduled from 29 August to 1 September 2016, where delegates will again visit CMOC-China to provide further guidance and discuss capacity building and cooperation with the expected future CMOCs – for ICOADS and for the World Ocean Database (WOD).

ETMC-V Updates

At ETMC-V (Geneva, Switzerland, 22-25 June 2015) the team identified Centres that would be appropriate candidates for DACs, GDACs and CMOCs within the new MCDS and began the 2nd phase of the MCDS – implementing the MCDS.

In doing so, discussions are underway to recruit those Centres identified for the MCDS implementation and will be finalized at the ETMC-6 meeting in July 2016. Details on how to apply will be drafted and prepared for adoption at JCOMM-5. The Secretariat has drafted a letter of invitation for new GDACs, which is under review. Something similar will be proposed for DACs.

Marine Climatology chapters in the WMO Publications No. 471 and 558 (Manual and Guides) are being updated to reflect the status of the MCDS, provide guidance on how to be a part of the MCDS, and to remove legacy information regarding the MCDS predecessor scheme, the Marine Climatological Summaries Scheme (MCSS). These updates will be submitted to JCOMM-5 for approval.

Regarding CMOC establishment, CMOC-China is operating and has produced a detailed report for their first year. They are progressing in their establishment. CMOC applications for a CMOC-ICOADS and a CMOC-WOD are underway and are being prepared for submission in 2016.

3.2 Data Acquisition Centres (DACs), ToR, and candidates

DACs in the MCDS

Recalling the proposed DAC Terms of Reference (ToR) in Appendix Annex IVXXXX, progress was noted in identifying potential DACs from WMO currently operating in the Marine Climatological Summaries Scheme being replaced by the new MCDS. At the Fifth Session of the Expert Team on Marine Climatology (ETMC-V), new (or existing) DACs were identified and mapped into the appropriate structure of the MCDS.

Recall that the goal of the MCDS is to harmonize data flows and to have the least amount of disruption to current duties and allow proposed centres to easily fulfill the MCDS role with little to no additional resource needs or substantial changes.

Candidate DACs for immediate transition to the MCDS are listed below in Table 1.

Table 1: Foreseen role of the MCSS Contributing Members in the MCDS

Responsible Member	***Foreseen role in MCDS***
Germany	Contributing Member to be migrated to DAC for delayed-mode VOS data
Hong Kong, China	Contributing Member to be migrated to DAC for delayed-mode VOS data in the South China Sea region.
India	Contributing Member to be migrated to DAC for delayed-mode VOS data in India's area of responsibility
Japan	Contributing Member to be migrated to DAC for delayed-mode VOS data
Russian Federation	Interested to play a role (particularly of regional Polar DAC)
United Kingdom	Contributing Member to be migrated to DAC for delayed-mode VOS data
United States of America	DAC for VOSClim Contributing Member to be migrated to DAC for US delayed-mode data & global R/T marine data from the Global Telecommunication System (GTS)

Identified groups are already carrying out DAC duties and would easily fit into the MCDS structure in order to expedite implementation of the MCDS and show proof of concept on how the system is expected to work.

The next phase of designating new DACs will be completed on a more long-term basis as gaps in the MCDS structure are identified. DACs will then be proposed that could help in filling those deficiencies.

The formal process to apply for DAC (and GDACs) was discussed and it is noted that efforts should be made to identify DACs from IODE to also fill the roles of DAC in the MCDS. Those groups such as ARGO (DM and RT), Moored Buoy (DM and RT), and Sea Ice would be beneficial contributors as DACs to the MCDS.

3.3 Global Data Assembly Centres (GDACs), ToR, and candidates (GCCs), a formal procedure

GDACs in the MCDS

Recalling the the proposed GDAC Terms of Reference (ToR) in Appendix XXXXnnex V, progress was noted in identifying potential GDACs from both IODE and WMO. At the Fifth Session of the Expert Team on Marine Climatology (ETMC-V), new (or existing) GDACs were identified and mapped into the appropriate structure of the MCDS.

Through informal discussions, Tim Boyer and Etienne Charpentier approached potential IODE GDACS to gauge their interest in formalizing their roles as GDACs in the new MCDS. Interest was expressed and it was agreed that WMO would draft invitation letters to the proposed GDACs to encourage them to formally register to assume these new roles. Recall that the goal of the MCDS is to harmonize data flows and to have the least amount of disruption to current duties and allow proposed centres to easily fulfill the MCDS role with little to no additional resource needs or substantial changes.

To date, there are a few GDACs that have been identified that could immediately assume the formal roles of GDAC under the MCDS. They are:

- NOAA's National Data Buoy Center (NDBC) – GDAC for Moored Buoys
- Coriolis (ARGO) – GDAC for ARGO
- CCHDO – GDAC for CTDs and Hydrographic Data
- SOC/DB (France) – GDAC for Real-Time Drifting Buoys
- RNODC/DB (Canada) – GDAC for Delayed-Mode Drifting Buoys
- WMO Global Collecting Centres (UK and Germany) – GDAC for Delayed-Mode VOS data
- Russian Federation – Polar GDAC

Identified groups are already carrying out GDAC duties and would easily fit into the MCDS structure in order to expedite implementation of the MCDS and show proof of concept on how the system is expected to work.

Furthermore, the meeting considered Hong Kong, China to be a GDAC for Delayed-Mode data in the South China Sea but discussions between the GCCs and Hong Kong determined that the work would duplicate that of the operating GCCs and it was recommended for Hong Kong to not proceed with the application of GDAC for delayed mode VOS data.

The next phase of designating new GDACs will be completed on a more long-term basis as gaps in the MCDS structure are identified. GDACs will then be proposed that could help in filling those deficiencies.

In April 2016, an invitation letter was drafted to be presented to ARGO (and possibly other potential GDACs with minimal edits) inviting their application to be a formal GDAC in the MCDS. The document is under final review and will be prepared by the WMO Secretariat.

IODE – WMO GDAC Comparisons

Referring to the graphic in Appendix Bnnex VI, Paul Poli (MeteoFrance) did a recent comparison of IODE and WMO GDACs to compare their Terms of Reference (ToR) for similarities and differences. It was noted that the ToRs are very similar and that merging the two ToRs into one GDAC ToR to cover JCOMM, rather than IODE and WMO individually, would be beneficial. This model would help all aspects of the MCDS, DAC to CMOC, and provide a comprehensive and detailed dataflow between all IODE and WMO groups moving to the MCDS.

While differences were noted in QC requirements between IODE and MCDS GDACs, it wasn't considered a blocking point and is something that could easily be rectified in a unified GDAC ToR and should be considered by the ETMC and TT-MCDS going forward. GDACs in the MCDS

Recalling the the proposed GDAC Terms of Reference (ToR) in Appendix Annex B, progress was noted in identifying potential GDACs from both IODE and WMO. At the Fifth Session of the Expert Team on Marine Climatology (ETMC-V), new (or existing) GDACs were identified and mapped into the appropriate structure of the MCDS.

Through informal discussions, Tim Boyer and Etienne Charpentier approached potential IODE GDACS to gauge their interest in formalizing their roles as GDACs in the new MCDS. Interest was expressed and it was agreed that WMO would draft invitation letters to the proposed GDACs to encourage them to formally register to assume these new roles. Recall that the goal of the MCDS is to harmonize data flows and to have the least amount of disruption to current duties and allow proposed centres to easily fulfill the MCDS role with little to no additional resource needs or substantial changes.

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- RNODC/DB (Canada) – GDAC for Delayed-Mode Drifting Buoys
- WMO Global Collecting Centres (UK and Germany) – GDAC for Delayed-Mode VOS data

Identified groups are already carrying out GDAC duties and would easily fit into the MCDS structure in order to expedite implementation of the MCDS and show proof of concept on how the system is expected to work.

The next phase of designating new GDACs will be completed on a more long-term basis as gaps in the MCDS structure are identified. GDACs will then be proposed that could help in filling those deficiencies.

In April 2016, an invitation letter was drafted to be presented to ARGO (and possibly other potential GDACs with minimal edits) inviting their application to be a formal GDAC in the MCDS. The document is under final review and will be prepared by the WMO Secretariat.

The formal process to apply for GDAC (and DACs) will be discussed further at the Sixth Session of the ETMC (ETMC-VI) being held in Southampton UK, 19-20 July 2016.

3.4 Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs)

3.4.1 Status of and linkages with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS)

The Team discussed recent improvements to the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) in the latest Release 3.0 (R3.0; covering 1662–2014), as described in detail in Freeman *et al.* (2016). Abstract excerpt from Freeman *et al.* (2016):

"ICOADS is the most widely used freely available collection of surface marine observations, providing data for the construction of gridded analyses of sea surface temperature, estimates of air–sea interaction and other meteorological variables. ICOADS observations are assimilated into all major atmospheric, oceanic and coupled reanalyses, further widening its impact. R3.0 therefore includes changes designed to enable effective exchange of information describing data quality between ICOADS, reanalysis centres, data set developers, scientists and the public. These user-driven innovations include the assignment of a unique identifier (*UID*) to each marine report—to enable tracing of observations, linking with reports and improved data sharing. Other revisions and extensions of the ICOADS' International Maritime Meteorological Archive common data format incorporate new near-surface oceanographic data elements and cloud parameters. Many new input data sources have been assembled, and updates and improvements to existing data sources, or removal of erroneous data, made. Coupled with enhanced 'preliminary' monthly data and product extensions past 2014, R3.0 provides improved support of climate assessment and monitoring, reanalyses and near-real-time applications."

The Team recognized with much appreciation that ICOADS was now successfully being managed and updated through an international partnership, specifically, as discussed in Freeman *et al.* (2016): "In 2014, the ICOADS program was expanded into international partnership to include research and operational organizations in the UK and Germany (http://icoads.noaa.gov/partners.html, accessed 1 January 2016), to leverage expertise and resources to complete Release 3.0 (R3.0) and enhance future ICOADS releases."

The Team noted with further appreciation that R3.0 was successfully completed in June 2016, and that the International Maritime Meteorological Archive (IMMA1) format observational data (see Smith *et al.*, 2016 and ETMC-6/Doc. 4.1), and associated monthly summary products for R3.0, are now freely available from NCAR, NCEI, and other project partners (follow links from: http://icoads.noaa.gov/products.html).

Looking to the future, since the long-term development of ICOADS has been strongly and beneficially guided from the user community though the CLIMAR/MARCDAT international marine climatology workshops, starting in 1999, the overall future priorities identified by the most recent Fourth JCOMM Workshop on Advances in Marine Climatology (CLIMAR-4; JCOMM 2015a) were reviewed again by the Team, as listed in Table 1. With completion of R3.0, we have made substantial progress on just some of these priorities as also described in Table 1, thus clearly much work remains.

Additionally, ICOADS is making preparations to become a JCOMM Centre for Marine Meteorological and Oceanographic Climate data (CMOC) as part of the Marine Climate Data System (MCDS). A formal application to JCOMM is being prepared.

Table 2. Overall future priorities identified by CLIMAR-4 (JCOMM, 2015b) and reviewed previously by ETMC-5 (JCOMM, 2015b)
(note: priorities marked in grey are not directly relevant to ICOADS)

#	*CLIMAR-4 Future Priority*	*Progress as of ICOADS R3.0*
1	Expand the ICOADS lineage record—and capture its scientific impact via metadata	(no noteworthy progress yet)
2	Promote formal ICOADS data citation using DOIs	Good progress here by NCAR, whereas NCEI is still developing procedures and policies. Specifically, at NCAR DOIs have been assigned separately for the R3.0 IMMA1 (see http://rda.ucar.edu/datasets/ds548.0/) vs. monthly summary products (see http://rda.ucar.edu/datasets/ds548.1/). Similarly, separate DOIs were assigned to the previously available R2.5 data and products (ds540.0/1 webpages).
3	Promote open-source software development for ICOADS	Some limited progress by Philip Brohan (UK Met Office; see https://github.com/oldweather/IMMA) and a few ICOADS users have also supplied code to NCAR
4	Promote QC and platform trajectory tracking – old and new sources	Some work by NOC continues (see: Carella G., E.C. Kent, D.I. Berry, 2015: A probabilistic approach to ship voyage reconstruction in ICOADS. *Int. J. Climatol.*, doi: 10.1002/joc.4492)
5	Advance the management and availability of wave, buoy, and platform data and metadata in ICOADS	While DBCP is progressing gradually on buoy/platform metadata issues, further work is needed on the wave data aspects, and e.g. further enhancements will likely be required in due course in the IMMA format to storage platform/buoy metadata
6	Enrich logbook rescued data with image linkage scheme	(no noteworthy progress yet)
7	Promote development of *in situ* to satellite, and vice versa, data matchup web service	(progress separately from ICOADS: NOAA/STAR & NCEI, DOMS)

8	Create climate credible products to inform IPCC and CMIP reports and research	
9	Participate in climate international service initiatives	
10	Promote availability of enhanced near real time data	To extend R3.0 data and products past 2014, improved NCEP-NCEI GTS blend data are becoming operational monthly (see: http://icoads.noaa.gov/merge.html)

3.4.2 CMOC/China development status

WMO-IOC Centre for Marine Meteorological and Oceanographic Climate Data, Tianjin, China (CMOC/China) has been operationally maintained and upgraded by National Marine Data and Information Service (NMDIS), State Oceanic Administration (SOA) to guarantee the oceanographic and marine meteorology data, metadata, and product service to end users. URL: http://www.cmoc-china.cn. NMDIS provides full technical and financial support. Delegates of CMOC/China presented a comprehensive report on its activities (see Annex III for details).

According to its statement of commitment submitted in 2012, CMOC/China committed to undertake the following tasks:

- Integrate marine-meteorological and oceanographic climate data, metadata, and actively conduct HLQC and produce specialized datasets of ECVs and EOVs;
- Actively participate in the research and development of oceanographic and marine-meteorological products, and their related services: climate statistical products and reanalysis products;
- 7X24 operation website to provide free services to users, and mirroring with other CMOCs when possible;
- Provide technical training, and carry out capacity building activities for countries in the region.

To promote the implementation of the CMOC/China project, NMDIS renewed the internal CMOC/China Steering Group (SG) which was set up in 2012. The SG is chaired by the Director-General of NMDIS Dr. HE Guangshun. Specialized Working Groups (CMOC/China Secretariat, Working Group on Website Operation, Working Group on Data Management, Working Group on Product R&D, Working Group on Infrastructure Construction) are established to ensure the implementation of the project.

To improve the operation of NMDIS and the working environment of CMOC/China, NMDIS started the re-construction of the main office building in 2015. The whole construction is expected to be completed in October 2016. Further improvements for CMOC/China network hardware environment (e.g. servers and data storage devices), and training facility are included in the plan.

The ET discussed some technical matters, including mirroring and acquisition of buoy metadata, and appreciated the report and progress of CMOC/China.

3.4.3 CMOC ICOADS and WOD application status

Following ETMC-V recommendations for ICOADS and WOD to apply for CMOC status within the MCDS, Statements of Commitment and Self-evaluation reports were drafted for both programs, and presented internally for review at NOAA/NCEI. The applications were reviewed favorably by NCEI, and work continues to refine the documents for formal submission to JCOMM.

To strengthen the submission, and streamline the bureaucratic processes necessary to approve it internally within NOAA first, it was agreed at NCEI that both applications should be

submitted to JCOMM jointly. However, while the WOD application is currently in a final form for submission to JCOMM, the ICOADS application has not quite reached that state of readiness, due to ongoing ICOADS resource and processing-readiness concerns.

Specifically, several months ago the ICOADS Steering Committee (ISC[1]) raised concerns about staffing (particularly programming) and other resource constraints at NCEI, and felt that it was premature to submit the ICOADS application until NCEI could take steps to assure adequate resources for ICOADS in general, including those needed to host the CMOC-ICOADS. NCEI has taken recent steps to assign (effective June 2016) a programmer in Asheville for ICOADS, which is an important initial step in increasing project resources.

As a result, confidence within the ISC is building but there are additional steps that the ISC would like to see, mainly a full porting of the ICOADS Release 3.0 (R3.0) delayed-mode post-translation processing system from Boulder to NCEI-Asheville. Discussions are underway at NCEI to make preparations for this process, potentially utilizing some WOD-resourced servers. In developing capabilities, NCEI was also recently awarded a Big Earth Data Initiative (BEDI) proposal to fund conversion of ICOADS to a CF-compliant netCDF format with ISO metadata, to be incorporated into NCEI Geoportal search and discovery tools, and served alongside WOD.

While noting these further resource concerns, the ISC planned to have further discussions at the end of MARCDAT-IV on the CMOC status and work to further assess the ICOADS resource issues at NCEI before proceeding to formally submit the application.

Additionally, the NCEI Director, Tom Karl, is retiring from NOAA in August and hiring another Director could potentially take 1-2 years. This may further delay approval within NCEI, but all efforts will be made to keep the NCEI Director's Office abreast of any advances in submitting the ICOADS and WOD applications and to receive their approval to submit the applications to JCOMM.

3.4.4 Manual on and Guide to Marine Meteorological Services (WMO No. 558 and 471)

Following ETMC-V, and taking into consideration proposed edits and recommendations from the team, WMO Pub Nos. 558 and 471 were revised and sent out to section leads for comment. Unfortunately, progress after that point has been slow. A few major items remain in order to move the publications along:

- Full top-to-bottom review of both documents to note the differences/similarities between the documents and provide clarity between the 2.
- Add/delete information based on recent proposed candidates for DAC/GDAC/CMOC (where possible)
- Check for coherency and accurate information
- Update diagrams representing the most current snapshot of the MCDS and how it should be perceived by IODE and WMO.
- Make sure all ToRs are up to date.
- Consider any other recommendations on format and propose additional sections (if needed)

While a lack of progress has been noted, following ETMC-VI the Chair has been tasked with hosting bi-weekly or monthly teleconference meetings with the TT-MCDS, as appropriate, to carry the work forward and maintain a steady progress towards completion of the documents.

Additionally, coordination with Neal Moodie (Australian Bureau of Meteorology), lead author for the full publications 471 and 558, is needed in order to determine the final due date

[1] Since 2012, ICOADS has operated as an international partnership among Germany, UK, and USA, led by NCEI (see: http://icoads.noaa.gov/partners.html).

for the Marine Climatology chapters in both. There is confusion as to when the Marine Climatology chapters are due, possibly in August 2016 or December 2016. Clarification from Mr. Moodie has been requested by the Secretariat.

The team discussed the workplan and provided updates to complete the Marine Climatology Chapters in coordination with final production of the full Pub Nos. 471 and 558.

3.5 Updating of the Implementation Plan

The Team will discuss the continued development of the Marine Climate Data System (MCDS) in line with the recommendations, decisions, and guidance from JCOMM-4.

The meeting will particularly review the potential contributions and roles of the various actors and stakeholders in the MCDS, particularly concerning foreseen role of the existing Marine Climatological Summaries Scheme (MCSS) Responsible Members to possibly become Data Acquisition Centres (DACs), or Global Data Assembly Centres (GDACs). It will review the role of DACs and GDACs, propose necessary updates to the Terms of Reference for such centres. The meeting will discuss the further development of the network of [less than ten] Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs), including status of the CMOC/China work plan, and the linkage with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) Partnership.

As essential part of the MCDS development, the Team will concentrate on detailed work plan to rewrite marine climatology chapters in the WMO 558 and 471. Taking into account of the timeline of JCOMM-5 session in October 2017, the draft texts should be prepared as soon as possible, no later than March 2017.

Finally, under this agenda item, the Team will review the MCDS Implementation Plan (Annex VII), and suggest revisions as needed.

4. FORMATS AND QUALITY CONTROL

4.1 Status of the International Maritime Meteorological Archive (IMMA) format

The Team reviewed the development and status of the International Maritime Meteorological Archive (initial version: IMMA0) format (ICOADS, 2010), which is in wide use for storing historical and contemporary marine data for ICOADS, and continues to be offered quarterly by the GCCs as an alternative to the IMMT format. The Team recalled that IMMA, which is used to store and provide ICOADS observational data to users, and also to permanently archive the data and metadata in a technologically stable and readily exchanged form, has been under review by ETMC and its predecessor Subgroup on Marine Climatology since 2000 (as detailed further in Smith et al. 2016)—and most recently reviewed internationally by CLIMAR-IV (JCOMM, 2015a) and by ETMC-5 (JCOMM, 2015b).

Briefly (adapted from Freeman et al. 2016), the format is ASCII-based, containing a Core section including date, time, location, and identification information along with commonly reported meteorological variables and associated metadata. A simple fixed-length encoding scheme is used, with floating-point numerical values scaled to integers, e.g. 19.23 stored as 1923, and non-numeric data, such as QC flags and metadata, stored as 1- or 2-character coded values that are then decoded via look-up tables. Following the Core, a variety of attachments (attms) is available to hold additional data elements or metadata not represented in the Core.

The Team reviewed the enhancements that have now been fully implemented and finalized in the latest format version, IMMA1. This new version of IMMA (Smith et al., 2016) was developed for the recently completed Release 3.0 (R3.0) of ICOADS (Freeman et al., 2016). This format version introduces several new features (summarized also in Freeman et

al., 2016). In addition, the Team was pleased to note that machine-transportable Fortran software to help read (and optionally write) the IMMA1 format ("rwimma1") is also available (http://icoads.noaa.gov/software/rwimma1).

The anticipated scope and form of most of these IMMA1 enhancements were previously reviewed by ETMC-5 (JCOMM, 2015b), following international user discussion at CLIMAR-4 (JCOMM, 2015a), together with potential avenues for formalization and publication of IMMA. Relevant excerpt from JCOMM (2015b):

"The Team discussed the possibility, and potentially important benefits, of formalizing IMMA within JCOMM. The Team reviewed previous recommendationsed that the GCCs begin transitioning to producing IMMA1 and discontinue production of IMMA0 when prepared., but Tthe Team instead agreed that the IMMA should be controlled by the ICOADS partnership, that the format should beand documented as part of the new JCOMM Technical Report No. 85 on the MCDS."

Proposed specific actions for discussion by ETMC-6:

Possibilities for formal publication of Smith et al. (2016), e.g. as a JCOMM Technical Report No. 85 as previously discussed by ETMC-5 (see above), possibly a separate JCOMM Technical Report, or alternative publication methods.

4.2 Status of the International Maritime Meteorological Tape (IMMT) format, and formalization

Fraser Cunningham (UK) reported on this item. The Global Collecting Centres for the Marine Climatological Summaries Scheme were established by Recommendation 11 (CMM-XI) (Lisbon, April 1993). Germany and the United Kingdom have been operating the GCCs and have responsibility for the upkeep of the International Maritime Meteorological Tape (IMMT) format and Minimum Quality Control Standard (MQCS).

Version 5 of the IMMT format was adopted by JCOMM-4 in May 2012 following minor amendments/additions to the previous versions. IMMT-5 is now the recommended version for use by all contributing members.

As of May 2012 IMMT-5 and MQCS-7 were the preferred format and quality standard for use by delayed-mode VOS observations. In 2015 17% of observations received were coded in IMMT-5 format, while 67% were coded in IMMT-4. This is largely due to the use of TurboWin version 5.0 which codes observations in the IMMT-4 format

As Contributing Members (CM) continually move to automate voluntary observing fleets there is a risk that data could be lost. At present a substantial volume of data produced by automatic weather systems on board VOS is not being submitted to the GCCs. In order to do this, common procedures for producing observations in the IMMT format directly from AWS, or for converting observations into the IMMT format downstream should be investigated.

With the move to BUFR as the primary format for exchange of real-time meteorological observations now would be a good time to consider if the IMMT format should be expanded to accommodate the extra resolution that BUFR provides for certain elements. For example positions and temperatures could be expanded to take the resolution to hundredth of degrees rather than tenths.

In addition, Scott Woodruff (USA) reminded the Team about a proposal made at the Fourth Session of ETMC (Ostend, Belgium, 26-28 November 2012) for development of a renovated historical state-of-art IMMPC/IMMT (and resultant IMMA1) archive, as described in more detail in Annex II. As feasible, this proposed initiative would ensure that surviving original forms of IMMPC and IMMT data held at Contributing and Responsible Members under the the MCSS would be archived, and also the initiative holds the potential to improve the quality and completeness of IMMPC/IMMT-based data included in ICOADS.

4.3 Status of the Minimum Quality Control Standard

Dr Lydia Gates, vice-chair of the Expert Team reported on this item. She explained that there are no MQC test criteria check existing for Element 102 / 103 (RH / RHi). Appropriate test criteria have need to be defined,. eE.g.: 0 ≤ RHi ≤ 4. If necessary, the respective quality indicators need to be added to IMMT.

For element 16 / 17 (sn / TTT), the following MQC-check is defined for these elements:
If Latitude ≥ 45 ° and Air Temperature < -25 °C then Quality Flag Q6 = 3 (doubtful)

This check is too rigorous in particular during wintertime in high latitude regions. Temperatures below -25°C regularly occur near landmasses and during cold air outbreaks. Many observations especially from Canadian ships fail this check although they are correct (see example in Figure 2 below).

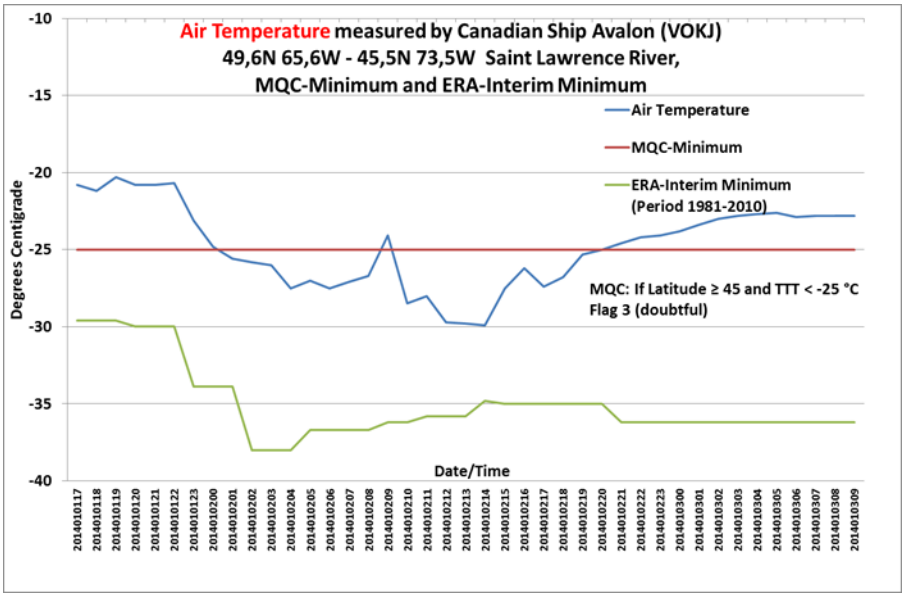

Figure 2: MQC flag for Air Temperature measured by Canadian shipAvalon(VOKJ)

4.4 Higher level quality control

Dr Lydia Gates reported on the status of Higher Level Quality Control Standard (HQCS). The HQC package 'validat' has been under development at Deutscher Wetterdienst for several years. It is used operationally for automatic and manual quality control of its maritime data archive. The focus during the development was on the handling of VOS data with up to hourly temporal resolution. Higher temporal resolutions can be handled as well, but currently require an additional procedure.

The HQC routines contain the following tests:

- Formal consistency
- Land/Water
- Course and speed
- Climatological
- Chronological check (detection of outliers)
- Repetition check
- Internal consistency checks
- Spatial consistency

A basic description of the validat package and the implemented test routines was presented at ETMC-5 and is documented in JCOMM/DMPA/ETMC-5 / Doc. 6.4(1)

In order to align the HQC routines with the MCDS data streams, the package is currently revised regarding the following points:

- Implementation of all MQC rules, capability to run as an MQC-only version
- Handling of data with high temporal resolution
- Improved quality flag scheme (e.g. compliant with IOC Manuals and Guides, 54, Volume 3 Version 1)
- Update the documentation of the individual test modules

5. CONSIDERATIONS OF MARCDAT-4 RECOMMENDATIONS

Following discussions during the MARCDAT-4 and ETMC-6 meetings, several recommendations were made for discussion within the MARCDAT and JCOMM communities. While some items seem more ICOADS-centric, they in-fact have impacts on the MARCDAT and JCOMM communities as a whole. They are listed below:

i. to aid climate studies the meeting recommended that data providers, and buoy data providers in particular, work with the JCOMM Observations Programme Area and subsidiary teams and panels to identify the metadata needs, both contemporary and historic, and to provide this metadata to JCOMM OPS for inclusion in the proposed metadata database.
ii. that JCOMM, and its parent bodies, remind network operators of the needs of the climate community, the GCOS climate monitoring principles and for any changes to the observing system to be assessed for their impact on the climate record, including the evaluation of new systems co-located with existing systems.
iii. that the community and JCOMM continue to promote and coordinate reference networks to support inter-comparisons of essential climate and ocean variables, e.g. OceanSites, field campaigns with different sensors / platforms co-located.
iv. that a common syntax to describe processing levels, including homogenisation, is adopted by the marine climate data community and that the community works with others, e.g. land / satellite, to harmonize across domains and observing systems. And that data at a various processing levels is made available.
v. that new approaches be developed, including those based on multivariate approached to statistical homogenisation and quality control.
vi. that the community, together with JCOMM and its parent bodies, push to raise awareness of the importance of homogenisation and reprocessing of the climate archives with funders and stakeholders at the national level.
vii. better documentation for climate data, and in particular ICOADS, be developed. Examples include: a beginners guide to ICOADS; a FAQs document / webpage; a forum / online user group or mailing list. The documentation needs to be searchable, updateable, comprehensive documentation (PDF, website, Wiki).
viii. more frequent updates to ICOADS be made, in both near real time and delayed mode. This will require good version control and the near real time processing and for the processing applied to the near real time updates to be consistent with that applied to the delayed mode data;
ix. capacity building and training resources be developed, including: examples; case-studies; and cookbooks (e.g. OceanTeacher);
x. the method for distributing ICOADS be improved, with the ability to subset and serve ICOADS in commonly used formats, such as NetCDF and delimited ASCII, be developed;
xi. improved quality control methods be developed and shared within the community;
xii. the use of collaborative software tools and shared code repositories be encouraged within the community as a mechanism for sharing code and best practices;
xiii. that AWS on VOS should be multivariate (not just pressure) and that network operators should be encouraged to deploy more multivariate AWSs.
xiv. that there are expanded efforts to develop new automated systems for cloud cover,

visibility, waves etc.

xv. that there is increased formal communication across JCOMM programme areas to ensure marine climate requirements are not lost in decisions made on the observing system development and data management practices.

xvi. that the use of thermistor chains / profilers on drifting buoys be increased to support ongoing satellite validation and air-sea interaction studies.

xvii. that the IMMA format be renewed, possible transitioning to delimited ASCII format for archival

xviii. that standard names and a common vocabulary be developed and used by the marine climate data community and that these be adopted by ICOADS. This would be in coordination with other international coordinating bodies (e.g. WMO, IODE, IOC, IHO)

xix. that a comprehensive user guide and manual for ICOADS be developed, targeted at non-expert and expert users.

xx. that the community develop on online resource for deciding / recommending what data to use for different purposes based on the characteristics of the data required (original, vs, homogenised vs gridded). This would be targeted at the non-expert user could take the form of a flow chart or decision tree.

xxi. that the ICOADS website, and websites for other climate archives, be augmented with links to community developed software .

xxii. that ICOADS provide a test suite of ICOADS records for testing and validating software against.

xxiii. that any solution developed for disseminating climate data, and in particular ICOADS, should be interoperable with the MSDS and other systems. This would be through the provision of discovery metadata and the use of standard names and units.

The ET will consider recommendations of MARCDAT-4 to be included and presented to the JCOMM-5 session.

6. INFORMATION EXCHANGE

The Team reviewed the status of marine climatology related web-pages on various websites:

http://www.jcomm.info/etmc
http://icoads.noaa.gov/etmc/ , and
http://www.marineclimatology.net

The ET made recommendations for further integration, taking into account the development of the MCDS. The main objective is to have a new page specifically for the MCDS, linked from the ETMC webpage and possibly others. The MCDS webpage URL will be included in the final versions of Pub Nos. 471 and 558.

The Team further suggested that any documents moved from the 3 sites mentioned above should be stored in 2 separate places to assure a redundant backup in order to avoid any potential future losses.

7. REVIEW OF ACTION ITEMS

The Team will be expected to review, modify as necessary, and approve action items and recommendations. The final report of the Session will be circulated to the Team Members shortly after the Session for review and approval.

8. CLOSURE OF THE SESSION

The Sixth Session of the JCOMM Expert Team on Marine Climatology (ETMC-6) closed by 1700 hours on Wednesday 20 July 2016.

Annex I

Provisional Agenda

1. **ORGANIZATION OF THE SESSION**
   - **1.1.** Opening
   - **1.2.** Adoption of the agenda
   - **1.3.** Working arrangements

2. **JCOMM ASPECTS AND REPORTS**
   - **2.1.** Report by the ETMC Chairperson
   - **2.2.** JCOMM Management Committee and Data Management Coordination Group guidance

3. **MARINE CLIMATE DATA SYSTEM (MCDS)TOP PRIORITY**
   - **3.1.** Review of MCDS developments, data and metadata, and WIGOS, platform data
   - **3.2.** Future of the Contributing and Responsible Members, and areas of responsibility
   - **3.3.** Data Acquisition Centres (DACs), ToR, and candidates
   - **3.4.** Global Data Assembly Centres (GDACs), ToR, and candidates (GCCs), a formal procedure, make sure no divergent documents
   - **3.5.** Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs)
     - **3.5.1.** Status of and linkages with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS)
     - **3.5.2.** CMOC/China development status
     - **3.5.3.** CMOC ICOADS and WOD application status
     - **3.5.4.** Manual on and Guide to Marine Meteorological Services (WMO No. 558 and 471)
     - **3.5.5.** Updating of the Implementation Plan

4. **FORMATS AND QUALITY CONTROL**
   - **4.1.** Status of the International Maritime Meteorological Archive (IMMA) format
   - **4.2.** Status of the International Maritime Meteorological Tape (IMMT) format
   - **4.3.** Status of the Minimum Quality Control Standard (MQCS)
   - **4.4.** Higher level quality control
     - **4.4.1.** Status of Higher Level Quality Control Standard (HQCS)

5. **CONSIDERATIONS OF MARCDAT-4 RECOMMENDATIONS**
   - **5.1.** Recommendations by 20 July
   - **5.2.** Recommendations MARCDAT-4 pending by conclusion of the workshop

6. **INFORMATION EXCHANGE**
   - **6.1.** ETMC / MCDS Website(s)
   - **6.2.** Other media

7. **REVIEW OF ACTION ITEMS**

8. **CLOSURE OF THE SESSION**

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Annex II

APPENDIX A from background document ETMC4-Doc-6.1-ICOADS-Subm.pdf
(http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=9727)

PROPOSED DEVELOPMENT OF A RENOVATED HISTORICAL STATE-OF-ART IMMPC/IMMT (AND RESULTANT IMMA1) ARCHIVE

Background

At the 21 July 2012 ICOADS international partnership teleconference, the possibility was discussed of organizing a comparison of all International Maritime Meteorological Punch Card (IMMPC) and Tape (IMMT) format (collectively referred to here as "IMM") data archives back to the 1960's when these data were apparently first exchanged,1 with the aim to eventually consolidate a single "state-of-art" archive constituting the most complete, and most original, set of these data still available. As a related possibility it has been suggested that this effort could link in usefully with the forthcoming creation of the new combined ETMC/MCDS website (e.g. include the structure for provision of all the relevant historic data decodes and software, a dataset catalogue and all the available datasets for download—both in the original IMM formats and in IMMA1).

Presently, the GCCs do not keep an archive of IMM data since that is the responsibility of each of the Responsible Members (RMs) within the Marine Climatological Summaries Scheme (MCSS). Thus as an initial step to make sure, that all available historical MCSS data are made available for the proposed global overall JCOMM-database, then the other RMs will need to be contacted and their archives compared and adjusted to determine what data they can retrieve in the original IMM formats, or could be made available otherwise in derivative (national) formats. Also, ICOADS includes or has access to extensive holdings of these data, some in the original IMM formats.

If such a state-of-art archive was constructed in time, or even useful incremental progress could be made toward this goal, the resultant IMMT data, if transformed into the latest IMMA format now under development (IMMA1, Woodruff et al. 2012), could form a valuable ingredient for the next ICOADS delayed-mode update (Release 2.6, planned for completion by early 2014). One important format evolution problem arises because the currently operational IMMA format (IMMA0) does not include a variety of fields that are now part of the latest IMMT format (IMMT5). Thus a reconversion to IMMA format of IMMT data previously provided to ICOADS will be needed.

Preliminary details regarding IMM holdings at GCC-Germany (DWD) (G. Rosenhagen)

Following MCSS data exist in our archives: Since the international data exchange was defined in 1963 by WMO in Res. 35 (CG-IV). the Deutscher Wetterdienst, Seewetteramt Hamburg was involved as Contributing Member (CM) and Responsible Member (RM) As CM all incoming delayed mode data from German ships were digitized and sent to the RMs according to their geographical responsibility. On the other hand DWD receives data for its area of responsibility (South Atlantic) from the other CMs.

In the beginning, there was no separate storage of incoming data. It was merged into the archive. Since the 1980s individual inputs could be identified, since 1985 the original data input is still available. All original input data to the GCC-Germany, beginning in 1994, is still available. To be used within the German maritime meteorological archive, the data is transferred into a national format, quality checked and corrected, if possible. In the course of time bilateral exchange regulations have been arranged (e.g. with USA and UK). Thus not only data of our area of responsibility was exchanged, but worldwide.

1: Although MCSS began in 1963 (WMO Cg-IV), an "international maritime punched card" (similar to IMMPC) was defined by the WMO Commission for Marine Meteorology (CMM) as far back as 1951: http://goos.kishou.go.jp/ws/ETMC/code_task/history/IMMT.html 2: Specifically (note: see Woodruff et al. 2012 for further details), the current IMMA0 "IMMT-2/FM 13" attm is updated to reflect changes made in three later versions of IMMT: IMMT-3 (effective 1 Jan. 2007), IMMT-4 (1 Jan. 2011), and IMMT-5 (1 June 2012). Differences between IMMT-4 and IMMA0 are documented at http://icoads.noaa.gov/immt4.html. For example a new field (IMMV) indicates the applicable IMMT version within the attm, which accommodates some format evolution problems, in that some IMMT fields changed meaning between IMMT-3 and IMMT-4.

Preliminary details regarding IMM holdings at GCC-UK (Met Office) (N. Scott)

The Met Office has MCSS data in IMMT format back to 1999 but before that I don't think there is an easy way of us identifying from our database what data is from the MCSS. Before then data was not set with flags as it is now to identify data source.

Preliminary details regarding additional UK Met Office IMM holdings (S. Woodruff)

The UK Main Marine Data Bank (MDB) (applicable to data spanning 1854-1994) has already been blended into ICOADS. For a list of all its "deck" (or per UK nomenclature "series"; most separate from/earlier than MCSS) numbers see Table D6b in:
http://icoads.noaa.gov/e-doc/imma/R2.5-imma_short.pdf
with decks 230 and 254 most clearly originating from the IMMPC/IMMT formats. While ICOADS extracted transformed (i.e. with respect to IMMPC/IMMT) main records for ICOADS from the MDB database, we also attached original "card images," when available (but we'd need to check if this was the case e.g. for decks 230/254). But in addition it is not known yet whether the GCC-UK in Edinburgh might hold any independent (possibly more original) IMM data separate from the MDB.

Annex III

CMOC/China Report

1. General status

WMO-IOC Centre for Marine Meteorological and Oceanographic Climate Data, Tianjin, China (CMOC/China) has been operationally maintained and upgraded by National Marine Data and Information Service (NMDIS), State Oceanic Administration (SOA) to guarantee the oceanographic and marine meteorology data, metadata, and product service to end users. URL: http://www.cmoc-china.cn. NMDIS provides full technical and financial support.

According to its statement of commitment submitted in 2012, CMOC/China committed to undertake the following tasks:

- Integrate marine-meteorological and oceanographic climate data, metadata, and actively conduct HLQC and produce specialized datasets of ECVs and EOVs;
- Actively participate in the research and development of oceanographic and marine-meteorological products, and their related services: climate statistical products and reanalysis products;
- 7X24 operation website to provide free services to users, and mirroring with other CMOCs when possible;
- Provide technical training, and carry out capacity building activities for countries in the region.

To promote the implementation of the CMOC/China project, NMDIS renewed the internal CMOC/China Steering Group (SG) which was set up in 2012. The SG is chaired by the Director-General of NMDIS Dr. HE Guangshun. Specialized Working Groups (CMOC/China Secretariat, Working Group on Website Operation, Working Group on Data Management, Working Group on Product R&D, Working Group on Infrastructure Construction) are established to ensure the implementation of the project.

To improve the operation of NMDIS and the working environment of CMOC/China, NMDIS started the re-construction of the main office building in 2015. The whole construction is expected to be completed in October 2016. Further improvements for CMOC/China network hardware environment (e.g. servers and data storage devices), and training facility are included in the plan.

2. Data processing and management

Several working items related to data were initialized in 2015, according to the work plan of 2015-2016 approved by the JCOMM expert team[2].
The oceanographic and marine meteorological data collected and processed by CMOC/China in 2015-2016 (June) is about 80GB. Quality control tests were applied to all the data (Table 1) to identify suspicious and erroneous values. The current quality manual in use is *Oceanographic and Marine Meteorological Data Quality Control Manual* issued by NMDIS. Its English version will be available online later in 2016.

[2] JCOMM Expert Team visited NMDIS in November 2014 China, per decision of the Data Management Coordination Group (DMCG). The Expert Group was led by Scott Woodruff (USA), representative of the Expert Team on Marine Climatology (ETMC) and of the International Comprehensive Ocean-Atmosphere Data Set (ICOADS). The other two members were Yutaka Michida (Japan), representative of the Expert Team on Data Management Practices (ETDMP); and Nelly Florida Riama (Indonesia), representative of JCOMM on Capacity Development issues.
The purposes of the Expert Group's visit were to address the recommendations of the CMOC/China evaluation report, and discuss with NMDIS and SOA how the conditions stated in the report for establishing CMOC/China can be met and future collaborations.

Table 1 Type and volume of data processed at CMOC/China[3] in 2015-2016

No.	Name of the dataset	Temporal coverage	Spatial coverage	Data volume
1	Delayed mode surface temperature and salinity , wind-wave data from 3 Chinese Oceanographic Stations: Shidao, Xiaomaidao, and Lianyungang	Jan. 2015 – Apr.2016	China coastal seas	3.2MB
2	Monthly mean sea level data from 6 Chinese Oceanographic Stations: Dalian, Lvsi, Kanmen, Zhapo, Xisha, and Nansha,	Jan. 2015 – Apr.2016	China coastal seas	3.2KB
3	Marine meteorological, wave, sea surface temperature and salinity data from 13 Stations: Xiaochangshan, Dalian, Yantai, Xiaomaidao, Lianyungang, Lvsi, Shengshan, Zhenhai, Dachen, Nanji, Beishuang, Dongshan, and Zhelang	Jan.2015 – Apr.2016	China coastal seas	6.4MB
4	Argo temperature and salinity profiles	Dec 2014- Apr. 2016	Global	8.6GB
5	GTSPP temperature and salinity data	Dec 2014- Apr. 2016	Global	3.3GB
6	WOD temperature and salinity	Jan 2013- Jun 2015	Global	63.3GB
7	GLOSS sea level data	1846- Oct 2015	Global	702MB
8	DBCP drifter data and metadata	1979 – Jun 2015	Global	3.6GB
9	Sea level pressure data from GTS	Jan 2014- Jul 2015	Global	179MB
10	Sea surface air temperature data from GTS	Jan 2014- Jul 2015	Global	159MB

3. Data and information products service

The marine meteorological and oceanographic data went through QC are operationally updated online and used to produce the climate statistical and re-analysis product. Meanwhile, research on the temperature and salinity data integration methodology was carried out, and the experimental version of T&S integration dataset derived from Argo, GTSPP and WOD were published online. In 2015-2016.6, the data, metadata and product served at CMOC/China are about 62.4GB (see Table 2 and Table 3 for details).

[3] Available at http://www.cmoc-china.cn/web/guest/access-to-data-and-product

Table 2 Type and volume of data and metadata served at CMOC/China[4] in 2015-2016

No	Name of the dataset	Temporal coverage	Spatial coverage	Data volume
1	Delayed mode surface temperature and salinity , wind-wave data from 3 Chinese Oceanographic Stations: Shidao, Xiaomaidao, and Lianyungang	Jan. 2015 – Apr.2016	China coastal seas	3.2MB
2	Monthly mean sea level data from 6 Chinese Oceanographic Stations: Dalian, Lvsi, Kanmen, Zhapo, Xisha, and Nansha,	Jan. 2015 – Apr.2016	China coastal seas	3.2KB
3	Marine meteorological, wave, sea surface temperature and salinity data from 13 Stations: Xiaochangshan, Dalian, Yantai, Xiaomaidao, Lianyungang, Lvsi, Shengshan, Zhenhai, Dachen, Nanji, Beishuang, Dongshan, and Zhelang	Jan.2015 – Apr.2016	China coastal seas	6.4MB
4	Argo temperature and salinity profiles	Dec 2014-Apr. 2016	Global	8.6GB
5	GTSPP temperature and salinity data	Dec 2014-Apr. 2016	Global	3.3GB
6	Integrated temperature and salinity datasets[5]	Dec 1772 – Dec 2012	Global	45.7GB
7	DBCP drifter data and metadata	1979 – Jun 2015	Global	3.6GB

Table 3 Type and volume of the product served at CMOC/China[6] in 2015-2016

No	Name of the dataset	Temporal coverage	Spatial coverage	Data volume
1	Graphic products of global monthly mean current fields at surface with resolution of 2°×2° and 5°×5°	Jan- Oct 2015	Global	6.5MB
2	Monthly report of sea level and climate change of China	Jan 2015 – March 2016	China Seas	82.5MB
3	Climatologic graphics of sea temperature and salinity over Northwest Pacific	1981-2010	100-170°E, 0-50°N	874MB

4. Data rescue

Rescue of historical ROSCOP metadata published by Member States of WESTPAC was initiated in 2015. Three paper version records *KODC Newsletter No.19*, *(Japan) Cruise Summary Report JP003-95-1* and *(China) NODC ROSCOP and Cruises 1983-1984* have been digitized and made available online. The integration of rescued ROSCOP metadata with their corresponding observational data was initialized in earlier 2016.

[4] Available at http://www.cmoc-china.cn/web/guest/access-to-metadata
[5] Higher-level QC to the datasets after duplicate elimination are applied to generate integrated global temperature and salinity datasets
[6] Available at http://www.cmoc-china.cn/web/guest/access-to-metadata

5. Capacity building

The IODE/OTGA-NMDIS Training Course: The Use of the Global Temperature and Salinity Profile Programme Data for the WESTPAC region was successfully held in Tianjin, China from 8-10 Dec. 2015. 12 participants from the Western Pacific region including Malaysia, Indonesia, Thailand, Korea, Vietnam, Bangladesh, Sri Lanka，Sudan, who applied through IODE/OTGA, and 12 Chinese participants selected by the State Oceanic Administration (SOA) of China attended the training course. Dr. Charles SUN, GTSPP Chair served as the lecturer. The trainees are mainly marine and coastal scientist, oceanographic data managers, as well as academic professors and students in the oceanographic or meteorological sciences.

The success of the training helped to promote the methodology of the GTSPP data management best practices, and to facilitate the data sharing and exchange with the GTSPP. With the officially running of CMOC/China, NMDIS will endeavor to provide more training opportunities for the developing countries in the WESTPAC region and make due contribution in promoting marine capacity construction of the region.

Ocean Data Assimilation Summer Training Course was held successfully in Harbin, China, during July 13-24, 2015. Sponsored by NMDIS and co-organized by Harbin Engineering University, 71 students from 21 agencies/institutes of China participated in the training. Dr. ZHANG Shaoqing from the Geophysical Fluid Dynamics Laboratory (GFDL) National Oceanic and Atmospheric Administration (NOAA)/US was invited as a keynote speaker to explain the theory and application of oceanic data assimilation for the students. Dr. HAN Guijun, Dr. LI Wei and Dr. ZHANG Xuefeng from NMDIS made a series of presentations on the ocean numerical model, data reanalysis and its application business, respectively.

6. Future plan

The First CMOC/China Workshop is scheduled to be held from 29 August to 1 September 2016 in Tianjin, China. The workshop will review the biennium Work Plan 2015-2016, report on progress and advise on the way forward. The workshop will also revisit guidance from the WMO and IOC on MCDS and CMOC.

Annex IV

Proposed DAC Terms of Reference (ToR)

Updates for WMO Pub. No. 471 (Chapter 3, Marine Climatology)

A global network of appointed DACs will receive and gather meteorological and/or oceanographic data (real-time or delayed-mode) and metadata directly from the observation platforms and then forward onto the relevant GDAC.

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

To meet these requirements DACs must have the following:

Scope

(a) Each DAC will define its scope of activities, that is the types of observing platform(s) for which data shall be collected, whether these are collected nationally, regionally and/or from a specific ocean region of interest, and what quality control standard is being applied to the data;

Capabilities:

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

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

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

Corresponding Functions and Tasks:

(a) Each Centre, within the confines of its agreed scope, must receive and gather meteorological and/or oceanographic data (real-time or delayed-mode) and metadata directly from the observation platforms;

(b) Each Centre must forward the data and metadata to the appropriate GDAC(s) in agreed format(s) within defined time-scales;

(c) Each Centre must have documented data processing and quality control procedures within its scope;

(d) Each Centre must provide feedback to the platform operators if data problems are encountered;

(e) Each Centre, within the confines of its agreed scope, must contribute to WMO and IOC Applications by collecting and processing worldwide marine-meteorological and/or oceanographic data and metadata (and optionally by mutually agreed CMOC-DAC products e.g. regional statistics) as documented in appropriate WMO and IOC publications;

(f) Each Centre must communicate and liaise within the DAC network and the wider MCDS;

(g) Each Centre should report, on an annual basis, to the JCOMM Management Committee through the DMCG on its status 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 DAC network as a whole, and proposed changes, as required.

Data Policy and Software Licensing Usage Rights Requirements

A DAC must be committed to make all the data, metadata, and products falling within the scope of the DAC network 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 shared.

Annex V

Proposed GDAC Terms of Reference (ToR)

Updates for WMO Pub. No. 471 (Chapter 3, Marine Climatology)

Global Data Assembly Centres (GDACs)

A global network of appointed GDACs will assemble and quality control meteorological and/or oceanographic data (real-time or delayed-mode) and metadata received from the appropriate DACs and then forward onto relevant CMOC(s).

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

To meet these requirements GDACs must have the following:

Scope

(a) Each GDAC will define its scope of activities, that is the types of observing platform(s) for which data shall be collected and compiled, and what quality control standard is being applied to the data before submission to a CMOC;

Capabilities:

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

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

(c) The JCOMM Data Management Coordination Group (DMCG) must assess each Centre, at least once every five years, to verify it meets the necessary capabilities and performance indicators as agreed by the Commission;

(d) Each Centre must be interoperable with the WMO Information System (WIS) and/or IODE ODP.

Corresponding Functions and Tasks:

(a) Each Centre, within the confines if its agreed scope, must receive and assemble meteorological and/or oceanographic data (real-time or delayed-mode) and metadata from the appropriate DAC;

(b) Each Centre should identify duplicates within the dataset and if possible resolve;

(c) Each Centre should flag/link like-for-like observations and identify differences, where both real-time and delayed-mode data streams exist;

(d) Each Centre must have documented data processing and higher quality control procedures within its scope;

(e) Each Centre must provide feedback to the DACs on data quality issues;

(f) Each Centre must make discovery metadata available to the WIS & IODE ODP;

(g) Each Centre must forward the data and metadata to the appropriate CMOC(s) in agreed format(s) within defined time-scales;

(h) Each Centre, within the confines of its agreed scope, must contribute to WMO and IOC Applications by collecting and processing worldwide marine-meteorological and /or oceanographic data and metadata (and optionally by mutually agreed CMOC-GDAC

products) as documented in appropriate WMO and IOC publications (and to the extent that these functions are not already carried out by other existing data centres, but are complimentary to the functions of these centres);

(i) Each Centre must communicate and liaise within the GDAC network and the wider MCDS;

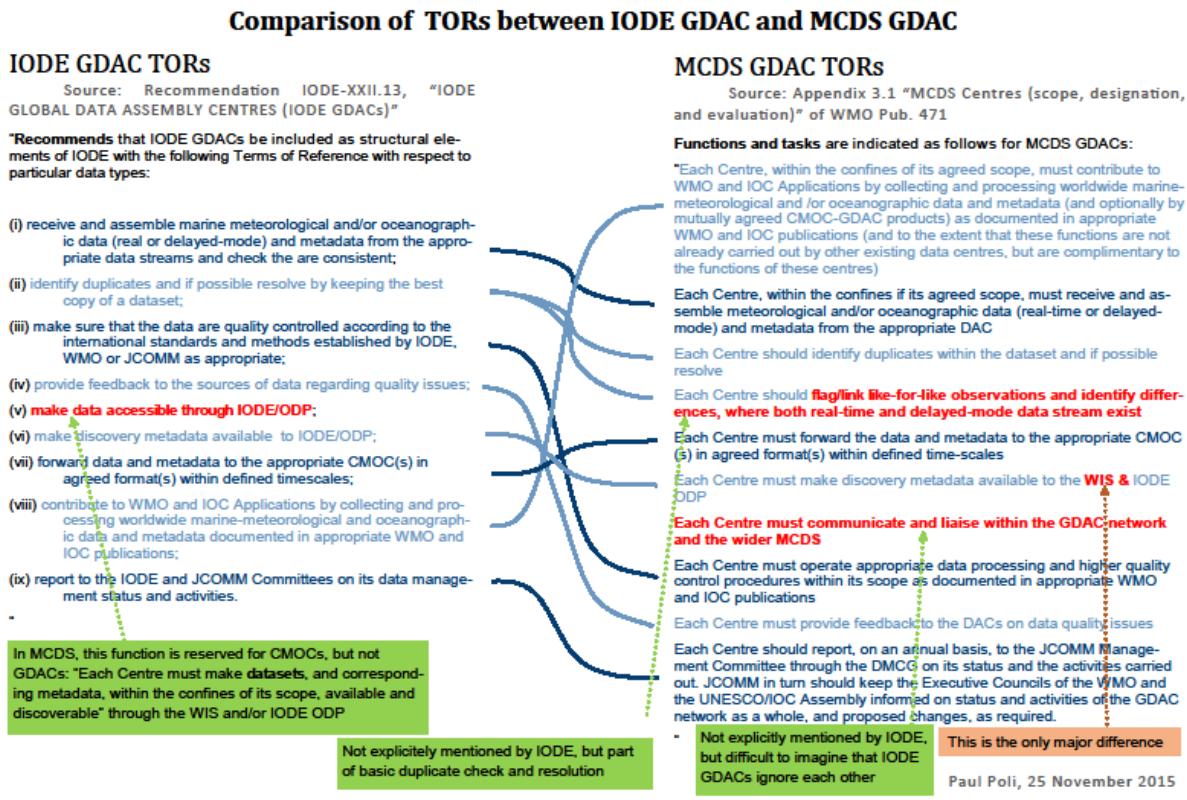
(j) Each Centre should report, on an annual basis, to the JCOMM Management Committee through the DMCG on its status and the activities carried out. JCOMM in turn should keep the Executive Councils of the WMO and the UNESCO/IOC Assembly informed on status and activities of the GDAC network as a whole,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

Data Policy and Software Licensing Usage Rights Requirements

A GDAC must be committed to make all the data, metadata, and products falling within the scope of the GDAC network 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 shared.

Annex VI

IODE and WMO GDAC Comparison
by Paul Poli (MeteoFrance)



Annex VII

UPDATED MCDS IMPLEMENTATION PLAN

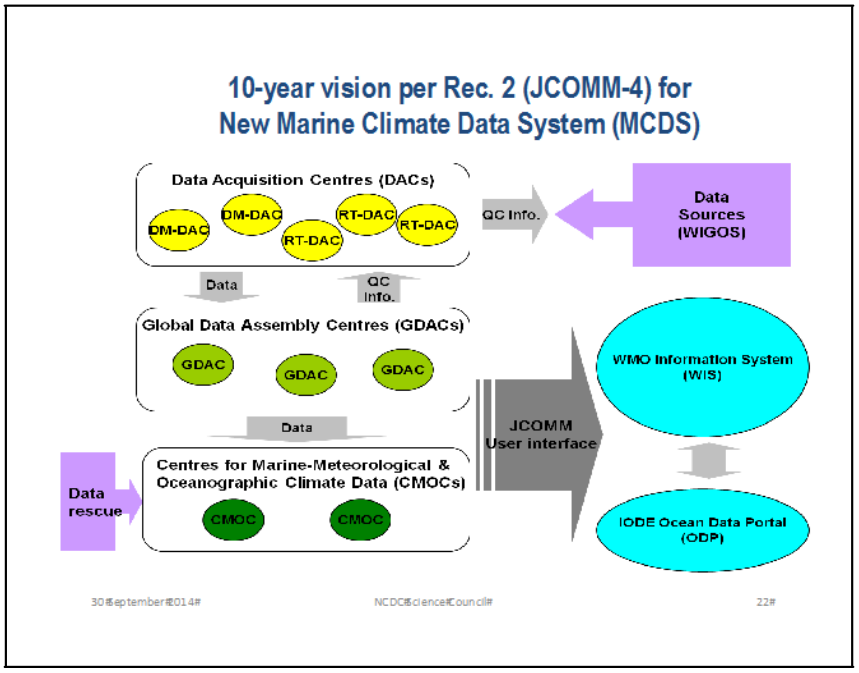
The Team agreed that the implementation of the MCDS – a JCOMM contribution to the GFCS – should be developed in the following phases:

- **Phase 1** (2012-2015): Definition of the MCDS: Writing of new Technical Regulations, establishment of CMOC/China, operations of trial GDACs for drifting buoys.

- **Phase 2** (2015-2017): Transitioning of the core existing systems: Modernization of the VOS delayed mode data management (i.e. integration of the GCCs as VOS GDACs), integration of the MCSS Responsible Members and other contributors as DACs, integration of the trial GDACs for drifting buoys, and implementation of the first CMOCs (China, Germany, ICOADS and/or WOD), and contributions of the NODCs and IODE GDACs (e.g. GTSPP).

- **Phase 3** (2018-2020): Achieving operational capability of the MCDS: Integration of additional data sources into the MCDS such as DACs and GDACs (moored buoys, wave observations, polar observations of the marine environment), and further expansion of the CMOC network (e.g. Polar).

- **Phase 4** (2020-2024): Inclusion of additional data sources: e.g. integration of satellite data, and alignment with the WIGOS vision for 2040 etc.



Annex VIII
Action Items List

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
1	10	Develop appropriate MCDS website and promotional material to make the system widely known within the marine community	ETMC	F. Cunningham	Ongoing	
2	11	Agree on ToR for the new TT-MCDS.	TT-MCDS	S. Woodruff	08/2011	Done
3	11	Organise MCDS preparatory workshop.	ETMC,TT- DMVOS, Secretariat	E. Charpentier	11/2011	Done
4	11	Propose draft Rec to JCOMM-4 on MCDS.	ETMC	S. Woodruff	11/2011	Done
5	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	S. Woodruff	11/2011	Done
6	6	Germany and China submit Statements of Compliance and Commitment for CMOCs	China and Germany	G. Roshenhagen S. Lin	02/2012	Done
7	6	Germany and China to operate CMOC on a trial basis	JCOMM-4	G. Roshenhagen S. Lin	05/2012	Done
8	6	Canada and France to operate GDACs on a trial basis	JCOMM-4	S. de Margerie J. Rolland	05/2012	Done
9		Approve JCOMM-4 Recs regarding MCDS.	JCOMM-4	Co-Presidents	05/2012	Done
10	2	Propose update of MQCS (& IMMT) to JCOMM-4 (MQCS-7).	GCCs	N. Scott G.Roshenhagen	05/2012	Done and MQCS-7
11	11	Finalize relevant documentation to IODE-22: MCDS Strategy MCDS Implementation Plan CMOC Evaluation Criteria	ETMC, DMCG, Secretariat	P. Pissierssens	12/2012	Done
12	11	The IOC Strategic Plan for Oceanographic Data and Information Exchange www.iode.org/strategy	Secretariat	P. Pissierssens	Jan 2013, then IODE-22	Done
13	1	Define Terms of Reference for IODE GDACs	IODE	A. Troisi / S. Iona	IODE-22 (for IODE GDACS)	Done

1 Deliverables of the MCDS Strategy: 1: Data flow; 2: Quality control; 3: Value added marine climate data; 4: Data exchange protocols; 5: Co-located data; 6: CMOC; 7: Metadata; 8: Interoperability; 9: MCS; 10: Information exchange and outreach; 11: Governance, technical regulations, and data policy

No.	Deliverable(s)[7]	Action	By	Lead or catalyst	Deadline	Comments
14	11	IODE-22 to: Approve MCDS Strategy Review draft MCDS Implementation Plan Agree on CMOC Evaluation Criteria	IODE-22	A. Troisi S. Iona	3/2013	Done
15	1	Identify Centres already carrying out similar roles. Identify existing tasks at each Centre consistent with the MCDS structure and highlight any tasks not already being done. Each data-type to create a work plan to make steps to introduce tasks and roles (if necessary) within routine processing to align with MCDS Structure.	VOS: GCC / ETMC Buoy: DBCP / ETMC Ocean Data:? DMCG / IODE Others:…	L. Gates E. Freeman	End 2015	Done.
16	1	Action individual data-type work plans (task 17) within agreed timescales in consultation with new DACs, GDACS, and CMOCs	All	L. Gates E. Freeman	Ongoing	Delayed until Centres' applications submitted.
17	6	DMCG and JCOMM Management Committee to evaluate CMOC proposals from China and Germany, and seek approval of CMOCs China and Germany through fast track procedures (consultation of JCOMM and IODE in writing)	DMCG, MAN	JCOMM Co-Presidents	Sep. 2013	Done for China Germany's
18	6	Other Candidates to submit Statement of Compliance for CMOC (e.g. ICOADS, etc)	Candidate CMOCs	E. Freeman	February. 2016	Delayed ICOADS delayed. WOD proposed to submit application in 2017.
19	1	Develop and refine dataflow proposal, with roles and responsibilities of the different actors.	OCG to lead VOS: GCCs Buoy: ISDM, AOML, Meteo France Ocean Data: DMCG In coop with IODE Others:…	N. Scott / E. Freeman / D. Legler & D. Meldrum	2015 VOS: 11/2011 Buoy: 11/2011 Ocean Data: 2015 Others:...	Done (VOS) Done (Buoy)

[7] 1 Deliverables of the MCDS Strategy: 1: Data flow; 2: Quality control; 3: Value added marine climate data; 4: Data exchange protocols; 5: Co-located data; 6: CMOC; 7: Metadata; 8: Interoperability; 9: MCS; 10: Information exchange and outreach; 11: Governance, technical regulations, and data policy

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
20	1	Create dataflow diagrams to show compliance with proposed structure.	DMCG to lead VOS: GCCs Buoy: ISDM, AOML, Meteo France Ocean Data: DMCG in coop with IODE. Others:…	N. Scott / S. Iona	2013	Done (VOS)
21	2	Document (in a standard way) current minimum quality controls standards used by existing centres across JCOMM and submit to ETMC.	DACs (or potential DACs)	L. Gates	2015	Done (VOS)
22	2	Refine, document & test a Higher QC (HLQC) for use by all atmospheric JCOMM data types. Submit standard to ETDMP (for Ocean Data Standards process).	DWD	L. Gates	2015 and ongoing	Ongoing; Progress on refinement, documentation and testing by DWD for semi-operational applications.
23	11	Compile required changes to WMO No. 558 and 471 for modernised VOS data flow, and draft JCOMM-4 Rec. ETMC-4 item 39 (ref: 8.2.2) : N. Scott, D. Berry, E. Freeman, and S. Iona to review the WMO 471 & 558 publications in light of the MCDS development, liaise with TT-MCDS, and propose an outline of the new technical regulations as soon as possible, as well as a workplan for filling out the relevant sections of these WMO Publications	ETMC, Secretariat	E. Freeman, (with D. Berry and S. Iona)	2015	Done

24	1, 11	Update relevant chapters of the relevant WMO/IOC Publications to reflect new structure for VOS Data. When possible provide a further update of the appointed roles and responsibilities of the different actors across the DAC/GDAC network (clearly aligning similarities and highlighting differences).	VOS: GCC / ETMC	E. Freeman	2015	Ongoing WMO No.s 471 and 558 (Chapters 3 and 5, respectively) updated for submission to JCOMM-5 in 2017. WMO No. 781 not started.

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
25	6	Define how Centres will 'mirror' data holdings. Develop synchronized data holdings with harmonised quality management.	S. Woodruff, L. Gates, S. Iona , E. Freeman, S. Lin	E. Freeman / L. Gates	February 2016 and ongoing	Ongoing; additional CMOCs needed to finalize
26	6	If successful evaluation, and approved by JCOMM and IODE, CMOCs China to be established as CMOCs by WMO and IOC Executive Bodies	WMO & IOC ECs	Secretariat	Done	Expected approval by Cg-17 and IOC Assembly in June 2015
27	1	Existing Centres 'mapped' to MCDS DAC/GDAC roles (i.e. trial GDAC/Canada, trial GDAC/France, and GCCs) to confirm their willingness to be listed as DAC/GDAC applicable to their relevant data platform to WMO/IOC in the new Technical Regulations to be submitted to JCOMM-5.	Canada, France, Germany, UK	E. Freeman / Secretariat	End 2016	Ongoing; Letters to be sent to candidate MCDS hosts by Secretariat
28	1	Appointed DACs & GDACs regularly liaise with other MCDS Centres (and potential candidates) as part of the defined MCDS framework.	DACs / GDACs	E. Freeman,	2018 and ongoing	Following #28
29	2	Compare all minimum QCs submitted, highlight differences and recommend a MQC standard for MCDS general/future use. Submit standard to ETDMP (for Ocean Data Standards process).	TT-MCDS	E. Freeman	2015	Ongoing Only VOS MQCS submitted so far defined at present in
30	4	Investigate requirements and possible options for data exchange format(s) (for use across MCDS). Propose new data format(s) (if necessary) and/or define which formats are being used in the various areas of MCDS (for data collection & exchange).	ETDMP & ETMC	S. Woodruff /E. Freeman	2015	IMMA or NetCDF format(s) can be considered. Scott to contact S. Belov.

No.	*Deliverable(s)1*	*Action*	*By*	*Lead or catalyst*	*Deadline*	*Comments*
31	4	Agree on data collection and processing formats for **Buoy Data**	Buoy: ISDM, AOML, Meteo France	S. Woodruff / E. Freeman	October 2017	
32	4	Agree on data collection and processing formats for **Ocean Data**	Ocean Data: ETDMP	S. Woodruff / E. Freeman	October 2017	See 31. Ongoing with potential IC OADS/WOD CMOC application.
33	8	CMOCs to apply as WIS National Centres (NC) or Data Collection and Production Centres (DCPC)	CMOCs	H.Y. Mok	2016	Ongoing and updated when more CMOCs are incorporated into the MCDS
34	2	Update relevant (or create new if needed) WMO & IOC Publications with details of standardised HLQC.	HLQC: ETMC	E. Freeman	2015 and ongoing as needed	
35	1	Update relevant chapters of the relevant WMO/IOC Publications to reflect new structure for **Buoy Data** and **Ocean Data**. When possible provide a further update of the appointed roles and responsibilities of the different actors across the DAC/GDAC network (clearly aligning similarities and highlighting differences).	Buoy: DBCP / ETMC Ocean Data: ETDMP	E. Freeman / Tim Boyer (IOC)	2016	
36	2	Update relevant (or create new if needed) WMO & IOC Publications with details of standardised MCDS MQC	MQC: ETMC	E. Freeman	2017	Done
37	2	To promote inter-comparison for the various MCDS centres (DACs, GDACs) that will be established, and to propose a template for that	ETMC Chair	G. Rosenhagen	2015	ETMC-4 action item no. 2 (ref: 2.5.4) Done at ETMC-5

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
38	3	Establish Pilot Project & Steering Team for value-added ICOADS (IVAD).	ETMC	S. Woodruff	2015	Currently utilizing Steering Committee forum for discussion and planning of IVAD (Dec '12).
39	4	Update relevant chapters of WMO & IOC Publications to reflect the MCDS preferred formats.	ETMC	E. Freeman	2018	WMO No. 471/558 Done. WMO 781 to be updated.
40	5	Establish an *ad-hoc* task team for use of Co- located Model & Satellite Data (TT-CMSD) within HLQC and investigate requirements and feasibility for possible use of co-located data in the new HLQC. Feedback findings to ETMC.	TT-CMSD**	L. Gates	2018	Complete prior to Phase 4.
41	7	Prepare white-paper on metadata collection and exchange format(s).	ODASMS, CMOC(s)	S. Woodruff	2016	
42	7	Investigate metadata rescue (e.g. for buoy metadata)	CMOC(S)	S. Woodruff	2016	Ongoing. Need this from DBCP
43	7	Update relevant chapters of the WMO and IOC Publications accordingly to reflect metadata obligations of Members/Member States as well as guidance to them respectively.	TT-MCDS, ETMC, ETDMP	E. Freeman / Scott Woodruff	2016 and ongoing	WMO No. 471/558 Done. WMO 781 to be updated.
44	6	Update relevant chapters of the WMO and IOC Publications to reflect obligations of CMOC Members/Member States as well as guidance to them respectively.	TT-MCDS, ETMC, ETDMP	E. Freeman	2016 and ongoing	WMO No. 471/558 Done (CMOC-China only one at present). WMO 781 to be updated.

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
45	1	Update relevant chapters of the relevant WMO/IOC Publications to reflect new structure for **Other MCDS Data Types**. When possible provide a further update of the appointed roles and responsibilities of the different actors across the DAC/GDAC network (clearly aligning similarities and highlighting differences).	Others:…	E. Freeman	2016 and ongoing	WMO No. 471/558 Done. WMO 781 to be updated.
46	11	Propose draft Rec to JCOMM-5	ETMC	E. Freeman	Mar. 2017	Done
47	11	Compile required changes to relevant WMO & IOC Publications for MCDS for submission to subsequent JCOMM and IODE Sessions.	Secretariat	E. Freeman E. Charpentier	Mar. 2017	WMO No. 471/558 Done for JCOMM-V (Oct. 2017). WMO 781 to be updated.
48	11	Define Terms of Reference for DACs & GDACs, and seek adoption by JCOMM-5	ETMC,ISDM, AOML, Meteo France	E. Freeman (and ETMC)	Mar. 2017	Done
50	1	Define and document the formal appointment and approval process for establishing DACs / GDACs, including template Statement of Compliance.	ETMC, ISDM, AOML, Meteo France	E. Freeman	JCOMM-5:2017	Done
49	2	Once approved by JCOMM, HLQC to be used by all atmospheric GDACs.	GDACs	L. Gates	2018 (after JCOMM-5)	
50	3	Run Pilot Project for creation of IVAD (e.g. bias corrected) and make recommendations.	PP Steering Team	S. Woodruff	2020	Done
51	3	Document procedures and detail how data within IVAD are to be interpreted (use a new JCOMM Technical Report	ETMC	E. Freeman	2020	Done
52	7	Develop an easily accessible comprehensive metadata guide including details of past date codes/formats (decodes, dates formats used, any updates made…) and metadata regarding whole datasets etc.	CMOC(s)	S. Woodruff	2016 and ongoing	Pub 47 and ESURFMAR formats initially, then ongoing as others are approved.

Annex IX

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Annex X

LIST OF ACRONYMS

AAA	Authorization, Authentication and Accounting
ABE-LOS	IOC Advisory Body on the Law of the Sea
ACCESS	African Centre for Climate and Earth System Science
ADB	AOML Data Buoy
ADOS	Autonomous Drifting Ocean Station
AG	DBCP Action Groups
AIC	Argo Information Center
ALD	UNESCO Appointment of Limited Duration
AODCJF	Australian Ocean Data Centre Joint Facility
AODN	Australian Ocean Data Network
AOML	NOAA Atlantic Oceanographic and Meteorological Laboratory (USA)
AOPC	Atmospheric Observation Panel for Climate
AP	Air Pressure
Argo	International profiling float programme (not an acronym)
ASAP	As soon as possible
ASAP	Automated Shipboard Aerological Programme
ASCII	American Standard Code for Information Interchange
ASCLME	Agulhas and Somali Current Large Marine Ecosystems
AST	Argo Steering Team
ATLAS	Autonomous Temperature Line Acquisition System
BAS	British Antarctic Survey
BCOS	Bureau Composite Observing System (Australia)
BGODC	Bulgarian National Oceanographic Data Centre
BODC	British Oceanographic Data Centre (UK)
BOM	Bureau of Meteorology (Australia)
BPEL	Business Process Engineering Language
BUFR	FM 94 BUFR GTS format: Binary Universal Form for Representation of meteorological data
BUOY	FM 18 BUOY GTS format: Report of a buoy observation
CB	Capacity-Building
CBS	Commission for Basic Systems (WMO)
CCHDO	CLIVAR and Carbon Hydrographic Data Office
CCl	Commission for Climatology (CCl)
CDI	SeaDataNET Common Data Index
CDIP	Coastal Data Information Program
CDMP	Climate Database Modernization Programme (USA)
CEOS	Committee on Earth Observation Satellites
Cg	Congress (WMO)
CIMO	Commission on Instruments and Methods of Observation (WMO)
CLIVAR	Climate Variability and Predictability (WCRP)
CLS	Collecte Localisation Satellites (France)
CMR	Christian Michelsen Research (Norway)
CONOPS	WIGOS Concept of Operations
CRREL	Cold Regions Research and Engineering Laboratory (USA)
CSV	Comma Separated Values format
DAR	Data Access and Retrieval
DAR	Data Discovery, Access and Retrieval service (WMO WIS)
DART	Deep-ocean Assessment and Reporting of Tsunami (buoy)
DB	Data Buoy
DBCP	Data Buoy Co-operation Panel (WMO-IOC)
DBMS	Database Management System
DB-TAG	E-SURFMAR Data Buoy Technical Advisory Group
DCP	Data Collection Platform
DCPC	Data Collection or Production Centre (of WIS infrastructure)
DCS	Data Collection System
DMAC	IOOS Data Management and Communications (USA)
DMCG	Data Management Coordination Group (JCOMM)
DMCG	JCOMM Data Management Coordination Group
DMPA	JCOMM Data Management Programme Area

DOI	Digital Object Identifier
DP	Data Provider
DWD	Deutscher Wetter Dienst
E2E	End-to-End Data Management
E2EDM	End-to-End Data Management Pilot Project
EB	DBCP Executive Board
EBD	Equivalent Buoy Density
EC WG WIGOS-WIS	Executive Council working Group on WIGOS and WIS
EC	Executive Council
ECMWF	European Centre for Medium-Range Weather Forecasts
EDMED	European Directory of Marine Environmental Data
EDMERP	European Directory of Marine Environmental Research Projects
EDMO	European Directory of Marine Organisations
EEZ	Exclusive Economic Zone
EOV	Essential Ocean Variable
ER	Expected Result
E-SURFMAR	Surface Marine programme of the Network of European Meteorological Services, EUMETNET
ET/AWS	CBS / IOS Expert Team on Requirements for Data from Automatic Weather Stations (WMO)
ET/DRC	CBS Expert Team on Data Representation and Codes (WMO)
ET/EGOS	CBS / IOS Expert Team on the Evolution of the Global Observing System (WMO)
ET-AWS	Expert Team on Requirements and Implementation of Automatic Weather Station (AWS) Platforms
ETCCDI	joint CLIVAR / CCl / JCOMM Expert Team on Climate Detection and Indices
ETDMP	Expert Team on Data Management Practices (JCOMM/IODE)
ET-EGOS	CBS Expert Team on the Evolution of the Global Observing System
ET-GDDP	CBS Expert Team on GISC and DCPC Demonstration Process
ETMC	Expert Team on Marine Climatology (JCOMM)
ETRP	WMO Education and Training Programme
ETSI	Expert Team on Sea Ice (JCOMM)
ET-WISC	CBS Expert Team on WIS GISCS and DCPCs
ETWS	Expert Team on Wind Waves and Storm Surge (JCOMM)
EUCOS	EUMETNET Composite Observing System
EUMETNET	Network of European Meteorological Services
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EuroSITES	European integrated network of open ocean multidisciplinary observatories
FAD	Fish Aggregation Device
FAO	Food and Agriculture Organization
FAQ	Frequently Asked Questions
FG	First Guess Field
FOAM	Forecasting Ocean Assimilation Model (United Kingdom)
FTP	File Transfer Protocol
GAW	Global Atmosphere Watch
GCC	Global Collecting Centre (of MCSS)
GCOS	Global Climate Observing System
GDAC	Global Data Assembly / Acquisition Centre
GDP	Global Drifter Programme
GEO	Group on Earth Observations
GeoNetWork	A catalog application to manage spatially referenced resources (http://geonetwork-opensource.org/)
GEOSS	Global Earth Observation System of Systems
GFCS	Global Framework for Climate Services
GHRSST	Group for High Resolution SST
GIS	Geographical Information System
GISC	Global Information System Centres (of WIS infrastructure)
GLOSS	Global Sea-level Observing System (JCOMM)
GMDSS	Global Maritime Distress and Safety System
GODAE	Global Ocean Data Assimilation Experiment (GOOS)
GOOS	Global Ocean Observing System (IOC, WMO, UNEP, ICSU)
GOS	Global Observing System (WMO)
GOSUD	Global Ocean Surface Underway Data Pilot Project

GPS	Global Positioning System
GPSRO	GPS Radio Occultation
GSM	Global System for Mobile Communications
GSOP	CLIVAR Global Synthesis and Observations Panel
GSSC	GOOS Scientific Steering Committee
GTS	Global Telecommunication System (of WWW of WMO)
GTSPP	Global Temperature and Salinity Profile Programme
HMEI	Association of Hydro-Meteorological Equipment Industry
HRPT	High Resolution Picture Transmissions
HRSST	DBCP/GHRSST High Resolution SST Pilot Project
HTTP	HyperText Transfer Protocol
IABP	International Arctic Buoy Programme
IBPIO	International Buoy Programme for the Indian Ocean
IBSS	Institute of Biology of the Southern Seas National Academy of Sciences of Ukraine
ICG	Intergovernmental Coordination Group
ICG/IOTWS	ICG for the Indian Ocean Tsunami Warning and Mitigation System (IOC)
ICG-WIS	Inter-commission Coordination Group on the WMO Information System
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA)
ICSU	International Council for Science
ICT-IOS	Implementation / Coordination Team on the Integrated Observing System (CBS)
ICTT-QMF	Inter Commission Task Team on Quality Management Framework
ID	Identification Number
IGDDS	Integrated Global Data Dissemination Service (satellite)
I-GOOS	Intergovernmental IOC-WMO-UNEP Committee for GOOS
IHO	International Hydrographic Organization
IMB	Ice Mass Balance
IMEI	International Mobile Equipment Identity
IMO	International Maritime Organization
IMOP	WMO Programme for Instruments and Methods of Observation
IMOS	Integrated Marine Observing System (Australia)
InaGOOS	Indonesian Global Ocean Observing System
IndOOS	Indian Ocean Observing System
INSPIRE	Infrastructure for Spatial Information in Europe
IOC	Intergovernmental Oceanographic Commission of UNESCO
IOCCP	International Ocean Carbon Coordination Project of IOC
IODE	International Oceanographic Data and Information Exchange (IOC)
IOOS	Integrated Ocean Observing System (USA)
IOS	Integrated Observing Systems
IP	Implementation Plan
IPAB	WCRP-SCAR International Programme for Antarctic Buoys
IPET-DRC	CBS Inter Programme Expert Team on Data Representation and Codes
IPET-MI	CBS Inter Programme Expert Team on Metadata Implementation
IPP	Iridium Pilot Project
IPY	International Polar Year (2007-2008)
ISABP	International South Atlantic Buoy Programme
ISDM	Integrated Science Data Management (formerly MEDS, Canada)
ISO	International Organization for Standardization
IT	Information Technology
ITP	International Tsunameter Partnership
ITT	Invitation To Tender
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMM-III	Third Session of JCOMM, Marrakech, Morocco, 4-12 November 2009
JCOMMOPS	JCOMM *in situ* Observations Programme Support Centre
JTA	Joint Tariff Agreement (Argos)
KML	Keyhole Markup Language
LDCs	Least Developed Countries
LDP	ODP light Data Provider
LOI	Letters of Intent
LUT	Local User Terminal (Argos)
M&G	Manual and Guides
MAN	JCOMM Management Committee

MARIS	Maris Technologies, Ltd (UK)
MCP	Marine Community Profile
MCS	Marine Climatological Summary
MCSS	Marine Climatological Summaries Scheme (WMO)
MDT	Modelling Development Team
MEDS	Marine Environmental Data Service (Canada, now ISDM)
MERSEA	Marine Environment and Security for the European Area (of EU)
META-T	Water Temperature instrument/platform Metadata Pilot Project (JCOMM)
METOP	Meteorological Operational satellites of the EUMETSAT Polar System (EPS)
MHI	Marine Hydrophysical Institute National Academy of Sciences of Ukraine
MIM	MERSEA Information Management
MOFS	Met-Ocean Forecasts and Services
MOI	Mauritius Oceanography Institute
MOU	Memorandum of Understanding
MQCS	Minimum Quality Control Standards
MSC	Meteorological Services of Canada
NAVOCEANO	Naval Oceanographic Office (USA)
NC	National Centre (of WIS infrastructure)
NCDC	NOAA National Climatic Data Center (USA)
NCEP	NOAA National Center for Environmental Prediction (USA)
NCOSM	SOA National Centre of Ocean Standards and Metrology (China)
NDBC	National Data Buoy Centre (of NOAA, USA)
NESDIS	NOAA National Environmental Satellite Data and Information Service (USA)
NetCDF	Network Common Data Form
NFP	National Focal Point
NIMRD	National Institute for Marine Research and Development (NODEC/NIMRD)
NIOT	National Institute of Ocean Technology (India)
NMDIS	SOA National Marine Data and Information Service (China)
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	IODE National Oceanographic Data Centre
NPDBAP	DBCP-PICES North Pacific Data Buoy Advisory Panel
NPOESS	National Polar-orbiting Operational Environmental Satellite System (USA)
NSF	National Science Foundation (USA)
NWP	Numerical Weather Prediction
NWS	NOAA National Weather Service (USA)
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
OBIS	Ocean Bio-geographical Information System
OceanSITES	OCEAN Sustained Interdisciplinary Timeseries Environment observation System
OCG	Observations Coordination Group (JCOMM)
OCO	NOAA Office of Climate Observation (USA)
ODAS	Ocean Data Acquisition Systems
ODASMS	ODAS Metadata Service (operated by China on behalf of JCOMM)
ODIN	IOC Ocean Data and Information Network (IODE)
ODINAFRICA	ODIN for Africa
ODINBlackSea	ODIN for the Black Sea
ODINCARSA	ODIN for the Caribbean and South America
ODINWESTPAC	ODIN for the WESTPAC
ODP	Ocean Data Portal (IODE)
ODS	Ocean Data Standards process
ODT	Observation Development Team
OGC	Open Geospatial Consortium
OGP	Oil and Gas Producers
OOPC	Ocean Observations Panel for Climate (GCOS-GOOS-WCRP)
OPA	Observations Programme Area (JCOMM)
OPAG	Open Programme Area Group
OPAG-IOS	CBS OPAG on the Integrated Global Observing System
OPeNDAP	Open-source Project for a Network Data Access Protocol
OPSC	Observing Programme Support Centre
OPSCOM	Argos Operations Committee
OSE	Observing System Experiment
OSMC	NOAA Observing System Monitoring Center (USA)

OT	OceanTeacher
OTN	Ocean Tracking Network
PA	Programme Area (of JCOMM)
PANGEA	Partnerships for New GEOSS Applications (JCOMM)
PDF	Portable Document Format
PGC	Principal GTS Co-ordinator (DBCP)
PICES	North Pacific Marine Science Organization
PICO	Panel for Integrated Coastal Observations
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
PMEL	NOAA Pacific Marine Environmental Laboratory (USA)
PMO	Port Meteorological Officer
PMOC	Principal Meteorological or Oceanographic Centres responsible for quality control of buoy data (DBCP)
PMT	Platform Messaging Transceivers
PO	Project Office
POGO	Partnership for Observation of the Global Oceans
PP-WET	DBCP/ETWS Pilot Project on Wave Measurement Evaluation and Test
PP-WMD	Pilot Project on Wave Measurement from Drifters (DBCP)
PSMSL	Permanent Service for Mean Sea Level
PTT	Platform Transmitter Terminal (Argos)
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
QMF	WMO Quality Management Framework
QMS	Quality Management System
RA	WMO Regional Association
RAMA	Indian Ocean Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction
RIHMI-WDC	All-Russian Research Institute of Hydrometeorological Information – World Data Center
RMIC	WMO-IOC Regional Marine Instrument Centre
RMS	Root Mean Square
RNODC	Responsible Oceanographic Data Centre (IODE)
RNODC/DB	RNODC for Drifting Buoys
RRR	Rolling Review of Requirements (WMO)
RTMC	VOSClim Real-Time Monitoring Centre
RUDICS	Iridium Router-Based Unrestricted Digital Interworking Connectivity Solution
RV	Research Vessel
SADC	South African Development Community
SAMS	Scottish Association for Marine Science
SAT	Site Acceptance Test
SAWS	South African Weather Service
SBD	Short Burst Data (Iridium)
SC	Steering Committee
SCAR	Scientific Committee on Antarctic Research
SCG	Services Coordination Group (JCOMM)
SDN	SeaDataNet
SeaDataNet	Pan-European infrastructure for Ocean and Marine Data Management
SFSPA	JCOMM Services and Forecasting Systems Programme Area
SG-ODP	IODE Steering Group for the Ocean Data Portal project
SIA	Seasonal to Inter-annual Forecast
SIO	Scripps Institution of Oceanography (University of California, USA)
SLP	Sea Level Pressure
SMOS	Soil Moisture and Ocean Salinity mission
SOA	Service-Oriented Architecture
SOA	State Oceanic Administration (China)
SOBP	Southern Ocean Buoy Programme
SOC	Specialized Oceanographic Centre (JCOMM)
SOC/DB	SOC for Drifting Buoys
SoG	Statements of Guidance
SOOP	Ship-Of-Opportunity Programme (JCOMM)
SOOPIP	SOOP Implementation Panel (JCOMM)

SOS	Sensor Observation Services
SOT	Ship Observations Team (JCOMM)
SPA	JCOMM Services Programme Area (now SFSPA)
SQL	Structured Query Language
SSA	WMO Special Service Agreement
SSG	Scientific Steering Group
SST	Sea-Surface Temperature
STIP	Stored Tiros Information Processing
SVP	Surface Velocity Programme (of TOGA and WOCE, replaced by GDP) drifter
SVP-B	SVP barometer drifter
SVP-BS	SVP drifter with salinity
SVP-BTC	SVP drifter with temperatures in depth
SVP-BW	SVP Abarometer and wind at a drifter
TAO	Tropical Atmosphere Ocean network of tropical moorings
TC	Technical Coordinator
TD	Technical Document
TIP	Tiros Information Processing
TIP	Tropical Moored Buoys Implementation Panel
TOGA	Tropical Atmosphere and Global Ocean programme
ToR	Terms of Reference
TOWS-WG	Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems
TRITON	Triangle Trans-Ocean buoy network
TT	Task Team
TT-CB	DBCP Task Team on Capacity-Building
TT-DM	DBCP Task Team on Data Management
TT-IBP	DBCP Task Team on Instrument Best Practices & Drifter Technology Developments (merged the TT-QM & TT-TD)
TT-MB	DBCP Task Team on Moored Buoys
TT-QM	DBCP Task Team on Quality Management (now merged into TT-IBPD)
TT-TD	DBCP Task Team on Technological Development (now merged into TT-IBPD)
TT-TDC	Task Team on Table Driven Codes (JCOMM/DMPA)
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United National Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
URL	Uniform Resource Locator
USA	United States of America
USD	United States Dollar
VAR	Value Added Reseller
VCP	Voluntary Cooperation Programme
VGISC	Virtual GISC (Europe)
VOS	Voluntary Observing Ship (WMO)
VOSClim	VOS Climate Project
W3C	World Wide Web Consortium
WCC-3	World Climate Conference 3
WCRP	World Climate Research Programme
WCS	Web Coverage Service
WDC	ICSU World Data Centre
WDIP	WIGOS Test of Concept Development and Implementation Plan
WDIS	WIGOS Development and Implementation Strategy
WESTPAC	IOC Sub-Commission for the Western Pacific
WFS	Web Feature Service
WG	Working Group
WHOI	Woods Hole Oceanographic Institution
WIGOS	WMO Integrated Global Observing System
WIP	WIGOS Implementation Plan
WIS	WMO Information System
WML	Extensible Markup Language
WMO	World Meteorological Organization (UN)
WMS	Web Map Service
WOA	World Ocean Atlas

WOCE	World Ocean Circulation Experiment
WWW	World Weather Watch (WMO)
XBT	Expendable BathyThermograph
XCTD	Expendable Conductivity/Temperature/Depth
XML	Extensible Markup Language