JOINT WMO-IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY (JCOMM)

EXPERT TEAM ON MARINE CLIMATOLOGY

FIFTH SESSION

Geneva, Switzerland

22-25 June 2015

FINAL REPORT

2015

JCOMM Meeting Report No. 122

World Meteorological Organization
Weather • Climate • Water

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

NOTES

WMO Regulation 42

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

WMO Regulation 43

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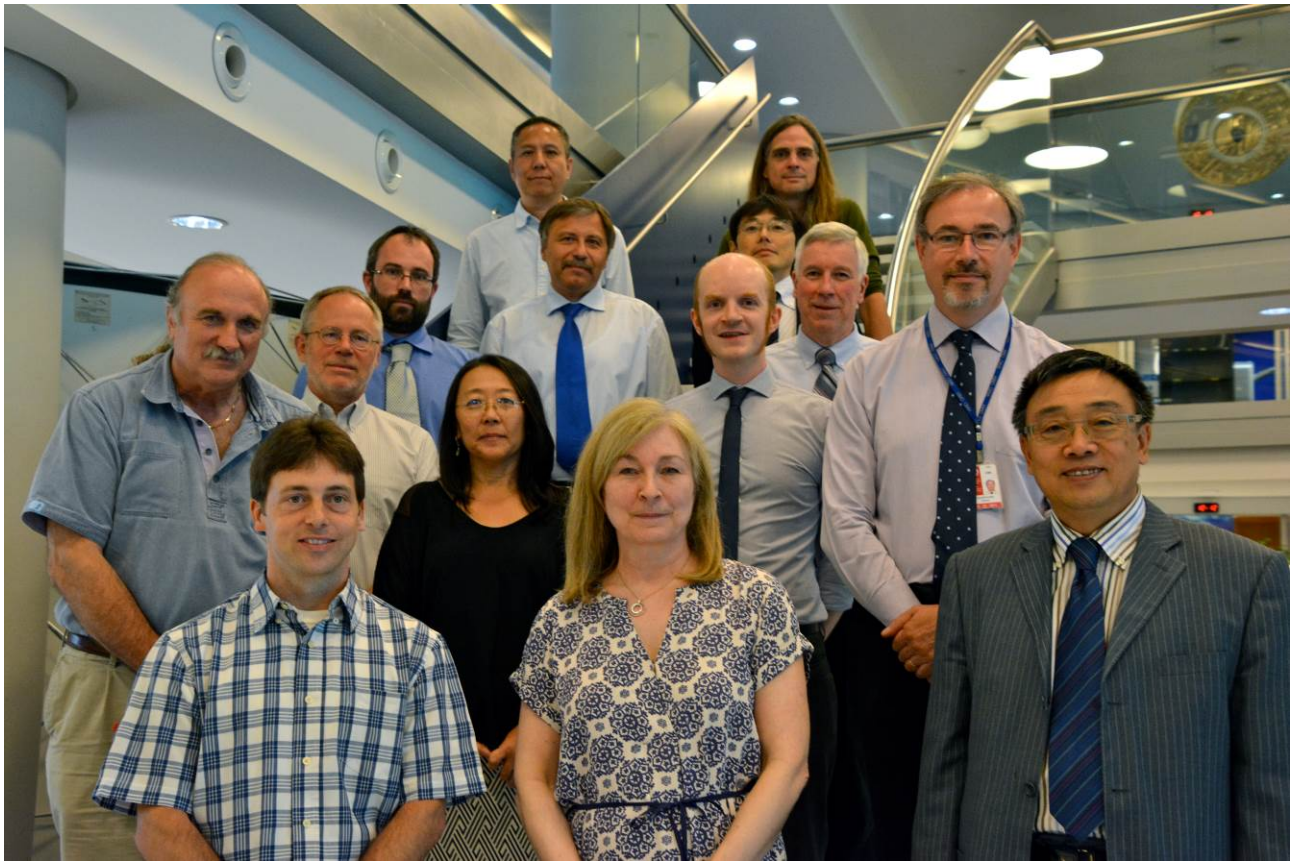
C O N T E N T S



(Group picture)

EXECUTIVE SUMMARY

The fifth session of the Expert Team on Marine Climatology (ETMC) was held at the WMO Secretariat headquarters in Geneva, Switzerland, from 22 to 25 June 2015.

The main goals of the meeting were to follow up from the previous ETMC meeting in order to address guidance from the fourth session of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), which was held in Yeosu, Republic of Korea, from 23 to 31 May 2012, and advance the team work programme during this JCOMM intersessional period according to JCOMM-4 priority activities for the Data Management Programme Area (DMPA) during this period. In particular, an important goal of the meeting was to make substantial progress regarding the development of the new Marine Climate Data System (MCDS) by proposing complete rewrite of the marine climatology chapters of WMO Publications No. 558, and 471, Manual on and Guide to Marine Meteorological Services.

The Chairperson, Mr Eric Freeman (USA) presented an overview of the activities of the ETMC since its fourth session, in particular with regard to the modernization of the Marine Climatological Summaries Scheme (MCSS) and the corresponding development of the MCDS. The Chairperson also recalled some issues that will have to be resolved by the Team during this Session and until the fifth JCOMM Session in 2017. He provided guidance to the Team regarding JCOMM priority activities that relate to marine climatology.

The Team considered the feedback and recommendations of the JCOMM Management Committee (MAN) with regard to Data Management Programme Area issues, including marine climatology. The establishment by MAN of a JCOMM Cross-cutting Task Team for Integrated Marine Meteorological and Oceanographic Services within the WMO Information System (WIS) (TT-MOWIS) was noted, and the ETMC agreed to actively participate in TT-MOWIS noting that the flow of marine climate data to the WIS was an important aspect of the MCDS.

The Team acknowledged the accomplishments of the JCOMM/IODE Expert Team on Data Management Practices (ETDMP) and noted its recommendations with regard to the International Oceanographic Data and Information Exchange (IODE) Ocean Data Portal (ODP) and the Ocean Data Standards and Best Practices Project (ODSBP).

The Team reviewed the current operation/activities of the Global Collecting Centres (GCCs) operated by the United Kingdom and Germany. The Team agreed that the role of the GCCs should eventually evolve as Global Data Assembly Centres (GDACs) in the framework of the MCDS.

The Team reviewed the reports of the Marine Climatological Summaries Scheme (MCSS) Responsible Members (RMs) on their current operation/activities (***Annex VII***). The Team discussed the role that the Responsible Members could play in the future under the MCDS taking into account their feedback in this regard.

The Team reviewed the requirements of the WMO-IOC-UNEP-ICSU Global Ocean and Climate Observing Systems (GOOS and GCOS) for climate datasets. The Team particularly made recommendations regarding (i) GCOS producing target equivalent number of standard observations required to meet the different user requirements, and (ii) the JCOMM Observations Coordination Group (OCG) to take such targets into account when designing the ocean observing system.

The meeting noted the recent developments with regard to the Global Framework for Climate Services (GFCS), in light of WMO executive bodies decision, including the recent WMO seventeenth Congress (Geneva, Switzerland, 25 May -12 June 2015). The Team recalled that the MCDS is regarded as one of JCOMM's contribution to the GFCS implementation.

The Team reviewed the existing and potential linkages with the WMO Commission for Climatology (CCl) and the WMO Commission for Agricultural Meteorology (CAgM). The ETMC

expressed its interest in continuing to participate in the activities of the CLIVAR[1]-CCl-JCOMM Expert Team on Climate Detection and Indices (ETCCDI), with an initial focus on the deep ocean. A new JCOMM member representing this activity, and ETMC, will be identified by the end of 2015, replacing Scott Woodruff who will be stepping down. ETMC will contribute to the overall JCOMM effort to work with the other ETCCDI partners (CLIVAR, GEWEX[2] and CCl) to develop indices of mutual interest.

The Team discussed the outcome and recommendations of the fourth JCOMM Workshop on Advances in Marine Climatology (CLIMAR-4, Asheville, USA, June 2014). It agreed that and the fourth Workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT-4) should be hosted by National Oceanography Centre in Southampton (United Kingdom) in the summer of 2016. Dr David Berry (United Kingdom) was tasked to set up and lead the Organizing Committee.

The Team discussed the continued development of the Marine Climate Data System (MCDS) in line with the recommendations, decisions, and guidance from JCOMM-4. The meeting particularly reviewed the potential contributions and roles of the various actors and stakeholders in the MCDS, particularly concerning foreseen role of the existing MCSS Responsible Members to possibly become Data Acquisition Centres (DACs), or Global Data Assembly Centres (GDACs). It reviewed the role of DACs and GDACs, proposed Terms of Reference for such centres, and identified potential candidates. The meeting discussed the further development of the network of [less than ten] Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs), and noted with appreciation that Cg-17 has adopted a Resolution establishing CMOC/China. The MCDS Implementation Plan was reviewed and updated. Much progress was made with regard to rewriting the marine climatology relevant WMO Technical Regulations in WMO Publication No. 471 and 558 to take into account MCDS developments. The goal is to submit final changes to these publications to JCOMM-5 in 2017; a workplan to achieve this was agreed upon.

Recalling that the initial concept of a CMOC was based on the model of the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), the Team reiterated the increasingly urgent desirability of ICOADS to apply to become a CMOC by mid-2016, prior to the next JCOMM session, and in order to fill more key gaps in the MCDS. The Team discussed the need for this to happen with the support of the US National Oceanic and Atmospheric Administration (NOAA), to provide the needed sustained resources to fulfill such duties, and in collaboration with International partners.

The Team reviewed the development and status of the International Maritime Meteorological Archive (currently IMMA0) format, 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 noted the enhancements proposed in a new version IMMA1. The Team discussed the possibility, and potentially important benefits, of formalizing IMMA within JCOMM. The Team recommended that the GCCs begin transitioning to producing IMMA1 and discontinue production of IMMA0 when prepared. The Team agreed that the IMMA should be controlled by the ICOADS partnership, that the format should be documented as part of the new JCOMM Technical Report No. 85 on the MCDS.

The meeting reviewed the status of the International Maritime Meteorological Tape (IMMT, currently IMMT-5 version) format and Minimum Quality Control Standard (MQCS, currently MQCS-7 version). The Team noted that as Contributing Members (CM) continually move to automate voluntary observing fleets there is a risk that data could be lost as some of such data are not distributed to the GCCs in IMMT format. The Team discussed solutions to address this issue. The team agreed that the replacement of the MCSS, which focused only on delayed-mode VOS observations, by the MCDS, which encompasses multiple data types, provides an opportunity to discuss the suitability of the IMMT format as the new system is developed, including its outdated "Tape" nomenclature. As the IMMT format is already well defined it could potentially be expanded

1 Climate and Ocean - Variability, Predictability, and Change
2 Global Energy and Water Cycle Experiment

upon or form the basis of distinct new formats encompassing multiple data types. However, it was highlighted that the widely used IMMA format is already flexible enough to store data and metadata from a variety of platform types so this may be a more suitable option to fulfill at least portions of the MCDS requirements. In addition a few other solutions were proposed including BUFR[3] and CREX[4]. The team agreed that continuing discussion was required.

The Team agreed with the proposal of the German GCC to consider the high quality control tool "validat" for marine meteorological data as a basis for the new Higher Level Quality Control Standard (HQCS) of the MCDS.

The Team reviewed the status of the ICOADS Value-Added Database (IVAD) project, including the outcome of the first ICOADS Value Added Database (IVAD-1) workshop (Asheville, USA, 13 June 2013).

The Team also reviewed status of migration to table driven codes, including the relevant BUFR templates for marine data. The Team made some recommendations in this regard to the JCOMM Task Team on Table Driven Codes (TT-TDC).

The Team reviewed the use of electronic logbooks (e-logbooks) taking into account the outcome of the previous ETMC meeting in this regard. The Team recommended to expedite the agreement on a common dew point temperature algorithm for use in all e-logbooks. The Team also requested the ETMC Chair to coordinate and discuss with the manufacturers of the three types of e-logbooks to agree on a common dew point temperature algorithm for use in all e-logbooks.

The Team discussed the current status of the ship masking issue, and noted progress regarding the proposal to encode ship call signs.

The Team discussed instrument/platform metadata related to marine climatological data-sets, and particularly reviewed the status of the ship metadata, buoy metadata, rigs and platform metadata, and WMO Integrated Global Observing System (WIGOS) metadata. The Team further discussed oceanographic data and metadata integration issues particularly regarding the latest developments with regard to the Expendable BathyThermograph (XBT) fall rate equation, and Sea Surface Salinity (SSS).

The Team was informed about national and international activities to recover logbooks and other international marine data and metadata. It discussed the need to further promote and enhance such activities. A selection of prominent activities in this general area, closely related to marine meteorology or oceanography, is listed in ***Annex XI***. The Team reviewed with interest the plans of CMOC/China in the area of data and metadata rescue, in coordination with the Atmospheric Circulation Reconstructions over the Earth (ACRE[5]) and other international activities, and looked forward to concrete progress in this area. The Team agreed to continue to seek ways to develop an improved international data rescue strategy in collaboration with other groups, including beyond JCOMM. The Team also noted that it would be useful if an agency or institute could volunteer to establish a wave GDAC or a moored buoy GDAC.

At previous ETMC Sessions, the Team reviewed the status of previous work related to documenting the history of the marine ship codes (results are available at the WMO website[6]).

The team discussed perspectives on contributions and climatological requirements from other JCOMM Expert Teams with regard the development of an extreme wave data set (EWDS), wave climate summaries, a global storm surge climatology, and sea-ice climatologies.

The Team noted the proposal of the JCOMM Expert Team on Sea Ice (ETSI) to proceed with the development of the WMO sea ice technical documentation as well as to continue to supervise extension of the Global Digital Sea Ice Data Bank (GDSIDB) collections. The Team recognized that there is a need for joint actions by the ETMC and the ETSI to ensure

3 FM 94 BUFR GTS format: Binary Universal Form for Representation of meteorological data
4 FM 95 CREX GTS format: Character form for the Representation and EXchange of data
5 http://www.met-acre.org/
6 https://www.wmo.int/pages/prog/amp/mmop/preservation_en.html

harmonization of the WMO standards for the world oceans and availability of historical sea ice collections. That may include at least: (i) reinforcement of the GDSIDB by integration with the MCDS for example as a CMOC;(ii) cross-harmonization of the marine climatology exchange formats (action by ETMC and JCOMM), and the Manual on Codes (action by the WMO Commission for Basic Systems, CBS) with sea ice exchange formats; and (iii) cross-harmonization of the manuals (WMO No. 558 etc.). The Team invited the ETSI to submit a GDAC or CMOC application for the GDSIDB with assistance from the ETMC members as needed.

No progress was noted with regard to developing wave climate summaries in ICOADS. In light of the situation with regard to the ICOADS partnership, the Team agreed that the issue should be deferred to the medium term (after JCOMM-5), and information with user requirements and justification based on MARCDAT-3 and MARCDAT-4 discussions should be submitted to JCOMM-5 on the issue for its guidance.

Good progress was made with regard to the EWDS where various databases have been scanned to identified records of interest to the EWDS. EWDS has then been used in model validation. However, it was noted that there was a lack of metadata in the EWDS, and that the sustainability of the database hosting remained to be addressed. The Team considered options for the future of the EWDS and agreed that further consideration should be deferred until after JCOMM-5 (fall 2017) when the metadata base may be more complete.

The Team noted with appreciation of the initiatives of the JCOMM Expert Team on Waves and Coastal Hazards Forecasting Systems (ETWCH) regarding the development of the global storm surge climatology and concurred with these developments.

The Team discussed information exchange, including consideration of additional Publications of interest to marine climatology (WMO No. 8, 100, and 781). An action plan was agreed in this regard for review of progress at ETMC-6.

The Team reviewed the status of marine climatology related web-pages on various websites (e.g. http://www.jcomm.info/etmc, http://icoads.noaa.gov/etmc/, and the former http://www.marineclimatology.net), and made recommendations for their further integration, taking into account the development of the MCDS.

Before concluding the meeting, the Team reviewed action items from the previous ETMC meeting, and advised on pending issues.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. ORGANIZATION OF THE SESSION

1.1. Opening

1.1.1. The Fifth Session of the JCOMM Expert Team on Marine Climatology (ETMC) was opened by Mr Eric Freeman (USA), Chair of the Expert Team, at 0900 hours on Monday, 22 June 2015 at the WMO Secretariat headquarters in Geneva, Switzerland.

1.1.2. The Director of the WMO Observing and Information Systems Department, Dr Wenjian Zhang welcomed the participants to the Session on behalf of the Secretary-General of WMO, Mr Michel Jarraud, and the Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, Dr Vladimir Ryabinin.

1.1.3. During the opening remark, Dr Zhang stressed on the importance of the work of the ETMC to make recommendations to help WMO and IOC provide even better service to their Member/Member States in order to face the challenges of improving weather forecasting, climate monitoring, climate change detection, climate services, disaster prevention and mitigation, and the many weather and marine oceanography related application areas, or "societal benefit areas". In particular, the results and recommendations from this meeting will be invaluable for JCOMM to make substantial progress in the integration of marine meteorological and oceanographic data management activities through the modernization of the Marine Climate Summaries Scheme (MCSS), and in developing the new Marine Climate Data System (MCDS), and advancing towards Higher-level of Quality Control (HQC) for relevant data. Dr Zhang recalled the outcome of the Seventeenth World Meteorological Congress (Cg-17, Geneva, Switzerland, 25 May – 12 June 2015), and particularly WMO priorities for the next financial period (2016-2019), including in particular climate services. He also recalled the establishment by Congress of the first Centre for Marine Meteorological and Oceanographic Climate data (CMOC) in Tianjin, China. Dr Zhang referred to the WMO Regional Climate Centres (RCC), and explained that more CMOCs need to be established. He finally wished the Team for a successful meeting.

1.2. Adoption of the agenda

1.2.1. The Team adopted the agenda for the Session on the basis of the Provisional Agenda prepared by the Secretariats in consultation with the Chair and vice-Chair of the ETMC. The agenda for the Session is provided in ***Annex I***.

1.3. Working arrangements

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

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

2. JCOMM ASPECTS AND REPORTS

2.1. Report by the ETMC Chairperson

2.1.1. The Chairperson, Mr Freeman presented an overview of the activities of the ETMC since its fourth session (ETMC-4, Ostend, Belgium, 26-28 November 2012). Following the

initial development work of the new Marine Climate Data System (MCDS), work continued to modernize the Marine Climatological Summaries Scheme (MCSS) into the MCDS and realize the vision of the MCDS, to be operational by 2020. During the intersessional period, work undertaken included:

- Continuing the development of the MCDS strategy and implementation plan.
- Proposing updated Terms of Reference of the MCDS Data Acquisition Centers (DACs) and Global Data Assembly Centers (GDACs).
- Evaluating China's application of the State Oceanic Administration (SOA) National Marine Data and Information Service (NMDIS) to be established as a WMO-IOC Centre for Marine Meteorological and Oceanographic Climate data (CMOC), and assisting China for developing a 2 year work plan with a focus on Asia-Pacific data and metadata rescue, and integration of the NOAA/AOML[7] Global Drifter Programme (GDP) and MCDS GDAC global drifting buoy observations and metadata.
- Organizing the Fourth Workshop on Advances in Marine Climatology (CLIMAR-4), and first workshop on the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) Value Added Database (IVAD-1) project in Asheville, North Carolina, USA, 9-12 June 2014 and 13 June 2014, respectively.
- Drafting the first versions of the re-writes of the 'Marine Climatology' Chapters of the WMO Manual on Marine Meteorological Services (WMO-No. 558) and the WMO Guide to Marine Meteorological Services (WMO-No. 471) (see document 8 for more details).
- Assuring representation of the ETMC at the International Oceanographic Data and Information Exchange (IODE) Steering Group on Ocean Data Standards and Best Practices Project (SG-ODSBP).
- Assuring representation of the ETMC at the Thirtieth Session of the Data Buoy Cooperation Panel (DBCP-30, Weihai, China, October 2014).
- Assuring ongoing collaboration with the ICOADS and assisting on the development of the ICOADS Value-Added Database (IVAD).
- Assuring formal recognition of the ICOADS International Partnerships. This was realized through a Letter of Agreement (LoA) between the partnerships' members USA, the United Kingdom (UK) and Germany for long-term collaborations, development of future releases, and future sustainability.
- Improving the links between ETMC and:
    - the JCOMM Expert Team on Waves and Coastal Hazards Forecasting Systems (ETWCH)
    - the JCOMM Expert Team on Sea Ice (ETSI)
    - the WMO Commission for Climatology (CCl) regarding the International Data Rescue Portal, I-DARE, and the High Quality Global Climate Data Management Framework (HQGCDM).

2.1.2. The Team recognized with much appreciation, the significant work of the former ETMC Chair Ms Nicola Scott (UK) and Vice-Chair Ms Gudrun Rosenhagen (Germany). During their tenure (May 2012 to January 2015 for Ms Scott and May 2012-to December 2014 for Ms Rosenhagen) much was accomplished including the significant task of developing the vision for a new MCDS, to replace the MCSS, and laying the groundwork for its full operationalization by 2020. In 2015 Ms Scott and Ms Rosenhagen were succeeded by Mr Freeman and Dr Lydia Gates (Germany) as the new ETMC Chair and Vice-Chair, respectively.

7 Atlantic Oceanographic and Meteorological Laboratory (AOML) of the US National Oceanic and Atmospheric Administration (NOAA)

2.1.3. 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 Global Collecting Centres (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, but rather slowly. Concerns in the community are still expressed regarding preservation of originally reported data. Ship-to-shore formats produced by E-SURFMAR[8] are being considered for replacement of FM-13 SHIP code and FM-18 BUOY code.

2.1.4. The Chairperson recalled a priority decided by the fourth Session of JCOMM (JCOMM-4, Yeosu, Republic of Korea, 23-31 May 2012) for the Data Management Programme Area (DMPA) for the current JCOMM intersessional period (2012-2017) that directly relate to the activities of the ETMC:

- Organize the fourth International Workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT-4) in 2016.

2.1.5. 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) (see agenda item 5);
- A review of existing ETMC/MCDS websites is needed and recommendations on how to merge/transfer content to a central website shall be undertaken (see agenda item 9.1);
- Continuation of the Marine Climate Workshops (see agenda item 4). A preliminary organizing committee to be established by the end of 2015 to manage and run the Fourth International Workshop on Advances in the Use of Historical Climate Data (MARCDAT-4) by 2016;
- Progress towards resolving the outstanding call sign masking issues including implementation of call sign encryption (see agenda items 6.5 and 6.7);
- Data preservation issues relating to migration of real-time transmission to FM-94 BUFR (see agenda item 6.5);
- Addressing the loss of International Maritime Meteorological Tape (IMMT) data from TurboWin e-logbooks from AWS (see agenda item 6). 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 (see agenda item 8.2); and
- Close interactions with the new CMOC/China to provide guidance in data rescue and buoy data/metadata integration (see agenda item 5.5).

2.1.6. The Team noted that the WMO Commission for Basic Systems (CBS) has decided to develop a vision for the WMO Integrated Global Observing System (WIGOS) in 2040. The

8 Operational service for Surface Marine Observations of the the Economic Interest Group (EIG) grouping of European National Meteorological Services (EUMETNET)

Team agreed that it could contribute to this CBS exercise through JCOMM, and requested the ETMC Chair to collect feedback from the ETMC members in the view to provide a consolidated ETMC feedback to JCOMM-5 (including beyond the MCDS Vision) (***action; E. Freeman; ETMC-6***). The Team agreed that another ETMC Session would be needed in 2016 in order to be able to provide appropriate input to JCOMM-5 (***action; Secretariat; mid-2016***).

2.1.7. Finally, Mr Freeman wished to say a few words about the passing of Team member Mr Frits Koek (the Netherlands). The Team acknowledged the excellent contribution of Mr Koek to JCOMM and marine climatology in particular. Mr Koek was heavily involved in maritime meteorology, data rescue and severe weather events, and he loved sailing: He was very successful as navigator on board of the BrunelSunergy during the Whitbread / Volvo Ocean race of 1998. Frits very actively supported the VOS program, as a (KNMI) specialist on the VOSClim project, but in the background also as a specialist on TurboWin. The Team was very thankful to him for that, and wished to express its sympathy to his colleagues, family, and friends.

2.2. JCOMM Management Committee guidance

2.2.1. The Team reviewed the outcome and guidance of the Eleventh Session of the JCOMM Management Committee (MAN-11, Geneva, Switzerland, October 2014) with regard to Data Management Programme Area issues, including marine climatology.

2.2.2. The Team noted that the JCOMM Data Management Plan[9] and its Implementation Details[10] have been updated by the DMCG and published in 2014. MAN-11 has reviewed the process for establishing a WMO-IOC Centre for Marine Meteorological and Oceanographic Climate Data (CMOC) in China (CMOC/China), recalling the continuing evaluation procedure through the DMCG. MAN-11 also welcomed the regional focus of the proposed CMOC activities. Furthermore, MAN-11 stressed that CMOC activities should complement existing activities such as the ICOADS, and the World Ocean Database (WOD), and not duplicate them. The Team noted with appreciation that the MAN-11 concurred with the DMCG recommendation to establish CMOC/China, subject to the fulfilment of their stated conditions.

2.2.3. The Team noted that MAN-11 recalled the need of identifying additional contributors to the Ocean Standards Process of IODE than the European Union (EU) funded Projects of SeaDataNet[11] and Ocean Data Interoperability Platform (ODIP). MAN-11 agreed on the importance of maintaining close linkage with the advanced EU data management activities.

2.2.4. Concerning the need to make ocean data more available, the Team noted that MAN-11 recalled the very important report by Bob Keeley "Data Systems Relevant to JCOMM Activities[12]". The report includes a number of recommendations that need to be followed up, including from an ETMC perspective. The Team therefore requested its members to review the Keeley report and to provide their feedback on the status of the proposed recommendations to the ETMC Chair and the Secretariat (***action; ETMC members; asap***).

2.2.5. The Team also noted establishment by the Management Committee of a JCOMM Cross-cutting Task Team for Integrated Marine Meteorological and Oceanographic Services within the WMO Information System (WIS) (TT-MOWIS). The Team noted the Terms of Reference and membership of the TT-MOWIS as well as the principal objectives for a JCOMM Strategy on Integrated Marine Meteorological and Oceanographic Services within WIS. The Team concurred with the participation of the ETMC vice-Chair, Dr Gates in the TT-MOWIS, and requested her to liaise with the ETMC Chair and Team members as needed (***action; L.***

9 JCOMM Technical Report No. 40, Revision 2, JCOMM Data Management Plan
10 Implementation Details of the JCOMM Data Management Plan (2015)
11 Pan-European infrastructure for Ocean & Marine Data Management
12 Data Systems Relevant to JCOMM Activities (R. Keeley report, 2014)

Gates; ETMC-6). Finally the Team noted that MAN-11 agreed that the TT-MOWIS should consider the MCDS as part of its overall strategy for data flow into the WMO Information Systems WIS, including making recommendations for improvement of any procedures now in place.

2.2.6. The Team also invited the Management Committee to consider establishing better connections of the TT-MOWIS with the Global Climate Observing System (GCOS) Atmospheric Observation Panel for Climate (AOPC) and the CBS Open Programme Area Group (OPAG) on the Integrated Observing System (OPAG-IOS) regarding the atmospheric observations made over the ocean.

2.2.7. The Team noted that Dr Margarita Gregg's (USA) responsibilities with regard to the IODE have now been given to Dr Hernan Garcia (USA) because of Dr Gregg's new responsibilities within NOAA's National Centers for Environmental Information (NCEI). It requested the Secretariat to propose replacing Dr Gregg by Dr Garcia in the TT-MOWIS membership to the JCOMM Co-Presidents (***action; Secr; asap***).

2.3. Data Management Practices

2.3.1. The Team reviewed a written report form the Chair of the joint IODE/JCOMM Expert Team on Data Management Practices (ETDMP), Dr Sergey Belov (Russian Federation). The ETDMP focused on adopting or developing principles and practices for the end-to-end data management processes, also including required data management best practices and standards for such subjects as metadata, common codes, vocabularies, etc. Data practices include tools and services developed under IODE projects such as the Ocean Data Portal (ODP), the Ocean Data Standards and Best Practices Project (ODSBP), OceanExpert, and the Ocean Biogeographic Information System (OBIS). The ETDMP helps to endeavour the development of tools and services within Ocean Data Portal project to better assist the development of distributed data network according to the end-to-end data managing principles, including data provider and end-user levels. The ETDMP is also investigating and proposing adoption of internationally endorsed metadata standards.

2.3.2. Dr Belov also recalled that the ETDMP activities are focusing on fulfilling the recommendations of:

(i) The IOC Committee on International Oceanographic Data and Information Exchange (IODE): Recommendations IODE-XX.3, IODE-XXI.4), IODE-XXII-5, IODE-XXII-6, IODE-XXII-7, IODE-XXII-8, IODE-XXII-9 ; and

(ii) Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM): Recommentations 1(JCOMM-3), 4(JCOMM-3), and 3 (JCOMM-4).

2.3.3. The Team noted that the main ETDMP activities have concentrated on the following items:

(i) conducting the IODE/JCOMM Ocean Data Standards Process (ODS);

(ii) improving the metadata management;

(iii) development of the IODE Ocean Data Portal (ODP) and establishment of interoperability with the WMO Information System (WIS, see agenda item 8.1.1), SeaDataNet and other projects.

2.3.4. The Team noted the following achievements of the ETDMP:

- Publication and promotion of recommended standards and best practices as appropriate;

- Development and publication of a list of agencies collaborating with ODP;
- Completion in cooperation with NODC of Russia of a major release of the ODP Toolkit V2 backend infrastructure
- Participation in series of WebEx meeting with SNDM[13] of Argentina and GOOS
- Creation of a template for the list of agencies/programs in collaboration with ODP and ODP nodes which identifies key tombstone information required;
- Completion of a review and comparison of several controlled vocabularies for commonalities, underlying supporting infrastructures, and recommendation with regard to the required elements for each of the identified vocabularies;
- Completion of a review on available XML-based tools, such as Simplified Knowledge Organization System (SKOS), the Marine Metadata Interoperability (MMI) project and other community-based tools;
- Coordination of activities and tasks of the Partnership Centre for IODE ODP for the IODE ODP technical development:

    a. installation of the ODP global node at National Oceanographic Data Centre (NODC) of Russia

    b. delivery of the ODP specialized node software to SNDM – Argentina and related technical documentation

    c. new web site on Ocean Data Project has been developed, hosted and launched by Partnership Centre (http://www.oceandataportal.org)

    d. new metadata registry service (http://meta.meteo.ru, http://metadata.oceandataportal.net) has been launched for interoperability need between ODP – SeaDataNet, ODP – WIS. This registry is populating ODP metadata in ISO 19139 metadata standard

    e. delivery of the ODP Ocean Data and Information Network for Africa (ODINAFRICA) regional node to SNDM – Argentina and related technical documentation

    f. delivery of the 46 new data sets, containing operational data from GTS

    and with regard to capacity building:

    g. Training course on the establishment of the Ocean Data Portal regional Node and data network for SNDM (Argentina) (7 – 11 October 2013, Buenos Aires, Argentina);

    h. Training course on the establishment of the Ocean Data Portal data network for the Southeast Pacific data and Information Network in support to Integrated Coastal Area Management (SPINCAM) (Buenos Aires, Argentina, 15 – 16 October 2013)

    i. ODINAFRICA Ocean Data Portal training-of-trainers course (16 – 21 December 2013, Oostende, Belgium)

    j. ODINAFRICA Training Course of Ocean Data Portal (10-14 March 2014, Oostende, Belgium) – coordination by WebEx

13 Sistema Nacional de Datos del Mar

k. The Ocean Data and Information Network for the Western Pacific (ODINWESTPAC) Ocean Data Portal training course (21 – 25 April 2014, Tianjin, China)

2.3.5. The Team also noted that the Group has participated in the series of events with the Research Data Alliance (RDA), ODIP, SeaDataNet and GOOS.

2.3.6. The Team acknowledged the accomplishments of the JCOMM/IODE Expert Team on Data Management Practices (ETDMP) and requested data and information managers to make contributions to the IODE ODP with data and information, and to the ODSBP with the submission of best practices and standards to sustain data and information exchange inside the marine community (***action; ETMC members; ongoing***).

2.3.7. The Team noted that having data-sets discoverable via the ODP did not necessarily imply that the data could be accessible and downloaded from the ODP.

2.3.8. The Team further noted that ocean data systems such as the WOD and the ICOADS are not well connected to the ODP. The Team therefore requested Tim Boyer (USA) and Scott Woodruff (USA) to communicate with the ETDMP Chair, Dr Sergey Belov (Russian Federation) in order to investigate how the WOD and the ICOADS data-sets can me made discoverable through the ODP (Dr Gates, Mr Freeman, Ms Sissy Iona (Greece), and the Secretariat to be associated with the relevant communication) (***action; T. Boyer & S. Woodruff; 30 Sep. 2015***).

2.4. Report of the Global Collecting Centres (GCCs)

2.4.1. Dr Gates reported on behalf of the two Global Collecting Centres (GCCs) operated by the United Kingdom and Germany on the respective operation and activities of these two centres. The Team recalled that the two GCCs for JCOMM's Marine Climatological Summaries Scheme (MCSS) were set up to improve data flow and quality of delayed-mode Voluntary Observing Ships (VOS) data by Recommendation 11 / CMM-XI (Lisbon, April 1993) of the former WMO Commission for Marine Meteorology (CMM). Since then both Germany and the United Kingdom have been operating the GCCs. The current activities of the GCCs are reported through the GCC annual reports available from the WMO website[14].

VOS Data volumes

2.4.2. The Team reviewed VOS data volumes processed by the GCCs in 2014. It was noted that the fluctuation in contributions results from a variety of Contributing Member (CM) issues including software, staff and technical problems. The number of contributing countries has remained at 23 Members for the last three years. The remaining four CMs are still having problems submitting their data. In recent years the Deutscher Wetterdienst (DWD) has assisted five Countries in preparing their contributions. The Team requested the GCCs to proactively encourage CM who haven't contributed much data to do more and help CM with automatic systems on board their ships to submit that data (***action; GCCs; ongoing***). Furthermore, the Team invited the JCOMM Co-Presidents to write to the CMs and RMs to remind them about their responsibilities with regard to the MCSS, and requested the Secretariat to assist in this regard (***action; Secr.; asap***).

2.4.3. The Team noted that the majority of data received by the GCCs arrive by email and anonymous FTP transfer, all of which are contributed in IMMT format. In 2012, 53% of data were in IMMT-3 and 47% in IMMT-4. In 2013, 65% were in IMMT-4 and 2% in IMMT-5 and in 2014 72% were in IMMT-4 and 4% in the most recent IMMT-5 format.

14 http://www.wmo.int/pages/prog/amp/mmop/gcc-reports.html

VOS data quality

2.4.4. Regarding data quality, the Team noted that the majority of observations continue to be of good quality with less than 0.1 % of the data being rejected by the MQCS, mostly due to duplication of data. In 2014, it was shown that for the main shipping lanes between continents, much data were concentrated along the coasts. Some locations of observations were reported erroneously. Problems with on-land positions have been on the decrease representing a very small percentage of total data in the last three years.

2.4.5. The Team noted that the TurboWin coding problem of the previous year persists, leading to a number of IMMT-4 and -5 files being submitted with erroneous relative humidity values. These data were identified and the corrected files made available on the German GISC (Global Information System Centre). Until the coding problem is resolved, the GCCs will correct the data before processing and distribution.

VOSClim data

2.4.6. From 2012 to 2014, the observations from the VOS Climate (VOSClim) class ships constituted 55% of the data received by the GCCs from the VOS fleet during this period. However, the Team noted with concerns that only 42% of the VOSClim observations contained the VOSClim defined additional elements. Ten of the twelve Contributing Members with registered VOSClim ships submitted observations. In addition, 133,058 observations including the VOSClim defined additional elements were received from non-VOSClim registered ships.

Standards and formats

2.4.7. Regarding standards and formats, the Team noted that as of 1st January 2011, IMMT-4 had been the preferred format for use by delayed-mode VOS observations. However IMMT-5 and MQCS-7 were adopted at JCOMM-4 in May 2012 and were in effect from June 2012. These include only minor updates of wording and QC limits. The 'Minimum Quality Control (MQC)-software for CMs' was updated to MQCS-7[15].

Evolution of the GCCs in the Marine Climate Data System (MCDS) development framework

2.4.8. The Team agreed that the role of the GCCs should eventually evolve into Global Data Assembly Centres (GDACs) in the framework of the developing Marine Climate Data System (MCDS). The concept of GCC will then become obsolete. This will be reflected in the new Technical Regulations discussed under items 5 and 8.2.

2.5. Report of the Responsible Members (RMs)

2.5.1. Dr Gates reported on the activities of the German Responsible Member of the MCSS, and Mr Hing-Yim Mok (Hong Kong, China) on the activities of the Hong Kong, China one. Mr Fraser Cunningham (United Kingdom) reported on the activities of the remaining six MCSS Responsible Members on the basis of the written reports received from them.

2.5.2. The Team recalled that according to the principles of the MCSS, regulated in the *Manual on Marine Meteorological Services* (WMO-No. 558) and *Guide to Marine Meteorological Services* (WMO-No. 471), the oceans and seas are divided into eight areas of responsibility for the purpose of preparing the marine climatological summaries, with a view to continued international cooperation regarding the collection, archiving and exchange of marine data.

15 http://www.wmo.int/pages/prog/amp/mmop/mqc_soft.html

2.5.3. The Team reviewed the reports of the Responsible Members (RMs) – Germany; Hong Kong, China; India; Japan; the Netherlands; the Russian Federation; the United Kingdom, and the United States of America – on their current operation/activities. Their reports are provided in ***Annex VII***.

2.5.4. The Team discussed the role that the Responsible Members could play in the future under the MCDS under agenda item 5.2. The feedback from the Responsible Members in this regard is summarized in Table 1 below.

Responsible Member	***Foreseen role in MCDS***
Germany	Will provide DAC and GDAC functions; GCC to be migrated to GDAC for VOS data Will initiate CMOC
Hong Kong, China	DAC for collecting marine climate data in the South China Sea region. Exploring acting as GDAC.
India	DAC for VOS in India's area of responsibility Upgrading to WMO Climate Data Management Systems (CDM)
Japan	DAC for marine climate data
The Netherlands	No role anticipated.
Russian Federation	Interested to play a role (particularly of regional Polar DAC & GDAC)
United Kingdom	CM to be migrated to DAC GCC to be migrated to GDAC for VOS data
United States of America	DAC for VOSClim DAC for US delayed-mode data & global R/T marine data from the Global Telecommunication System (GTS)

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

2.5.5. On the basis of the review of the reports from Responsible Members, the Team agreed on the following:

(i) The Team requested Germany to submit an updated consolidated CMOC/Germany proposal to the JCOMM Co-Presidents in due course (***action; L. Gates; end 2015***);

(ii) The Team requested the Secretariat to invite Members who have potential interest in the current area of responsibility of the Netherlands (Mediterranean Sea, South Indian Ocean, Southwest Pacific Ocean) to provide feedback to the ETMC Chair regarding their possible future involvement in the MCSS for such areas (***action; Secr.; asap***).

(iii) Assuming the target of establishing the ICOADS as a CMOC by JCOMM-5 (Nov. 2017), the Team invited the USA to make a CMOC/USA application no later than the end of February 2016 (***action; USA; 29 Feb. 2016***).

3. REQUIREMENTS

3.1. Review the WMO-IOC-UNEP-ICSU Global Ocean Observing System (GOOS), and the WMO-IOC-UNEP-ICSU Global Climate Observing System (GCOS) requirements for climatological data sets

GOOS / GCOS Requirements for Climate Datasets

3.1.1. The meeting reviewed the GOOS and GCOS requirements for climatological datasets, noting the lack of information other than in the Observing Systems Capability Analysis and Review tool (OSCAR16).

3.1.2. The meeting noted the lack of rationale behind a number of the user requirements and inconsistencies between application areas, in particular relating to the spatial and temporal resolution and uncertainty and the relationship of these requirements with the geophysical signal to be detected. The meeting subsequently made the following recommendation:

Recommendation: to aid the specification of user requirements and aid the design and specification of observing systems the scientific justification for those user requirements specified in OSCAR should be linked to from within OSCAR.

Quality, integration and assessment of the marine climate observing system

3.1.3. The meeting noted the lack of relationship between past assessments of the marine climate observing system and implementation plans and the requirements as specified in the OSCAR database.

3.1.4. The meeting noted that this lack of integration was being addressed by the ocean observing community and a move to performing integrating assessments of the ocean observing system through the "Framework for Ocean Observing". The meeting also noted that there is a recommendation for GCOS to follow this approach within the "GCOS Programme Review - Synthesis Report"[17]. **The ETMC endorsed this review, and in particular recommendation 18**.

3.1.5. To address the lack of relationship between implementation plans for observing networks and the user requirements, such as those specified in the OSCAR database, Dr David Berry (United Kingdom) recommended the development of an "*equivalent number of standard observations*" metric and target for the different Essential Climate Variables (ECVs). These metrics could then be used by observation coordination groups to recommend targets to the different network operators, noting the operational requirements of those operators. The meeting noted that this approach would help address the decline in certain aspects of the climate observing system.

3.1.6. The ETMC endorsed this recommendation and made the following recommendations:

Recommendation: That GCOS, as part of its review and implementation plan, specifies standard observation uncertainties for the different ECVs and domains and develops target equivalent number of standard observations required to meet the different user requirements (such as specified in the OSCAR database).

16 http://oscar.wmo.int
17 http://www.wmo.int/pages/prog/gcos/Publications/gcos-181.pdf

Recommendation: That observation coordination groups, such as the JCOMM Observation Coordination Group (OCG), takes into consideration the equivalent number of standard observations for the different ECVs, both oceanic and atmospheric, specified by GCOS and reach agreement between the different panels on how to achieve these goals.

3.1.7. The Team requested the Secretariat to inform the Management Committee about the above ETMC recommendations, and invite it to consider and relay them to the relevant bodies (***action; Secr.; asap***).

3.1.8. The meeting noted that the contribution of sampling errors to grid box uncertainty remained unresolved and should be addressed as a priority.

3.2. Global Framework for Climate Services (GFCS)

3.2.1. The Director of the Global Framework for Climate Services (GFCS) Project Office, Mr Filipe Lucio (Secretariat), reported on the status and recent developments of the GFCS in light of the decisions of the WMO Executive Bodies and of the first and second sessions of the Intergovernmental Board on Climate Services (IBCS) held in Geneva, Switzerland in July 2013, and November 2014 respectively.

3.2.2. The Team recalled that the MCDS is regarded as one of JCOMM's contribution to the GFCS implementation. According to the MCDS Vision, JCOMM will strive to address the WMO and IOC applications requirements for appropriate marine-meteorological and oceanographic climatological data (met-ocean climate data), and particularly address those for long term climate monitoring (Global Climate Observing System – GCOS), seasonal to inter-annual climate forecasts, for the Global Framework for Climate Services (GFCS), and ocean climate requirements of the Global Ocean Observing System (GOOS).

3.2.3. The Team also recalled that according to the MCDS Strategy, the data policy for the integrated products as well as the GFCS data policy must be followed. It was noted that the Seventeenth World Meteorological Congress (Cg-17, Geneva, Switzerland, 25 May – 12 June 2015) adopted Resolution 8.1(2)/1 – WMO Policy on the International Exchange of Climate Data and Products to Support the Implementation of the GFCS. According to this Resolution, the following was particularly decided:

- To adopt the policies and practices, including the guidelines, of Resolution 40 (Cg-12) and Resolution 25 (Cg-13) for the exchange of GFCS relevant data and products to enable the achievement of the goals and objectives of the GFCS;
- That the climate data and products covered by Resolution 40 (Cg-12I) and the GFCS relevant data and products subsumed under Resolution 25 (Cg-13) will continue to be governed by these resolutions;
- That the GFCS relevant data and products from the WMO WDCs, GPCLRFs, RCCs, and RCOFs, the ICSU WDS, as well as from the framework of the GCOS ECVs (Atmospheric, Oceanic and Terrestrial), will constitute an essential contribution to the GFCS and therefore should be made accessible among Members, in particular through the GFCS CSIS, on a free and unrestricted basis;

3.2.4. The Team agreed that the MCDS should be developed in such a way as to fully comply with the above Resolution.

3.2.5. The Team also noted that Cg-17 decided to add "Energy" as the 5th GFCS Priority.

3.2.6. The Sixty-seventh Session of the WMO Executive Council (Geneva, Switzerland, 15-

17 June 2015), taking into account the decisions and guidance of Cg-17 decided to establish and Executive Council Task Team on Data Policy and Emerging Issues. JCOMM is represented in this Task Team.

3.2.7. The Team noted that Dr Vasily Smolyanitsky (Russian Federation) was representing JCOMM at the first meetings of the *ad ho*c Task Team on Monitoring and Evaluation of Implementation of the GFCS (27-28 April, 2015) and of the Task Team on Operational and Resource plan for the GFCS for the period 2015 – 2018 (29-30 April, 2015), held at the WMO Secretariat. The meetings aimed to "(1) refine and finalize the monitoring and evaluation (M&E), criteria and process for the GFCS and (2) finalize the operational and resource plan for the period 2015-2018. Resulting work is summarized in the "Monitoring and evaluation Working Document (last draft 18 June, 2015). The Team requested Dr Smolyanitsky to share with the Team members GFCS, Global Cryosphere Watch (GCW), and Polar Regional Climate Centre (PRCC) materials he is presenting to meetings on the above programmes activities of JCOMM (***action;V. Smolyanitsky; ongoing***).

3.3. Existing and potential linkages with the WMO Commission for Climatology (CCl) and the World Climate Research Program (WCRP)

Linkages with the WMO Commission for Climatology (CCl)

3.3.1. The Team reviewed the existing and potential linkages with the WMO Commission for Climatology (CCl). It noted that the CCl decided on its new structure at its sixteenth session, July 2014, Heidelberg, Germany. The Team noted the following expert teams or activities, which link to the activities of JCOMM and the ETMC:

1) The creation of an Inter-Programme Expert Team on Climate Data Modernization Programme (IPET-CDMP) of the Open Panel of CCl experts on Climate Data Management. It was noted that JCOMM was invited to be represented through Dr Gates (Germany). It is expected that this team will meet in summer 2015.
2) The Joint CCl/WCRP/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI[18]) has been re-established with more focus on addressing WCRP Grand Challenge on Extremes. But also Marine indices have got more focus in the Terms of Reference of ETCCDI. See below for details.
3) The CCl Expert Team on Data Rescue[19] met in November and developed its work-plan, which considered the development of an international Data Rescue Portal (I-DARE) to inform on existing climate archives and those in need for rescue and digitisation. I-DARE will also be an entry point access to existing references, guidelines and knowledge base on tools and methods for Data Rescue (DARE). A side event on Data Rescue was held at Congress-17 to inform on Data Rescue. A white Paper on I-DARE was published[20].
4) WMO in collaboration with several partners launched in April 2014 an Indian Ocean Data Rescue initiative (INDARE), both land and marine data records are being considered for their rescue and digitisation. An implementation plan[21] was developed and agreed by the countries delegates at the first meeting of the steering committee of INDARE[22]. ETMC was represented by MS Gudrun Rosenhagen who made an excellent contribution.
5) A GFCS related workshop involving INDARE communities is planned to take place in September or October 2015. Venue yet to be determined,

18 Terms of Reference at https://www.wmo.int/pages/prog/wcp/ccl/opace/opace2/ET-CCDI-2-3.php
19 Terms of Reference at https://www.wmo.int/pages/prog/wcp/ccl/opace/opace1/ET-DARE-1-2.php
20 http://www.wmo.int/pages/prog/wcp/wcdmp/documents/IDARE_wcdmp83.pdf.
21 https://www.wmo.int/pages/prog/wcp/wcdmp/documents/INDAREimplementationPlan.pdf
22 https://www.wmo.int/pages/prog/wcp/wcdmp/INDARE.php

3.3.2. The Team explored JCOMM and CCl activities regarding indices, data rescue, and data flow, and the experts involved in such activities on both Technical. Commissions. It further compared JCOMM and CCl activities in terms of specific activities of each Technical Commission, and things in common. The result of such comparison is provided in ***Annex XIII***.

3.3.3. Prof Rob Allan (United Kingdom) reported on the activities of the international Atmospheric Circulation Reconstructions over the Earth (ACRE[23]) initiative. ACRE undertakes and facilitates historical global surface terrestrial and marine weather data recovery, imaging and digitisation, feeding these data into the international repositories[24], which are responsible for such material, seeing that these repositories provide the best quality and quantity of surface weather observations for assimilation into all reanalyses (especially the ACRE-facilitated 20th Century Reanalysis) and ensuring that reanalyses outputs are freely available and feed seamlessly into the climate science, climate applications, impacts, risks and extremes communities.

3.3.4. The Team noted that ACRE is run from the Met Office Hadley Centre, but relies on the continuation of 'grassroots' support from the international weather/climate data community and some funding and in kind support from a core consortium of nine partners[25]. Under ACRE's broad international focus, it has worked to develop various regional data rescue foci, such as in Chile, the Pacific, China, Canada, Meso-America, India, Southeast Asia, Africa, Arctic, and the Southern Ocean/Antarctica, all of which are at various stages of development. ACRE is also expanding to develop an integrated cross-disciplinary focus (climate science melding with social sciences and humanities) on historical reanalyses and weather reconstructions, ensuring that the global historical weather observations and reanalyses outputs are analysed and assessed in a longer historical context, and tailored to the needs of educators, students and the general public.

CCl/WCRP/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI)

3.3.5. The Team discussed new directions and activities planned for the CCl/WCRP/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI[26]), with which ETMC (and other JCOMM, including ETWCH) members have been involved since 2006. The ETCCDI is a joint effort by CCl, WCRP and JCOMM to provide international coordination and collaboration on climate change detection and indices relevant to climate change detection, and encourage the comparison of modelled data and observations. In doing so, the ETCCDI addresses the need for the objective measurement and characterization of climate variability and change. The Team recalled that JCOMM is represented in the ETCCDI by Prof. Kevin Horsburgh (UK, Chair ETWCH), Dr Xiaolan Wang (Canada), and Mr Scott Woodruff (USA, representing ETMC), who lead components of the ETCCDI Work Plan relating to marine/ocean data management and development of marine climate indices.

3.3.6. The Team recalled that the general topic of marine climate indices was discussed in a plenary session entitled "Extreme Indices" at the Fourth JCOMM Workshop on Advances in Marine Climatology (CLIMAR-4; Asheville, USA, 9-12 June 2014), with results summarized first informally to the ETCCDI JCOMM members in Appendix A of ETMC-5 preparatory document No. 3.3(2), and then in the published proceedings of the Workshop. The Team noted that, while the CLIMAR-4 discussion concluded that only a limited set of marine climate indices was likely to be feasible at this time, the latest ETCCDI Workplan comprised a wider

23 http://www.met-acre.org

24 The International Comprehensive Ocean Atmosphere Data Set (ICOADS), the International Surface Temperature Initiative (ISTI), the Global Precipitation Climatology Centre (GPCC), and the International Surface Pressure Databank (ISPD).

25 The University of Southern Queensland in Australia; the US National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) and Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado; The National Climatic Data Center (NCDC) of NOAA; the International Environmental Data Rescue Organization (IEDRO); the University of Sussex in the UK, the British Library; the University of Giessen in Germany and the University of Bern in Switzerland

26 http://www.wcrp-climate.org/etccdi

extent of marine indices. The Team expressed its appreciation for WCRP's strong interest in marine indices, especially in the context of the WCRP Grand Challenges (GC) on "understanding and predicting weather and climate extremes" (GC-Extremes) as well as "regional sea level change and coastal impacts" (GC-Sea Level), meanwhile, agreed that the recommendation of CLIMAR-4 should be re-conveyed to the ETCCDI to drop the surface marine (air and sea temperature) aspects from the work scope. The Team requested Mr Val Swail (Canada) to liaise with the other two JCOMM-nominated ETCCDI members and to work on a revised ETCCDI work plan in this regard taking the ETMC-5 guidance into account, before and during the upcoming ETCCDI meeting (Paris, France, 6-8 July 2015) (***action; V. Swail; 30 June 2015***).

3.3.7. The Team recognized that the ETCCDI plays the key role in the implementation of the WCRP GC-Extremes and provides major contributions to the GC-Sea Level, and in doing so, makes significant support to the GFCS implementation to develop extremes-related climate services. The Team therefore agreed to continue its active involvement in the activities of the ETCCDI with an initial focus on the deep ocean. ETMC will contribute to the overall JCOMM effort to work with the other ETCCDI partners (CLIVAR, GEWEX and CCl) to develop indices of mutual interest.

3.3.8. The Team requested Prof. Allan to investigate who could be nominated for replacing Mr Woodruff in the membership of the ETCCDI to represent the ETMC and with an ocean sub-surface perspective (***action; R. Allan; end 2015***). The Team also requested Mr Swail to work with Mr Freeman and Mr Woodruff for developing an ETMC statement to be presented to the ETCCDI meeting in July 2015 on the ETMC perspective with regard to the role of the ETMC representative in the ETCCDI (***action; V. Swail; asap***).

3.4. Existing and potential linkages with the WMO Commission for Agricultural Meteorology (CAgM)

3.4.1. Dr Robert Stefanski (Secretariat) and Mr Woodruff reported on the activities of the Joint CAgM-JCOMM Task Team on Weather, Climate and Fisheries (TT-WCF[27]), on which Mr Woodruff currently serves as one JCOMM representative, and Dr Ed Harrison from NOAA's Pacific Environmental Marine Laboratory (PMEL) as the other. The Task Team met[28] in Nouméa, New Caledonia on 16 February 2013. In 2014, a TT-WCF poster[29] was presented at the CLIMAR-4 Workshop. More recently, the following [abbreviated] abstract submitted to the 3rd CLIOTOP (CLimate Impacts on Oceanic TOp Predators) Symposium (14-18 Sept. 2015, San Sebastián, Spain), discusses the planned preparation of a synthesis report and policy brief:

> *Scientific information often needs to be translated to policy makers to be useful for decision making. To support this, [CAgM and JCOMM] convened a task team in 2013 focused on weather, climate and fisheries to assess the likely impacts of climate variability and change on oceanic fisheries. The overall objective of the task team was to assist in the development of tools capable of improving management of pelagic fishery resources and to build on the regional and fisheries chapters of the Inter-Governmental Panel on Climate Change (IPCC) Assessment Report 5, Working Group II.*
>
> *Of a number of outputs identified by the task team, the first is to compile a synthesis report and policy brief providing a comparison of the impacts of climate variability on pelagic fisheries across the following regions: North Atlantic Ocean and the Mediterranean Sea, North Pacific, Southwest Pacific, southwest Pacific, Southern,*

27 http://www.jcomm.info/index.php?option=com_oe&task=viewGroupRecord&groupID=273
28 http://www.wmo.int/pages/prog/wcp/agm/meetings/ttfish13/index_en.php
29 http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=14016

South Atlantic and Indian Oceans. The report will also provide an overview of relevant tools which incorporate climate information which may be used to assess risks and develop coastal, marine ecosystem and fishery management responses to climate variability and change. This presentation will provide an update on progress made to date in the compilation of the synthesis report and policy brief and next steps of the task team in achieving its objectives.

3.4.2. As part of this synthesis report, for example, JCOMM's representatives on TT-WCF were tasked to lead a section on *Meteorological and ocean climate observations indices that support the information requirements to manage ocean ecosystems*. Thus far however there appears to have been no progress on drafting this section. In view of Mr. Woodruff's now very limited availability, the Team requested Dr Berry in liaison with Mr Tim Boyer (USA) to investigate and propose someone to represent the ETMC in the TT-WCF in replacement of Mr Woodruff (***action; D. Berry; end 2015)***).

4. MARINE DATA AND CLIMATOLOGY WORKSHOPS, AND RECOMMENDATIONS

4.1. CLIMAR-4 outcome, recommendations, and follow up

4.1.1. The Team recalled that the continuity and coordination for marine climatology issues (including ICOADS) has been promoted by two series of meetings that began about fifteen years ago. The JCOMM Workshops on Advances in Marine Climatology (CLIMAR) were held in Vancouver, Canada, 1999, Brussels, Belgium, 2003, Gdynia, Poland, 2008, and Asheville, USA, 2014. Alternating approximately biennially with CLIMAR, the Workshops on Advances in the Use of Historical Marine Climate Data (MARCDAT) have been held in Boulder, USA, 2002, Exeter, UK, 2005, and Frascati, Italy, 2011. Following JCOMM-4 recommendation, it was proposed continuing both successful workshop series with a CLIMAR-4 around 2014, followed as appropriate in approximately two years by a MARCDAT-4.

4.1.2. Dr Berry reported on the 4th JCOMM Workshop on Advances of Marine Climatology (CLIMAR-4) held in Asheville, North Carolina, USA, 9 – 12th June 2015 and the first ICOADS Value Added Database (IVAD-1) workshop held on the 13th June 2015.

4.1.3. The goals of CLIMAR-4 were:

(i.) to highlight the societal benefits of the applications of marine climatology, including for climate services;

(ii.) to review the needs of the scientific and operational communities for marine climate data and products;

(iii.) to assess the state of the marine climate data component of the global climate observing system, identify gaps, and provide guidance on how to address them;

(iv.) to review ongoing developments in the integration of observations across multiple observing domains (land - lower atmosphere / surface ocean - deep ocean - space); and

(v.) to encourage submissions to the Dynamic Part of the WMO Guide to the Applications of Marine Climatology.

4.1.4. These were achieved through invited and contributed presentations[30] organised into 8 thematic sessions and three plenary sessions. Proceedings of the meeting have been published as a JCOMM technical report[31] and a WCRP Flux News article[32]. Submissions to a

30 Presentations available from http://www.jcomm.info/index.php?option=com_oe&task=viewEventDocs&eventID=1384
31 http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=15293

special issue of the International Journal of Climatology, forming an update to the Dynamic Part of the WMO Guide to the Applications of Marine Climatology, were also invited.

4.1.5. Key issues were identified during the meeting, both in session and during the plenary discussions. Recommendations made during the plenary sessions were:

Applications of marine climatology

(i.) That within the area of climate services improvements be made to the communication and coordination between regions, the WMO regional associations, GOOS regional alliances and JCOMM to avoid duplication of effort in specifying observational needs and requirements

(ii.) That improvements be made to the communication between the data providers and end users and for the coordination between the JCOMM Programme Areas to be enhanced with respect to the WMO Global Framework for Climate Services.

(iii.) That, where existing, pilot projects with a strong marine element under the GFCS be highlighted and the visibility of these projects to the science community be enhanced.

Extreme indices

(iv.) The set of proposed extreme indices for ocean waves should be developed

(v.) That extreme indices for storm surges be investigated

4.1.6. Future priorities identified by the meeting were:

(i.) Increasing the availability of enhanced near real time data from ICOADS.

(ii.) The creation of climate quality data products to inform IPCC and Coupled Model Intercomparison Project (CMIP) reports and research.

(iii.) Encourage participation in international climate service initiatives.

(iv.) Promotion of the development of an *in situ* to satellite, and vice versa, data matchup web service.

(v.) Promote quality control and platform trajectory tracking

(vi.) Improved management and availability of wave, buoy and platform reports and observational metadata in ICOADS.

(vii.) Enhance rescued logbook data in ICOADS with image linkage scheme.

(viii.) Promote open-source software development for ICOADS

(ix.) Encourage the formal citing of ICOADS by using Digital Object Identifiers (DOIs)

(x.) Expand the ICOADS lineage record, including the identification of source data and users of and developers of products based on ICOADS, and highlighting its scientific impact via metadata and citation records.

4.1.7. Dr Berry reported that, following CLIMAR-4, a one-day workshop on the ICOADS Value-added Database (IVAD) was held as a forum for users of ICOADS and future users of the IVAD. The IVAD will provide a mechanism for scientists developing bias corrections, and other Quality Control (QC) indicators, to exchange bias adjusted and QC'd observations with other ICOADS users. Dr Berry reported that a summary of the IVAD discussion is included in the meeting report[2].

32 http://sail.msk.ru/newsletter/FluxNews7.pdf

4.2. Preparations for MARCDAT-4

4.2.1. The meeting was reminded that the next International Workshop on Advances in the Use of Historical Climate Data (MARCDAT) is due to be held in 2016. Dr Berry reported on the offer by the UK National Oceanography Centre to host the next workshop in Southampton during the summer of 2016.

4.2.2. Dr Berry also reminded the meeting that the science community found the differentiation of the CLIMAR and MARCDAT workshops confusing given the similar names and same organizing committee. While the team considered whether the two series of workshops could be merged, it recommended to keep them separate but to sharpen the scope of each type of workshop (**Recommendation**).

4.2.3. The Team nominated Dr Berry to Chair the MARCDAT-4 Organizing Committee. Mr Swail, and Mr Woodruff expressed interest in participating in the committee. The Team requested Dr Berry to complete the membership of the organizing committee while considering including representatives of different application areas in the membership (e.g. fisheries, …) (***action. D. Berry; 31 Aug. 2015***).

5. MARINE CLIMATE DATA SYSTEM (MCDS)

5.1. Review of MCDS developments

5.1.1. The Team reviewed status of the MCDS developments in light of JCOMM-4 decisions, recommendations and guidance in this regard. It recalled the related decisions of ETMC-4 (Ostend, Belgium, 26-28 November 2012) and actions undertaken by the Team and the Task Team on the MCDS since then. This included discussions at the Twenty-Second Session of the International Oceanographic Data and Information Exchange (IODE) Committee (IODE-22, Ensenada, Mexico, 11-15 March 2013), which adopted Recommendations IODE-XXII.13 (IODE Global Data Assembly Centres (IODE GDACs), and IODE-XXII.14 (the Marine Climate Data System (MCDS)).

5.1.2. The Team noted that the Fourth Session of the Data Management Coordination Group (DMCG-4, Geneva, Switzerland, 29-31 January 2014) had noted the progress with regard to the development of the MCDS, in particular with regard to the definition of evaluation process and criteria for MCDS candidate centres. DMCG-4 also expressed satisfaction of the integration of the former IODE Responsible National Oceanographic Data Centre for Drifting Buoys (RNODC/DB) and former JCOMM Specialized Oceanography Centre for Drifting Buoys (SOC/DB) operated by Canada and France respectively, and encouraged both Countries to strongly contribute to the MCDS developments, and invited them to submit applications for DAC/GDACs as appropriate for their formal evaluation and establishment.

5.1.3. The Team noted that an informal meeting of the ETMC was organized on side of CLIMAR-4 in Asheville, USA on 10 June 2014. The side meeting reviewed action items from ETMC-4, the MCDS Abridged Strategy and Implementation Plan and discussed status of establishment of CMOC/China. The meeting agreed on an action plan for updating the relevant WMO Technical Regulations. The future potential role of the ICOADS in the MCDS framework was also discussed.

5.1.4. The Team reviewed progress with regard to the establishment of CMOCs, and noted with appreciation that CMOC/China has now been formally established by the WMO Seventeenth Congress (Geneva, Switzerland, 25 May – 12 June 2015). See agenda item 5.5 for details.

5.1.5. The Team recalled that after CLIMAR-4 it has been focusing on the revision of the marine climatology relevant WMO Technical Regulations in WMO Publication No. 471 and 558. Series of teleconferences were organized in December 2014, January 2015, and February 2015, and workplan discussed and refined. The participants at the teleconference reviewed the outlines of WMO No. 558 and 471, proposed some adjustments, in particular to assure some consistency between the relevant chapters in the two publications. They agreed to call the two chapters "Marine Climatology", and to address not only the MCDS, but also met-ocean climatology products. They agreed to include a section on terminology in each Publication. The participants agreed to assign names, including leaders, for writing specific sections. They agreed on the new proposed outline with writing assignments. It was agreed that Mr Freeman would be coordinating input from all contributors, act as overall "lead", and compile such input in the final draft master copies.

5.1.6. A document with writing assignment, guidance, and outline of the marine climatology chapters of WMO No. 558 and 471 was prepared. A workplan (see updated workplan in ***Annex IV***) was also agreed upon for such a review of the two publications. In addition, it was proposed to draft a JCOMM Technical Report on the MCDS (JCOMM TR No. 85) that will complement the Technical Regulations while providing more flexibility for its update.

5.1.7. The Team thanked the TT-MCDS and the contributors to this effort, and concurred with the actions and recommendations taken so far.

5.2. Future of the Contributing and Responsible Members, and areas of responsibility

5.2.1. The Team discussed the current deficiencies, and possible further improvements of the data exchange system for VOS data as regulated in the MCSS for the Responsible Members. The Team then discussed the changes in the roles of the RMs, in light of the development of the MCDS. Responsible Members could for example be invited to switch to Data Acquisition Centres (DACs) for regional specialized data sets and/or to Global Data Assembly Centres (GDACs) for global specialized data sets. The result of the Team's discussion in this regard is reflected in the proposed changes to the WMO Technical Regulations in WMO No. 558, Manual on Marine Meteorological Services, and WMO No. 471, Guide to Marine Meteorological Services as discussed under agenda item 8.2.

5.2.2. Noting the Responsible Member report of the Netherlands, the Team requested the Secretariat to write to the Permanent Representative (PR) of the Netherlands with the WMO and ask about the Country's intentions with regard to their possible future role in the MCDS and its current MCSS areas of responsibility (***action; Secr.; asap***). Should the Netherlands decide to give up its responsibilities in one or more of these areas, the Team also requested the Secretariat to write to the PRs of other countries with potential interest in such regions and ask them if they'd like to play a role in the MCDS for those regions (***action; Secr.; end 2015***).

5.2.3. Regarding the Marine Climate Summaries, the Team agreed that the way they are currently regulated in the WMO Technical Regulations was too specific, and that the corresponding products made available by the Responsible Members were not really being used as the end users could obtain better products from the ICOADS or other centres anyway, or could even produce their own summaries on the basis of consolidated and quality controlled data-sets available from the ICOADS. The Team therefore agreed that it was not required anymore to regulate the production of marine climate summaries in such level of detail anymore, but rather to outline a couple of principles regarding their production by the CMOCs.

5.3. Data Acquisition Centres (DACs), ToR, and candidates

5.3.1. The Team reviewed the latest versions from the Task Team on the MCDS of the proposed Terms of Reference (ToR) for Data Assembly Centres (DAC) and Global Data

Assembly Centres (GDAC) under the new Marine Climate Data System (MCDS) and proposed some changes reflected in the new draft of the Marine Climatology Chapter of WMO Publication No. 471, Appendix 3.1, Section 2.

5.3.2. A list of candidate DACs and GDACS (***Annex X***) was reviewed together with the feedback from the Responsible Members in light of the MCDS development and the roles they may wish to play in the future in this regard (see doc 2.5). The team discussed a proposal to contact the groups identified in the list as well as the interested Responsible Members, and request their approval to move from their old classifications under the Marine Climatological Summaries Scheme (MCSS), or under IOC governance, to the new DAC or GDAC status under the MCDS. The Team also agreed that each of the IODE National Oceanographic data Centres (NODCs) and IODE GDACs should be invited to confirm their willingness to also be recognized as MCDS DACs and GDACs respectively. The Team requested the ETMC chair and vice-chair to work with the Secretariat in drafting a letter of recommendation to the targeted groups to upgrade to the new MCDS classification with request to reply no later than the end of 2015 (***action; ETMC chair & vice-Chair & Secretariat; end 2015***).

5.3.3. Upon approval, the candidate MCDS centres will be reviewed according to the proposed governance, and their scope clarified (***action; evaluation team; mid-2016***). The goal will be to invite JCOMM-5 to review and endorse a list of candidate MCDS centres for their formal establishment with assistance from the Secretariat for preparing the relevant JCOMM-5 Session documentation (***action; Secretariat: end 2016***).

5.3.4. The Team also agreed that the current contribution of the GCCs should be recognized and sustained, and that the UK and German GCCs should therefore automatically become GDACs for VOS data without having to submit GDAC applications nor to go through an evaluation process. This should be reflected in the proposed update of the marine climatology chapters of WMO No. 558 and 471.

5.3.5. The Team agreed that the designation of DACs and GDACs should be undertaken in two phases: (1) mapping existing appropriate structures into the MCDS and acknowledging their contributions as DACs and GDACs in conjunction with the adoption of the new Technical Regulations in WMO No. 558 and 471 targeted for JCOMM-5, and (2) then looking at the desired long term MCDS structure to fill the gaps and to seek new DAC and GDAC candidates.

5.4. Global Data Assembly Centres (GDACs), ToR, and candidates

5.4.1. See discussion under item 5.3 above.

5.5. Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs)

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

5.5.1.1. The Team was updated on the status of ICOADS and related activities since ETMC-4 and noted that core ICOADS operations performed at NOAA's Earth System Research Laboratory (ESRL) continue to be transitioned to NOAA's National Centers for Environmental Information (NCEI). While funds for ICOADS core duties have stabilized, more resources are needed at NCEI to complete the full transition and ensure long-term stability for the program.

5.5.1.2. To assist with the transition and resource issues, ICOADS was expanded in 2014 to an international partnership between the core US partners—NCEI and the US National Center for Atmospheric Research (NCAR)—and research and operational

organizations in the UK and Germany[33]. This provides additional expertise and resources needed to complete Release 3.0 (R3.0) and future data set developments. Additionally, ICOADS is now being guided by the ICOADS Steering Committee (ISC) which meets approximately quarterly to discuss and address current issues and make decisions on pressing items.

5.5.1.3. The Team noted with appreciation that the ICOADS intends to eventually be formalized as a CMOC under the MCDS, suggested by the ISC to be sought via an application from NOAA, but NCEI must assure that sufficient resources are available to carry such long-term duties.

5.5.1.4. The Team also noted that the ICOADS is currently working to operationalize a new Near-Real-Time (NRT) product, consisting of a blend of GTS data streams from NCEI and from the National Centers for Environmental Prediction (NCEP), replacing the NCEP-only GTS NRT product, thus providing a more complete dataset and recovery of masked callsigns (~70% recovery) back to 2008. Blending has been completed for 2008-2014, i.e. R2.5.2, and is being used for reanalyses internationally. The 2008-14 period is being included in R3.0 and the new NRT will follow R3.0 beginning in 2015 and be updated on a monthly basis thereafter.

5.5.1.5. It was further noted that as part of the full transition of ICOADS central production from US partner facilities to NCEI, i.e. delayed-mode and near-real-time dataset production, NCEI is producing ICOADS R3.0 in tandem with US partner facilities to assure that identical observational and gridded products are generated at both facilities and at that point the duties can be appropriately handed off officially to NCEI. Following R3.0, central production of ICOADS will be carried out at NCEI, in continuing collaboration with NCAR and other international partners, and parallel production will cease.

5.5.1.6. Under agenda item 6.1 the Team reviewed in detail the development and status of the International Maritime Meteorological Archive (IMMA) format, which has helped expand linkages with reanalysis projects, for example, through incorporation of QC/feedback information into the format. Satellite matchup services are also being developed external to ICOADS, but will utilize IMMA as the *in situ* basis for calibration and validation of satellite observations.

5.5.1.7. Recalling that the initial concept of a CMOC was based on the model of ICOADS, the Team reiterated the increasingly urgent desirability of ICOADS to apply to become a CMOC by mid-2016, prior to the next JCOMM session, and in order to fill more key gaps in the MCDS. The Team discussed the need for this to happen with the support of NOAA, to provide the needed sustained resources to fulfill such duties, and in collaboration with International partners.

5.5.2. CMOC/China development status

5.5.2.1. The Team recalled that the concept of CMOC was established through Recommendation 2 (JCOMM-4), which included their Terms of Reference and details on the overall governance for their establishment.

5.5.2.2. The Team also recalled that following submission by China of a statement of compliance and commitment for establishing a CMOC in Tianjin, China, at the State Oceanic Administration (SOA) National Marine Data and Information Service (NMDIS), an evaluation committee was formed under the JCOMM Data Management Programme Area (DMPA) and in collaboration with the IODE to evaluate the proposal. A preliminary report on CMOC/China evaluation was presented to DMCG-4 in January 2014. DMCG-4

33 http://icoads.noaa.gov/partners.html

requested China to clarify its proposal according to the evaluation criteria, and to indicate priorities (e.g. what ECVs, with timeline) and what would be the regional focus. Accordingly, CMOC/China provided the required clarifications, and the final report of the committee was submitted to the DMCG on 8 July 2014 for its approval, and approved on 15 July 2014.

5.5.2.3. The Team noted that the eleventh Session of the JCOMM Management Committee (MAN-11, Geneva, 20-23 October 2014) agreed to accept the CMOC application from China, recalling the continuing evaluation procedure through the DMCG. The regional focus of proposed CMOC activities is welcomed and encouraged as a positive contribution to JCOMM. Furthermore, CMOC activities should complement existing activities such as the ICOADS, and the World Ocean Database (WOD), and not duplicate them. MAN-11 agreed that the Team for Integrated Marine Meteorological and Oceanographic Services within WIS (TT-MOWIS) should consider the MCDS as part of its overall strategy for data flow into the WMO Information Systems WIS, including making recommendations for improvement of any procedures now in place. MAN-11 therefore concurred with the DMCG recommendation to establish CMOC/China, subject to the fulfilment of their stated conditions.

5.5.2.4. The JCOMM co-Presidents then consulted JCOMM in writing, with draft Resolution establishing CMOC/China. Per WMO Regulation 77, Members/Member States had 90 days to possibly object the proposed draft Resolution. No objection has been received within that period and draft Resolution could therefore be submitted to Cg-17. Cg-17 finally adopted the draft Resolution establishing CMOC/China subject to similar decision by the IOC Assembly.

5.5.2.5. The Team further noted that 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, the DMCG Chair has also proposed to have JCOMM experts lead by ETMC member Mr Woodruff visit the NMDIS the week of 3-5 November 2014: The Team reviewed the report of the visit team and concurred with their recommendations. CMOC/China will for example focus on the integration of global drifting buoy observations and metadata, in cooperation with NOAA/AOML and MCDS Global Data Assembly Centres (GDACs). CMOC/China will also have a focus on historical metadata and data rescue in the Asian-Pacific region, as well as on capacity building in this region.

5.6. Updating of the Implementation Plan

5.6.1. The Team reviewed the updated version of the MCDS Implementation Plan (MCDS-IP), which took into account all related activities since the last ETMC Session. The Team requested the ETMC Chair and vice-Chair to review the MCDS-IP taking into account ETMC-5 discussions, and to propose an updated version for inclusion in the final report of this Session (***Annex V***) (***action; E. Freeman & L. Gates; 17 July 2015***).

6. FORMATS AND QUALITY CONTROL

6.1. Status of the International Maritime Meteorological Archive (IMMA) format

6.1.1. The Team reviewed the development and status of the International Maritime Meteorological Archive (currently 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.

6.1.2. The Team discussed extensive improvements now being implemented in prototype form and planned for final adoption (as IMMA1; see Woodruff et al. 2015 and Appendix A of ETMC-5 preparatory document No. 6(1)) for Release 3.0 (R3.0) around early 2016 (Freeman et al. 2016). Among these, a wide variety of enhancements are being implemented, e.g.: to bring IMMA into closer agreement with recent IMMT formats; to include near-surface ocean temperatures, salinities and other profile/oceanographic parameters (see also Doc. 6.2); and to provide the infrastructure to store edited visual reports of the amounts and types of cloud over the oceans.

6.1.3. Also new to R3.0 and IMMA1 is the addition of a unique report-level identifier (*UID*), which will assist with record tracking and provenance while providing users and external developers including QC/feedback records from reanalysis projects, and bias adjustments and other community-developed information from the IVAD project (see Doc. 5.4(2)) with a systematic method to provide feedback information to ICOADS for further improvements and identification of data quality and homogenization issues.

6.1.4. The Team recommended that the GCCs begin transitioning to producing IMMA1 and discontinue production of IMMA0 when their preparations are complete (***action; GCCs; asap***).

6.1.5. Related to format evolution issues, Appendix A of ETMC-4's (2012) Doc. 6.1 described a potential ETMC and GCC activity, i.e. proposed development of a new state-of-art historical IMMT archive, which could potentially also benefit ICOADS through the provision of optimally reconstructed IMMA1 records, but no progress has been reported on this work since ETMC-4.

6.1.6. The Team discussed the possibility, and potentially important benefits, of formalizing IMMA within JCOMM. On the marine side, IMMA has been suggested for international formalization by JCOMM, including under the new Marine Climate Data System (as yet unresolved, but netCDF + IMMA have tentatively been suggested as possibilities, where the more primitive IMMT format is already formalized within JCOMM/WMO for the exchange of delayed-mode ship data). The Team agreed that while the IMMA format should remain controlled by the ICOADS partnership, that the format should also be documented as part of the new JCOMM Technical Report No. 85 on the MCDS.

6.1.7. The Team also discussed a proposal (see Appendix B of ETMC-5 preparatory document No.6(1)) to extend IMMA with revisions (or develop an alternative "IMMA-land" version) so as to also incorporate synoptic land station data fields. This 2013 proposal was reviewed by Databank Working Group of the International Surface Temperature Initiative (ISTI[34]), but, in spite of some positive reviews, and shortcomings on the terrestrial side in development of a standardized alternative archive format for higher-resolution land data (surface air temperatures and beyond), this proposal has not yet gained any international traction.

6.1.8. In addition to IMMT files distributed by the GCCs, the IMMA format has also been produced and distributed by the GCCs, but to date, no comparisons have been made between the IMMA produced at the GCCs and conversions of the GCC quarterly IMMT files to the IMMA format performed by ICOADS. The Team recommended that a comparison be done to assess if there are any differences between the 2 conversions to IMMA, and if differences are found that the GCCs and ICOADS work together to rectify those differences. (***action: ICOADS & GCCs; end 2015***).

6.2. Status of the International Maritime Meteorological Tape (IMMT) format

6.2.1. The Team recalled that under the MCSS, Germany and the United Kingdom have

34 http://www.surfacetemperatures.org/databank

been operating the GCCs and have responsibility for the upkeep of the International Maritime Meteorological Tape (IMMT) format and Minimum Quality Control Standard (MQCS).

6.2.2. Versions 5 of the IMMT format and version 7 of the MQCS were adopted by JCOMM-4 in May 2012 following minor amendments/additions to the previous versions. IMMT-5 and MQCS-7 are now the recommended versions for use by all contributing members. There have been no further updates to either format since JCOMM-4.

6.2.3. As of May 2012 IMMT-5 and MQCS-7 were the preferred format and quality standard for use by delayed-mode VOS observations. In 2014 only 4% of observations received were coded in IMMT-5 format, while 72% 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.

6.2.4. The Team noted that 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.

6.2.5. Considering the move to BUFR as the primary format for exchange of real-time meteorological observations, the Team discussed whether 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. The Team agreed with this proposal.

6.2.6. The team agreed that the replacement of the MCSS, which focused only on delayed-mode VOS observations, by the MCDS, which encompasses multiple data types, provides an opportunity to discuss the suitability of the IMMT format as the new system is developed, including its outdated "Tape" nomenclature. As the IMMT format is already well defined it could potentially be expanded upon or form the basis of distinct new formats encompassing multiple data types. However, it was highlighted that the widely used IMMA format is already flexible enough to store data and metadata from a variety of platform types so this may be a more suitable option to fulfill at least portions of the MCDS requirements. In addition a few other solutions were proposed including BUFR and CREX. The team agreed that continuing discussion was required.

6.3. Status of the Minimum Quality Control Standard (MQCS)

6.3.1. See item 6.2 above.

6.4. Higher level quality control

6.4.1. Status of the Higher Level Quality Control Standard (HQCS)

6.4.1.1. Dr Gates reported on the status of the development of the Higher-level Quality Control Standard (HQCS). In particular she reported on the higher-level quality control tool “validat” for marine meteorological data that was recently developed by the Deutscher Wetterdienst (DWD). The data validation tool “validat” is used operationally at DWD. It is planned to apply “validat” to the entire set of data archived at the Global Collecting Centre for Marine Meteorological Observations hosted by DWD in Hamburg. Details about “validat” are provided in ***Annex XII***.

6.4.1.2. Dr Gates proposed to incorporate “validat” as an initial higher-level quality control standard contribution within MCDS. The Team agreed with this proposal and

requested Dr Gates to provide the detailed documentation about this HQCS to make sure that relevant details will be properly reflected in the revised WMO Publications No. 558 and 471, and the new proposed JCOMM Technical Report no. 85 on the MCDS (***action; L. Gates; end 2015***). The Team also requested its members to provide details about their own quality control procedures to Dr Gates (***action; ETMC members; asap***).

6.4.2. Potential linkages with satellite data

6.4.2.1. The Team recalled its discussion at the previous ETMC meeting regarding potential linkage with satellite data, and the development of a prototype project to match ICOADS observations with satellite data collections using a web services approach. The Team also recalled that one of the future priorities proposed by CLIMAR-4 was the promotion of the development of *in situ* to satellite, and vice versa, data matchup web service.

6.4.2.2. Mr Freeman reported on behalf of Steve Worley (NCAR) on the work of a team of experts from the Center for Ocean-Atmospheric Prediction Studies (COAPS), National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory (JPL), and the National Center for Atmospheric Research (NCAR) proposes to develop a dynamic, distributed tool capable of matching marine observations collected by satellites and in situ platforms (e.g., ships, moored buoys, drifters). Development will focus on a flexible infrastructure capable of matching a diverse suite of satellite products (e.g., swath level 2 and gridded level 4) to both well-established and innovative in situ observing platforms (e.g. ships vs. gliders). The Primary objectives of this proposed technology development include (i) exposing select satellite and marine in situ datasets in a manner that will allow spatial (latitude, longitude, depth), temporal, and parameter matching across a distributed network; (ii) creating a two-function user interface (a web portal for human interactions and web services for machine-to-machine interoperability) that supports selection of datasets and criteria to return a matched dataset along with sufficient metadata to scientifically interpret the data; and (iii) developing middle-ware that efficiently performs user-specific matchups.

6.4.2.3. The proposed system will be developed and tested using a subset of satellite products and in situ datasets that include sea-surface salinity (SSS), sea surface temperature (SST), and ocean vector wind measurements. In situ data will be extracted from the ICOADS, the Shipboard Automated Meteorological and Oceanographic System (SAMOS)) initiative, and the Salinity Processes in the Upper Ocean Region Study (SPURS). Satellite products will include JPLv3 QuikSCAT winds4, the Aquarius v3.0 L2 orbital/swath dataset5, and the high-resolution gridded L4 MUR-SST product6. Importantly, although the system will be established with these selected datasets, it will be readily extendable to other in situ and satellite collections, which could support additional science disciplines (e.g., ecosystems science, the carbon community, or terrestrial satellite and in situ observations). Once developed, the system will be accessible to the public, including the commercial/private sector, which can use the service to conduct comparative analyses and add value to the products they develop and provide to their clients.

6.4.2.4. The Team noted that the *in situ* SST quality monitor (iQuam)[35] seems to overlap with the above initiative, and requested Mr Freeman to approach both groups and seek clarification on their respective scopes (***action; E. Freeman; asap***).

6.4.3. Status of the ICOADS Value-Added Database (IVAD) project

35 http://www.star.nesdis.noaa.gov/sod/sst/iquam/

6.4.3.1. The Team discussed work underway in the US and with international partners on an ICOADS Value-Added Database (IVAD). As noted at ETMC-4 (2012), this project had been funded for three years (FY2011-13) by the NOAA Climate Program Office, and, while seeking additional US or international resources, the project continues to operate in minimal fashion based on the previously funded infrastructure.

6.4.3.2. In general terms, this on-going project seeks to capitalize on the work of community experts working on specific variables and time periods—to enhance homogeneity across observing systems, estimate the uncertainty of observations, and improve data quality control (QC). In the past these activities have typically resulted in analyzed (gridded) datasets, but IVAD seeks to make the underlying observations used in these improved datasets readily available to all ICOADS users.

6.4.3.3. The Team noted that the revised IMMA (IMMA1) format (see Doc. 5(1) and Woodruff et al. 2015) is serving as the underpinning for IVAD, coupled with a dedicated database management system (DBMS) at the US National Center for Atmospheric Research (NCAR). Specifically, the new *IVAD* "attachment" in IMMA1 supports the linking of community-developed information with individual fields within ICOADS marine reports.

6.4.3.4. The Team also noted that *I*VADattms are being developed by experts in the marine climate community, and two prototype adjustments will be associated with ICOADS in conjunction with the upcoming (~early 2016) Release 3.0 (R3.0) update (Freeman et al. 2016):

(a) visually estimated (Beaufort) winds following Lindau (1995), and

(b) air temperature (AT) adjusted for ship heating following Berry et al. (2004).

6.4.3.5. In addition, the Team noted with interest the summarized discussion and outcomes from the first ICOADS Value Added Database (IVAD-1) workshop, which was held 13 June 2014 following CLIMAR-4[36], as a forum for the CLIMAR community to provide feedback to the developers of the prototype database.

6.4.3.6. The Team noted these developments with appreciation, and encouraged their continuation.

6.5. Review of the BUFR (and other) templates for surface marine data

Ship to shore templates

6.5.1. Dr Berry presented an overview of the different data formats used to report meteorological and surface oceanographic observations from ships and other platforms to shore (ship-to-shore). The Team, noting the increasing number of alphanumeric and binary formats used, and to aid data governance and traceability, recommended the creation and publication of a catalogue of data formats and versions used in liaison with the JCOMM Observations Programme Area (OPA). The Team invited the Ship Observations Team to develop, publish, and maintain (including preservation of historical versions) a catalogue of ship-to-shore data formats on the JCOMM *in situ* Observations Programme Support Centre (JCOMMOPS) website. The Team also agreed that traceability of the observations should be assured, and that the ship to shore data ought to be preserved by the VOS operators nationally. The Team requested the Secretariat to forward these recommendations to the SOT and the VOS Panel (VOSP) Chairs ***(action; Secr.; asap)***.

BUFR Templates

36 http://icoads.noaa.gov/climar4/

6.5.2. Dr Berry, ex-Chair of the Task Team on Table Driven Code forms (TT-TDC), reported on progress of the migration to Table Driven Codes (TDCs). Dr Berry reported that the majority of TACs previously used to transmit marine data on the GTS now have a BUFR equivalent that has been validated and approved for operational use. Dr Berry reported that "Templates for the reporting of wave observations from different platforms suitable for WAVEOB[37] data" are the exception but that these templates have been approved for validation and are currently being used on a limited pre-operational basis. However, Dr Berry reported that there were a number of issues with the templates, and in particular a number of BUFR descriptors that had been passed for operational use but that were inadequate / incorrectly specified. The meeting noted that these are currently being revised and that updated versions will be submitted to the CBS Inter Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM) in 2015.

6.5.3. Dr Berry reported on progress with the revised VOS template, allowing the encryption of ship's callsigns and the reporting of additional parameters, such as limited oceanographic data (currents / salinity), the VOSClim elements and enhanced metadata for the reporting of temperature and humidity observations. The Team requested Dr Berry, by IPET-DRMM-3 (July 2015) to submit the revised VOS template to the IPET-DRMM for approval (***action; D. Berry; Jul. 2015***). The Team also requested Dr Berry, by November 2015 to validate the VOS BUFR template and submit the results to the IPET-DRMM for approval (***action; D. Berry; Nov. 2015***).

6.5.4. Dr Berry also reported on the status of a new template for the reporting of meteorological observations from platforms currently undergoing validation. The Team requested Dr Berry, by IPET-DRMM-3 (July 2015) to coordinate the validation of the template for observations from platforms with the DBCP (***action; D. Berry; Jul. 2015***).

6.5.5. The meeting was updated on future work for the TT-TDC, including the development of BUFR templates for the reporting of glider data and of additional parameters reported by Argo floats. The Team invited the TT-TDC Chair to coordinate with the DBCP on the development of templates for glider observations and the submission of a proposal to the IPET-DRMM (***action; TT-TDC Chair; mid-2016***).

6.5.6. Dr Berry reported that no progress has been made on Master Table 10 (MT10) but that, during its 2nd session, the IPET-DRMM approved the use of an additional BUFR class for the reporting of oceanographic parameters. The meeting noted that this alleviates some of the pressure for MT10 but that this new class still needs to be populated. The Team requested the TT-TDC Chair to lead the specification of parameters for inclusion in the new oceanographic data class in BUFR Master Table 0 (***action; TT-TDC Chair; mid-2016***).

6.5.7. Dr Berry reminded the meeting that he initially took over the role as chair of the TT-TDC for a limited period of two years and that this period had now expired. Dr Berry invited the team to make recommendations for a new chair of the TT-TDC to the DMPA coordinator, either directly or via the secretariat.

6.5.8. The Team invited its members to identify and recommend a new chair of the TT-TDC to the DMPA coordinator through the ETMC Chair (***action; E. Freeman; asap***).

6.6. Review of electronic logbooks

6.6.1. Mr Mok reported on the use of electronic logbook (e-logbooks) in the framework of their use in marine climatology. Members operating ships under the Voluntary Observing Ships scheme (VOS) have been encouraged to use e-logbooks. The Team noted the report by

37 FM 65 WAVEOB GTS code format: Report of spectral wave information from a sea station or from a remote platform (aircraft or satellite)

the Chair of the VOS Panel at the Eighth Session of the JCOMM Ship Observations Team (SOT-8, Cape Town, South Africa, 20-24 April 2015) that despite a gradual rise in the provision of e-logbook software on observing ships over the last decade, there had been a disappointing fall in numbers over the last year. According to the report of the Chair of VOS Panel at SOT-8, there were several possible reasons for this decline. Firstly the figures are derived from information submitted in national VOS reports and unfortunately several national VOS operators had again failed to submit their reports. As a consequence numbers had, in some cases, to be estimated based on previous years' submissions. Secondly the plans by some National Meteorological Services (NMSs) to migrate to automatic weather systems appear to be having gradual impact on the size of national VOS fleets. In addition it was known that some VOS Operators were rationalizing the composition of their national fleets by focusing mainly on the higher quality VOS Climate (VOSClim) class ships.

6.6.2. At present, there are three main types of e-logbooks – OBSJMA (developed by the Japan Meteorological Agency, JMA), AmverSEAS/SEAS (developed by the US National Oceanic and Atmospheric Administration, NOAA) and TurboWin (developed by the Royal Netherlands Meteorological Institute, KNMI). It was noted at SOT-8 that NOAA's National Weather Service (NWS) had recently made a policy decision to transition their VOS to the use of TurboWin software, as a replacement for Amver/SEAS and well over a hundred of their observing ships had already moved over to using TurboWin software. The Team also noted the latest development of TurboWin, TurboWeb and TurboWin+ reported at SOT-8.

6.6.3. The Team recalled that on request by SOT-4, the SOT Task Team on Instruments Standards was requested to conduct an inter-comparison of the three types of e-logbooks and the results and recommendations were presented and discussed at SOT-5. The significant variations between the three e-logbooks were related to the algorithms for calculating the dew point temperature, the true wind speed and direction, and mean sea level pressure, as well as the coding of swell. The Team further discussed the recommendations made by the inter-comparison at ETMC-3 (Melbourne, Australia, February 2010). Among the others, the Team at ETMC-3 endorsed that the algorithm for calculating dew point temperature be standardized between e-logbooks according to WMO technical regulations and approved by ETMC. In this respect, the Team at ETMC-4 (Ostend, Belgium, November 2012) recommended the manufacturers of the three types of e-logbooks to expedite the agreement on a common dew point temperature algorithm for use in all e-logbooks. However, the meeting noted that this issue has yet to be resolved and is still outstanding.

6.6.4. The Team further recalled that at ETMC-4, the Team had noted that since operation, there have been a number of modifications of the three types of e-logbooks and that the details on the modifications in each new version and the version number of the e-logbook version used for each ship observation are important information for using the ship observations in marine climatology. In this respect, the ETMC Chair was asked to send request to the manufacturers of the three types of e-logbooks to provide the past versions of their e-logbook algorithms, along with their periods of validity to WMO Secretariat for posting on the WMO website. The meeting noted that the requested information has been made available at WMO website[38].

6.6.5. The Team recommended to expedite the agreement on a common dew point temperature algorithm for use in all e-logbooks (***recommendation***).

6.6.6. The Team requested the ETMC Chair to contact the VOSP chair in the view to coordinate and discuss with the manufacturers of the three types of e-logbooks to agree on a common dew point temperature algorithm for use in all e-logbooks (***action; ETMC Chair; asap***).

38 https://www.wmo.int/pages/prog/amp/mmop/JCOMM/OPA/SOT/dewpoint-algo.html

6.7. Ship call sign masking (including encode proposal)

6.7.1. The Team recalled that following concerns expressed by ship owners and masters with regard to ship's identification and position being made available via public websites, the WMO Executive Council adopted Resolution 27 (EC-LIX) authorizing Members, under certain conditions, to mask the identification of the ship from Voluntary Observing Ship (VOS) reports being exchanged in real-time. Several masking schemes[39] have now been implemented by Members in accordance with this Resolution. The Team also recalled its concerns and discussion and recommendations at the previous ETMC meeting. The Team again stressed the importance of having access to the ship's identification in the long term archives in order to be able to access ship metadata, and undertake proper data processing including quality control and bias correction.

6.7.2. The Team noted that the decision of the Co-Presidents of JCOMM concerning *Security requirements for the encryption/decryption of ship's call signs within BUFR[40] reports distributed on GTS*. The Team also recalled that the ship masking issue was discussed at the Eighth Session of the JCOMM Ship Observations Team (Cape Town, South Africa, 20-24 April 2015). The SOT-8 made the following recommendations:

(i) Members using the E-SURFMAR VOS Metadata Database operationally, to continue to maintain their MASK details as an alternative to submitting a quarterly advice to JCOMMOPS;

(ii) E-SURFMAR to continue to provide JCOMMOPS with a list of current MASK details on a daily basis;

(iii) To establish a JCOMM Focal Point on Ship Masking. In particular, the Focal Point shall be responsible for managing encryption / decryption keys;

(iv) The SOT Chair to submit the draft Terms of Reference of the JCOMM Focal Point on Ship Masking to the JCOMM Co-Presidents for their approval;

(v) Once approved, the Chair of the Task Team to nominate through the SOT Chair someone to become the new Focal Point on Ship Masking and submit the proposal to the JCOMM Co-Presidents for their approval;

6.7.3. The Team also noted that following the discussion on progress with ship call-sign masking and encoding schemes, Prof David Meldrum (OPA Co-chair) reminded the SOT-8 meeting that much ship data was in fact freely available in the public domain, and that open access to these data would not be restricted by the proposed schemes. In consequence, the view might be taken that, realistically, the call-sign masking and encoding schemes were now more or less superfluous, at least from the point of view of ship security. The SOT-8 meeting agreed that, while it was bound by previous decisions of the WMO Executive council to proceed with the schemes for the time being, it should take stock of the current situation with regard to the increasing amount of ship data now available publicly, investigate with concerned Members whether their views can evolve in light of this information, and, if felt realistic to achieve better solutions, report this situation back to the WMO Executive Council through JCOMM for a review of its decisions in this regard. In particular, recognizing the difficulties that call sign masking introduced for research users, it asked the WMO to be careful not to promote call sign masking in areas where it might not be needed, and to review its guidance

39: Implemented schemes include (i) SHIP: the generic "SHIP" letters are used in place of the ship's call sign within GTS VOS reports, while unmasked data are distributed to authorized legitimate users through a secured parallel system (this scheme is used by Japan, USA, and Canada), and (ii) MASK: using SOT managed unique ship identifiers in place of the original ITU callsign (this scheme is used by Australia, and E-SURFMAR). The long term universally accepted solution (ENCODE) is foreseen to propose the encryption of the ship's call sign within VOS GTS reports using the BUFR code.

40 FM-94 BUFR: Binary Universal Form for the Representation of Meteorological data

material in this light. SOT-8 also asked the Members with ship security concerns to raise AIS security concerns with the IMO and to report back to the next session.

7. DATA AND METADATA: ARCHEOLOGY AND ARCHIVAL

7.1. Instrument/Platform metadata

7.1.0.1 The Team reviewed Instrument and Platform (I-P) metadata user requirements and recalled that these are essential to understand the observations, as well as for programme monitoring, platform operator diagnostic and follow up, and identification of the observing platforms. The Team also recalled that the Fourth Session of JCOMM (JCOMM-4, Yeosu, Republic of Korea, May 2012) had urged Members/Member States to collect, distribute and record I-P metadata together with the ocean observational data, and had adopted Recommendation 1 (JCOMM-4) – Provision of Ocean/Instrument Metadata. This requirement was also stressed by JCOMM-4 as part of the development of the Marine Climate Data System (MCDS) and the adopted Recommendation 2 (JCOMM-4) on the MCDS.

7.1.1. Ship metadata

VOS Metadata and status of the WMO Ship Catalogue (WMO-No. 47)

7.1.1.1. The Team recalled that VOS metadata are managed through the WMO Publication No. 47, International list of Voluntary Observing Ships (Pub47). The Team noted the outcome of the Eighth Session of the Ship Observations Team (SOT-8, Cape Town, South Africa, 20-24 April 2015) with regard to VOS metadata. SOT-8 made some proposals for slightly updating the format of WMO Publication No. 47 (Pub47) for consistency with its decisions during the Session (e.g. new type of reporting ship; type of temperature/humidity sensor). These changes will be submitted to JCOMM-5. SOT-8 also agreed that Pub47 metadata should be integrated in the Observing Systems Capability Analysis and Review tool (OSCAR) as soon as possible (see item 9 below). It requested the WMO Secretariat to discuss the issue with JCOMMOPS, E-SURFMAR, and MeteoSwiss in the view to undertake the necessary developments in this regard. SOT-8 endorsed a change in the location of the Pub47 XML Schema namespace variable as a result of the transfer of the VOS Website from the Australian Bureau of Meteorology (BOM) to JCOMMOPS. SOT-8 also requested the SOT Task Team on Pub47 to further examine the requirements to collect metadata about instruments sampling rates and instrument accuracies and precision, and to further examine the need to record the data format used to send data from ship-to-shore.

Ship Of Opportunity Programme (SOOP) Metadata

7.1.1.2. The Team noted that the SOT-8 has decided to establish an *ad hoc* Task Team on SOOP metadata for establishing a proper SOOP platform metadata collection in addition to operational deployment metadata. The *ad hoc* Task Team shall report to the SOT Chair no later than mid-2016. SOT-8 has also recommended SOOPIP members (active XBT agencies) to provide the SOOP metadata on a semestrial basis to JCOMMOPS or AOML.

GO-SHIP Metadata

7.1.1.3. It was also noted that the Global Ocean Ship-Based Hydrographic Investigations Programme (GO-SHIP) has established a format and procedure to gather and publish cruise metadata[41] and a mechanism is under construction to monitor the

41 http://www.go-ship.org/Cruise-Notice.pdf

fulfillment of GO-SHIP data-requirements[42], in close cooperation with the CLIVAR and Carbon Hydrographic Data Office (CCHDO). Similar to the so-called hydrotable[43] a new JCOMMOPS tool will allow registering and monitoring of GO-SHIP cruises from the earliest planning phase to the final delivery of all emerging data to appropriate data centers.

7.1.2. Buoy metadata

7.1.2.1. The Team noted that metadata needing to be collected for moored buoy systems has been defined by the Data Buoy Cooperation Panel (DBCP) and formats for its submission to JCOMMOPS agreed. Initial metadata submissions have been made to JCOMMOPS to enable the Technical Coordinator (TC) to develop the capability to ingest the metadata and make it accessible via the JCOMMOPS website, although progress in developing a system for this has been severely limited by the absence of an IT expert in JCOMMOPS. The DBCP affirmed that this work is now a priority action for the Technical Coordinator and JCOMMOPS, and that once a system is in place with JCOMMOPS for the moored buoy operators to compile and submit their metadata. The DBCP also agreed that once this is done, it should look at developing a metadata submission format for Rigs and other fixed Platforms similar to that for moored buoys.

7.1.2.2. The Team noted that Mr Swail also reported at DBCP-31 (Weihai, China, October 2014) on the outcome of CLIMAR-4[44]. Noting the critical situation with regard to availability of buoy metadata as highlighted at CLIMAR-4, the DBCP recommended its members to check their records, and make sure that the historical and present (wave and other) buoy metadata are made available to international archives (e.g. ICOADS[45]) in a suitable exchange format such as that recently developed by the DBCP Task Team on Moored Buoys.

7.1.2.3. The Team also recalled that the small team of JCOMM experts who visited the trial CMOC/China from 3 to 5 November 2014 had discussed and agreed with the China National Marine Data and Information Service (NMDIS) on a 2-year work plan (2015 – 2016) for CMOC/China development, which includes the following elements concerning metadata: (i) cooperation with NOAA/AOML and the MCDS Global Data Assembly Centres (GDACs) to integrate global drifting buoy observations and metadata; (ii) support to historical metadata and data rescue activities; (iii) improving existing metadata standards and translate them into English; (iv) developing metadata schema for integrated and specialized datasets; and (v) facilitating the archival transition to JCOMMOPS and other appropriate permanent repositories of any unique metadata held at the former ODASMS.

7.1.3. Rig and platform metadata issues

7.1.3.1. The Team recalled that the Terms of Reference of the DBCP have been updated after JCOMM-4 in order for the DBCP to take over full responsibility for all types of Rigs and Platforms reporting meteorological and/or oceanographic measurements, and for all related aspects. As such, the DBCP is tasked to promote data exchange, including the insertion of all available and relevant platform data and metadata into the Global Telecommunication System (GTS), and the submission of data and metadata to the appropriate archives. Noting that instrument practices related to the making of observations from Rigs and Platforms are close to those for the making of observations for the Voluntary Observing Fleet, the Data Management Coordination Group invited the

42 http://www.go-ship.org/GO-SHIP_CMST.pdf
43 http://ushydro.ucsd.edu/hydrotable/
44 CLIMAR-4 noted that metadata for platforms and moorings is a huge problem. The workshop agreed on the following among future priorities: Advance the management and availability of wave, buoy, and platform data and metadata in ICOADS.
45 International Comprehensive Ocean-Atmosphere Data Set (USA)

DBCP and the Ship Observations Team (SOT) to cooperate with regard to the definition and collection of metadata for Rigs and Platforms.

7.1.4. WIGOS Metadata

7.1.4.1. The Team noted the recent development by the WMO of a WIGOS[46] Metadata Standard. The Standard has been adopted by the Seventeenth WMO Congress (Geneva, Switzerland, 25 May – 12 June 2015) and was included in the new Manual on WIGOS[47] in its section 2.5.3. From that perspective, WMO Members have obligations to record, monitor, and make the WIGOS metadata required for international exchange available. The Observing Systems Capabilities Analysis and Review tool (OSCAR[48]), which surface observing systems component (OSCAR/Surface[49]) is currently under development and planned to become operational as of September 2015 will eventually become the official repository of WIGOS metadata once the new WIGOS Technical Regulations will come into force (i.e. in principle in July 2016).

7.1.4.2. Per decision of the eleventh Session of the JCOMM Management Committee (Geneva, Switzerland, October 2014) JCOMMOPS was requested to collaborate with the OSCAR Platform development project in order to keep the status of the marine observing systems capabilities up to date into OSCAR. JCOMM Observation Panel and Associated Programmes members will have to make sure that the marine and ocean observing systems metadata are being collected by JCOMMOPS.

7.2. Oceanographic data and metadata integration issues (XBT fall rate equation, SSS, etc.)

7.2.1. To help support a variety of marine climatological applications, the Team recalled that data from oceanographic profiling instruments are an important supplement to near-surface data. Similarly to how ICOADS provides access to the most complete and extensive collection of surface marine meteorological data available today, access to the world's largest collection of oceanographic data is provided through the World Ocean Database (WOD) (NOAA/NCEI-Maryland). For periodic major ICOADS delayed-mode updates moreover, near-surface temperature profile measurements have routinely been selected from WOD, and blended into ICOADS.

7.2.2. The Team recognized however that data from different oceanographic temperature instrument types have different characteristics, which can create time- and space-dependent biases. For reference, the following selection procedure was previously used for ICOADS, as was reviewed at ETMC-3 (2010) and ETMC-4 (2012):

> *"For the latest ICOADS Release 2.5 [Woodruff et al. 2011], near-surface profile temperatures were selected from the depth closest to 4m and ≤10m. In previous Releases the scheme started at the shallowest depth in a profile and used the first temperature value at any depth ≤3m. Neither approach is ideal. Better schemes, which could be instrument-type dependent, might be needed. The general impact across all profile types for derived SST from the WOD is that 5% more SST were recovered in ICOADS (7.1 M) and average depth of SST estimate increased from approximately 0.2 to 2.2 meters."*

7.2.3. The Team recalled that past ICOADS Releases have been restricted in what measured oceanographic data could be included. SST was the most significant parameter, but even it was included without a reference depth as part of the *Core* of IMMA (see ETMC-5, Doc. 5(1)). This situation has been remedied with an IMMA format modification, which allows

46 WMO Integrated Global Observing System
47 https://docs.google.com/a/wmo.int/file/d/0B-Uo8XYH2gzqV29taUl6NUZmMGs/edit?usp=drivesdk
48 http://www.wmo.int/oscar (prior to Sept. 2015), and http://oscar.wmo.int (as of Sept. 2015)
49 http://oscar.wmo.int/surface (as of Sept. 2015)

each record to include a Near-surface Oceanographic (*Nocn*) attachment. *Nocn* can hold up to 11 commonly sampled water parameters and importantly the associated sample depths. They include temperature, salinity, oxygen, phosphate, silicate, nitrate, pH, total chlorophyll, alkalinity, partial pressure of carbon dioxide, and dissolved inorganic carbon. Integration of these parameters along with the previously conventional ICOADS fields will better support research that require single or multiple variables at the ocean-atmosphere interface, e.g. *in situ* sea temperature, salinity, and wind in comparison to satellite estimates of sea surface salinity.

7.2.4. The Team noted that the upcoming ICOADS Release 3.0 (planned for availability around early 2016) will contain *Nocn* populated from the WOD 2013, from the Global Ocean Surface Underway Data (GOSUD) project (via an intermediate translation into the WOD13 format), and from research vessels providing flow-water system measurements to the SAMOS archive. In the future, wider use of *Nocn* is intended and could include many additional near surface measurements, e.g. thermosalinograph data and time series from moored and drifting buoys that have observations of other than sea water temperature.

7.2.5. Regarding what constitutes SST (or SSS), the Team noted that the Group for High-Resolution SST (GHRSST] provides an excellent breakdown of the different SST measurements and exactly what is being measured in each case (see website[50]). Briefly, 'skin' temperature is measured by most infrared satellites and ship based radiometers. It is the temperature across the upper 20 microns of the water column; 'sub-skin' temperature is measured by microwave radiometers, and is the temperature across the upper 1 mm of the water column. 'SST*depth'* is the temperature at a given depth in the water column close to the surface. This is the temperature measured by most *in situ* instruments. SST*depth* is usually reported as 'bulk' SST or simply SST. The name SST*depth* is an attempt to emphasize the importance of recording the actual depth in the water column at which the temperature was actually measured. Finally, 'foundation' temperature is 'subskin' temperature free of any diurnal signal, equivalent to a nightly low or predawn measurement. While these definitions were set up for SST, there is no reason not to use the same delineations for SSS, although there are very few studies on diurnal variations in SSS, nor any indication that a pre-dawn SSS would be free of diurnal variation in the case of a foundation value. Drucker and Riser (2014) present a study comparing Aquarius SSS with in situ measurements of salinity, with emphasis on the vertical salinity differences from the surface. They found that over much of the ocean, there is little difference between subskin SSS and SSS*depth,* but there are areas and circumstances in which the difference can be significant. The main point here is to emphasize the need to ensure appropriate metadata for *in situ* measurements, including the depth of the measurement. Without such information, proper satellite validation or even use in a blended product of SST or SSS is suspect.

7.2.6. The Team also noted that the XBT time variant bias first reported in Gourestki and Koltermann (2007) has been studied in great detail. There are three main components of systematic bias: 1) a fall-rate equation bias with both depth invariant and depth dependent components, 2) a temperature bias, also with depth invariant and depth dependent components and 3) a near –surface offset (see Cheng et al. 2014, Cheng et al., 2015). The first component is not relevant to SST, since it is dependent on time since deployment and so near-surface effect is negligible. The second components depth invariant component is relevant and has been estimated to be on the order of 0.05°C, but varies slightly by probe type. The third component is also relevant and is a combination of recorder specific problems and a delay in the instrument reaching terminal velocity, from which depth is calculated. This delay is dependent, at least partly, on the height from which the instrument is dropped. The relevance here is again to ensure that proper metadata accompanies the depth/temperature data. This includes probe manufacture and make and height of deployment.

50 http://ghrsst-pp.metoffice.com/pages/sst_definitions/

7.3. International marine data and metadata recovery

7.3.1. RECovery of Logbooks and International Marine data (RECLAIM) and related projects (ACRE[51], GODAR[52], HISKLIM[53], HISTOR[54], etc.)

7.3.1.1. The Team was informed about national and international activities to recover data and metadata, from historical ships' logbooks and other international marine meteorological and oceanographic data (and metadata) rescue activities, and discussed the need to further promote and enhance such activities. A selection of prominent activities in this general area, closely related to marine meteorology or oceanography, is listed in ***Annex XI***.

7.3.1.2. The Team recalled that as previously noted at ETMC-4 (2012), partially in recognition of the sudden loss of the widely valued USA-operated CDMP programme[55], JCOMM-4 (2012) had recommended:

> "7.2.14 The Commission strongly encouraged Members / Member States to continue their support for data rescue—through the development of more robust institutional arrangements, possibly linked with the Global Framework for Climate Services (GFCS), and through inter-Commission collaboration with the WMO Commission for Climatology (CCl)—to provide ongoing resources to recover, image, digitize, and preserve historical marine and oceanographic climate data. The Commission requested the ETMC to develop a strategy for the further encouragement and coordination of these efforts by Members / Member States."

7.3.1.3. The Team reviewed with interest the proposed CMOC/China's plans in the area of data and metadata rescue, in coordination with ACRE and other international activities, and looked forward to concrete progress in this area.

7.3.1.4. The Team was also informed about CCl's Expert Team on Data Rescue (ET-DARE[56]), which discussed the proposal in a white paper (ET-DARE 2014) and recently initiated an International Data Rescue web portal (I-DARE[57]) now in "proof of concept" status and presented to the 17th WMO Congress (as part of a 27 May 2015 data rescue information event).

7.3.1.5. The Team noted with concerns that ET-DARE does not anymore seem to have any direct membership from the marine/ocean community. Related to I-DARE, the Team reviewed an earlier *Proposed Overarching Framework for Tracking Data Rescue Activities Stratified by Data "Domains*", which had emerged from the 6th (2013) ACRE Workshop, but has not advanced further subsequently, and may not be familiar to ET-DARE (ref. Appendix C in ETMC Doc.7.3).

7.3.1.6. Similarly, the CCl/WCRP/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI[58], see also agenda item 3.3), has under its ToR the goal to: "Encourage and facilitate the development of national and international datasets to support research and services related to climate extremes and land and ocean data management and rescue efforts."

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51 Atmospheric Circulation Reconstructions over the Earth
52 Global Oceanographic Data Archaeology and Rescue
53 HIStorical CLIMate (the Netherlands)
54 Digitization of historical navigation logbooks and meteorological ship journals (Germany)
55 A major negative development, previously noted at ETMC-4 (2012), was that NOAA's successful public-private partnership Climate Database Modernization Program (CDMP) was dramatically scaled back in 2010, and eventually discontinued in fiscal year 2012. A positive development on the other hand, while indirectly related to JCOMM's central focus, was the initiation in late 2010 of the International Surface Temperature Initiative (ISTI; http://www.surfacetemperatures.org), which is seeking to provide access from rescued source data images all the way to the related products and analyses created after digitization (Thorne et al. 2011).
56 http://www.wmo.int/pages/prog/wcp/ccl/opace/opace1/ET-DARE-1-2.php
57 http://www.idare-portal.org
58 http://www.wcrp-climate.org/etccdi

7.3.1.7. Additionally, the Team discussed how WMO's Marine Meteorology and Oceanography Programme (MMOP) is now helping address important ancillary requirements to preserve marine climate metadata and historical publications (e.g. regulatory materials). These materials are accessible, together with links to a variety of major data rescue initiative and programmes, through the WMO website[59].

7.3.1.8. The meeting made the following recommendations:

i. Following along from the JCOMM-4 guidance and a similar ETMC-4 (2012) recommendation, the Team agreed to continue to seek ways to develop an improved international data rescue strategy with collaboration among ETMC, GFCS, CCl, ET-DARE, and ETCCDI, together with ACRE and other relevant initiatives listed in ***Annex XI***.

ii. The Team recommended continuing development, as resources permit, under the leadership of Shawn Smith (USA), of the Research Vessel Digital Observation Catalogue (current version available on the web[60]).

iii. The Team recommended that international mirroring (i.e. at two independent locations) of imaged historical marine/oceanographic publications and other materials be actively explored, so as to mitigate the risks of losing any possibly irreplaceable materials, through organizational changes, retirements, etc.

7.3.2. Lloyds commercial ship particulars

7.3.2.1. The Team discussed a past proposal, which was being coordinated with the International Maritime Organization (IMO), to access Lloyds commercial ship "particulars" (platform metadata). See ETMC-4 (2012) Final Report, paragraphs 6.4.2.1 to 6.4.2.3 reflected in footnote[61] below for details.

7.3.2.2. Mr. Woodruff updated the Team that, since ETMC-4, he has had no additional contact with historical ship metadata from Lloyds, and that there has been no progress on this issue. The Team noted the kind offer of Prof Allan to assist on this issue (***action; R. Allan; June 2016***). While the Team agreed that it remains useful to keep this general matter under review, under the same reasoning as stated in 2012, it further agreed that Dr Gates would now take ownership of this issue and report at the next ETMC Session (***action; L. Gates; ETMC-6***).

7.4. History of the marine ship code

7.4.1. The Team recalled work under past ETMC actions by the Japan Meteorological Agency (JMA), the US Climate Database Modernization Programme (CDMP), and WMO, to preserve and make accessible historical documents detailing the Global Telecommunication

59 https://www.wmo.int/pages/prog/amp/mmop/preservation_en.html

60 See Annex H of Woodruff, E. Freeman, C. Wilkinson, et al., 2015: *ICOADS Marine Data Rescue: Status and Future Priorities* (RECLAIM report available at: http://icoads.noaa.gov/reclaim/pdf/marine-data-rescue.pdf)

61 6.4.2.1 The Team recalled the proposal discussed at the previous [2010] ETMC meeting to access Lloyds commercial ship "particulars" (platform metadata, available back to 1764) in coordination with the International Maritime Organization (IMO). The goal was to augment metadata records from Pub. 47 by adding e.g. ship dimension and tonnage information, to improve our understanding of data biases in ICOADS, and provide better estimates of random errors.
6.4.2.2 The Team recalled action No. 45 from the previous ETMC meeting to produce some statistics on ship sizes over time based on the Lloyds data that were purchased by NOC. The Team noted that the information purchased by NOCS from Lloyds on further examination seems unlikely to be suitable for meaningful statistics to be calculated prior to 1970. However there are now many imaged issues of Lloyd's Register of Shipping available online, some of which contain annual summaries of tonnage which may prove useful.
6.4.2.3 Regarding action No. 46, to explore feasibility of using the Lloyds Educational Trust mechanism for possibly accessing historical Lloyds particulars in digital form, the Team noted that the ETMC original contact at IMO on this matter left that organization and consequently there has been no further progress towards approaching the Lloyds Educational Trust. The Team agreed to keep this general matter under review in case it can be reinvigorated at some future date, and invited Scott Woodruff to follow up in this regard and report at the next ETMC Session (***action; S. Woodruff; ETMC-5***).

System (GTS) SHIP code (now FM-13; i.e. preserving *Manual on Codes* changes extending only through those effective 5 Nov 2003), the IMMPC[62]/IMMT formats (only through IMMT-3; effective through 1 Jan. 2007), and of the MQCS (only through MQCS-5, also effective only through 1 Jan. 2007). Meeting reports of the WMO Commissions for Marine Meteorology (former CMM), for Basic Systems (CBS) and for Synoptic Meteorology (former CSM) were also imaged under this past initiative. While these documents have now all been successfully migrated from JMA hosting to a dedicated WMO webpage[63], the Team noted the need to update these holdings to include more recent information.

7.4.2. Following ETMC-2, some limited work was completed to locate and document existing copies of WMO No. 306 – *Manual on Codes*, and Supplemental materials, and the items are provided in a Google Docs[64] for further coordination and potential future digitization. Efforts should continue to image and permanently preserve these documents, to eventually be added to the WMO preservation website mentioned in Section 7.4.1.

7.4.3. The Team agreed to continue to work on those issues, and consider the related outstanding ETMC-4 actions (***action; ETMC; ETMC-6***).

7.5. Sea-ice climatology

7.5.1. Dr Smolyanitski reported on the activities of the Expert Team on Sea-Ice (ETSI), including the outcome of the Fifth Session[65] of the ETSI (Ottawa, Canada, 25 - 28 March 2014). He recalled that the majority of activities for sea-ice climatology within the WMO is traditionally carried out by the ETSI with the International Ice Charting Working Group (IICWG) serving as an active and vital advisory body to ETSI, and include the following areas:

- Support for terminology, symbology, coding;
- Support for data exchange and archival formats (main documents SIGRID-3 -“Sea Ice Geo-referenced ”Information and Data”, “Ice Objects Catalogue”); and
- Historical sea-ice data archival and processing.

Support for terminology, symbology and coding related to sea ice climatology

7.5.2. The WMO Sea Ice Nomenclature (WMO-No. 259, volume I – Terminology and Codes, Volume II – Illustrated Glossary and III – International System of Sea-Ice Symbols), is a top level WMO sea-ice standard, regulating the descriptive (nomenclature and glossaries), coding, exchange and presentation procedures for sea ice cover, being in relation with all other WMO documents (Manual on codes, WMO-558, etc.) By March 2014 Volume I contains 220 terms and definition in 13 sections in four WMO languages (English, French, Russian, and Spanish). Sea-ice terminology includes both basic terms (floating ice, sea ice, fast ice, drift ice, ice of land origin, lake ice, river ice) which are used both for sea ice analysis, observations, historical data as well as specific terms used only in connection with sea ice climate (ice cover or ice extent, ice limit, mean ice edge, median ice edge). Volume III, the International System of Sea-Ice Symbols is a 14-pages document contains coding and presentation rules for sea-ice variables. As the new ice charting and ice coding standards (“SIGRID-3”, “Color Standard for Ice Charts”, “Ice Objects Catalogue”, S-411) are now on hand, the document will further contain static versions of the rules. .All three Volumes of the publication are formally managed as electronic database[66] with content and interface available in English, French, Russian, and Spanish.

62 International Maritime Meteorological Punch Card
63 https://www.wmo.int/pages/prog/amp/mmop/preservation_en.html
64 https://docs.google.com/spreadsheet/ccc?key=0Al_lu5KXJvjgdEJodDdPZFVkanUwYlY4SzBxVUVsX3c&hl=en_GB#gid=0
65 JCOMM Meeting Report No.114, ETSI-5/GDSIDB-13 final report
66 http://www.aari.ru/gdsidb/XML/wmo_259.php

Support for data exchange and archival formats (SIGRID-3, "Ice Objects Catalogue")

7.5.3. Sea ice information exchange and archival formats include:

- Ice analysis standards (observations, charting) for ice services:
    - o "SIGRID-3: -"Sea Ice Georeferenced "Information and Data" (WMO Technical Document No. 1214, revision 3 May 2014) is the main transport format for ice charts at a level of ice services (geometry based on shapefile format, thematic content and coding compliant with WMO No.259, supports all types of sea ice objects: polygons (areas), lines and points, contains metrics(units) for sea-ice variables, Open Geospatial Consortium (OGC) supported, WIS friendly);
    - o "SIGRID (WMO-716, CMM-X, Rec.11) and SIGRID-2 are older raster formats for historical collections (geometry based on 0.25x0.25 geographic grid, thematic content and coding compliant with WMO No.259
- Standards for ice (sea, fresh-water) display on Electronic Chart Display and Information Systems (ECDIS):
    - o Ice Object Catalogue (version 5.2, May 2014) is a standard sea ice content for Electronic Navigation Charts (ENC) (basic building block of S-411, describes ice classes (polygon, linear, point) and attributes equivalent to codes of SIGRID-3, contains metrics(units) for sea-ice variables);
    - o Ice Information Product Specification Edition 1.1.0, June 2014 Special Publication JCOMM S-411 Defines how ice information is displayed on an ECDIS, ice information exchange standard of the International Hydrographic Organization (IHO) S-100 family, includes portrayal Standard, OGC supported, WIS friendly.

Historical sea-ice data processing

7.5.4. Since 1989 the Team's as well as former CMM Sub-Group on Sea-Ice (SGSI) activity for the sea-ice climatology collection and archival is concentrated within the Global Digital Sea Ice Data Bank (GDSIDB), initiated by the WMO CMM in 1989 and aimed to support access to collections and development of the means of processing the historical ice charting material. Since 1990s most of the ice services including the Baltic Sea-Ice Service (BSIS), Canada, Japan, Russia, USA, are contributing to the project. Presently most of the ice charting data prior to 2000s are stored in a 0.25°x0.25° raster SIGRID and SIGRID-2 (WMO, 1989 and 1994) or Ease-grid formats, while after 2000s the data is stored in a more flexible vector SIGRID-3 format (WMO, 2004-2014) and blended datasets. The national ice services are also undertaking efforts to convert the older collections presently in raster SIGRID to vector SIGRID-3. The sea ice charting collections for the period of instrumental ice observation (i.e. ~1933 till present moment) are available either via the GDSIDB centers at the Arctic and Antarctic Research Institute (AARI)[67], St. Petersburg, Russian Federation, or National Snow and Ice Data Center (NSIDC)[68], Boulder, USA or dedicated web geo-portals at USA National Ice Center (NIC)[69] or AARI[70]. The latter two along with advance with the SIGRID-3 format, form the basement for providing the sea ice charting material to the WMO Global Cryosphere Watch (GCW) and the WIS.

67 http://wdc.aari.ru/datasets
68 http://nsidc.org
69 http://www.natice.noaa.gov
70 http://gisa.aari.ru

7.5.5. The Team noted that the ETSI will proceed with the development of the WMO sea ice climatic documentation as well as will continue to supervise extension of the GDSIDB collections. The Team recognized that there is a need for joint actions by the ETMC and the ETSI to ensure harmonization of the WMO standards for the world oceans and availability of historical sea ice collections. That may include at least:

- Reinforcement of the GDSIDB by integration with the MCDS for example as a CMOC;
- Cross-harmonization of the marine climatology exchange formats (action by ETMC and JCOMM), and the Manual on Codes (CBS to be invited to act upon) with sea ice exchange formats; and
- Cross-harmonization of the manuals (WMO No. 558 etc.).

7.5.6. The Team invited the ETSI to submit a GDAC or CMOC application for the GDSIDB with assistance from the ETMC members as needed (***action; V. Smolyanitsky; June 2016***).

7.5.7. The Team invited the ETSI Chair to discuss the IMMT and MQCS related issues with the GCCs (Dr Gates, and Mr Cunningham) (***action; V. Smolyanitsky; asap***).

7.5.8. The Team requested Dr Berry to coordinate with the ETSI and Jon Turton (DBCP) to modify / develop a BUFR template for the representation of data from ice buoys (***action; D. Berry; end 2015***).

7.6. Interactions with ETWCH, including wave and storm surge data

7.6.0.1 Mr Swail reported on the several areas of joint interest between ETMC and the JCOMM Expert Team on Waves and Coastal Hazards Forecasting Systems (ETWCH), including the development of an extreme wave data set, wave climate summaries and a global storm surge climatology. The Team also recalled the involvement of both ETMC and ETWCH in the activities of the Expert Team on Climate Change Detection and Indices, which was discussed under agenda item 3.3.

7.6.1. Status of the global extreme wave event archive

7.6.1.1. The Team recalled that it has been leading the development of an Extreme Waves Data Set (EWDS), in cooperation with ETWCH, since the previous intersessional period. The Team further recalled that JCOMM-4 (Yeosu, Republic of Korea, May 2012) had requested the ETMC and the ETWCH to revisit and possibly restructure the project, with a simpler initial design and product. JCOMM-4 also recommended the establishment of a pilot version of the project for the USA and Canada, to develop the necessary technological framework and thus encourage and facilitate contributions from other countries.

7.6.1.2. Following the JCOMM-4 recommendation, Environment Canada arranged for scans of the measured in situ wave data archives at the National Oceanographic Data Center (NODC)—now the NOAA National Centers for Environmental Information (NCEI)-Maryland— which is the official measured wave archive in the United States (widely and erroneously thought to be the National Data Buoy Center (NDBC)), and the Marine Environmental Data Service (MEDS), which is the official measured wave archive in Canada. All wave measurements greater than or equal to 12 m significant wave height were identified (although the target threshold has been selected as 14 m), compiled into a comma-delimited ASCII file and provided informally to NCEI, but have not yet been proposed for permanent NCEI archiving through a required Submission Agreement. At the same time, the Meteorological Office in the United Kingdom carried out similar scans of its measured wave data archives, using the agreed 14 m threshold, which scan results were

recently provided to Mr Woodruff at NCEI.

7.6.1.3. Environment Canada also arranged for scans of the ICOADS, even though most of the wave data is based on visual observations rather than measurements, and suffer from significant quality issues. Environment Canada also scanned the GlobWave altimeter data base, developing a global data set from that, which was also informally provided to NCEI in a comma-delimited data set.

7.6.1.4. The Team noted that based on those scans, two presentations (Swail, Steventon (poster)) were made to the JCOMM 4th Workshop on Advances in Marine Climatology (CLIMAR-4) in Asheville, NC, June 9-12, 2014, representing version 1 of the JCOMM Extreme Wave Data Set (EWDS). The data sets each contained a large number of measured extreme waves:

- UK Met 96 occurrences greater than 14 m
- NODC 385 occurrences greater than 12 m
- MEDS 415 occurrences greater than 12 m
- ICOADS 742,288 observations greater than 12 m
- GlobWave 5256 satellite estimates greater than 12 m

7.6.1.5. The databases of extreme waves have already been used in model validation, and in the case of the GlobWave archive, comprehensively analyzed in the study “Global Distribution and Risk to Shipping of Very Extreme Sea States (VESS)” (Cardone et al., 2014, International Journal of Climatology, doi: 10.1002/joc.3936).

7.6.1.6. While the first version of the EWDS represents an interesting and useful collection of extreme wave measurements, its utility is compromised by the lack of accompanying metadata associated with the observations. As the JCOMM Pilot Project on Wave measurement Evaluation and Test (PP-WET [71]) has shown, significant differences can occur in wave measurements due to hull type, wave sensor and processing; therefore comprehensive metadata for each measurement is vital. As noted at CLIMAR-4, as well as at the 30th Session of the Data Buoy Cooperation Panel (DBCP-30, Weihai, China, 27-31 October 2014), the availability and ready accessibility (comparable to WMO No. 47) of historical buoy metadata to support wave climate analysis, the EWDS, as well as PP-WET, was described as “abysmal”.

7.6.1.7. Since buoy metadata are essential to all wave applications, it is recommended that the ETMC follow the lead proposed at DBCP-30, and encourage member countries to take action to remedy this situation (**recommendation**). Specifically, wave archive agencies are encouraged to check their records, and make sure that the historical and present wave buoy metadata and data are made available to international archives (e.g. ICOADS) in a suitable exchange format such as that recently developed by the DBCP Task Team on Moored Buoys (TT-MB).

7.6.1.8. The Team noted that in addition to the metadata concerns, there are other issues to be addressed, including sustainability and data base hosting. The EWDS is only useful in as far as it is kept reasonably up to date. This requires a commitment from the archive holders, or third party, to commit to regular scanning of their archives to identify all candidate observations and provide them (with metadata) to the hosting agency. This is more complicated with the satellite altimeter data, since the GlobWave project is now completed and the dataset will no longer be updated. Even if the similar Ifremer dataset were to be used instead, it is not clear who would carry out the scans.

71 www.jcomm.info/WET

7.6.1.9. The Team recalled that hosting of the EWDS had originally been envisaged to be done by NODC (now NCEI). However, it might be considered that this should be part of the ICOADS data framework instead, which is led by NCEI. The measured extreme data sets are sufficiently small, even if the initial pilot is extended to a much larger range of countries, that hosting is not burdensome, at least from a size perspective, and the comma-delimited ASCII files are easy to access and interpret, so more sophisticated data formats such as NetCDF are not required.

7.6.1.10. In summary, the Team agreed that the EWDS is at a crossroads. Without accompanying metadata, the utility of the data set is limited. Without an update strategy and commitment from Members, the static archive also loses utility. Without the satellite altimeter component, the measured data base is largely restricted to moored buoys close to the coastal margins, mostly off North America and western Europe, at least until the wave drifter technology presently being developed within DBCP is operational.

7.6.1.11. The Team therefore considered options for the future of the EWDS, which could include, among others:

1) discontinuing it,
2) actively promoting the database to other countries with substantial measured wave archives, and obtaining a commitment from them to scan their archived data annually and provide the appropriate data, and metadata, to the hosting agency,
3) deferring further consideration until after JCOMM-5 (fall 2017) when the metadata base may be more complete, or
4) taking a different approach such as having specific identifiers in wave data within ICOADS denoting an extreme event, as defined in the EWDS context, bearing in mind that any added complexity would likely take us back to the pre-JCOMM-4 state.

7.6.1.12. The Team agreed that option (3) above was preferable.

7.6.1.13. The Team also noted that it would be useful if an agency or institute could volunteer to establish a wave GDAC or a moored buoy GDAC (***recommendation***). The Team requested its members to engage discussions with potential candidates and then to provide feedback to the ETMC Chair (***action; ETMC members; June 2016***). It also requested the Secretariat to write to some potentially interested Members in the view to inform them about the need to establish such GDACs and invite them to consider submitting an application (***action; Secr.; end 2015***).

7.6.1.14. It was also noted that not all operational wave observation systems currently appear on the JCOMMOPS status maps, e.g. for Australia, Brazil and others, and that further investigation of this issue is needed. The Team invited the Technical Coordinator of the DBCP to investigate this problem, and ensure that the maps include all wave observing buoys (***action; TC DBCP; asap***).

7.6.2. Potential for calculation of wave monthly summaries

7.6.2.1. The Team recalled that the notion of producing wave climate summaries in the ICOADS has been considered for several years, most recently at the Third International Workshop on Advances in The Use of Historical Marine Climate Data (MARCDAT-3, Frascati, Italy, 2-6 May 2011; JCOMM Technical Report No. 59).

7.6.2.2. While significant technical challenges are expected in the development of wave climate summaries in ICOADS, particularly related to quality control and metadata, the

consensus of MARCDAT-3 was that wave and swell summaries would be worth producing, **if ICOADS project resources could be located** to add them to the regular product mixture. No specific agreement was reached on the specific variables that should be summarized (again as practical), but extending the scope of these very basic, but important, benchmark products was thought to be important.

7.6.2.3. The Team noted that since 2011 there has been no progress on developing wave climate summaries in ICOADS. As noted during ETMC-4, this has been largely based on broader issues related to sustaining ICOADS as a whole, and the general lack of resources for new developments. Since the establishment of the new international ICOADS partnership, the entire framework of the ICOADS program has become much more robust, although resources for new product development are expected to be limited, and prioritization will be required.

7.6.2.4. The ETMC discussed whether the development of wave climate summaries within ICOADS should be considered a short term priority, deferred to the medium term (e.g. post-JCOMM-5) following the implementation of the new framework, or dropped from future consideration. In light of the situation with regard to the ICOADS partnership, the Team agreed that the issue should be deferred to the medium term (after JCOMM-5), and information with user requirements and justification based on MARCDAT-3 and MARCDAT-4 discussions should be submitted to JCOMM-5 on the issue for its guidance. The Team requested Mr Swail to compile such information for discussion at the next ETMC meeting (***action; V. Swail; June 2016***).

7.6.3. Global storm surge climatology

7.6.3.1. The Team noted that coastal flooding represents one of the major challenges of global climate change for humanity. It is estimated that by 2070, approximately 150 million people and USD 35,000 billion of assets will be exposed to a 1 in 100 year flood event. Any increase in flood frequency or severity due to sea level rise or changes in storminess would adversely impact society. It is crucial to understand the physical drivers of extreme storm surges to have confidence in the datasets used for extreme sea level statistics.

7.6.3.2. Mr Swail reported that ETWCH is presently developing an approach to a global storm surge climatology. This project has two components (1) developing a consistent approach to the statistical analysis of tide gauge records where one is lucky enough to have them and (2) global model hindcasts that are credible.

7.6.3.3. The Team noted that point (1) above requires a starting point so a web repository[72] of all UK tide gauge analyses has been established. The Dutch data is now being similarly analyzed, to be followed by the US and Canadian tide gauge data. Through ETWCH, the rest of the world will be encouraged to do likewise, following the guidance developed by ETWCH.

7.6.3.4. The Team further noted that objectives of the second component include the development of a comprehensive statistical model of storm surge distributions, explaining the physical (dynamical and meteorological) reasons why the main body of observed storm surges follow a gamma distribution; to prove that joint probability methods are the most appropriate for estimating extreme sea level probabilities in regions of high tidal range and examine whether plausible (oceanographic) limits on storm surge maxima constrain the family of extreme value methods for the most extreme storm surges; critically assess whether extreme water level results from a multi-decadal numerical hydrodynamic model hindcast run represent a reliable means of deriving extreme water

72 http://www.ntslf.org/storm-surges/storm-surge-climatology

level statistics.

7.6.3.5. This project is creating a zoomable world map of storm surge climatology. The results will advance our scientific knowledge of storm surges as well as provide valuable policy guidance to decision makers and planners.

7.6.3.6. The Team also noted that the ETWCH storm surge questionnaire was in the process of being updated and extended.

7.6.3.7. The Team took note with appreciation of the initiatives of ETWCH regarding the development of the global storm surge climatology and concurred with these developments.

8. UPDATING OF RELEVANT WMO MANUALS, GUIDES AND OTHER TECHNICAL PUBLICATIONS

8.1. Guide to the Applications of Marine Climatology

8.1.1. The Team recalled that the proceedings of CLIMAR-4 (Asheville, USA, 9-12 June 2014) have been incorporated into JCOMM Technical Report No. 79[73], and a selection of papers will be published in a forthcoming special issue of the International Journal of Climatology (IJClim; Royal Meteorological Society, United Kingdom). The Team discussed the status of this IJClim Special Issue, which will form the latest update to the Dynamic part (i.e. a future revision of JCOMM Technical Report No. 13) of the Guide to the Applications of Marine Climatology (WMO No. 781), and further updates to the Dynamic part.

8.1.2. The Team recalled that although dynamic parts of the guide are published within revisions of JCOMM Technical Report No. 13, the WMO No. 781 publication itself is dated of 1994 and would deserve a complete review and update. The Team therefore requested Dr Berry, Mr Swail and Dr Smolyanitsky to review for the next ETMC Session WMO No. 781, to identify what sections will have to be updated and how, and to propose a workplan and guidance for updating it (***action; D. Berry; June 2016***).

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

8.2.1. The Team recalled that the Task Team on the Marine Climate Data System (TT-MCDS) has initiated a review and complete re-writing of the Marine Climatology chapters of the WMO Manual on Marine Meteorological Services (WMO-No. 558) (Chapter 5: Marine Climatological Summaries Scheme), and the WMO Guide to Marine Meteorological Services (WMO-No. 471) (Chapter 3: Marine Climatology). These substantial changes are taking into account the modernization of the Marine Climatological Summaries Scheme (MCSS) and the development of the new MCDS.

8.2.2. Beginning in December 2014, teleconferences were held with TT-MCDS members to discuss and propose a plan for the publication re-writes in order to update changes in marine climatology and reflect current efforts to modernize the Marine Climatological Summaries Scheme (MCSS) to the new Marine Climate Data System (MCDS). As a priority, it was agreed to immediately focus on Pubs No. 471 and 558, but noted that Pub No. 781 (Guide to the Applications of Marine Climatology) would eventually need to be fully rewritten and to consider it as a future task.

8.2.3. It was noted that WMO No. 558 is a WMO Manual regarded as an annex to WMO Technical Regulations, and which is meant to provide information on what WMO Members are

73 http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=15293

mandated to do; they are normally approved by the WMO Congress following Recommendation by JCOMM [Session]. WMO No. 471 is not Regulatory Material, and rather consists of guidance materials and best practices, which WMO Members are invited to follow (not mandatory). WMO No. 471 can also include descriptions of some required standards. Guidance material can be approved by the WMO Executive Council, which is meeting on a yearly basis, and following JCOMM Recommendation using the fast-track procedure. Other guidance material can also be included in JCOMM Technical Reports if needed. The latter only require the JCOMM Co-Presidents' approval for being published, following recommendation from the ETMC and the DMCG (more flexible). A draft JCOMM Technical Report on the MCDS was started.

8.2.4. Following the December teleconferences, outlines for the sections were prepared and distributed to team members for comment. In January, the TT-MCDS met again on 2 occasions, via teleconference, to review the outlines and assign sections to team members.

8.2.5. The outlines were considered and changes made to align the chapters in WMO 471 and 558 and it was agreed to title the chapters "Marine Climatology". The team agreed to not only address the MCDS, but also marine climatology products. Terminology was also agreed to be a necessity in both documents. The agreed outlines of WMO No. 558 and 471 are provided in ***Annexes VIII*** and ***IX*** respectively.

8.2.6. Sections were delegated to Team members based on volunteers and areas of expertise. It was agreed that Mr Freeman (USA) would coordinate input from all section leads and produce a first draft master copy for review at ETMC-5.

8.2.7. The Team produced first-draft versions of both Publication Nos. 471 and 558 prior to the meeting in order to review the documents and comment or propose changes at the meeting.

8.2.8. During the course of this ETMC Session, the Team further reviewed, in plenary, major portions of these marine climatology chapters, and agreed on some further revisions listed below, and on a workplan to complete the work by JCOMM-5 (November 2017). The workplan is provided in ***Annex IV***.

8.2.9. The Team also noted that the second meeting of the *ad hoc* Team for the Review of WMO Manual 558 and Guide 471 was taking place during the same week as this ETMC-5 meeting in Tromso, Norway from 22 to 24 June 2015, and that ETMC's input to the review of the two Publications had to be synchronized with the work of the ad hoc Team. The Team requested the ETMC Chair to liaise as soon as possible with the *ad hoc* Team co-Chairs, John Parker and Neal Moodie for this purpose (***action; E. Freeman; asap***).

8.2.10. During the meeting, all sections were reviewed and changes were proposed.

8.2.11. The team discussed issues surrounding the flow of delayed mode VOS data, including the role of DACs, GDACS and CMOCS in the new MCDS system. The team noted that a large proportion of real time data does not make it into the delayed mode data stream for several reasons, including: the lack of collection of delayed mode data from ships by PMOs; and the lack of resources within some National Meteorological and Hydrological Services (NHMSs) to apply the MQCS to the data. The representatives for the GCCs (Mr Cunningham (UK) and Dr Gates (Germany)) noted that they apply the MQCS when they receive the delayed mode IMMT data and that, whilst not ideal, they would be able to receive and apply the MQCS to data that had not had the MQCS applied. The following additions to the Manual on and Guide to Marine Meteorological Services were agreed:

- Members contributing data to the MCDS should apply the Minimum Quality Control Standard (for marine meteorological data), or other minimum quality control appropriate, to the data prior to submission to the GDACs.
- Members contributing data to the MCDS shall collect and submit delayed mode data to the appropriate GDACs within 12 months of the observations being made.
- The GDACs shall monitor the submission of delayed mode data and shall approach members not submitting delayed mode within agreed time frames to work with those member to resolve any data flow issues.

8.2.12. Further revisions to the documents will be made after conclusion of ETMC-5 and the next draft will be prepared by Mr Freeman and distributed to Team members for their comments (***action; E. Freeman; Sept. 2015***).

8.3. Guide to Climatological Practices (WMO-No. 100).

8.3.1. Following discussions at previous ETMC meetings, the Team reviewed actions previously undertaken and the current status of the Guide to Climatological Practices (WMO-No. 100).

8.3.2. The Team requested Mr Swail and Mr Freeman to review WMO No. 100 and propose a workplan and guidance for updating it at the next ETMC Session (***action; V. Swail & E. Freeman; June 2016***). The Team requested Dr Berry and Mr Woodruff to review JCOMM Technical Report No. 63 and to propose possible additions to the SOT through the SOT Task Team on Instrument Standards in they are participating (***action; D. Berry & S. Woodruff; asap***).

9. INFORMATION EXCHANGE

9.1. ETMC / MCDS Website(s)

9.1.1. The Team reviewed the status of marine climatology related web-pages on various websites, and made recommendations for their further integration, taking into account the development of the MCDS.

- ETMC activities on the JCOMM website: http://www.jcomm.info/etmc
- ETMC activities on the ICOADS website: http://icoads.noaa.gov/etmc/
- MCSS webpage: http://www.jcomm.info/mcss
- Other materials also appear on the WMO website: http://www.wmo.int/pages/prog/amp/mmop/data_management_en.html

9.1.2. The Team agreed that the ETMC webpage on the JCOMM website should be regarded as the Marine Climatology homepage (http://www.jcomm.info/etmc). The Team also agreed that efforts should be made to review and update this website and decided on the following:

(i.) the Secretariat to update the link on the WMO website to the ETMC to the link http://www.jcomm.info/etmc (***action; Secr; asap***).

(ii.) Mr Woodruff to provide a list of materials from the ICOADS website which should be integrated in the JCOMM/ETMC website (uploaded or linked) (***action; S. Woodruff; 31 July 2015***).

(iii.) Mr Freeman to investigate using EV2 for preserving ETMC materials for the long term (***action; E. Freeman; end 2015***).

(iv.) Dr Berry (lead), Mr Woodruff, Mr Freeman, and Dr Gates to discuss between themselves, review existing materials and to provide guidance to the Secretariat on how the JCOMM/ETMC website could be updated (***action; D. Berry; end 2015***).

(v.) As a temporary measure, the Secretariat to add a link on the JCOMM/ETMC website to the existing ICOADS materials (***action; Secr.; asap***).

(vi.) Mr Cunningham to review the MCSS section of the JCOMM/ETMC website for possible required updates (***action; F. Cunningham; asap***).

9.1.3. The Team requested Mr Freeman to discuss with Dr Elizabeth Kent (UK) and the IODE Project Office regarding the use of OceanDocs for making ETMC materials further visible, and to help provide long-term mirroring redundancy (***action; E. Freeman; asap***).

9.2. Other media

9.2.1. The Team discussed the opportunity to produce a small ETMC brochure (e.g. 2 or 4 pages) for example on the MCDS. The Team agreed on the following:

(i.) To tentatively produce a 2-pager on the MCDS Vision by JCOMM-5;

(ii.) Dr Gates to coordinate the writing of the 2-pager (***action; L. Gates; Feb. 2016***).

(iii.) Mr Freeman to investigate using NCEI print shop (***action; E. Freeman; asap***)

(iv.) Dr Gates to investigate using DWD graphic artist (***action; L. Gates; asap***).

9.2.2. The Team discussed the status of the former http://www.marineclimatology.net webpages. The Team agreed that the website should be stopped.

10. REVIEW OF ACTION ITEMS

10.1. The Team reviewed and approved action items and recommendations from the Session as well as those of the previous ETMC Session with status of actions. The final report of the Session will be circulated to the Team Members shortly after the Session for review and approval. Pending action items from ETMC-4 as well as those arising from this ETMC-5 session are reflected in ***Annex 3***.

11. CLOSURE OF THE SESSION

11.1. Mr Freeman thanked all for participating and for their comments and support to the ETMC, as well as the Secretariat for organizing the meeting and hosting it. The Chair was glad to report that the Team was effectively moving forward from the MCDS Vision to concrete MCDS implementation. The Chair looked forward to next ETMC meeting in mid-2016 and the further progress of the Team.

11.2. The Fifth Session of the JCOMM Expert Team on Marine Climatology (ETMC-5) closed by 16:45 hours on Thursday 25 June 2015.

ANNEX I

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 guidance
2.3 Data Management Practices
2.4 Report of the Global Collecting Centres (GCCs)
2.5 Report of the Responsible Members (RMs)

3. REQUIREMENTS

3.1 Review the WMO-IOC-UNEP-ICSU Global Ocean Observing System (GOOS), and the WMO-IOC-UNEP-ICSU Global Climate Observing System (GCOS) requirements for climatological data sets
3.2 Global Framework for Climate Services (GFCS)
3.3 Existing and potential linkages with the WMO Commission for Climatology (CCl) and the World Climate Research Program (WCRP)
3.4 Existing and potential linkages with the WMO Commission for Agricultural Meteorology (CAgM)

4. MARINE DATA AND CLIMATOLOGY WORKSHOPS, AND RECOMMENDATIONS

4.1 CLIMAR-4 outcome, recommendations, and follow up
4.2 Preparations for MARCDAT-4

5. MARINE CLIMATE DATA SYSTEM (MCDS)

5.1 Review of MCDS developments
5.2 Future of the Contributing and Responsible Members, and areas of responsibility
5.3 Data Acquisition Centres (DACs), ToR, and candidates
5.4 Global Data Assembly Centres (GDACs), ToR, and candidates
5.5 Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs)
  5.5.1 Status of and linkages with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS)
  5.5.2 CMOC/China development status
5.6 Updating of the Implementation Plan

6. FORMATS AND QUALITY CONTROL

6.1 Status of the International Maritime Meteorological Archive (IMMA) format
6.2 Status of the International Maritime Meteorological Tape (IMMT) format
6.3 Status of the Minimum Quality Control Standard (MQCS)
6.4 Higher level quality control
  6.4.1 Status of Higher Level Quality Control Standard (HQCS)
  6.4.2 Potential linkages with satellite data
  6.4.3 Status of the ICOADS Value-Added Database (IVAD) project

6.5 Review of the BUFR (and other) templates for surface marine data
6.6 Review of electronic logbooks
6.7 Ship call sign masking (including encode proposal)

7. DATA AND METADATA: ARCHEOLOGY AND ARCHIVAL

7.1 Instrument/Platform metadata
  7.1.1 Ship metadata
  7.1.2 Buoy metadata
  7.1.3 Rig and platform metadata issues
  7.1.4 WIGOS Metadata
7.2 Oceanographic data and metadata integration issues (XBT fall rate equation, SSS, etc.)
7.3 International marine data and metadata recovery
  7.3.1 RECovery of Logbooks and International Marine data (RECLAIM) and related projects (ACRE, GODAR, HISKLIM, HISTOR, etc.)
  7.3.2 Lloyds commercial ship particulars
7.4 History of the marine ship code
7.5 Sea-ice climatology
7.6 Interactions with ETWCH, including wave and storm surge data
  7.6.1 Status of the global extreme wave event archive
  7.6.2 Potential for calculation of wave monthly summaries

8. UPDATING OF RELEVANT WMO MANUALS, GUIDES AND OTHER TECHNICAL PUBLICATIONS

8.1 Guide to the Applications of Marine Climatology
8.2 Manual on and Guide to Marine Meteorological Services (WMO-No. 558 and 471)
8.3 Guide to Climatological Practices (WMO-No. 100).

9. INFORMATION EXCHANGE

9.1 ETMC / MCDS Website(s)
9.2 Other media

10. REVIEW OF ACTION ITEMS

11. CLOSURE OF THE SESSION

ANNEX II

LIST OF PARTICIPANTS

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(Geneva, Switzerland, 22-25 June 2015)

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ANNEX III

LIST OF ACTION ITEMS FROM ETMC-5

(including pending actions from previous ETMC Sessions)

1. LIST OF ACTION ITEAMS FROM ETMC-5

No.	*Ref.*	*Action item*	*By*	*Deadline*
1	2.1.6.	to collect feedback from the ETMC members in the view to provide a consolidated ETMC feedback to JCOMM-5 regarding the WIGOS Vision in 2040 (including beyond the MCDS Vision)	E. Freeman	ETMC-6
2	2.1.6	to organize another ETMC Session in 2016 in order to be able to provide appropriate input to JCOMM-5	Secretariat	mid-2016
3	2.2.4.	to review the Keeley report[1] and to provide their feedback on the status of the proposed recommendations to the ETMC Chair and the Secretariat	ETMC members	asap
4	2.2.5.	Lydia Gates participating in TT-MOWIS to liaise with the ETMC Chair and Team members as needed	L. Gates	ETMC-6
5	2.2.7.	to propose replacing Dr Gregg by Dr Garcia in the TT-MOWIS membership to the JCOMM Co-Presidents	Secr	asap
6	2.3.6.	data and information managers to make contributions to the IODE ODP with data and information, and to the ODSBP with the submission of best practices and standards to sustain data and information exchange inside the marine community	ETMC members	ongoing
7	2.3.8.	to communicate with the ETDMP Chair, Dr Sergey Belov (Russian Federation) in order to investigate how the WOD and the ICOADS data-sets can me made discoverable through the ODP (L. Gates, E. Freeman, S. Iona, and the Secretariat to be associated with the relevant communication)	T. Boyer & S. Woodruff	30 Sep. 2015
8	2.4.2.	to proactively encourage CM who haven't contributed much data to do more and help CM with automatic systems on board their ships to submit such data	GCCs	ongoing
9	2.4.2	JCOMM Co-Presidents to write to the CMs and RMs to reminder them about their responsibilities with regard to the MCSS, and requested the Secretariat to assist in this regard	Secr.	ASAP

1 http://www.jcomm.info/index.php?option=com_content&view=article&id=331

No.	Ref.	Action item	By	Deadline
10	2.5.5(i)	Germany to submit an updated consolidated CMOC/Germany proposal to the JCOMM Co-Presidents in due course	L. Gates	29 Feb. 2016
11	2.5.5 (ii)	to invite Members who have potential interest in the current area of responsibility of the Netherlands (Mediterranean Sea, South Indian Ocean, Southwest Pacific Ocean) to provide feedback to the ETMC Chair regarding their possible future involvement in the MCSS for such areas	Secr.	asap
12	2.5.5 (iii)	to make a CMOC/USA application	USA	29 Feb. 2016
13	3.1.7.	to inform the Management Committee about the following ETMC recommendations, and invite it to consider and relay them to the relevant bodies : That GCOS, as part of its review and implementation plan, specifies standard observation uncertainties for the different ECVs and domains and develops target equivalent number of standard observations required to meet the different user requirements (such as specified in the OSCAR database). That observation coordination groups, such as the JCOMM Observation Coordination Group (OCG), takes into consideration the equivalent number of standard observations for the different ECVs, both oceanic and atmospheric, specified by GCOS and reach agreement between the different panels on how to achieve these goals.	Secr.	asap
14	3.2.7.	to share with the Team members the GFCS, GCW, and Polar Regional Climate Centre (PRCC) materials he is presenting to these meetings on the activities of JCOMM	V. Smolyanitsky	ongoing
15	3.3.6.	to liaise with the other two JCOMM-nominated ETCCDI members and to work on a revised ETCCDI work plan in this regard taking the ETMC-5 guidance into account, before and during the upcoming ETCCDI meeting (Paris, France, 6-8 July 2015)	V. Swail	Done
16	3.3.8.	to investigate who could be nominated for replacing Scott Woodruff in the membership of the ETCCDI to represent the ETMC and with an ocean sub-surface perspective	R. Allan	end 2015
17	3.3.8	to work with Eric Freeman and Scott Woodruff for developing an ETMC statement to be presented to the ETCCDI meeting in July 2015 on the ETMC perspective with regard to the role of the ETMC representative in the ETCCDI	V. Swail	30 June 2015
18	3.4.2.	in liaison with Tim Boyer (USA) to investigate and propose someone to represent the ETMC in the TT-WCF in replacement of Scott Woodruff	D. Berry	end 2015
19	4.2.3.	to complete the membership of the MARCDAT-4 organizing committee while	D. Berry	31 Aug. 2015

No.	Ref.	Action item	By	Deadline
		considering including representatives of different application areas in the membership (e.g. fisheries, …)		
20	5.2.2.	to write to the Permanent Representative (PR) of the Netherlands with the WMO and ask about the Country's intentions with regard to their possible future role in the MCDS and its current MCSS areas of responsibility	Secr.	asap
21	5.2.2.	Should the Netherlands decide to give up its responsibilities in one or more of these areas, to write to the PRs of other countries with potential interest in such regions and ask them if they'd like to play a role in the MCDS for those regions	Secr.	end 2015
22	5.3.2.	to work with the Secretariat in drafting a letter of recommendation to the targeted groups to upgrade to the new MCDS classification with request to reply no later than the end of 2015	ETMC vice-Chairs & Secretariat	end 2015
23	5.3.3.	to invite JCOMM-5 to review and endorse a list of candidate MCDS centres for their formal establishment with assistance from the Secretariat for preparing the relevant JCOMM-5 Session documentation	Secretariat	end 2016
24	5.6.1.	to review the MCDS-IP taking into account ETMC-5 discussions, and to propose an updated version for inclusion in the final report of this Session (Annex V)	E. Freeman & L. Gates	17 July 2015
25	6.1.4.	to begin transitioning to producing IMMA1 and discontinue production of IMMA0 when prepared	GCCs	asap
26	6.1.8.	to undertake a comparison to assess if there are any differences between the 2 conversions to IMMA, and if differences are found that the GCCs and ICOADS work together to rectify those differences.	ICOADS & GCCs	end 2015
27	6.4.1.2.	to provide the detailed documentation about the HQCS to make sure that relevant details about the HQCS will be properly reflected in the revised WMO Publications No. 558 and 471, and the new proposed JCOMM Technical Report no. 85 on the MCDS	L. Gates	end 2015
28	6.4.1.2.	to provide details about their own quality control procedures to Lydia Gates	ETMC members	asap
29	6.4.2.4.	to approach both group (iQUAM and NCAR) and seek clarification on their respective scopes	E. Freeman	asap
30	6.5.1.	to forward these recommendations regarding establishing a catalogue of ship-to-shore formats to the SOT and VOSP Chairs	Secr.	asap
31	6.5.3.	to submit the revised VOS template to the IPET-DRMM for approval	D. Berry	Jul. 2015
32	6.5.3	to validate the VOS BUFR template and submit the results to the IPET-DRMM for approval	D. Berry	Nov. 2015

No.	Ref.	Action item	By	Deadline
33	6.5.4.	to coordinate the validation of the template for observations from platforms with the DBCP	D. Berry	Jul. 2015
34	6.5.5.	to coordinate with the DBCP on the development of templates for glider observations and the submission of a proposal to the IPET-DRMM	TT-TDC Chair	mid-2016
35	6.5.6.	to lead the specification of parameters for inclusion in the new oceanographic data class in BUFR Master Table 0	TT-TDC Chair	mid-2016
36	6.5.8.	ETMC members to identify and recommend a new chair of the TT-TDC to the DMPA coordinator through the ETMC Chair	E. Freeman	asap
37	6.6.6.	to contact the VOSP chair in the view to coordinate and discuss with the manufacturers of the three types of e-logbooks to agree on a common dew point temperature algorithm for use in all e-logbooks	ETMC Chair	asap
38	7.3.2.2.	to assist on the issue of the historical ship metadata from Lloyds	R. Allan	June 2016
39	7.3.2.2	to take ownership of the issue of historical ship metadata from Lloyds and to report at the next ETMC Session	L. Gates	ETMC-6
40	7.4.3	to continue to work on the history of the marine ship code issue, and consider the related outstanding ETMC-4 actions	ETMC	ETMC-6
41	7.5.6	ETSI invited to submit a GDAC or CMOC application for the GDSIDB with assistance from the ETMC members as needed	V. Smolyanitsky	June 2016
42	7.5.7	to discuss the IMMT and MQCS related issues with the GCCs (L. Gates, and F. Cunningham)	V. Smolyanitsky	asap
43	7.5.8	to coordinate with the ETSI and Jon Turton (DBCP) to modify / develop a BUFR template for the representation of data from ice buoys	D. Berry	end 2015
44	7.6.1.13.	to engage discussions with potential wave GDAC candidates and then to provide feedback to the ETMC Chair	ETMC members	June 2016
45	7.6.1.13	to write to some potentially interested Members in the view to inform them about the need to establish wave GDACs and invite them to consider submitting an application	Secr.	end 2015
46	7.6.1.14.	to investigate the issue that not all operational wave observation systems currently appear on the JCOMMOPS status maps, and ensure that these maps include all wave observing buoys	TC DBCP	asap
47	7.6.2.4.	to compile information on wave climate summaries with user requirements and justification based on MARCDAT-3 and MARCDAT-4 discussions for discussion at the next ETMC meeting and later submission to JCOMM-5	V. Swail	June 2016

No.	*Ref.*	*Action item*	*By*	*Deadline*
48	8.1.2.	to review for the next ETMC Session WMO No. 781 to identify what sections will have to be updated and how, and to propose a workplan and guidance for updating it	D. Berry & V. Swail, V. Smolyanitsky	June 2016
49	8.2.9.	to liaise as soon as possible with the *ad hoc* Team for the Review of WMO Manual 558 and Guide 471 co-Chairs, John Parker and Neal Moodie for this purpose	E. Freeman	asap
50	8.2.12.	Further revisions to the WMO No. 558 and 471 documents will be made after conclusion of ETMC-5 and the next draft will be prepared by Eric Freeman and distributed to Team members for their comments	E. Freeman	Sept. 2015
51	8.3.2.	to review WMO No. 100 and propose a workplan and guidance for updating it at the next ETMC Session	V. Swail & E. Freeman	June 2016
52	8.3.2	to review JCOMM Technical Report No. 63 and to propose possible additions to the SOT through the SOT Task Team on Instrument Standards in which Scott Woodruff is participating	D. Berry & S. Woodruff	asap
53	9.1.2 (i.)	to update the link on the WMO website to the ETMC to the link http://www.jcomm.info/etmc	Secr	asap
54	9.1.2 (ii.)	to provide a list of materials from the ICOADS website which should be integrated in the JCOMM/ETMC website (uploaded or linked)	S. Woodruff	31 July 2015
55	9.1.2 (iii.)	to investigate using EV2 for preserving ETMC materials for the long term	E. Freeman	end 2015
56	9.1.2 (iv.)	David Berry (lead), Scott Woodruff, Eric Freeman, and Lydia Gates to discuss between themselves, review existing materials and to provide guidance to the Secretariat on how the JCOMM/ETMC website could be updated	D. Berry	end 2015
57	9.1.2 (v.)	to add a link on the JCOMM/ETMC website to the existing ICOADS materials	Secr.	asap
58	9.1.2 (vi.)	to review the MCSS section of the JCOMM/ETMC website for possible required updates	F. Cunningham	asap
59	9.1.3.	to discuss with Elizabeth Kent and the IODE Project Office regarding the use of OceanDocs for making ETMC materials further visible	E. Freeman	asap
60	9.2.1 (ii.)	to coordinate the writing of the 2-pager brochure	L. Gates	Feb. 2016
61	9.2.1 (iii.)	to investigate using NCEI print shop	E. Freeman	asap

No.	Ref.	Action item	By	Deadline
62	(iv.)	to investigate using DWD graphic artist	L. Gates	asap

2. PENDING ACTION ITEMS FROM ETMC-4 WITH UPDATED STATUS

No.	Ref.	Action	By	Deadline	Status
9	4.1.4	To prepare a working document as well as a draft Recommendation for JCOMM-5, taking into account the documented clarifications and revisions of Recommendation 2 (JCOMM-4) on the MCDS, and based on experiences during the intersessional period.	ETMC Chair	JCOMM-5	Clarified Recommendation 2 was submitted to IODE-22. IODE was happy and adopted a Resolution on the MCDS. MCDS input to JCOMM-5 to include a reference to IODE-22 report and clarified Recommendation 2 (JCOMM-4). New JCOMM Recommendation on the MCDS to be prepared for JCOMM-5.
29	6.2.5	To request JCOMM observations Panels and associated programmes to make sure that the rigs & platform metadata are properly rescued	OCG	ongoing	Was discussed at DBCP-30. Check status at DBCP-31
38	8.1.5	To achieve another update to the dynamic part of the guide to the applications of marine climatology from the proposed CLIMAR-4 (~2014)	CLIMAR-4 Organizing Committee	2014	Underway for end 2014 (15 papers to be published)
42	8.3.4	To address the issue of preserving the WMO Publications, and to report at the next ETMC Session	Secretariat	ETMC-5	

2. PENDING ACTION ITEMS FROM ETMC-3 WITH UPDATED STATUS

No.	Ref.	Action	By	Status
47	6.4.2	to investigate whether a policy could be set up to preserve previous versions of the manual on codes	Secretariat	No progress; still under consideration in a wider context
48	6.4.2	to provide paper and/or scanned/e-versions of national versions of the manual on codes to the CMDP (contact: E. Freeman), as well as past official versions of the WMO Manual on Codes to the WMO	ETMC members	Some progress. Pub 306 versions were never imaged, but we made a very good stab at noting every edition and supplement still physically in existence at various

No.	Ref.	Action	By	Status
		Secretariat for inclusion in the marine climatology pages of the WMO web site		institutions. The following is a link to this document: https://docs.google.com/spreadsheet/ccc?key=0Al_lu5KXJvjgdEJodDdPZFVkanUwYlY4SzBxVUVsX3c&hl=en_GB#gid=0 Between KNMI, NCDC, Scott and Liz, I think we have most of this collection and could possibly stitch things together at some point in the future to note the evolution of the manual on codes. Unfortunately, with CDMP no longer in service, scanning of these will be delayed until we can find another volunteering agency to take that on.

ANNEX IV

WORKPLAN FOR THE REVIEW OF WMO NO. 558 AND 471

(Updated by ETMC-5, June 2015)

No.	***Ref.***	***Action item***	***by***	***Deadline***	***Status***
1	Teleconf. 20141211/W Action 1	to provide proposal of a draft outline of Manual (558) and Guide (471) for discussion and feedback at the 'East' teleconference. New version should include links to GFCS and non in situ data sources (e.g. reanalysis data) and shared with ETMSS (Neal Moodie).	E. Freeman	16 Dec. 2014	Done
2	Teleconf. 20141211/W Action 2	to investigate and provide latest Word versions of the marine climatology chapters of WMO No. 558 and 471	Secr.	20 Dec. 2014	Done
3	Teleconf. 20141211/W Action 3	to provide an update of new contacts/email addresses of TT-MCDS to Gudrun	Secr.	19 Dec. 2014	Done
4	Teleconf. 20141211/W Action 4	to provide suggestions of changes/additions to TT-MCDS membership to Gudrun	Teleconf. Participants	19 Dec. 2014	Done
5	Teleconf. 20141211/W Action 5	to email non-teleconference attendees to confirm interest in remaining within the TT-MCDS	L. Gates	19 Dec. 2014	Done
6	Teleconf. 20141217/E Action 1	To invite ETSI Chair at ETMC-5	Secr.	ASAP	Done
7	Teleconf. 20141217/E Action 2	to review the draft outline, and propose changes to E. Freeman (cc Secretariat	Teleconf. participants	ASAP	Done
8	Teleconf. 20141217/E Action 3	to seek volunteers for providing input for specific sections according to the agreed outline	E. Freeman	Jan. 2015	Done
9	Teleconf. 20141217/E Action 4	to organize teleconference to propose options regarding areas of responsibility, and future role of existing RMs	E. Freeman	Jan. 2015	Done
10	Teleconf. 20141217/E Action 5	Once options are available, to write to existing RMs, and seek their feedback on their future roles in the MCDS	Secr.	Feb. 2015	Done (as part of ETMC-5 preparatory documentation)
11	Teleconf. 20141217/E Action 6	to formalize the nomination of the new TT-MCDS co-Chairs	E. Freeman	Jan. 2015	
12	Teleconf. 20141217/E Action 7	to request DMCG Chair to make a proposal to the JCOMM Co-Presidents regarding ETMC Chair	Secr.	ASAP	Done
13	Teleconf. 20141217/E Action 8	to approach the UK in order to have a nomination for ETMC in replacement of N. Scott.	Secr.	ASAP	Done

No.	Ref.	Action item	by	Deadline	Status
14	Teleconf. 20141217/E Action 9	to provide the CMOC/China workplan to the ETMC, and then the ETMC to review the workplan and provide further guidance.	S. Woodruff, ETMC	Mar. 2015	Workplan provided to ETMC-5
15	Teleconf. 20141217/E Action 10	to promote discussions between the Hong Kong Observatory and NMDIS regarding whether CMOC/China could contribute to the rescue of marine meteorological data of Hong Kong, China.	H.Y. Mok, S.H. Lin	Feb. 2015	
16	Teleconf. 201401 Action 1	To send copies of the current versions of the marine climatology chapters of WMO No. 558, and 471 and other existing materials to the specific items leads.	Secretariat	ASAP	Done
17	Teleconf. 201401 Action 2	To discuss with the Secretariat, and propose a workplan for the period February to June 2015, and leading to zero drafts by ETMC-5.	Eric Freeman (assisted by Secr.)	7 Feb.	Done
18	Teleconf. 201401 Action 3	to discuss with the Secretariat and refine the current outlines of the marine climatology chapters of WMO No. 558, and 471 so that they also include details and guidance on what needs to be written.	Eric Freeman (assisted by Secr.)	7 Feb.	Done
19	n/a	To create templates of the new versions of 558 and 471 on the basis of the new outlines & guidelines, and provided them to Eric Freeman	Secretariat.	15 Feb.	Done
20	Teleconf. 201401 Action 4	To organize another East/West teleconference to discuss methodology for updating the publications.	Eric Freeman	16 Feb.	Done
21	Teleconf. 201401 Action 5	Eric Freeman as overall lead, to coordinate with the identified items/sections leads, provide guidance materials and templates, and seek their input (deadline for providing their input: 30 April 2015)	Eric Freeman (assisted by Secr.)	20 Feb. 2015 to 15 June 2015	Initiated
22	n/a	To review the current versions of WMO No. 558 and 471 publications, and identify the elements, which will have to be kept and were not yet considered within the new proposed outline (i.e. that may have been forgotten)	Scott Woodruff, Eric Freeman	31 Oct. 2015	
23	Teleconf.	Specific items/sections leads	Items/section	20 Feb.	Initiated

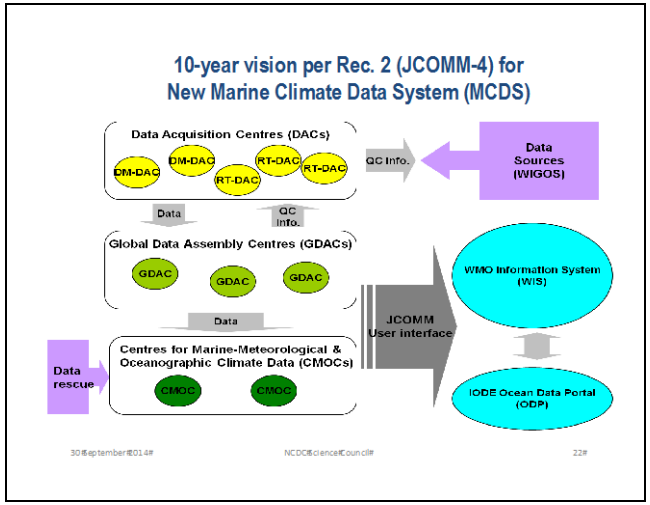
No.	*Ref.*	*Action item*	*by*	*Deadline*	*Status*
	201401 Action 6	to start coordinating and collecting input from the identified contributors, and to write those items/sections as needed (deadline to provide input 15 April 2015).	leads	2015	
24	Teleconf. 201401 Action 7	Specific text contributors to provide their input to the Items/Sections leads	Text contributors	15 April 2015	Underway
25	n/a	Items/Sections leads to provide their input to Eric Freeman	Items/section leads	30 April 2015	Underway
26	Teleconf. 201401 Action 5	To consolidate the marine climatology chapters of WMO No. 558, and 471, in the view to provide a zero draft by ETMC-5.	Eric Freeman, Secretariat	15 May 2015	
27	n/a	Draft versions sent to TT-MCDS for their review (deadline 31 May 2015)	Eric Freeman	15 May 2015	
28	n/a	TT MCDS to review draft	TT-MCDS	31 May 2015	
29	n/a	To consolidate comments from TT-MCDS	Eric Freeman, Secretariat	7 June 2015	
30	n/a	ETMC-5 to review draft and agree on future workplan	ETMC-5	22-25 June 2015	

ANNEX V

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.



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	G. Roshenhagen	Ongoing	*(taken from TT-DMVOS WP)* Oct '12: GCCs developing
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. RoshenhagenS. 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 now adopted
11	4	Propose a new ad hoc task team for Data Exchange Protocols (DEP*).	ETDMP	S. Belov	2012	
12	11	Finalize relevant documentation to IODE-22: MCDS Strategy MCDS Implementation Plan CMOC Evaluation Criteria	ETMC, DMCG, Secretariat	P. Pissierssens	12/2012	Done
13	11	The IOC Strategic Plan for Oceanographic Data and Information Exchange www.iode.org/strategy	Secretariat	P. Pissierssens	Jan 2013, then IODE-22	Done
14	1	Define Terms of Reference for IODE GDACs	IODE	A. Troisi / S. Iona	IODE-22 (for IODE	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)1	Action	By	Lead or catalyst	Deadline	Comments
					GDACs)	
15	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
16	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	Deadline updated (delayed) MCDS presented at DBCP-30 and SOT-8.
17	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	(see data type work plans for details)	Delayed
18	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 proposal withdrawn
19	6	Other Candidates to submit Statement of Compliance for CMOC (e.g. ICOADS, etc)	Candidate CMOCs	E. Freeman	February. 2016	Delayed Encourage ICOADS partnership steering team to submit 5-year workplan, and statement of compliance and commitment by mid-2016
20	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:	N. Scott / E. Freeman / D. Legler & D. Meldrum	2015 VOS: 11/2011 Buoy: 11/2011 Ocean Data: 2015	 Done (VOS) Done (Buoy)

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
			DMCG in coop with IODE Others:…		Others:…	
21	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)
22	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	Deadline updated (delayed)
23	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
24	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	Underway; outline ready, writing teams set up; zero draft to be discussed at ETMC-5 Done
25	1, 11	Update relevant chapters of the relevant WMO/IOC Publications to reflect new	VOS: GCC / ETMC	E. Freeman	2015	Ongoing

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
		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).				
26	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
27	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
28	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	End 2016	Deadline updated (delayed)
29	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
30	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	
31	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*
32	4	Agree on data collection and processing formats for **Buoy Data**	Buoy: ISDM, AOML, Meteo France	S. Woodruff / E. Freeman	2015	
33	4	Agree on data collection and processing formats for **Ocean Data**	Ocean Data: ETDMP	S. Woodruff / E. Freeman	February 2016	See 31. Ongoing with potential ICOADS/WOD CMOC application.
34	8	CMOCs to apply as WIS National Centres (NC) or Data Collection and Production Centres (DCPC)	CMOCs	H.Y. Mok	2016	
35	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	
36	1	Update relevant chapters of the relevant WMO/IOC Publications to reflect new structure for **Buoy 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	E. Freeman / Tim Boyer (IOC)	2015	
37	2	Update relevant (or create new if needed) WMO & IOC Publications with details of standardised MCDS MQC	MQC: ETMC	E. Freeman	2015	
38	1	Update relevant chapters of the relevant WMO/IOC Publications to reflect new structure for **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).	Ocean Data: ETDMP	E. Freeman	2016	
39	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
40	3	Establish Pilot Project & Steering Team for value-added ICOADS (IVAD).	ETMC	S. Woodruff	2015	Currently utilising the ICOADS partnership and

No.	Deliverable(s)1	Action	By	Lead or catalyst	Deadline	Comments
						Steering Committee forum for discussion and planning of IVAD (Dec '12). Done
41	4	Develop software to convert historical formats to MCDS format(s) and make freely available.	GDACs / CMOCs	T. Sakama	2015	Ongoing
42	4	Update relevant chapters of WMO & IOC Publications to reflect the MCDS preferred formats.	ETMC	E. Freeman	2016 and ongoing as needed/or new items added	Currently re-writing Pubs 558/471 to incorporate,
43	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.
44	7	Prepare white-paper on metadata collection and exchange format(s).	ODASMS, CMOC(s)	S. Woodruff	2016	
45	7	Investigate metadata rescue (e.g. for buoy metadata)	CMOC(S)	S. Woodruff	2016	
46	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	
47	9	Agree on some minimum requirements for the production of MCS.	CMOC, ETMC, ETDMP	D. Berry	2016	
48	9	Define roles and responsibilities for producing MCSs (e.g. CMOC).	CMOC, ETMC, ETDMP	D. Berry	2016	
49	9	Update relevant chapters of the WMO and IOC Publications to reflect MCS obligations of Members/Member States as well as guidance to them respectively.	CMOC, ETMC, ETDMP	D. Berry	2016	

No.	*Deliverable(s)1*	*Action*	*By*	*Lead or catalyst*	*Deadline*	*Comments*
50	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	
51	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	
52	11	Propose draft Rec to JCOMM-5	ETMC	E. Freeman	Mar. 2017	Discuss at ETMC meeting at MARCDAT-4
53	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	
54	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	ETMC-4 item no. 14 (ref: 4.3.1.1) Will be part of the new Technical Regulations Definitions complete; Prepare proposal for JCOMM-5.
55	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	Started; will be part of new Technical Regulations.
56	2	Once approved by JCOMM, HLQC to be used by all atmospheric GDACs.	GDACs	L. Gates	2018 (after JCOMM-5)	
57	3	Run Pilot Project for creation of IVAD (e.g. bias corrected) and make recommendations.	PP Steering Team	S. Woodruff	2020	Started in 2012. Continuing in consulation with ICOADS International Partners and ICOADS Steering Committee.
58	3	Document procedures and detail how data within IVAD are to be interpreted (use a new	ETMC	E. Freeman	2020	Started in 2012. Continuing in consulation with ICOADS

No.	*Deliverable(s)1*	*Action*	*By*	*Lead or catalyst*	*Deadline*	*Comments*
		JCOMM Technical Report).				International Partners and ICOADS Steering Committee.
59	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.

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____

ANNEX VI

REPORT BY THE GLOBAL COLLECTING CENTRES (GCCS)

1. INTRODUCTION

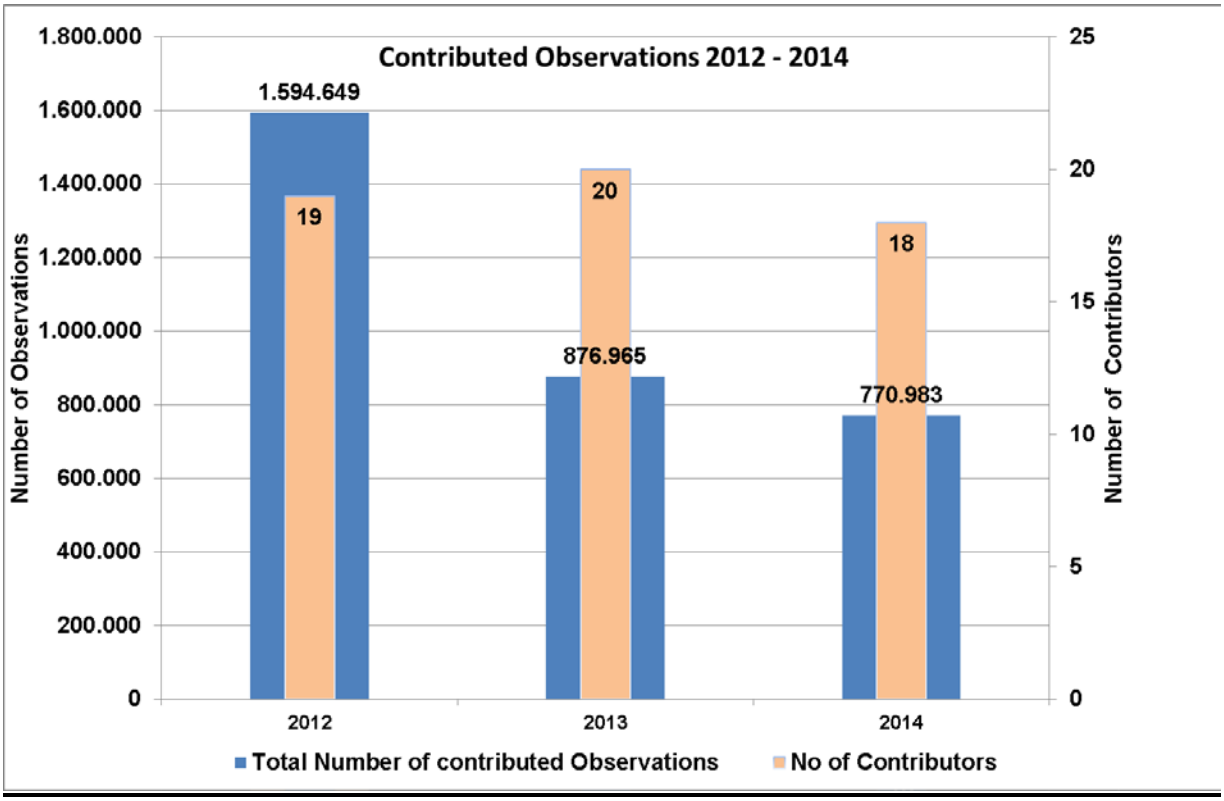
The two Global Collecting Centres (GCCs) for JCOMM's Marine Climatological Summaries Scheme (MCSS) were set up to improve data flow and quality of delayed-mode Voluntary Observing Ships (VOS) data by Recommendation 11 / CMM-XI (Lisbon, April 1993). Since then both Germany and the United Kingdom have been operating the GCCs. The current activities of the GCCs are reported through the GCC annual reports.
(http://www.wmo.int/pages/prog/amp/mmop/gcc-reports.html)

2. GCC REPORT

2.1 VOS Data Volumes

The most recent GCC annual report of 2014 marks the 21st year of GCC operation. The number of observations received in 2012, 2013 and 2014 were 1,594,649, 876,965 and 770,983 respectively. The high number of observations in 2012 was due to a number of countries processing and contributing large volumes of backlogged data (Figure 1). The fluctuation in contributions results from a variety of Contributing Member (CM) issues including software, staff and technical problems.

Figure 1 Number of Observations and active Contributing Members in the last three Years



The number of contributing countries has remained at 23 Members for the last three years. The remaining four CMs are still having problems submitting their data (Table 1). Argentina's most recent contributions are from 2008; Brazil only contributed data between the years 1994 – 1997

and neither Kenya or Nigeria have ever sent any data to the GCCs. In recent years the DWD has assisted Israel, Sweden, Greece, the Netherlands and Canada in preparing their contributions.

The GCCs should proactively encourage CM who haven't contributed much data to do more and help CM with automatic systems on board their ships to submit that data.

Table 1 Number of Observations by CMs for the last three Years

Number of CM Observations 2012 - 2014			
Country Name	***2012***	***2013***	***2014***
Argentina	0	0	0
Australia	0	14.728	1.700
Brazil	0	0	0
Canada	400.690	291.929	310.490
Croatia	0	43.016	9.910
France	330.126	96.441	115.834
Germany	283.619	137.885	72.289
Greece	530	167	0
Hong Kong, China	2.033	1715	4.371
India	1.215	295	0
Ireland	1.525	0	19.934
Israel	4.332	4.952	0
Italy	0	7.847	0
Japan	16.078	14.258	10.819
Kenya	0	0	0
Malaysia	1.217	1.363	271
Netherlands	49.877	41.351	23.248
New Zealand	7.121	0	4.976
Nigeria	0	0	0
Norway	298.144	0	59.073
Poland	538	932	1.117
Russian Federation	40.100	20.265	17.805
Singapore	427	0	0
South Africa	648	778	521
Sweden	0	57.476	20.800
United Kingdom	154.894	87.385	85.904
USA	1.535	1.390	11.921
Total	**1.594.649**	**876.965**	**770.983**

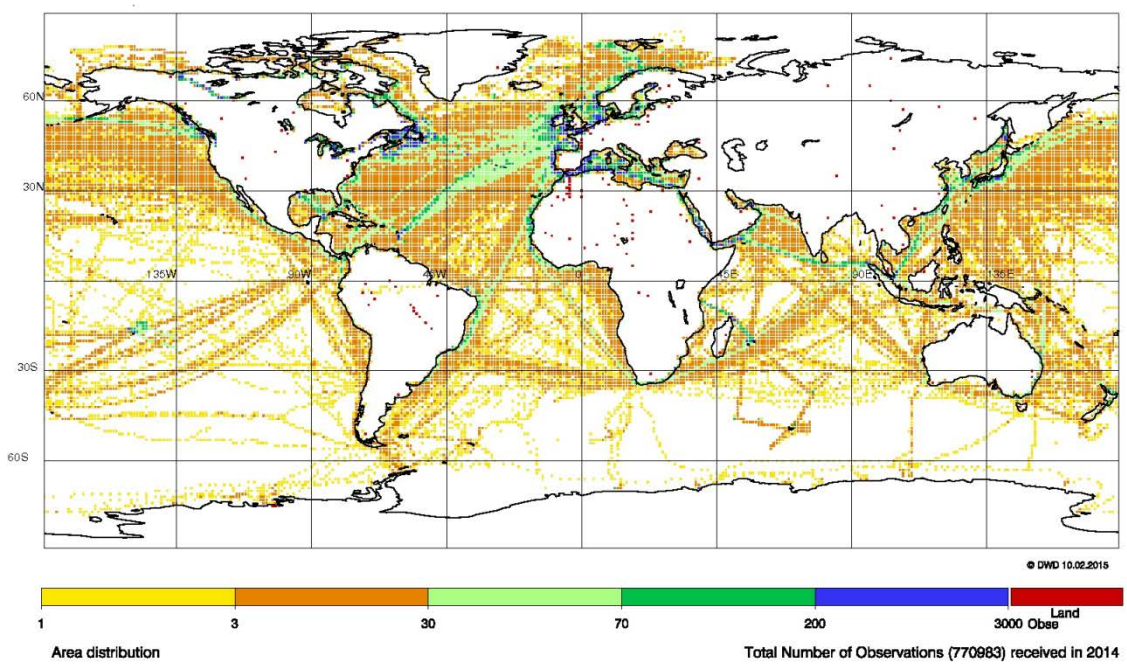
The majority of data received by the GCCs arrive by email and anonymous FTP transfer, all of which are contributed in IMMT format. In 2012, 53% of data were in IMMT-3 and 47% in IMMT-4. In 2013, 65% were in IMMT-4 and 2% in IMMT-5 and in 2014 72% were in IMMT-4 and 4% in the most recent IMMT-5 format.

2.2 VOS Data Quality

The majority of observations continue to be of good quality with less than 0.1 % of the data being rejected by the MQCS, mostly due to duplication of data. The 2014 areal distribution map (Figure 2) shows the main shipping lanes between continents, with much data concentrated along the coasts. The locations of observations reported erroneously on-land are highlighted in red. Problems with on-land positions have been on the decrease representing a very small percentage of total data in the last three years.

The TurboWin coding problem of the previous year persists, leading to a number of IMMT-4 and -5 files being submitted with erroneous relative humidity values. These data were identified and the corrected files made available on the German GISC (Global Information System Centre). Until the coding problem is resolved, the GCCs will correct the data before processing and distribution.

Figure 2 Distribution of Observations received in 2014



2.3 VOSClim Class Data

From 2012 to 2014, 1,784,395 observations from VOSClim class ships were received and processed by the GCCs. This constitutes 55% of the data received by the GCCs from the VOS fleet during this period. However, only 42% of the VOSClim observations contained the VOSClim defined additional elements. Ten of the twelve Contributing Members with registered VOSClim ships submitted observations. In addition, 133,058 observations including the VOSClim defined additional elements were received from non-VOSClim registered ships (Table 2).

Table 2 VOSClim Class Observations submitted by CMs for the last three Years

Total Number of Observations from VOSClim-Ships / Number of Observations with VOSClim-Elements from VOSClim-Ships / Number of Observations with VOSClim-Elements from not listed ships 2012 - 2014

Country Name	2012			2013			2014		
Australia	0	0	0	1,037	877	318	0	0	1
Canada	400.248	0	0	291.929	0	0	301.060	0	0
France	262.901	262.901	63.905	92.626	92.626	3.695	109.795	109.795	4.167
Germany	46.862	42.142	367	25.145	22.048	260	19.216	17.154	962
Hong Kong and China	0	0	0	0	0	0	0	0	47
India	238	0	0	140	0	0	0	0	0
Italy	0	0	0	0	0	7.847	0	0	0
Japan	3.061	3.061	0	2.782	2.782	0	3.026	3.026	0
Netherlands	16.707	11.979	2.051	26.706	26.228	3.445	15.033	14.766	2.864
New Zealand	1.305	900	6	0	0	0	991	941	2
United Kingdom	48.078	41.290	11.633	42.406	35.647	26.982	68.066	50.496	2.187
USA	0	0	0	944	943	420	4.093	4.083	1.899
10 of 12 Countries	**779.400**	**362.273**	**77.962**	**483.715**	**181.151**	**42.967**	**521.280**	**200.261**	**12.129**

3. HIGHLIGHTS and ISSUES

3.1 Formats and Standards

As of 1st January 2011, IMMT-4 was the preferred format for use by delayed-mode VOS observations. IMMT-5 and MQCS-7 were adopted at JCOMM-4 in May 2012 and were in effect from June 2012. These include only minor updates of wording and QC limits (see Appendices C & D for the full IMMT-5 & MQCS-7).

The 'MQC-software for CMs' was updated to MQCS-7 and the 7th version is available at

http://www.wmo.int/pages/prog/amp/mmop/mqc_soft.html.

3.2 Data Management and Quality of Climate Observations JCOMM Wide

3.2.1 MCDS

The Marine Climate Data System (MCDS) is currently in the implementation phase. It encompasses a generic data flow structure with defined roles and tasks to be applied to all data types across JCOMM for the management of climate data. The MCDS Strategy and implementation plan were proposed and endorsed at JCOMM-4. The new JCOMM Task Team on the Marine Climate Data System (TT-MCDS) was formed, absorbing the work and tasks of the TT-DMVOS & TT-MOCS.

Members of the Expert Team on Marine Climatology (ETMC) and Task Team on the Marine Climate Data System (TT-MCDS) held a joint meeting at CLIMAR-4 (June 2014). At the meeting the MCDS implementation plan was updated to reflect work carried out to date on developing plans for the Data Acquisition Centres (DACs) and Global Data Assembly Centres (GDACs). The meeting also recognised that there was a need to update WMOTechnical Regulations to reflect the development of the MCDS.

Following on from this, in December 2014, TT-MCDS teleconferences, East and West, were held to discuss updates to the relevant sections of the WMO Guide to Marine Meteorological Services (No 471) and the Manual on Marine Meteorological Services (No 558). New structures for the Marine Climatology sections were proposed with a view to having draft versions ready for ETMC-5 (June 2015). The membership of the TT-MCDS was also reviewed at the meeting.

In 2014 the CMOC (Centre for Marine-Meteorological and Oceanographic Climate Data) application from the State Oceanic Administration (SOA) National Marine Data and Information Service (NMDIS) in Tianjin, China was successfully evaluated against the CMOC evaluation criteria proposed by the ETMC and Data Management Coordination Group (DMCG). A draft resolution for submission at the 17th WMO congress has been prepared to approve China as the first official CMOC.

3.2.2 WIS DCPC

Both GCCs have been identified as 'Data Collection & Production Centres' (DCPCs) for the WMO Information System (WIS) and are able to provide nearly 19.3 million MQCS-checked and flagged observations received by the GCCs from 1996 to 2014. Additionally, all original contributed records are saved and available at:
http://gisc.dwd.de/GISC_DWD/toExtendedSearch.do

3.2.3 HQCS

In 2014 the new Higher Quality Control Standard (HQCS) developed by DWD was used as the basis for a software package for automatic quality checking to be used by the new MCDS GDACs.

Documentation of the code has been translated into English and will be made available in 2015.
New features include a new spatial check and an integrated land-sea-mask with an accuracy of 0.1 degree, which helps to identify observations with on-land-positions, and a climatology check based on the background fields using the ERA-Interim-Reanalysis 1981 – 2010.

ANNEX VII

REPORT BY THE RESPONSIBLE MEMBERS

(Germany; Hong Kong, China; India; Japan; the Netherlands; Russian Federation; United Kingdom; United States of America)

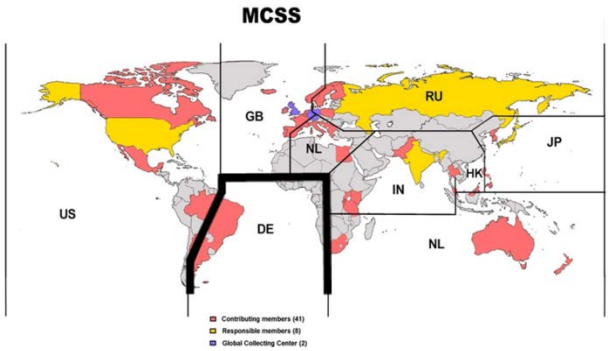
REPORT OF RESPONSIBLE MEMBER - GERMANY

(Report submitted by Hildrun Otten-Balaccanu – Hildrun.Otten-Balaccanu@dwd.de)

1. INTRODUCTION AND BACKGROUND

Germany is one of eight responsible members of the Marine Climatological Summaries Scheme (MCSS) and is responsible for the South Atlantic Ocean between 20°N and 90°S.

Figure 1



Area of responsibility, Germany

To ease the selections the number of observations and plots in this document refer to an area which spans from 20°N to 90°S and from 80°W to 20°E.

In 1963, by WMO Resolution 35, CG-IV, the international exchange of delayed-mode marine climatological data was established to feed the Marine Climatological Summaries Scheme (MCSS). Since then Germany has been acting as Contributing Member (CM) and Responsible Member (RM).

In 1993, by WMO Resolution 11, CMM-XI; two Global Collecting Centres (GCCs) were established, one of them in Germany, to facilitate and enhance the flow and quality control of the data. The GCCs are collecting, processing and distributing all delayed marine Voluntary Observing Ship (VOS) data.

In Germany the GCC is a Data Collection and Production Centre (DCPC) within the Global Information System Centre (GISC) DWD. This meets the international plans (ETMC and SOT) of modernizing the delayed mode VOS data management.

The Centre in charge of the MCSS in the Germany is the Marine Climatological Monitoring Centre of Deutscher Wetterdienst (DWD) in Hamburg.

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Co-chair of TT-MCDS

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20359 Hamburg
Germany

2. ACTIVITIES OF GERMANY AS MCSS CONTRIBUTING MEMBER (CM)

The following number of observations was contributed from ships of the German VOS fleet during the last three years (Table 1):

Table 1

	2012		2013		2014	
	No. of Ships	**No. of Obs.**	**No. of Ships**	**No. of Obs.**	**No. of Ships**	**No. of Obs.**
Unknown			17	1.430	19	1.577
Selected Ships	423	101.413	460	124.784	304	61.922
Supplementary Ships	1	397	1	3	1	1
Auxiliary Ships	2	639	3	997	2	643
Automated Stations	2	3.280				
Registered VOSClim Ship			36	10.671	50	16.249
Total	**428**	**105.729**	**517**	**137.885**	**376**	**80.392**

The number of active ships of the German VOS fleet has slightly decreased (Table 2). The number of ships supplied with an automatic weather station will continue to increase, especially those with measurements of sea level pressure only contributed via satellite and GTS.

Table 2

German VOS fleet, active ships	
Year	*No. of active ships in GTS*
2012	684
2013	627
2014	552
2015 (until May)	438

The number of registered ships of the German VOS fleet (Table 3):

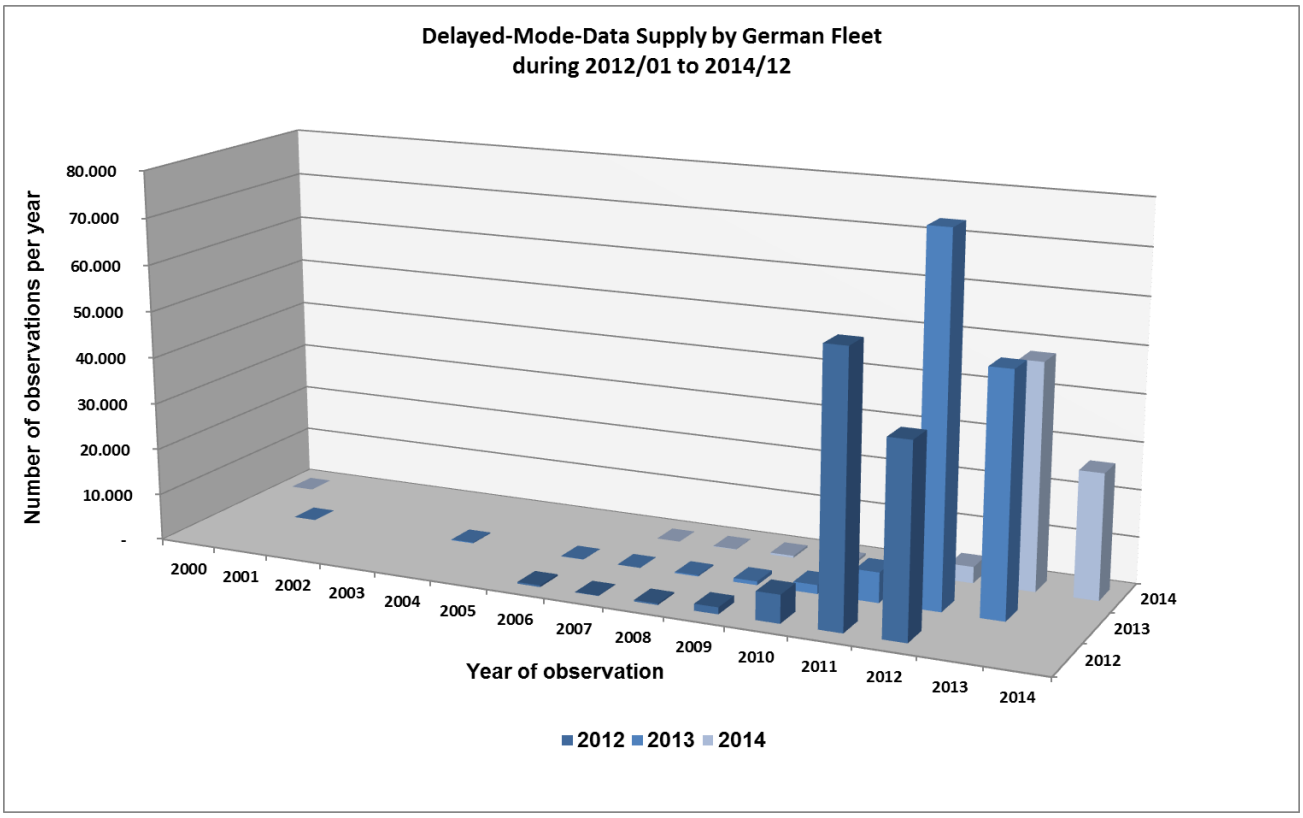
Table 3

German VOS fleet, registered ships (07.05.2015)				
Type of platform	*Manual*	*Automated*	*Supplemented by manual input*	*total*
Auxiliary	5			*5*
Selected	476	18		*494*
VOSClim	81		*2*	*83*
Total	***562***	***18***	***2***	***582***

All manually generated observations are produced using the TurboWIN software. After the Minimum Quality Control (MQC) has been applied by the Port Meteorological Officers (PMO), the data is forwarded to the quality control group, where the national High Quality Control (HQC) is performed. The HQC runs automatically and sets flags to all data according to the level of confidence. Observations which failed the QC are checked manually and are corrected if possible.

All data is sent to the GCCs immediately after it has passed the QC. The annual number of observations sent to the GCCs for the period of 2012 to 2014 is shown in Figure 2 below.

Figure 2



The oldest observation received from German VOS by the PMO during 2012 - 2014 was from the year 2000. Most of the delayed mode data is from the past two years. More and more manual observations are also transmitted also near-real-time via GTS, whereas all data from automatic weather stations are submitted via the GTS. This is a fast growing data source.

3. ACTIVITIES OF GERMANY AS MCSS RESPONSIBLE MEMBER (RM)

3.1 Data Processing

From 2012 to 2014 the RM Germany received 164,341 observations within the area of its responsibility from the GCCs. Data originated from 17 different contributing members, with a minimum of one observation (from CM Ireland) up to a maximum of 51,763 observations)from CM Germany) (Figure 3). The oldest observation was from 1997 with rising numbers of observations up to a maximum of 51,354 out for the year 2012 (Figure 4).

Figure 3

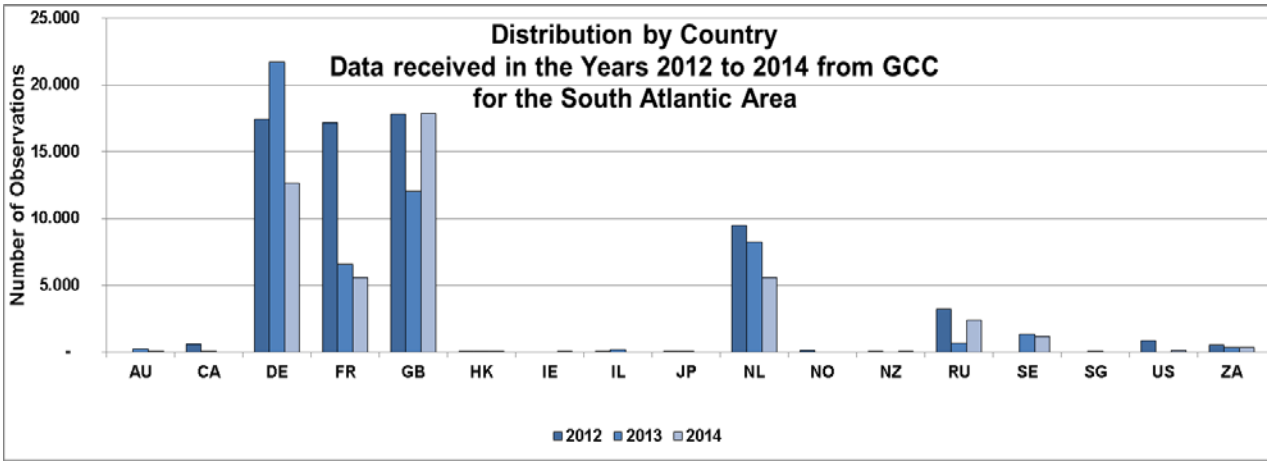
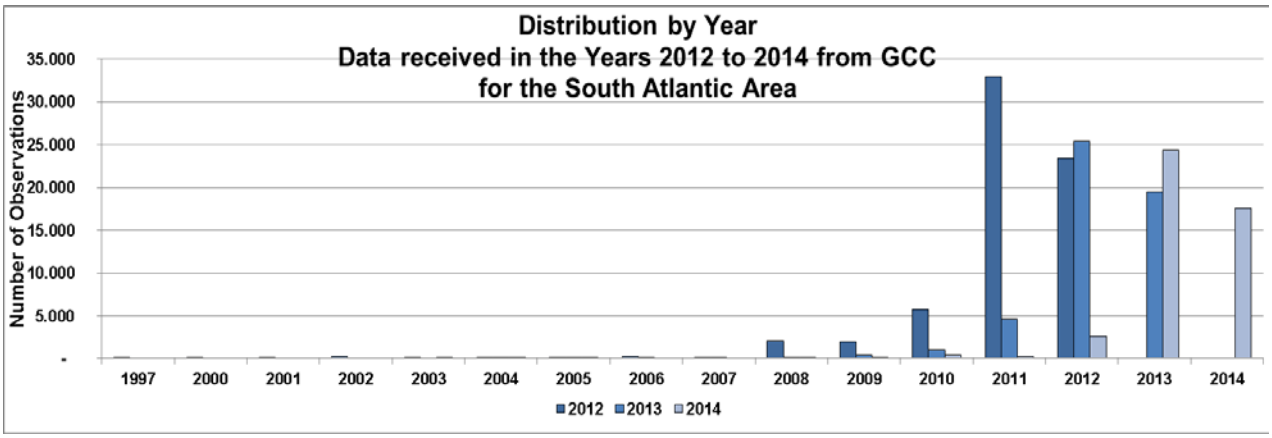


Figure 4

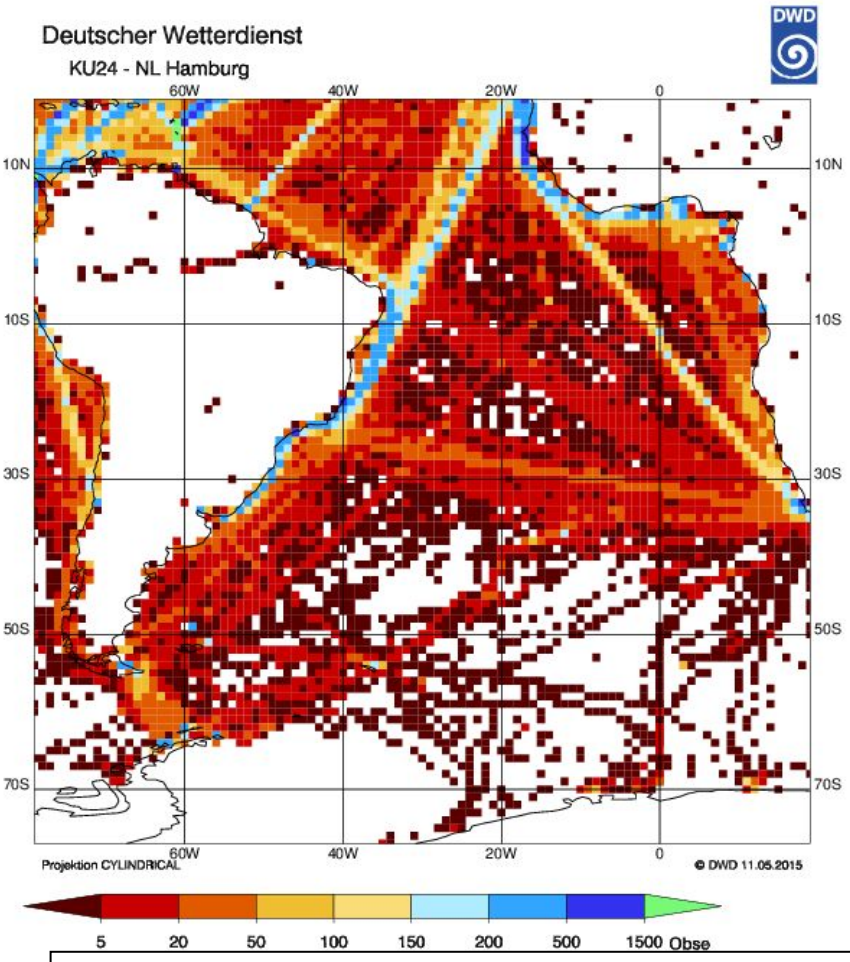


The RM Germany accepts data in all versions of IMMT. All input data is saved in the original format. The data is then converted into a national format for further checking and archiving. We do not use the MQC-Software, but the MQCS is an integrated part within our QC.

The areal distribution of all incoming data during 2012 to 2014 is shown in Figure 5. Note some scattered on-land positions, which have been corrected during quality control activities.

Areal distribution
Data received during 2012/01 to 2014/12 from GCC
for the South Atlantic Area

Figure 5



Total number of observations: 166,694
From date: 17th July 1997
Until date: 28th November 2014

The observations received were checked by our national QC, which includes the following steps:

Date/time check, duplicate check, formal check, land/water check, course and speed check, climatological check, chronological check, repetition check, internal consistency check, spatial consistency check

Data is flagged by an automatic routine, suspicious values are corrected manually, if possible.

The German GCC supports some countries, including Canada, Greece, Israel, the Netherlands and Sweden in their efforts to contribute their data to the MCSS. DWD assists by digitizing

observations from paper logbooks and developed a software to convert records from FM13-Ship code into the IMMT4-Format.

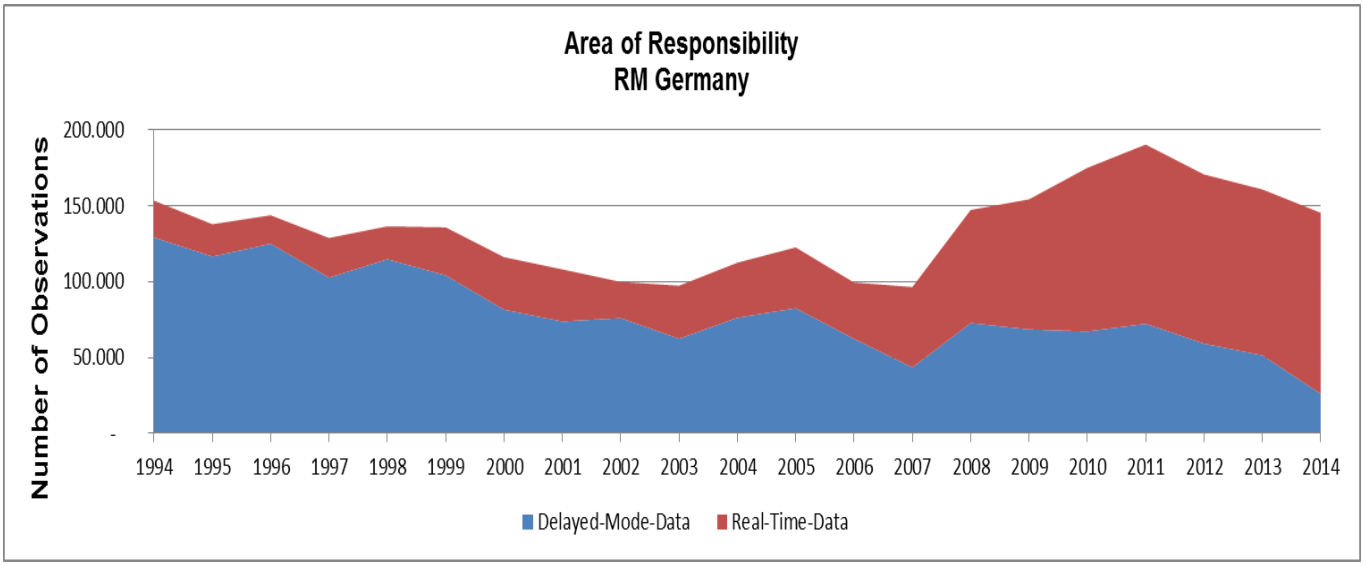
3.2 Climatological Summaries

No climatological summaries have been produced in the years 2012, 2013 and 2014.
The last summaries were produced for the decade 1981 – 1990.
There were no requests for such products.

3.3 Archives

At the end of the year 2014 there were 7.166.124 observations in the delayed-mode archive of the German area of responsibility.

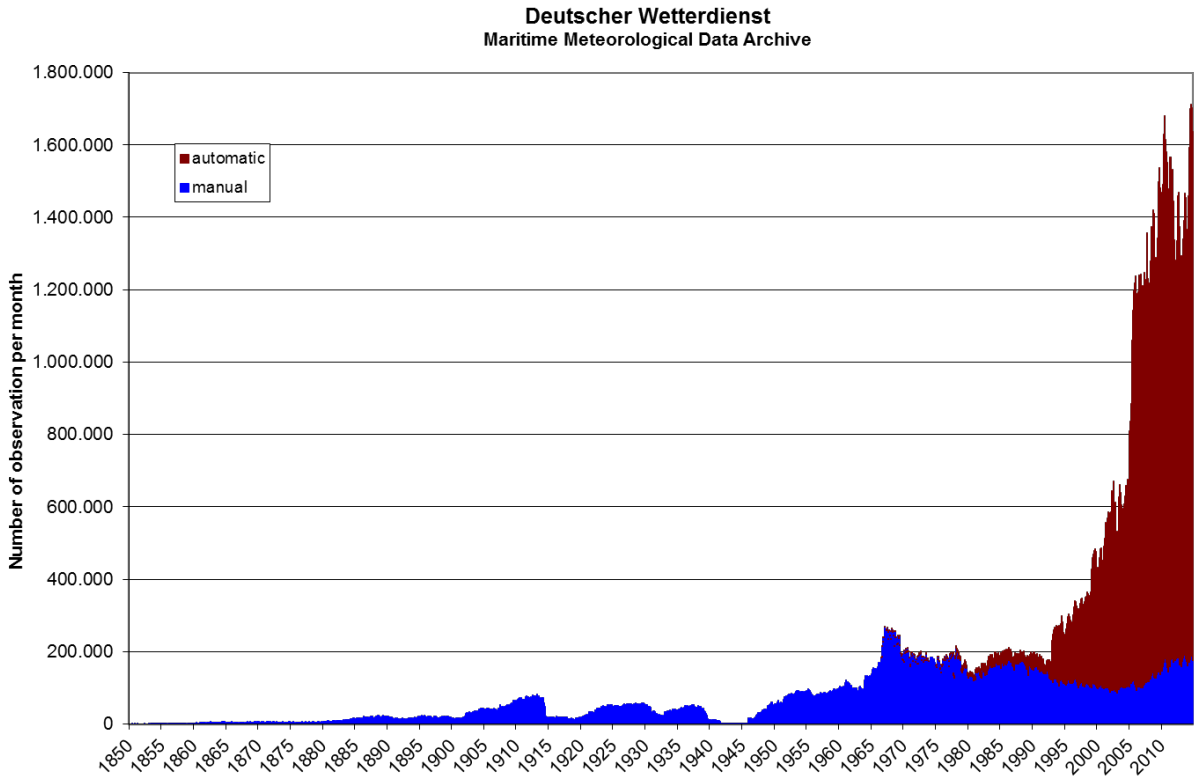
Figure 6



The slowly decreasing number of delayed-mode observations is remarkable. Thanks to the rapidly growing number of real-time-data the total number of observations is rising (Figure 6). This mostly hourly data mainly come from automatic weather stations (AWS) on board of research vessels.

In addition the data of our area of responsibility, DWD stores all available data in the German Global Maritime Meteorological Data Archive (Figure 7).
This includes world-wide data received from the GCC and historical collections. Additionally, to provide access to near-real-time data, we archive observations received from GTS.
To avoid duplicates within the archive the real-time data is replaced by data received via the delayed-mode data stream as it is expected to be of higher quality.

Figure 7



3.4 Data requests

There were several data requests during the years 2012 to 2014.
The requests concerned different locations all over the world, with a focus on the North Atlantic, North Sea, Baltic Sea and Mediterranean Sea.

4. National proposal regarding Germany's future role in the MCDS

Germany is a partner and signatory country of the international partnership which signed a letter of intent in support of ICOADS (International Comprehensive Ocean-Atmosphere Data Set) in 2014. Deutscher Wetterdienst (DWD) will continue its activities in the new Marine Climate Data System (MCDS).

Germany will continue its support by providing a Data Acquisition Centre (DAC), and a Global Data Assembly Centre (GDAC), which will replace the current involvement as a Contributing Member and a Global Collecting Centre (GCC), and will initiate a Centre of Marine Meteorological and Oceanographic Climate Data (CMOC) in the near future.

As a delayed-mode DAC all marine meteorological data received in delayed mode from the German fleet will be subjected to an automated standardized High Quality Control (HQC) programme with manual checking of suspicious values. Problems will be investigated and data will be forwarded to the appropriate GDAC.

As a GDAC, DWD will be one of the selected centres combining data of all streams from the DACs. Our role will be to establish a unique, complete dataset (including metadata), to perform standardized quality checks and to forward the data and metadata with flags to the CMOCs in agreed formats. Data from both, delayed-mode and real-time, sources will be compared and linked.

As it is mandatory that the GDACs are registered as WMO Information System (WIS) Data Collection and Production Centres (DCPCs), DWD has installed a DCPC within the GISC DWD. It will be an integrative part of the future DWD Climate Data Centre (DWD-CDC).

In addition to the activities mentioned above, Germany has already expressed its willingness and commitment to establish a CMOC at DWD to WMO in February 2012. The available facilities and infrastructure permit the generation and provision of the following marine-meteorological data, metadata and products by a CMOC-DWD:

I. Product development
    i. High quality historical data set: rescuing the existing data of the archives of Deutsche Seewarte
    ii. High quality observation data from the German fleet
II. Development of high quality checking applications
III. Processing of data
IV. Dissemination of high quality data and products for interdisciplinary use
V. Mirroring facility of ICOADS data holdings contingent on the development of a CMOC-ICOADS.

REPORT OF RESPONSIBLE MEMBER - HONG KONG, CHINA

(Report submitted by Hing-yim Mok – hymok@hko.gov.hk)

1. INTRODUCTION AND BACKGROUND

Hong Kong, China is one of eight responsible members of the Marine Climatological Summaries Scheme (MCSS) and is responsible for the area bounded by the Equator and latitude 30°N, and longitudes 100°E and 120°E. The Hong Kong Observatory (HKO) is in charge of the MCSS in Hong Kong, China, and the contact point is Mr Mok Hing-yim, Senior Scientific Officer. His contact details are as follow:

Name : Mr Mok Hing-yim
Address : Hong Kong Observatory, 134A Nathan Rd., Kowloon, Hong Kong
Tel: 852-2926 8451
Fax: 852-2311 9448
Email: hymok@hko.gov.hk

2. ACTIVITIES OF HONG KONG, CHINA AS MCSS CONTRIBUTING MEMBER (CM)

The Hong Kong Observatory is managing a fleet of 59 Voluntary Observing Ship as at 30 April 2015, with 8 VOSClim and 53 of them installed with the TurboWin electronic logbook software.

Delay mode data sent to Global Collecting Centres (GCC) by the Hong Kong Observatory in 2012, 2013 and 2014 are summarized below:

Number of data sent in 2012:

Year of observation					Total
≤ 2008	2009	2010	2011	2012	
619	524	748	142	-	2033

Number of data sent in 2013:

Year of observation					Total
≤ 2009	2010	2011	2012	2013	
282	580	1225	112	-	2199

Number of data sent in 2014:

Year of observation					Total
≤ 2010	2011	2012	2013	2014	
2089	464	935	390	9	3887

Data processing and data exchange frequency are summarized in the table below:

Frequency of data exchange with GCC	Quarterly
Data format	International Maritime Meteorological Tape-5 (IMMT-V)
Quality control	GCC minimum quality control software MQC version 5 Minimum Quality Control Standards version 7 (MQCS-7)
Frequency of submitting metadata to WMO	Quarterly

Metadata format	WMO Pub 47 version 04 (Document Revision 4.0)

3. ACTIVITIES OF HONG KONG, CHINA AS MCSS RESPONSIBLE MEMBER (RM)

3.1 Data Processing

Data processing, data exchange frequency and details on delayed mode data submitted quarterly to the GCCs in 2012, 2013 and 2014 are same as in section 2.

3.2 Climatological Summaries

Annual marine climatological summaries for the area of responsibility of Hong Kong, China have been compiled and published for 1961 to 1990. Decadal marine climatological summaries have been compiled and published for 1961-70, 1971-80, and 1981-90. Decadal marine climatological summaries have also been compiled for 1991-2000. Web version of the marine climatological summaries from 1961 to 2000 is being generated.

3.3 Archives

For the delayed mode data observed within Hong Kong's Area of Responsibility, the numbers of observation reports taken in the past five years that have been digitized in the GCC archive are:

2010	2011	2012	2013	2014	Total
12223	14270	21389	18742	10396	77020

Since 1949, the total number of delayed mode data stored in HKO's database is 2,229,424.

3.4 Data requests

There were no data requests under the MCSS originating from contributing members and other users so far.

4. National perspective with regard to the developing MCDS

Hong Kong, China would like to play the role of Data Acquisition Centre (DAC) to continue to collect marine climate data and would also like to explore the feasibility to play the role of Global Data Assembly Centre (GDAC) in the new Marine Climate Data System (MCDS).

REPORT OF RESPONSIBLE MEMBER - INDIA

(Report submitted by Dr G. Krishnakumar gk.kumar@imd.gov.in, krisndc@yahoo.com)

1. INTRODUCTION AND BACKGROUND

India is one of the eight responsible members of the Marine Climatological Summaries Scheme (MCSS) and is responsible for the Indian Ocean Area north of 15º S bounded by the longitudes of 20° E and 100° E. India Meteorological Department (IMD) carries out the responsibility. The name of the Centre in charge of the MCSS in India is Dr. L.S. Rathore, Director General of Meteorology and the contact point of the Responsible Member (RM) is Mr. B. Mukhopadhyay, Additional Director General of Meteorology (Research), IMD, Ganeshkhind Road, Shivajinagar, Pune-411005, Tel. 0091-20-25535886, 0091-20-25535411, 0091-20-25535211 Fax 0091-20-25521529, 0091-20-25535435 & 0091-20-25533201 and email: mukhoddg@gmail.com, bmukho@gmail.com , adgmrpune@hotmail.com.

2. ACTIVITIES OF INDIA AS MCSS CONTRIBUTING MEMBER (CM)

Marine weather observations from the meteorological log books of the VOS were scrutinized to eliminate instrumental, positional and coding errors and were digitized using the International Maritime Meteorological Tape-2 (IMMT-2) format. These data together with those received from other WMO Members were checked by an in-house quality control software application. The Minimum quality control software MQC version 4 obtained from GCC was also used for quality control. All flagged data were reviewed and corrected as far as possible, and the corrected data were then sent to GCC.

3. ACTIVITIES OF INDIA AS MCSS RESPONSIBLE MEMBER (RM)

3.1 Data Processing

Marine weather observations from the meteorological log books of the VOS were processing undertaken by the RM, and data exchanged with the GCCs. The International Marine Meteorological Tape-2 (IMMT-2) and Minimum Quality Control Standard (MQCS) version 4 are being used. No additional quality control is applied to the data. In particular, all flagged data were reviewed and corrected as far as possible, and the corrected data were then sent quarterly to the GCCs in 2013, 2014 and 2015 (for Dec 2014).

3.2 Climatological Summaries

Annual Marine Climatological Summaries for seventeen selected areas of the Indian area of responsibility were compiled and published for the period 1961 to 1970. Following the recommendations of the WMO Commission for Marine Meteorology at its eighth session held in 1981, chart form of the decadal summary for the decade 1971-80 was published. Surface Marine Climatological Atlas 1961-90 was published along with electronic form on CD-ROM. The decadal Marine Climatological summary charts for 1991-2000 were published along with CD. The Pentadal Marine Climatological Summaries Charts 2001-2005 has been produced in 2010 along with CD. About 2.3 lakhs marine observations from the area of responsibility of RM India were used for this purpose. The task of preparation of decadal Marine Climatological Summaries Charts for the period 2001-2010 is in progress.

3.3 Archives

Marine weather observations made within the area of responsibility of RM India are received regularly from GCC (through ftp web link of UK Met Office ftp://ftp.metoffice.gov.uk/) and archived in the National Data Center of India Meteorological Department, Pune, India. A Total of **45,55,087** records of marine weather observations made till date (**1961-2014**) within the area of responsibility of RM India were archived in National Data Center. Annual distribution of these observations for the period **1961-2014** is given in figure 1 below.

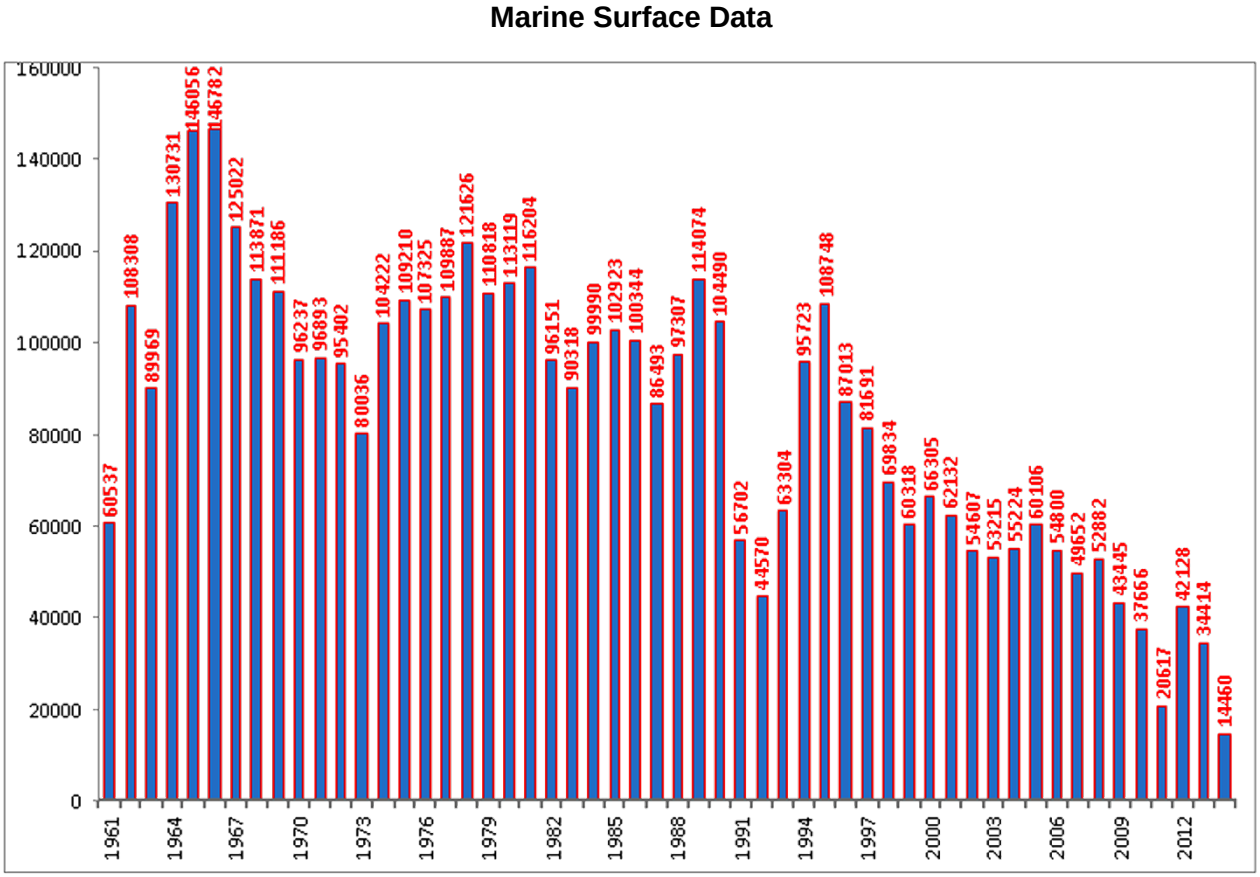


Figure 1: Annual distribution of the number of VOS observations archived by RM/India within its Area of Responsibility for the period 1961-2014.

3.4 Data requests

The number of data requests by various users (Indian party) for the years 2012, 2013 and 2014 are 10, 8 and 1 respectively. The supply of these marine data include some experimental and expedition cruise / ship data also.

4. National proposal regarding India's foreseen role in the MCDS:

As of now there is no separate proposal for Marine Climate Data System (MCDS). India (IMD) has a consolidated Climate Database Centre in which data acquisition of Marine data is also included. So India will be interested to offer Data Acquisition Centre facilities for VOS data collected in the area of responsibility. India is initiating the process of improving the capabilities of **Climate Data Management (CDM) Systems** having its specifications on similar lines with the WMO proposed CDM in order to focus on the integrated Climate Service Information as per the GFCS.

India will be interested to have a role in the future MCDS.

REPORT OF RESPONSIBLE MEMBER - JAPAN

(Report submitted by Tomoko Sakama – t-sakama@met.kishou.go.jp)

1) Introduction and background with area of responsibility

Japan is one of the eight Responsible Members for the Marine Climatological Summary Scheme (MCSS) and is responsible for the western North Pacific and its marginal seas. The Japan Meteorological Agency (JMA) has taken charge of it since the beginning of MCSS. The contact point's e-mail address is mcss@climar.kishou.go.jp.

2) Activities as MCSS Contributing Member

The numbers of reports JMA collected for last four years are shown in the table below.

	Number of reports	Proportion of reports submitted using OBSJMA
2012	21,905	73%
2013	25,465	78%
2014	21,075	88%
2015 (as of Mar.)	6,928	92%

The proportion of reports submitted in the form of electrical logs using OBSJMA has been steadily increasing recent years and reached about 90% in 2014.

The numbers of reports JMA submitted to the Global Collecting Centres (GCCs) each quarter are summarized in the table below.

	January	April	July	October	Total
2012	5,346	5,633	2,668	2,431	16,078
2013	3,556	5,535	2,407	2,760	14,258
2014	1,053	4,818	3,561	1,387	10,819
2015	1,749	5,065			6,814

The reports are checked the quality along with MQCS-6 until 2012 and MQCS-7 from 2013 using MQC software. Submissions in the IMMT-5 format started in January 2013.

The number of reports JMA submit to the GCCs during 1994 to 2014 is shown in figure.

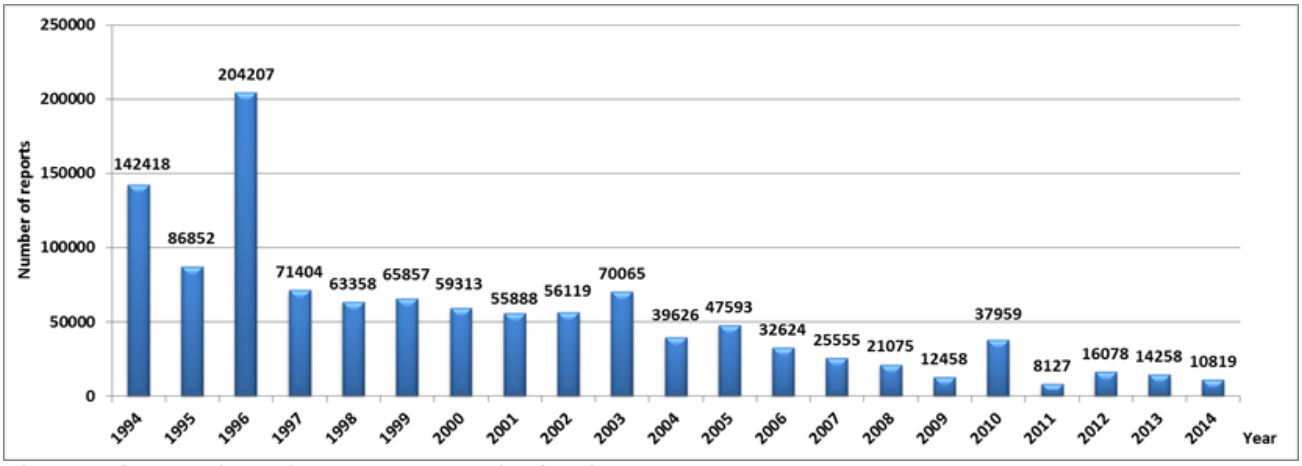


Figure: The number of reports JMA submitted

3) Activities as MCSS Responsible Member

3.1) Data processing

JMA has been operating the call sign masking scheme since December 2007, which replaces original call signs of weather reports with the generic one “SHIP” when the reports are exchanged via GTS. Because some of the ships which request call sign masking do not allow their call sign to be released even in delayed mode, JMA does not provide GCCs with weather reports of such ships.

JMA released an updated version of electronic logbook software “OBSJMA for WIN version 3.00” in February 2014. It works on Windows XP/VISTA/7/8 (both English and Japanese version) and makes marine meteorological logbook on IMMT-5 format.

The software and its manual are available from the following website:

http://marine.kishou.go.jp/en/obsjma-en.html

3.2) Climatological summaries

No climatological summaries have been published since ETMC-4.

The last summary published by JMA was for 1981-1990.

3.3) Archives

As of April 2015, JMA has archived 27.8 million reports as delayed-mode data since 1961. Reports coming from JMA’s responsible area as well as other areas around the world are contained in the archive.

3.4) Data requests

No data requests have been received since ETMC-4.

4) National perspective with regard to the developing Marine Climate Data System (MCDS), and possible or desired future role as MCDS Data Acquisition Centre (DAC) or Global Data Assembly Centre (GDAC).

JMA can continue to collect marine meteorological data as MCDS Data Acquisition Centre (DAC).

REPORT OF RESPONSIBLE MEMBER - NETHERLANDS

1. INTRODUCTION AND BACKGROUND

The Netherlands is one of eight responsible members of the Marine Climatological Summaries Scheme (MCSS) and is responsible for the Mediterranean, Southern Indian Ocean and the Australian waters.

Centre in charge of the MCSS in The Netherlands:
Royal Netherlands Meteorological Institute (KNMI)

Contact point:
Mr. Jan Rozema
P.O. box 201
3730 AE DE BILT
The Netherlands
Telephone: +31 30 2206911
Fax: +31 30 2210407
E-mail: Jan.Rozema@knmi.nl

2. ACTIVITIES OF THE NETHERLANDS AS MCSS CONTRIBUTING MEMBER (CM)

As MCSS Contributing Member the Netherlands has a fleet of approximately 100 Voluntary Observing Ships that actively take part in both the VOS and VOSClim programmes. There are no further activities in the field of MCSS.

Date	Number of submitted observations
Feb-2010	16,029
Aug-2010	22,537
Jan-2011	33,494
Jul-2011	31,123
Oct-2011	8,173
Jan-2012	1,661
Apr-2012	21,093
Jul-2012	7,315
Oct-2012	12,855
2013	35,867
2014	30,181
Total	**492,558**

With respect to the MQC: all observations we receive from the Dutch VOS fleet are made with TurboWin. This implies that MQC has been done adequately.

3. ACTIVITIES OF THE NETHERLANDS AS MCSS RESPONSIBLE MEMBER (RM)

3.1 Data Processing

Until January 2011 the Netherlands sent a quarterly collection of Dutch VOS observations to both GCC's. Due to understaffing at KNMI, from that time on we regularly (quarterly) sent the received raw TurboWin IMMT-files to GCC Germany, where the observations are extracted and processed.

All observations on the Dutch VOS fleet are made with TurboWin. We try to keep up to the latest TurboWin, IMMT and MQCS versions as possible. The version of each system is caught in each individual record.

3.2 Climatological Summaries

No climatological summaries have been (or will be) produced for the years 2013-2014.

3.3 Archives

The Dutch national database still exists, but is not actively maintained anymore. Data is archived via the GCC's and upstream databases. The situation per 01-01-2012 was as follows:

Responsible Area	**Number of observations**
Mediterranean	4,250,482
Southern Indian Ocean	2,261,027
Australian waters	3,228,480
Total	**9,739,989**

3.4 Data requests

No data requests concerning MCS have been received.

4. National proposal regarding The Netherlands' foreseen role in the MCDS

Since we are dealing with cutbacks in staff and finances, there are no active roles anticipated in the MCDS.

REPORT OF RESPONSIBLE MEMBER - RUSSIAN FEDERATION

(Report submitted by Somova Svetlana – ssm@meteo.ru)

1. INTRODUCTION AND BACKGROUND

The Russian Federation is one of the eight Responsible Members for the Marine Climatological Summaries Scheme (MCSS).

The All Russian Research Institute of Hydrometeorological Information - World Data Center (RIHMI-WDC), Roshydromet, has been in charge of MCSS since its inception.

In accordance with WMO Resolution 35 and under the WMO Marine Climatological Summaries Scheme, CG-4, prepares ship meteorological data sets and send them to German and UK Global Collecting Centres on a quarterly basis.

2. Activities of the RUSSIAN FEDERATION as the MCSS contributing member (CM)

This report presents RIHMI-WDC's activities for MCSS in 2010-2014.

In the last 5 years (2010-2014), 164 503 ship meteorological observations were processed and sent to the Global Collecting Centres (GCCs) on a quarterly basis.

Delayed-mode data were provided by Russian Ships from 2002 to 2014. All observations were received from our Supplementary Ships.

Frequency of data exchange and data management procedures are based on the Recommendations of the WMO Commission for Marine Meteorology.

Frequency of data exchange with GCC	Quarterly
Data format	International Maritime Meteorological Tape-3, IMMT-3
Quality control	GCC minimum quality control software MQCS version 5.

The QC component used includes the software developed on the basis of the WMO recommendations on the QC criteria and additional QC software.

Additional check of humidity parameters: water vapor pressure (e), dew point temperature (TdTdTd), wet-bulb temperature(TbTbTb) and relative humidity (U).
It is considered that wind wave direction (dWdW) does not correspond to other elements if ff=0 and dd=0 (calm sea), and dWdW≠0. Wind wave height and wind wave length measured in meters are checked.

The number of observations submitted to the GCCs in the period from 2010 to 2014 are shown in Fig.1, 2, 3.

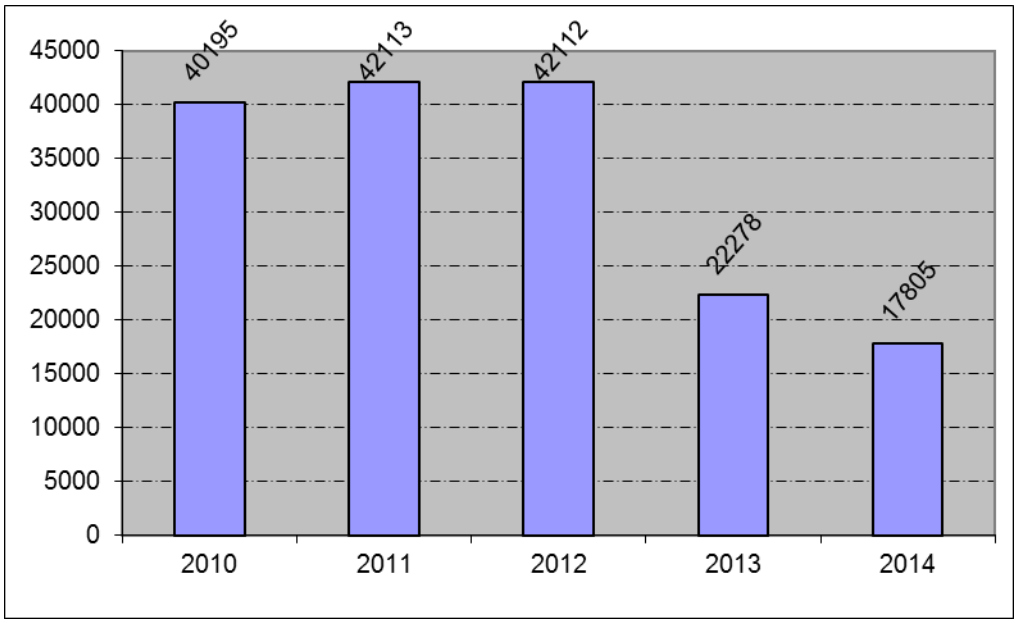
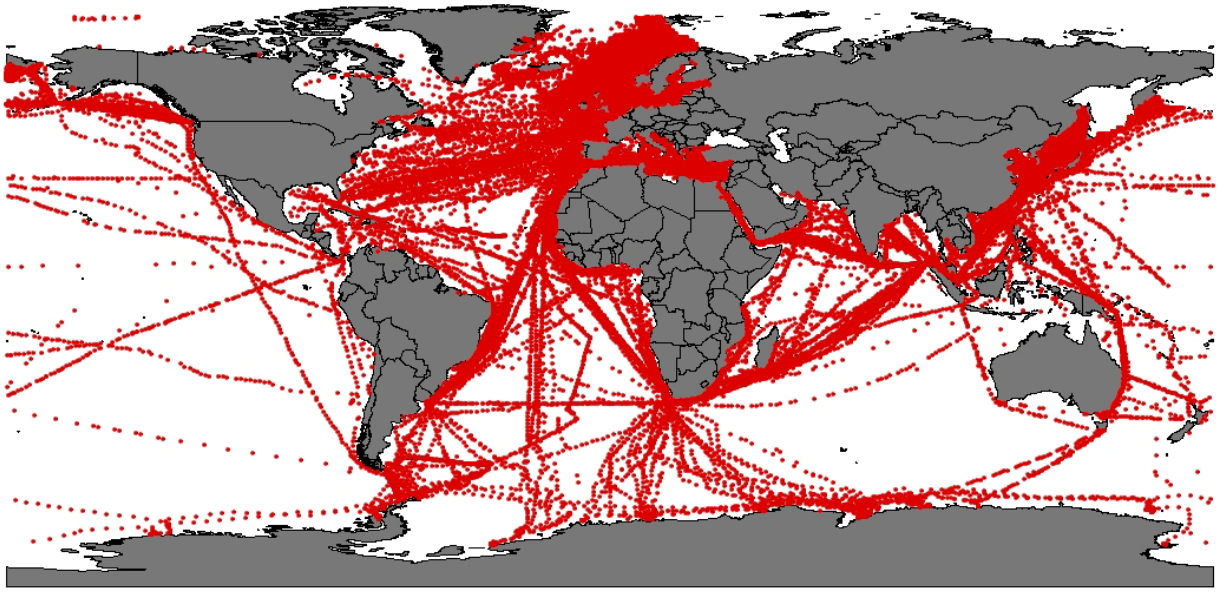
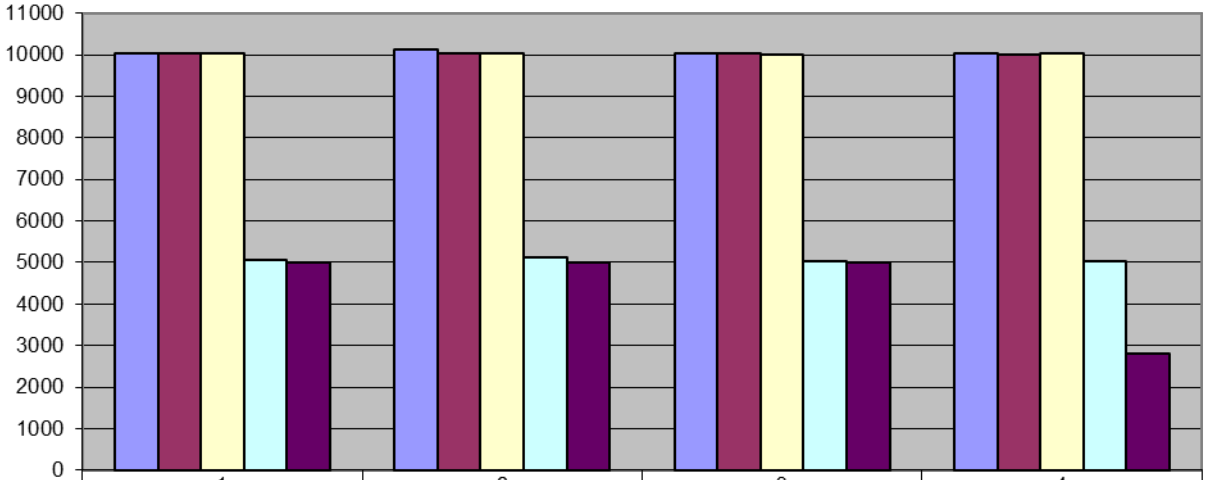


Figure 1. Distribution of the total number of ship observations contributed by RM Russia in the last 5 years (2010 – 2014)



6
Figure 2. Spatial distribution of observations submitted to the GCCs in the last 5 years
7
In particular, details on delayed mode data submitted quarterly to the GCCs in 2010, 2011, 2012, 2013 and 2014, are shown in Fig.3.



	1	2	3	4
2010	10027	10113	10019	10036
2011	10034	10018	10048	10002
2012	10040	10037	10003	10020
2013	5059	5132	5035	5039
2014	5004	5003	5003	2795

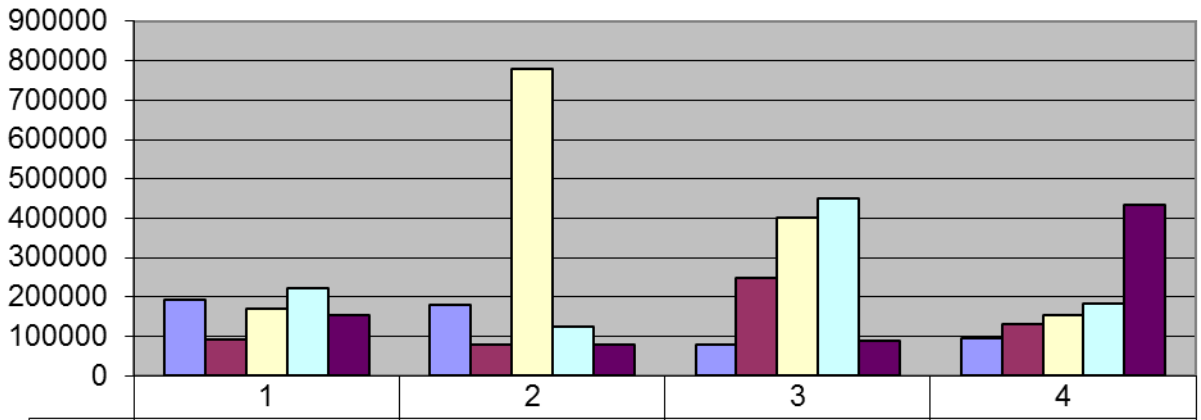
Figure 3. Delayed mode data submitted quarterly to the GCCs in 2010, 2011, 2012, 2013 and 2014.

3. Activities of the RUSSIAN FEDERATION as the MCSS Responsible member (RM)

3.1 Data Processing

As a representative of the MCSS responsible member RIHMI-WDC receives the global dataset from the GCCs at the end of each quarter in IMMT format, version 3, 4, 5 (Recommendation 9/3 (JCOMM-II), Recommendation 12/1 (JCOMM-III) and Recommendation 10/1 (JCOMM-4). All input data are saved in original format.

Figures 4 and 5 show graphs of data quarterly received by RIHMI-WDC from German GCC for the period of 2010-2014 and the total distribution of ship data by years.



	1	2	3	4
2010	193156	179177	79102	96495
2011	93757	80879	249491	132623
2012	171834	779336	401217	155818
2013	222944	123791	451763	183548
2014	154058	78312	89994	432,852

Figure 4. Delayed mode ship observations data submitted quarterly to the RIHMI-WDC in 2010, 2011, 2012, 2013 and 2014.

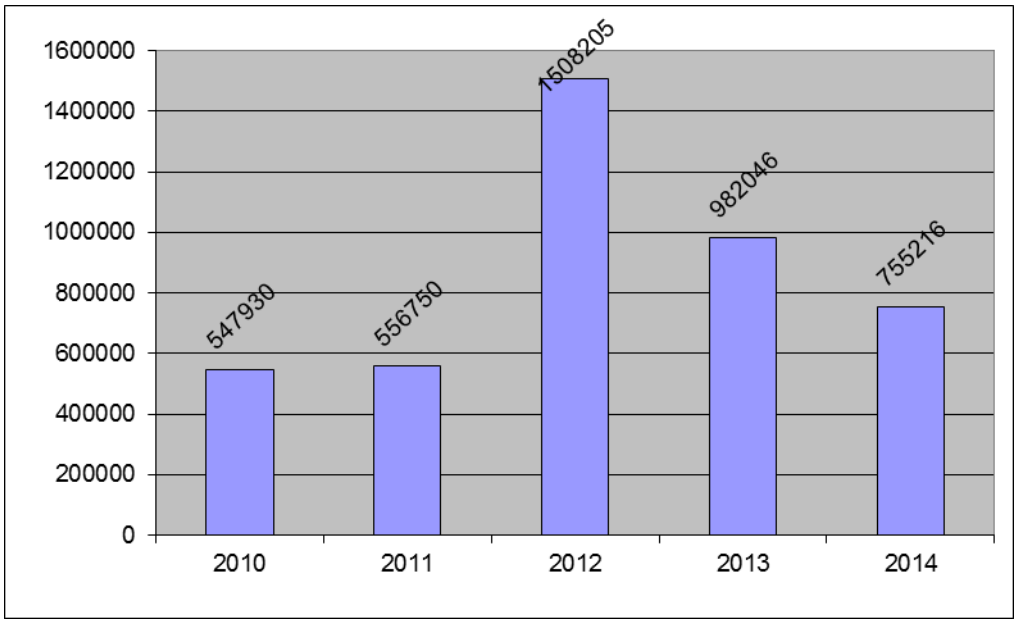


Figure 5. The total number of delayed mode ship observations data submitted yearly to RIHMI-WDC in 2010 - 2014.

As seen from Fig.5 the volume of the international ship meteorological data exchange under the MCSS was the largest in 2012 and 2013: 1 508 205 and 982 046 records in 2012 and 2013, respectively.

3.2 Climatological Summaries

No climatological summaries have been produced in the period of 2010 – 2014.

3.3 Archives

All the German GCC data received by RIHMI-WDC in five years were subjected to additional processing, converted into national format, checked and became the component of the ship meteorological data archive of the Roshydromet Unified National Data Fund. The data obtained are frequently used in creating different information resources on the state of the atmosphere over different water bodies of the World Ocean.

The RIHMI-WDC collects IMMT data for the whole globe and stores the global marine datasets in the national database and historical archives.

4. National proposal regarding the Russian's foreseen role in the MCDS Summaries

The Russian Federation is going to continue the current activity under the international projects, and will contribute to the new Marine Climate Data System.

REPORT OF RESPONSIBLE MEMBER - UNITED KINGDOM

(Report submitted by Fraser Cunningham – fraser.cunningham@metoffice.gov.uk)

1. INTRODUCTION AND BACKGROUND

The UK Met Office is one of eight Responsible Members of the Marine Climatological Summaries Scheme (MCSS) and is responsible for the North Atlantic Ocean. It also acts as a Contributing Member for UK data.

The UK Met Office has a third role within MCSS as one of two Global Collecting Centres (GCC) for the global marine meteorological dataset. The activities of the GCC are not detailed below because these are published annually by JCOMM. The most recent 'GCC 2014 Annual Report' was published in early 2014 and also reported at ETMC-5 in Doc. 2.4.

GCC United Kingdom
Met Office
GCC
S9 Saughton House
Broomhouse Drive
Edinburgh, EH11 3XQ
Scotland UK
Email: gcc@metoffice.gov.uk
Telephone:+44 (0)131 528 7313
Fax:+44 (0)131 528 7345

2. ACTIVITIES OF THE UK AS MCSS CONTRIBUTING MEMBER (CM)

The UK endeavour to submit their quality controlled delayed-mode VOS data to the GCCs on a quarterly basis. The total observations submitted to the GCCs between 2013 and the firstquarter of 2015 are shown in figure 1:

Fig. 1: UK Contributions to the GCCs

Year	***Total Obs***
2013	87,385
2014	85,904
2015 (Q1)	14,366

All UK VOF ships now have access to Turbowin electronic logbook software so the number of paper logbooks received is small (usually from old logs discovered on a ship or where technology problems have not permitted the use of TurboWin).

Like many others, the UK is automating much of its voluntary observing fleet, with 40 systems in operation at present. Procedures for contributing these data need to be defined.

After receipt, delayed-mode UK VOF data are batched and a pre-ingestion check program is run on the data. This program highlights issues such as duplicate date/time and out of range positions. Once any problems are resolved the data are loaded to the Met Office relational (Oracle) database, MIDAS. During storage of a delayed-mode observations, if the date/time/position/id matches a GTS observation already stored (VOS GTS data are ingested daily), this process overwrites the record with the delayed mode observation remaining (metadata records whether a GTS observation did originally exist).

Within 24 hours of storage, an automatic higher quality control software checks the data and sets quality flags. These flags are based on position, range, internal consistency, rate of change and climatology checks. Manual quality control provides further analysis of the data and addresses issues related to out of range values, conflicts with climatology and positional problems. Both automatic and manual quality control is performed within 1 month of loading to the database and if any changes are made to data, two versions will be stored in the database – one original version & one quality controlled version.

3. ACTIVITIES OF THE UK AS MCSS RESPONSIBLE MEMBER (RM)

3.1 Data Processing

As a responsible member country the UK receive the complete global dataset from the GCCs at the end of each quarter.

Data are received in IMMT-5 having been checked by the GCCs with MQCS-7.

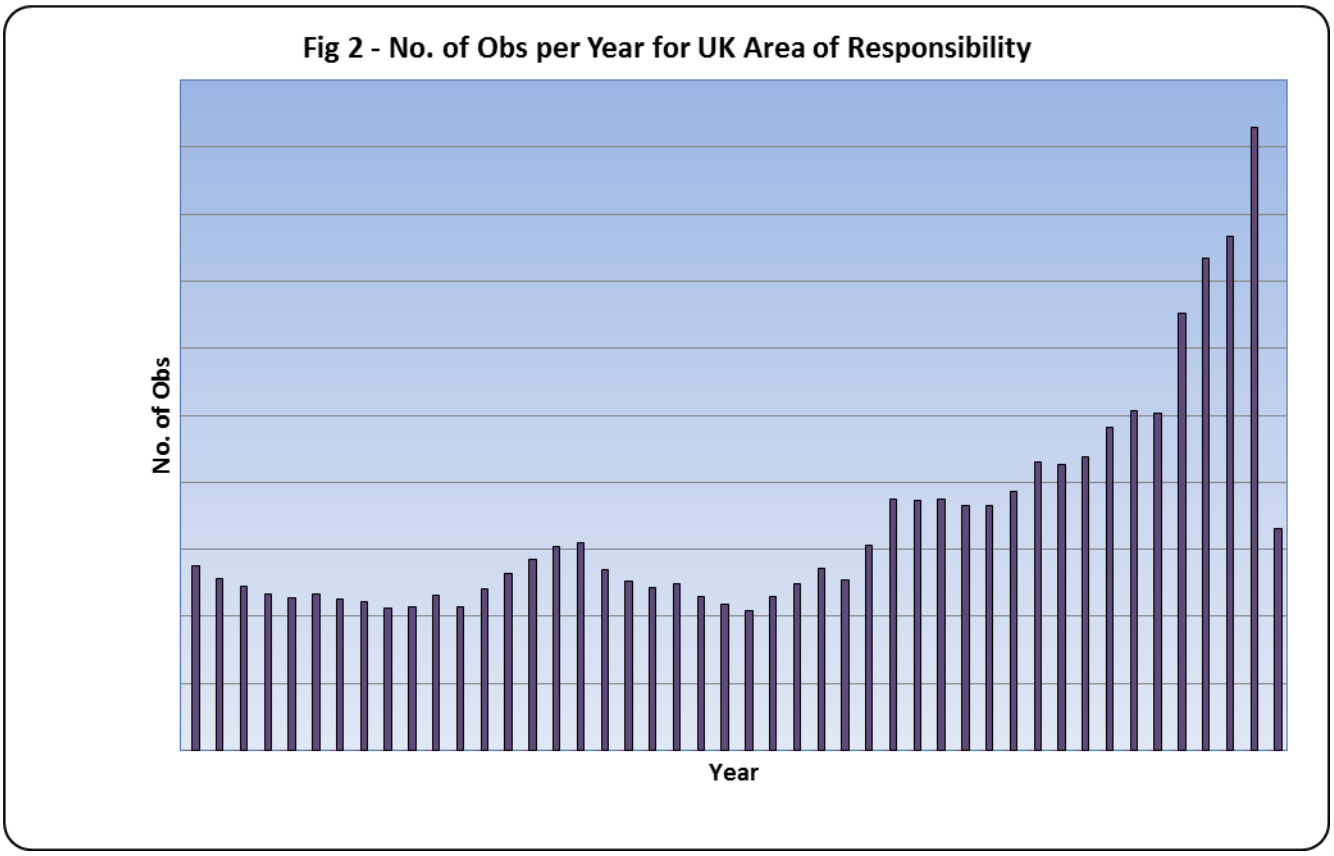
In addition to the MQCS, the UK applies a higher level of additional quality control similar to that it applies to its own data, as outlined in section 2. These checks include range, rate of change, internal consistency, climatology and position checks.

3.2 Climatological Summaries

During 2013, 2014 and 2015 there were no summary requests and as a consequence no charts were produced.

3.3 Archives

Figure 2 shows the volume of data stored in the database for the UK's area of responsibility from 1970-2015. It is assumed the significant increase in data volumes from 2011 onwards is related to the increasing number of automatic systems now reporting.



3.4 Data requests

The UK received no MCSS-related data requests during the period 2013-2015.

4. National proposal regarding the UK's foreseen role in the MCDS

The UK Met Office is heavily involved with the development of the new Marine Climate Data System (MCDS). We would like to migrate our role as CM to the role of Data Acquisition Centre (DAC), as well as moving from our GCC role to a Global Data Assembly Centre (GDAC) role for VOS data.

Indicate any additional challenge useful to report to the ETMC.

REPORT OF RESPONSIBLE MEMBER - UNITED STATES OF AMERICA

(Report submitted by Eric Freeman – Eric.Freeman@noaa.gov)

1. INTRODUCTION AND BACKGROUND

USA is one of eight responsible members for the Marine Climatological Summaries Scheme (MCSS) and is responsible for the Western Atlantic and Central/Eastern Pacific Oceans. NOAA's National Centers for Environmental Information (NCEI) is responsible for exchanges under the MCSS and questions regarding these data can be directed to:

Eric Freeman
NOAA's National Centers for Environmental Information
151 Patton Avenue, Asheville, NC 28801-5001, USA
Phone: +1 828.271.4463
Fax: +1 828.271.4022
Email: Eric.Freeman@noaa.gov.

2. ACTIVITIES OF USA AS MCSS CONTRIBUTING MEMBER (CM)

The USA provides delayed-mode observations from US Voluntary Observing Ships (VOS) to the Global Collection Centres (GCC) on a quarterly basis. These observations are primarily from a variety of e-logbook software suites, i.e. Shipboard Environmental Acquisition System (SEAS) version 9.1 (IMMT-5), TurboWin 5.0 (IMMT-4), and TurboWin+ (IMMT-5). The data are quality controlled using MQCS-7 standards.

Due to NOAA's paperless initiative, digitization of paper logbook forms from US VOS ships ceased on 31 December 2012. Since then, NOAA has been transitioning from paper forms to digital submissions using internationally-accepted e-logbook software packages. Additionally, SEAS (versions prior to 9.1) were not IMMT compliant and therefore the observations were not shared with the GCCs. Errors in the SEAS software were also detected by the International Comprehensive Ocean Atmosphere Data Set (ICOADS) and the data considered erroneous. The US VOS is in the process of fully transitioning all vessels to using TurboWin.

Below is a summary on the number of observations provided by the US as CM to the MCSS since 2013. Note – many months are blank due to the transition from paper to internationally approved e-logbook software:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
2013	112	-	1278	-	1390
2014	3125	3968	2225	2603	11921
2015	2553	-	-	-	2553

3. ACTIVITIES OF USA AS MCSS RESPONSIBLE MEMBER (RM)

3.1 Data Processing

As Responsible Member (RM) to the MCSS, NCEI receives and archives global delayed-mode files distributed by the GCCs on a quarterly basis. The files are also made available to the ICOADS for inclusion in future data set releases.

3.2 Climatological Summaries

NCEI has not produced any climatological summaries since ETMC-IV.

3.3 Archives

Marine weather observations made within and outside of the USA area of responsibility are routinely received from the GCCs and archived at NCEI.

4. National proposal regarding the USA's foreseen role in the MCDS

NCEI currently serves as the Data Assembly Centre (DAC) for the Voluntary Observing Ship Climate Fleet (VOSClim). NCEI will investigate additional participation in the MCDS, possibly as DAC for US delayed-mode data as well as global, real-time marine data collected from the GTS.

ANNEX VIII

PROPOSED NEW VERSION OF CHAPTER 5 OF WMO NO. 558, MANUAL ON MARINE METEOROLOGICAL SERVICES

LEAD AUTHOR – ERIC FREEMAN (USA)

MAXIMUM NUMBER OF WORDS: 6000

DEFINITIONS

5. MARINE CLIMATOLOGY

5.1 Introduction

5.1.1 General purpose of marine climatology and societal applications

5.1.2 Modernization of the MCSS

5.1.3 Introduction of MCDS

5.1.4 Other marine climatology activities

5.2 MCDS

5.2.1 Overview of Structure

5.2.2 Schematic Diagram

5.2.3 Generic Roles & Responsibilities – DAC/GDAC/CMOC

5.2.4 Designation and evaluation process

5.2.5 Quality Management

5.2.6 Metadata

5.2.7 Data rescue

5.3 Marine Climatology Products

Appendix 5.1 MCDS Centres (scope, designation, and evaluation)

1. Scope and governance
2. Data Assembly Centres (DACs)
3. Global Data Assembly Centres (GDACs)
4. Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs)

ANNEX IX

NEW VERSION OF CHAPTER 5, MARINE CLIMATOLOGY OF WMO NO. 471, GUIDE TO MARINE METEOROLOGICAL SERVICES

LEAD AUTHOR – ERIC FREEMAN (USA)

MAXIMUM NUMBER OF WORDS: 14000

DEFINITIONS

3. MARINE CLIMATOLOGY

3.1 Introduction

3.1.1 General purpose of marine climatology and societal applications

3.1.2 Modernization of the MCSS

3.1.3 Introduction of MCDS

3.1.4 Other marine climatology activities

3.2 Best Practices

3.2.1 General guidance

3.2.1.1 Retaining the original data

3.2.1.2 High-resolution, and high-accuracy data

3.2.2 General guidance on the application of quality control and monitoring

3.2.3 Metadata: Observational & Discovery

3.2.4 Data rescue

3.2.5 Elimination of duplicates and tracking data provenance

3.3 MCDS

3.3.2 Ship Observations

3.3.3 Data Buoys

3.3.4 Rigs, Platforms, and Coastal Stations – High Resolution data

3.3.5 Ocean data

3.3.6 CMOC and other related activities

3.3.6.1 Data formats for storage

3.3.6.2 Access to Data

3.3.6.3 Products

Appendix 3.1 MCDS Centres (scope, designation, and evaluation)

1. Introduction
2. Data Assembly Centres (DACs)
3. Global Data Assembly Centres (GDACs)
4. Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs)

Appendix 3.2 MCDS Standards

1. Introduction
3. MQCS

ANNEX X

POTENTIAL CONTRIBUTING DATA TYPES TO THE MARINE CLIMATE DATA SYSTEM (MCDS)

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

Data type	*Panel*	*Contact point(s)*	*Effort*[1]	*Existing RT source*	*Existing DM source*	*DAC*	*GDAC*	*CMOC*
VOS	VOSP[2]	Eric.Freeman@noaa.gov Lydia.Gates@dwd.de	Underway/2012	GTS/FM-13 SHIP GTS/FM-94 BUFR	PMOs[3]	RT[4]: GCCs[5] DM[6]: CMs[7]	GCCs[5]/IMMT	ICOADS[8] NODCs[9] RMs[10]
SAMOS / Underway marine MET and surface ocean data[11]	None, but SAMOS collaborates with JCOMM SOT	smith@coaps.fsu.edu	Moderate	SAMOS 1.0 (custom ASCII format)	Research Vessel operators	Florida State University		ICOADS[8] NODC[9]
Surface underway T&S	GOSUD[12]	loic.petit.de.la.villeon@ifremer.fr	Moderate	GTS/FM-62 TRACKOB GTS/FM-94 BUFR	GOSUD[12] PIs	GOSUD[12] Participants	GOSUD GDAC[13]/netCDF	ICOADS[8] WDCs[14] WOA[15] ? WOD[16] NODCs[9]
Upper Ocean T&S	GTSPP[17]	charles.sun@noaa.gov	Moderate	GTS/FM-63 BATHY	GTSPP[17] PIs	RT[4]: ISDM[18] DM[6]: GTSPP[17] DACs	US-NODC/ netCDF	WDCs[14], WOA[15] WOD[16] NODCs[9]
Argo	AST[19]	sylvie.pouliquen@ifremer.fr Susan.Wijffels@csiro.au	Moderate	GTS/FM-64 TESAC GTS/FM-94 BUFR Argo PIs	Argo/NetCDF	Argo national DACs[20] ARCs[21]	Argo GDACs[22]/netCDF Argo GADR[23]	WDCs[14], WOA[15] WOD[16] NODCs[9]
Drifters	DBCP[24]/GDP[25]	Sylvain.deMargerie@dfo-mpo.gc.ca rick.lumpkin@noaa.gov	Underway/2012	GTS/FM-18 BUOY GTS/FM-94 BUFR	Service Argos	RT[4]: SOC/DB[26] DM[6]: GDP[25] DAC [27] & SOC/DB[26]	RNODC/DB [28] (Canada)	ICOADS[8] NODCs[9,] WOD[16] (th. chains only)
Meteorological Moored Buoys	DBCP[24]	jean.rolland@meteo.fr	To be discussed	GTS/FM-13 SHIP GTS/FM-94 BUFR	NMHSs[29]	To be decided	To be decided	ICOADS[8] NODCs[9] ?
Global Tropical	DBCP[24]/TIP[30]	paul.freitag@noaa.gov	Moderate	Surface data &	Sub-surface	???	TAO GDACs[32]	ICOADS[8]

Data type	*Panel*	*Contact point(s)*	*Effort*[1]	*Existing RT source*	*Existing DM source*	*DAC*	*GDAC*	*CMOC*
Moored Buoys Array (GTMBA)				T profiles GTS/FM-18 BUOY GTS/FM-94 BUFR	data TAO[31] PIs			WDCs[14] WOA[15] WOD[16] NODCs[9]
Ocean Reference Sites	OceanSITEs[33]	richard.crout@noaa.gov sylvie.pouliquen@ifremer.fr	Moderate	GTS/FM-18 BUOY GTS/FM-94 BUFR	OceanSITEs[33] PIs	DACs	OceanSITEs[33] GDACs[34]/netCDF	ICOADS[8] WDCs[14] WOA[15] WOD[16] NODCs[9]
Tide gauges	GLOSS[35]	Torkild Aarup t.aarup@unesco.org psmsl@noc.ac.uk	To be discussed		GLOSS[35] PIs	National Centres	- DM[6]: PSMSL[36] & UHSLC[37] JASL[38] - RT[4]: VLIZ[39]& UHSLC[37] - HF[40]: BODC[41] & UHSLC[37] - GNSS[42]: TIGA[43]	ICOADS[8] ? NODCs[9] ?
Tsunameters	DBCP[24]/ITP[44]	Richard Bouchard richard.bouchard@noaa.gov	To be discussed	GTS/FM-94 BUFR FTP/FM-94 BUFR	USA (15sec data by FTP)	Regional Tsunami Watch Centres (input from Australia, Chile, Russia, Thailand, USA) India/FTP	NDBC provides global visual interface	ICOADS[8] ? NODCs[9]
Gliders	None	TBD	Important	Miscellaneous	Miscellaneous	To be discussed	To be discussed	NODCs[9] WOD[16]
High Resolution SST data from satellites	GHRSST[45]	Silvia Bragaglia-Pike s.bragagliapike@reading.ac.uk	Moderate	Space agencies GTS/Multiple sources for *in situ* data	Space agencies	RDACs[46]	GHRSST GDAC[47] GHRSST LTSRF[48]	WDCs[14], NODCs[9]

1: Effort needed to have the considered data contribute to the MCDS
2: VOSP: Ship Observations Team (SOT) Voluntary Observing Ship's Scheme (VOS) Panel
3: PMOs: Port Meteorological Officers
4: RT: Real-Time
5: GCCs: Marine Climatological Summaries Scheme (MCSS) Global Collecting Centres (UK, Germany)
6: DM: Delayed Mode
7: CMs: Marine Climatological Summaries Scheme (MCSS) Contributing Members
8: ICOADS: International Comprehensive Ocean-Atmosphere Data set (NOAA [USA], NCAR [USA] and International Partners [UK, Germany])
9: NODCs: International Oceanographic Data and Information Exchange (IODE) National Oceanographic Data Centres
10: RMs: Marine Climatological Summaries Scheme (MCSS) Responsible Members
11 Beyond standard VOS; flow water system; can be more than T & S
12: GOSUD: Global Ocean Surface Underway Data Project
13: GOSUD GDAC: Global Data Assembly Centre (Coriolis, France)
14: WDCs: World Data Centres for Oceanography (National Oceanographic Data Centres of USA, Russia, China)
15: WOA: World Ocean Atlas (National Oceanographic Data Centre, USA)
16: WOD: World Ocean Database (National Centers for Environmental Information, USA)
17: GTSPP: Global Temperature and Salinity Profile Programme
18: ISDM: Integrated Science Data Management (Canada)
19: AST: Argo Steering Team
20: Argo DACs: Data Assembly Centres
21: ARCs: Argo Regional Centres
22: Argo GDACs: Global Data Assembly Centres: FNMOC (USA) and Coriolis (France)
23: GADR: Global Argo Data Repository (National Oceanographic Data Centre, USA)
24: DBCP: Data Buoy Cooperation Panel
25: GDP: Global Drifter Programme
26: SOC/DB: JCOMM Specialized Oceanography Centre for Drifting Buoys (Météo France)
27: GDP DAC: Global Drifter Programme (GDP) Drifter Data Assembly Centre (NOAA/AOML, USA)
28: RNODC/DB: JCOMM-IODE Responsible Oceanography Data Centre for Drifting Buoys (ISDM, Canada)
29: NMHSs: National Meteorological and Hydrological Services
30: TIP: Tropical Moored Buoy Implementation Panel
31: TAO: Tropical Atmosphere Ocean Array of moored buoys
32: TAO GDACs: NDBC (USA) for TAO, PMEL (USA) for ATLAS & sub-surface sites in PIRATA & RAMA, JAMSTEC (Japan) for TRITON and sub-surface sites in tropical Pacific and Indian oceans; NIOT (India) for 3 subsurface sites in RAMA, FIO (China) for the Bai Long and sub-surface mooring in RAMA. PMEL collects all real time data and most of the delayed mode data from the various moorings and delivers them from PMEL web site, http://www.pmel.noaa.gov/tao/disdel/disdel.html. NDBC, JAMSTEC, NIO and FIO each have their own data centers containing data from the subset of moorings which they operate. PMEL's QC procedures are available at http://www.pmel.noaa.gov/tao/proj_over/qc.html. The other data centers have adopted procedures patterned after PMEL's. A number of data formats are available including ASCII and NetCDF.
33: OceanSITEs: OCEAN Sustained Interdisciplinary Timeseries Environment observation System
34: OceanSITEs GDACs: Global Data Assembly Centree (Coriolis-France, and NOAA/NDBC-USA)
35: GLOSS: Global Sea Level Observing System
36: PSMSL: Permanent Service for Mean Sea Level (National Oceanography Centre, Liverpool, UK) – receiving mean delayed mode monthly QC'ed data
37: UHSLC: University of Hawaii Sea Level Centre (USA) - The UHSLC together with the BODC (UK) are receiving higher frequency (hourly or better; delayed mode to near real-tie) sea level data for GLOSS. The UHSLC together with VLIZ (Belgium) are collecting real-time sea level data via the GTS
38: JASL: UHSLC (USA) Joint Archive for Sea Level
39: VLIZ: Flanders Marine Institute (Belgium) – The VLIZ together with the UHSLC (USA) is collecting real-time sea level data via the GTS

40: HF: High Frequency data
41: BODC: British Ocean Data Centre (UK) – The BODC together with the UHSLC (USA) are receiving higher frequency (hourly or better; delayed mod
42: GNSS: Geo-Referenced station using Global Navigation Satellite System (e.g. GPS)
43: TIGA: Continuous GNSS/GPS data to Tide Gauge Benchmark Monitoring data centre
44: ITP: International Tsunameter Partnership
45: GHRSST: Group for High Resolution SST
46: RDACs: GHRSST Regional Data Assembly Centres
47: GDAC: GHRSST Global Data Assembly Centre (NASA, USA)
48: LTSRF: GHRSST Long Term Stewardship and Reanalysis Facility (US NODC)

ANNEX XI

UPDATED TABLE OF MAJOR INTERNATIONAL DATA RESCUE ACTIVITIES

(Note: After similar ETMC-4 (2012) table)

Table A. Overview of major national and international data (and metadata) rescue activities closely related to marine meteorology and oceanography.

Acronym	*Project URL*	*Activity (nationality)*	*Status notes/references*
ACRE	http://www.met-acre.org	Atmospheric Circulation Reconstructions over the Earth (international)	ACRE both undertakes and facilitates the recovery of historical instrumental surface terrestrial and marine global weather observations to underpin 3D weather reconstructions spanning the last 200-250 years for climate applications and impacts needs worldwide (see Allan et al. 2011, Williamson et al. 2015).
ARCdoc	https://arcdoc.wordpress.com/about/	Arctic climate change 1750-1850: new insights from historical documents	A collaboration between U. Sunderland, Scott Polar Research Institute, U. Cambridge, U. Hull and the UK Met Office/Hadley Centre, previously funded by the Leverhulme Trust. Data rescue activities included Canadian Hudson's Bay Co. Logbooks (https://arcdoc.wordpress.com/category/hudsons-bay-company/) and whaling logbooks.
ERA-CLIM2	http://www.era-clim.eu/ERA-CLIM2/	European Reanalysis of Global Climate Observations ERA-CLIM2 (WP3; Earth Obs.)	See Stickler et al. (2014).
EV2	https://www.ncdc.noaa.gov/EdadsV2/	Environmental Document Access and Display System, Version 2 (EV2) (USA)	"The vast majority of the images scanned under CDMP are accessible through the NCDC-developed Environmental Document Access and Display System, Version 2 (EV2) application. Access to EV2 is available to United States government employees and their contractors, educational institutions doing environmental research, and other researchers associated with NOAA projects."
GODAR and WOD	http://www.nodc.noaa.gov/General/NODC-dataexch/NODC-godar.html	Global Oceanographic Data Archaeology and Rescue (GODAR) and the World Ocean Database (WOD) Project* (IOC/IODE)	"The international oceanographic community has had a long history of exchanging oceanographic data that begins with the founding of the International Council for Exploration of the Sea (ICES) in 1902 and the publication of ICES-related oceanographic profile and plankton data in 1907.[…] In December 1992, NODC/ WDC presented a proposal for the Global Oceanographic Data Archaeology and Rescue (GODAR) Projectat the 14th Session of the Committee on International Oceanographic Data and Information Exchange (IODE) where it was approved.. […] In recognition of the success by the GODAR project, a proposal was presented at the 16th Session of the IODE, which was held in Lisbon, Portugal, in October-November 2000, to establish the World Ocean Database Project."
HISKLIM	http://www.knmi.nl/research/climate_services/hisklim.html	HIStorical CLIMate (Netherlands)	The objective of KNMI's HISKLIM program is "to make historical climate data physically accessible for both land and sea, from

			sources in the Dutch language, with the highest possible temporal resolution and of the best possible quality. The project started at the beginning of the year 2000 with a term of 5 to 10 years."
HISTOR	ww.dwd.de	Digitization of historical navigation logbooks and meteorological ship journals, etc. (Germany)	See Kaspar et al. (2015).
OceanDocs	http://www.oceandocs.org/handle/1834/5101	Infrastructure provided by the Intergovernmental Oceanographic Commission (IOC)	OceanDocs is supported by IOC to "…collect, preserve and facilitate discovery and access to all research output from members of the ocean research and observation community and specifically their Ocean Data and Information Networks (ODINS)." While several early editions of the US *Manual of Marine Meteorological Observations* (1906-59) has been installed (by E. Kent) at this location, decisions are needed whether this is the best approach for hosting additional historical publications, etc. In particular, more authoritative advice appears needed on national/international copyright issues, to avoid inadvertently infringing copyright.
oldWeather	http://www.oldweather.org	One of a suite of projects produced, maintained and developed by the Citizen Science Alliance (http://www.citizenscience alliance.org) and accessible on-line through Zooniverse (https://www.zooniverse.org) (international)	Since oldWeather began in 2010, ~16K volunteers transcribed 1.6M weather observations from British Royal Navy (World War I-era; ~1914-23) logbooks (see Wilkerson et al. 2012). More recently, oldWeather has been digitizing Arctic area logbooks from the US National Archives (Showstack, 2012).
RECLAIM	http://icoads.noaa.gov/reclaim/	RECovery of Logbooks And International Marine data (international)	See Wilkerson et al. (2011) and Woodruff et al. (2012). As this activity was formerly largely CDMP-funded, new development work has slowed since around early 2010 but is continuing at a reduced level, e.g. with a southern ocean regional focus in association with ACRE.
Weather Detective	http://www.weatherdetective.net.au/	Citizen-science based logbook keying initiative (Australia)	From Freeman et al. (2016): "Inspired by oldWeather, the Australian Broadcasting Corporation and the University of South Queensland set up the Weather Detective project, to transcribe abstract logs collected by the Queensland climatologist Clement Wragge towards the end of the nineteenth century. This work is ongoing, but so far, more than 11K volunteer contributors have provided more than 37K new reports covering a wide region centred on Australia."

* Note: Coordination following EMTC-3 (2010) confirmed that all profile data digitized and exchanged under GODAR are added to WOD. Thus as long as ICOADS continues to process all WOD data types, any GODAR marine near-surface meteorological data associated with the profiles will become part of ICOADS (see also Doc.6.2).

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ANNEX XII

HIGHER-LEVEL QUALITY CONTROL TOOL VALIDAT FOR MARINE METEOROLOGICAL DATA

The proposed hqc tool “validat” for marine meteorological data in the MCDS is introduced.

The following is a description of the newly developed automated HIGH QUALITY CONTROL TOOL VALIDAT for marine meteorological data in the MCDS. Compared to earlier high quality control (hqc) tools used e.g. at DWD (Deutscher Wetterdienst) for data validation, validat provides improved land/sea and course and speed checking modules, and introduces a new climatological check based on the ERA-Interim reanalysis as well as a new spatial consistency check. After each step in this modular data validation process, a new quality byte (QB) is assigned.

The data validation tool validat is used operationally at DWD. It is planned to apply validat to the entire set of data archived at the Global Collecting Centre for Marine Meteorological Observations hosted by DWD in Hamburg. Validat is proposed to become an international standard of JCOMM (WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology). It is currently being tested and expanded to comply with the special characteristics of observations such as historical data from the overseas stations and signal stations of the German Marine Observatory and for high-frequency measurements from the FINO offshore research platforms. The system is also being tested for international use with a view to apply it to the quality control in the MCDS and of global marine meteorological data sets such as the ICOADS data set.

The aim of data validation is to identify erroneous data and to flag the data by means of quality bytes. Erroneous data may result from instrument errors, reading errors or errors that occur during the coding or data entry process or during data transmission. The data validation checks are carried out to identify as many errors as possible while as few as possible correct data are wrongly flagged as erroneous. The original record is preserved because new data that becomes available at a later stage – e.g. as a result of the digitisation of historical data records - might confirm the accuracy of a value which was flagged as erroneous at an earlier stage.

Since 1997, quality control of marine meteorological data has been performed at the DWD's Marine Meteorological Office using the hqc software. The following data values are verified: clouds, visibility, wind speed, wind direction, air temperature, dew point, relative humidity, air pressure, weather, water temperature, waves (sea and swell), air pressure change, course and speed, wet-bulb temperature, position, and date and time. Precipitation is only checked for formal compliance.

Before being forwarded to the Global Collecting Centres (GCC), all non-real-time data received at the DWD's Port Meteorological Office are subjected to an internationally standardised minimum quality control check (mqc). First, the group of year/month/day/time data, the geographic coordinates as well as all marine meteorological data have to pass a formal check (range check) as well as a check for internal consistency.

The data collected by ships and buoys are exchanged in real time via the Global Telecommunication System of World Meteorological Organization (WMO).
The international exchange of non-real-time data is based on the International Maritime Meteorological Tape format (currently valid versions: IMMT-4 andand IMMT-5). The data are made available by the Port Meteorological Offices or by other national meteorological services within the framework of international exchange of data among GCCs and other institutions. The data have at least passed the mqc checks and are flagged with quality bytes (0–9).

Both data sets, real time and non-real time, are held in the archives of the DWD Centre for Marine Meteorological Observations in Hamburg and is accessible in the German WMO Information System (WIS) GISC. All data exchanged are collected in the International Comprehensive Ocean Atmosphere Data Set (ICOADS) of NOAA (National Oceanic and Atmospheric Administration) [http://icoads.noaa.gov], using the International Marine Meteorological Archive format (IMMA),

which includes annexed information on data quality as well as historical elements or analysis results.

Validat is written in Fortran 90/95 and is subdivided into separate modules. The marine-meteorological elements to be checked with validat and parameter ranges are defined in an external configuration file.

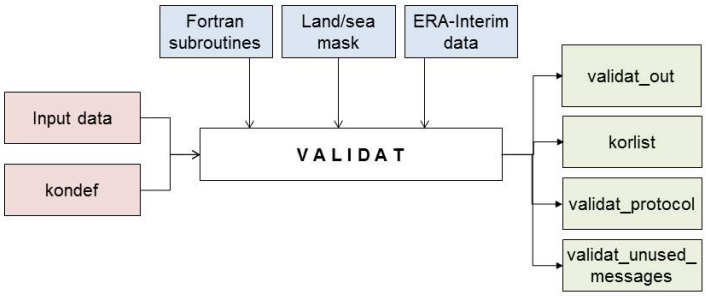

Fig. 1: Sequence of data validation checks in validat.

All input data is required in a column-based integer format. Position and units of measurements of the elements as well as the quality bytes are given in the configuration file. During the validation process, ships, buoys and platforms are allocated their call sign/identifier which comes with the FM13-coded report and must be included in the input file.

The software executes the following sequence of checks:

- Formal check
- Land/water check
- Course and speed check
- Climatological check
- Chronological check
- Repetition check
- Internal consistency check
- Spatial consistency check.

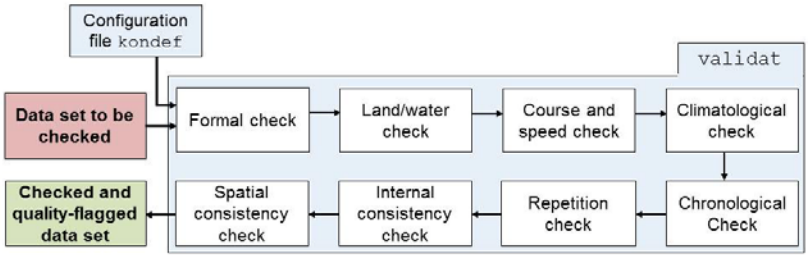

Fig. 2: Schematic representation of the data validation process.

1. Formal check

The first step in the validation process is to check the data for any forbidden characters (all values must be integer).

2. Land/water check

The land/water check serves to verify whether the ship's position is at sea, and not on land. Being part of the climatological check, it produces no quality byte of its own. It is based on the global land/sea mask developed by DWD's data validation team.
The land/sea mask makes it possible to verify the coordinates of the reporting station at a resolution of 0.01°. Graded values between 0 and 1 are assigned to coastal areas, depending on the amount of land. The land/sea mask also takes account of navigable rivers and lakes (Fig. 3).

Fig. 3: Global land/sea mask. The areas to be examined are gridded at a resolution of 0.01°. Account is also taken of the distribution of land, sea and coastal area as well as of navigable rivers and lakes (shown here for the Amazon (zoom)).

3. Course and speed check

The course and speed is checked by computing the moving platform (e.g. ship) average speed based on the changes in the geographic position between observational times. This check is part of the chronological check and also produces no quality byte of its own.

4. Climatological check

Previous methods relied on the climatological range limits resulting from the marine meteorological data available for the oceanic region in question. The monthly extremes were determined on the basis of averages and standard deviations. This method, however, has its limits in data-sparse areas. The climatological check of validat is based on monthly minimum and maximum extreme values of the 30-year climatology of the ERA-Interim reanalysis re-gridded to a uniform 1°x1°grid. The absolute climatological minimum and maximum values were determined monthly for each grid point over the whole period of 1981–2010. As the 6-hourly data of ERA-Interim may not capture extremes that may have occurred, supplemental values were defined for each element in order to better cover the potential range of extremes. The climatological check is carried out for the elements air temperature, dew point, air pressure, water temperature, and wind speed.

5. Chronological check

Often, there are sign errors in the reports or 5 K/10 K errors, in the following referred to as outliers. It is important that such outliers are not confused with significant frontal temperature changes. Such changes may well exceed 10 K per hour and are referred to as sudden jumps.

6. Repetition check

As a next step the data is checked for repetition of values. The check serves to examine whether any of the values remains unchanged over an unusually long period of time. The number of repetitions to be tolerated is given in the configuration file.

7. Internal consistency check

The internal consistency check aims to identify any inconsistencies that might exist between the available marine meteorological observations, e.g. for the consistency of air temperature and dew point.

8. Spatial consistency check

Each element to be checked for spatial consistency must be indicated in the configuration file, specifying the radius within which neighbouring reports are taken into consideration as well as the absolute tolerance and the percentage of tolerance.

All suspected values are written to a correction list in a uniform format, together with boundary values, related elements and ship observations with diverging spatial values. After the hourly values have gone through the automated check, the flagged values can be verified manually by visual inspection of the correction list or using the additional software tool “valikor”.

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ANNEX XIII

COMPARISON OF JCOMM AND CCL ACTIVITIES CONCERNING INDICES, DATA RESCUE, AND DATA-FLOW

Tables 1 and 2 below provide information on the (i) JCOMM and CCl activities regarding indices, data rescue, and data flow, and the experts involved in such activities on both Technical. Commissions, and (ii) differences and similarities between JCOMM and CCl activities respectively.

	Indices	***Data Rescue***	***Data Flow***
JCOMM activities	Through ETCCDI for leading the components of the ETCCDI Work Plan relating to marine/ocean data management and development of marine climate indices.	Collaboration with new CMOC/China Contributions to DARE, ARCdoc, ERA-CLIM2, EV2, GODAR & WOD, HISKLIM, HISTOR, OceanDocs, OldWeather, RECLAIM, Weather Directive JCOMM wishes to participate in CCl ET-DARE R/V digital observation catalogue CMDP programme stopped.	Development of the Marine Climate Data System (MCDS)
JCOMM experts	Kevin Horsburgh (UK, Chair ETWCH) Xiaolan Wang (Canada) Scott Woodruff (USA, representing ETMC)	Eric Freeman (ETMC Chair) Scott woodruff (ETMC) Tim Boyer (TT-MCDS)	Lydia Gates (ETMC vice-Chair, Germany GCC) Fraser Cunningham (ETCM, UK GCC)
CCl activities	Through ETCCDI for leading the components of the ETCCDI Work Plan relating to atmospheric climate indices	CCl- Expert Team on Data Rescue,	**CCl/IPET-CDMP** climate Data Modernisation Programme: Development of integrated framework for enhancing the quality of climate data and provide guidance on best practices for managing data from other sources for their use in climate such as remote sensing, model and marine data. This will lead to establish a HQ-GDMFC with the contribution of other commissions and programmes.
CCl experts	Dr Albert Klein Tank, The Netherlands Co-chair , Mr Moukoba Moutoumounkata, Congo, Ms Yin Sun, China, Mr Jorge Vazquez-Aguirre, Mexico, Dr James, New Zealand	Rob Allan, UK, Nancy Westcott, USA (leader) , Meaghan Flannery, Australia (co-leader), Richard Crouthamel, USA	IPET-CDMP: Meriem Alaouri, Morocco, Guofu Wang, China, Christiana Lief, USA, William Wright, Australia (co-leader), Mithat Ekici, Turkey, Lydia Gates, Germany (JCOMM) to be confirmed.

Table 1: JCOMM and CCl activities regarding indices, data rescue, and data flow, and experts involved.

	Indices	***Data Rescue***	***Data flow***
Things specific to JCOMM	Limited resources for the activity; slow progress	Data sharing more easy ICOADS, WOD, CMOCs	Data sharing more easy Present: MCSS Under development: MCDS
Things specific to CCl	High priority for CCl	Capacity Development , International, Data Rescue Portal	CDMS specifications for NMHS Data Management and Capacity Building
Things in common	Participation in ETCCDI, Addressing requirements for Climate issues.	DARE: Workshop on climate data (INDARE, MEDARE). Workshops on Data such as CLIMAR, MARCDAT	JCOMM joined IPET-CDMP. Both data systems contribute to GFCS JCOMM proposes to contribute its MCDS to the HQ-GDMFC.

Table 2: Differences and similarities between JCOMM and CCl activities

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ACRONYM LIST

AARI	Arctic and Antarctic Research Institute (Russian Federation)
ACRE	Atmospheric Circulation Reconstructions over the Earth - http://www.met-acre.org/
AMVER	Automated Mutual-Assistance Vessel Rescue System
AmverSEAS	US electronic logbook software
AOML	NOAA Atlantic Oceanographic and Meteorological Laboratory (USA)
Argo	Argo Profiling Float Pilot Project
ASCII	American Standard Code for Information Interchange
AWS	Automatic Weather Station
BAS	British Antarctic Survey
BOM	Bureau of Meteorology (Australia)
BSIS	Baltic Sea-Ice Service (Germany)
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
CAgM	Commission for Agricultural Meteorology (WMO)
CB	Capacity-Building
CBS	Commission for Basic Systems (WMO)
CCHDO	CLIVAR and Carbon Hydrographic Data Office
CCl	Commission for Climatology (CCl)
CDM	Climate Data Management
CDMP	Climate Database Modernization Programme (USA)
Cg	Congress (WMO)
CLIMAR	JCOMM Workshop on Advances in Marine Climatology
CLIOTOP	CLimate Impacts on Oceanic TOp Predators
CLIVAR	Climate and Ocean - Variability, Predictability, and Change (WCRP)
CM	Contributing Member (of MCSS)
CMM	Former WMO Commission for Marine Meteorology
CMIP	Coupled Model Intercomparison Project
CMOC	Centres for Marine Meteorological and Oceanographic Climate Data (JCOMM)
COAPDS	Center for Ocean-Atmospheric Prediction Studies (USA)
CREX	FM 95 CREX GTS format: Character form for the Representation and EXchange of data
CSM	Former Commission for Synoptic Meteorology (WMO)
DAC	Data Acquisition Centre
DARE	Data Rescue
DB	Data Buoy
DB	Drifting Buoy
DBCP	Data Buoy Co-operation Panel (WMO-IOC)
DBMS	Data Base Management System
DMCG	Data Management Coordination Group (JCOMM)
DMPA	Data Management Programme Area (JCOMM)
DOI	Digital Object Identifier
DWD	Deutscher Wetterdienst
EC	Executive Council
ECDIS	Electronic Chart Display Information System
ECV	Essential Climate Variable (GCOS)
EIG	Economic Interest Group
ENC	Electronic Navigation Charts
EOV	Essential Ocean Variable
ESRL	Earth System Research Laboratory (NOAA)
E-SURFMAR	Operational service for Surface Marine Observations of the EUMETNET

ETCCDI	joint CLIVAR / CCl / JCOMM Expert Team on Climate Detection and Indices
ET-DARE	Expert Team on Data Rescue (CCl)
ETDMP	Expert Team on Data Management Practices (IODE-JCOMM)
ETMC	Expert Team on Marine Climatology (JCOMM)
ETSI	Expert Team on Sea Ice (JCOMM)
ETWCH	Expert Team on Waves and Coastal Hazards Forecasting Systems (JCOMM)
EUMETNET	EIG grouping of European Meteorological Services
EWDS	Extreme Wave Data Set
FTP	File Transfer Protocol
FY	Fiscal Year
GC	Grand Challenge (WCRP)
GCC	Global Collecting Centre (of MCSS)
GCOS	Global Climate Observing System (WMO, IOC, UNEP, ICSU)
GCW	Global Cryosphere Watch (WMO)
GDAC	Global Data Assembly / Acquisition Centre
GDP	Global Drifter Programme
GDSIDB	Global Digital Sea Ice Data Bank (WMO project)
GEWEX	Global Energy and Water Cycle Experiment (WCRP)
GFCS	Global Framework for Climate Services
GHRSST	Group for High-Resolution SST
GODAR	Global Oceanographic Data Archaeology and Rescue
GOOS	Global Ocean Observing System (IOC, WMO, UNEP, ICSU)
GO-SHIP	Global Ocean Ship-Based Hydrographic Investigations Programme
GOSUD	Global Ocean Surface Underway Data
GTS	Global Telecommunication System (WWW)
HISKLIM	HIStorical CLIMate (the Netherlands)
HISTOR	Digitization of historical navigation logbooks and meteorological ship journals (Germany)
HQC	Higher-level Quality Control
HQCS	Higher Level Quality Control Standard
HQGCDM	High Quality Global Climate Data Management Framework (CCl)
IBCS	Intergovernmental Board on Climate Services
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA led partnership with Germany and UK)
ICSU	International Council for Science
ICT-IOS	CBS Implementation / Coordination Team on the Integrated Observing System
ID	Identification Number
I-DARE	International Data Rescue Portal
IHO	International Hydrographic Organization
IICWG	International Ice Charting Working Group
IJClim	International Journal of Climatology
IMMA	International Maritime Meteorological Archive
IMMPC	International Maritime Meteorological Punch Card
IMMT	International Maritime Meteorological Tape
IMO	International Maritime Organization
INDARE	Indian Ocean Data Rescue initiative
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCCP	International Ocean Carbon Coordination Project
IODE	International Oceanographic Data and Information Exchange (IOC)
I-P	Instrument and Platform
IPCC	Inter-Governmental Panel on Climate Change
IPET	Inter-Programme Expert Team

IPET-CDMP	IPET on Climate Data Modernization Programme (CCl)
IPET-DRMM	IPET on Data Representation Maintenance and Monitoring (CBS)
iQuam	*In situ* SST Quality Monitor – http://www.star.nesdis.noaa.gov/sod/sst/iquam/
ISC	ICOADS Steering Committee
ISDM	Integrated Science Data Management (formerly MEDS, Canada)
ISO	International Organization for Standardization
ISTI	International Surface Temperature Initiative
IT	Information Technology
IVAD	ICOADS Value-Added Database
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM *in situ* Observations Programme Support Centre
JMA	Japan Meteorological Agency
JPL	Jet Propulsion Laboratory (NASA)
KNMI	Royal Netherlands Meteorological Institute (the Netherlands)
LOA	Letter of Agreement
M&E	Monitoring and evaluation
MAN	JCOMM Management Committee
MARCDAT	Workshop on Advances in the Use of Historical Marine Climate Data
MASK	Unique, repeating identifier. The masking identifier is assigned by the NMS that recruited the ship
MCDS	Marine Climate Data System
MCSS	Marine Climatological Summaries Scheme
MEDS	Marine Environmental Data Service (Canada, now ISDM)
MMI	Marine Metadata Interoperability
MMOP	Marine Meteorology and Oceanography Programme (WMO)
MQC	Minimum Quality Control
MQCS	Minimum Quality Control Standard
MT	Master Table
NASA	National Aeronautics and Space Administration (USA)
NCAR	National Center for Atmospheric Research (USA)
NCDC	NOAA National Climatic Data Center (USA)
NCEI	NOAA's National Centers for Environmental Information
NCEP	NOAA National Center for Environmental Prediction (USA)
NDBC	NOAA National Data Buoy Center (USA)
NetCDF	Network Common Data Format
NFP	National Focal Point
NIC	National Ice Center (USA)
NMDIS	National Marine Data and Information Service (China)
NMHS	National Meteorological and Hydrological Service
NMS	National Meteorological Service
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre (IODE)
NRT	Near-Real-Time
NSIDC	National Snow and Ice Data Center (USA)
NWS	NOAA National Weather Service (USA)
OBIS	Ocean Biogeographic Information System
OBSJMA	Electronic logbook developed by the JMA
OCG	Observations Coordination Group (JCOMM)
ODAS	Ocean Data Acquisition Systems
ODASMS	Former ODAS Metadata Service (JCOMM)
ODINAFRICA	Ocean Data and Information Network for Africa (IODE)
ODINWESTPAC	Ocean Data and Information Network for the Western Pacific
ODIP	Ocean Data Interoperability Platform

ODP	Ocean Data Portal (IODE)
ODS	Ocean Data Standards Process (IODE/JCOMM)
ODSBP	Ocean Data Standards and Best Practices Project
OGC	Open Geospatial Consortium
OOP	Ship-Of-Opportunity Programme
OOPC	Ocean Observations Panel for Physics and Climate (GCOS-GOOS-WCRP)
OPA	Observations Programme Area (JCOMM)
OPAG	Open Programme Area Group
OPAG-IOS	CBS OPAG on the Integrated Global Observing System
OSCAR	Observing Systems Capability Analysis and Review tool
PA	Programme Area (JCOMM)
PMEL	NOAA Pacific Marine Environmental Laboratory (USA)
PMO	Port Meteorological Officer
PP-WET	JCOMM Pilot Project on Wave measurement Evaluation and Test from moored buoys
PRCC	Polar Regional Climate Centre
Pub 47	WMO Publication No. 47, International List of Selected, Supplementary and Auxiliary Ships
QA	Quality Assurance
QC	Quality Control
QMF	WMO Quality Management Framework
QMS	Quality Management Systems
RCC	Regional Climate Centres
RDA	Research Data Alliance
RECLAIM	RECovery of Logbooks and International Marine data
RM	Responsible Member (of MCSS)
RMS	Root Mean Square
RNODC	Former Responsible Oceanographic Data Centre (IODE)
RNODC/DB	Former RNODC for Drifting Buoys (now GDAC for Drifting Buoys)
RRR	Rolling Review of Requirements
RV	Research Vessel
SAMOS	Shipboard Automated Meteorological and Oceanographic System Project
SC	Steering Committee
SCAR	Scientific Committee on Antarctic Research
SeaDataNET	Pan-European infrastructure for Ocean & Marine Data Management
SFSPA	JCOMM Services and Forecasting Systems Programme Area
SGSI	Sub-Group on Sea-Ice of the former CMM
SIGRID	A vector archive format for sea ice geo-referenced information and data
SKOS	Simplified Knowledge Organization System
SLP	Sea level pressure
SNDM	Sistema Nacional de Datos del Mar (Argentina)
SOA	State Oceanic Administration (China)
SOC	Former Specialized Oceanographic Centre (JCOMM) (now GDAC for Drifting Buoys)
SOOP	Ship-of-Opportunity Programme
SOOPIP	SOOP Implementation Panel (JCOMM)
SOT	Ship Observations Team (JCOMM)
SPINCAM	Southeast Pacific data and Information Network in support to Integrated Coastal Area Management
SPURS	Salinity Processes in the Upper Ocean Region Study
SSS	Sea Surface Salinity
SST	Sea-Surface Temperature
TAC	Traditional Alphanumerical Code

TAO	Tropical Atmosphere Ocean Array
TC	Technical Co-ordinator
TD	Technical Document
TDC	Table Driven Code
TT	Task Team
TT-MB	DBCP Task Team on Moored Buoys
TT-MOWIS	JCOMM Cross-cutting Task Team for Integrated Marine Meteorological and Oceanographic Services within WIS
TT-TDC	Task Team on Table Driven Codes (JCOMM)
TT-WCF	Joint CAgM-JCOMM Task Team on Weather, Climate and Fisheries
TurboWin	Electronic logbook developed by the Netherlands
UID	Unique report-level identifier
UN	United Nations
UNESCO	UN Educational, Scientific and Cultural Organization
URL	Uniform Resource Locator
USA	United States of America
VOS	Voluntary Observing Ship (JCOMM)
VOSClim	VOS Climate class of vessel
VOSP	VOS Panel
WAVEOB	FM 65 WAVEOB GTS code format: Report of spectral wave information from a sea station or from a remote platform (aircraft or satellite)
WCRP	World Climate Research Programme
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization (UN)
WOD	World Ocean Database
WWW	World Weather Watch (WMO)
XBT	Expendable Bathythermograph
XML	Extensible Markup Language

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