

SUBGROUP ON MARINE CLIMATOLOGY

Eighth Session

Asheville, NC, USA, 10 to 14 April 2000

FINAL REPORT

JCOMM Meeting Report No. 2

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. ORGANIZATION OF THE SESSION (agenda item 1)

1.1 Opening (agenda item 1.1)

1.1.1 The eighth session of the Joint WMO/IOC Technical Commission For Oceanography and Marine Meteorology (JCOMM) Subgroup on Marine Climatology (SGMC) was opened at 10.00 hrs on Monday, 10 April 2000, in a conference room of the National Climatic Data Center (NCDC, NOAA, Asheville, NC, USA), under the chairmanship of Mr Joe Elms. Mr Elms welcomed participants to the session and called on the Director of the NCDC, Mr Thomas R. Karl, to address the session.

1.1.2 Mr Karl welcomed participants to the session, to Asheville in general and to the NCDC in particular. He indicated that the NCDC had always provided support both to WMO activities, particularly climate related issues such as climate change and the work of the Intergovernmental Panel on Climate Change (IPCC). He expressed being highly impressed by the work already achieved by the Working Group and by the agenda in front of the session, containing some critical world issues that would be a challenge also to the recently formed JCOMM. He said to be certain that this session would be as successful as the CLIMAR99 workshop had been (Vancouver, Canada, September 1999). He was not able to mention all the important items to be considered, but wanted to underline the importance and absolute need to focus on the metadata issue and on the SHIP code, which if wrong, ruined the observation as a whole, observations which continued to be critical for the functioning of many other programmes. He closed by welcoming the initiative to establish a selected group of Voluntary Observing Ships (VOS) to better handle the aspects of accuracy and precision of marine observations. He reiterated his welcome to all participants wishing them a pleasant stay in Asheville and assured everybody that he and his staff would do everything possible for the session to be a most successful one.

1.1.3 The list of participants in the meeting is given in **Annex I**.

1.2 Adoption of the agenda (agenda item 1.2)

1.2.1 The subgroup adopted its agenda for the session on the basis of the provisional agenda with the addition of **agenda item 6.4: Review of global tropical cyclone data**: This then required the renumbering of agenda items 6.4 and 6.5 as new agenda items 6.5 and 6.6 respectively. The final agenda for the session is given in **Annex II**. A list of acronyms is in **Annex XV**.

1.3 Working arrangements (agenda item 1.3)

1.3.1 Under this agenda item the subgroup agreed its hours of work and other arrangements necessary for the session. The list of session documents was introduced by the Secretariat, as well as a session timetable.

2. REVIEW OF THE DECISIONS OF CMM-XII CONCERNING THE SUBGROUP ON MARINE CLIMATOLOGY (agenda item 2)

2.1 The meeting was informed that the establishment of the JCOMM had been approved by 13th WMO Congress and the 20th Intergovernmental Oceanographic Commission (IOC) Assembly, respectively in May and July 1999. JCOMM replaces the former Commission for Marine Meteorology (CMM) and the Integrated Global Ocean Services System (IGOSS) and becomes the formal reporting and coordinating mechanism for virtually all other operational ocean-related activities of the two sponsoring Organizations (including the Data Buoy Co-operation Panel (DBCP), the ASAP Panel (ASAPP) and the Global Sea-level Observing System (GLOSS)). As such, it is now the parent body, *inter alia*, for the Subgroup on Marine Climatology.

2.2 A first transition planning meeting for JCOMM took place in St Petersburg, Russian Federation, in July 1999. A report on the work of the Subgroup on Marine Climatology was presented to this meeting by the chair of the Working Group on Marine Meteorological Services, Therese Pierce. The meeting put in place a variety of transitional arrangements for JCOMM, which included: interim co-presidents to be the president of the former CMM, Johannes Guddal and chairman of the former IGOSS, Dieter Kohnke; interim management committee to include the chairs of all existing bodies which are now a part of or report to JCOMM; all existing bodies to continue their present work plans and to report on these to JCOMM-I. The meeting also initiated the process to develop detailed proposals for an integrated work plan and sub-structure for JCOMM, as well as a capacity building strategy. Final agreement on these is to be reached at a second transition planning meeting scheduled for Paris in June 2000. The first formal session of JCOMM is scheduled for 19-29 June 2001, in Iceland. A schematic for the draft proposed substructure for JCOMM is given in **Annex III**.

2.3 The meeting noted all these developments with interest. It welcomed the advent of JCOMM as a significant step in the implementation of operational oceanography, in the same sense as operational meteorology. JCOMM would, indeed be the body with prime responsibility for the international coordination, management and regulation of a comprehensive, operational ocean observing, data management and services system, to serve all ocean users, including global climate studies. The meeting therefore pledged its full support to JCOMM. In doing so, it noted with particular interest the proposals concerning the Data Management Programme Area (DMPA). It agreed that this was perhaps the key programme area for JCOMM, in particular in the context of providing a fully integrated stream of oceanographic and marine meteorological data, metadata, products, services and information to users. It was therefore important that questions relating to both the assembly and archival of oceanographic and marine meteorological data and metadata should be treated in an as integrated a way as possible, and the meeting supported the proposed draft structure for this programme area. At the same time, it agreed that there remained issues specific to particular data types, such as ship meteorological reports, which required specialist treatment. It therefore urged that this concern should be taken into account when establishing the draft terms of reference for the Expert Teams within the Data Management Programme Area.

2.4 Further relating to JCOMM, the meeting noted with interest the proposal to form an integrated Ship Observations Group, within the JCOMM Observations Programme Area, through a close association of the existing VOS Subgroup, ASAPP and the Ship of Opportunity Programme (SOOP) Implementation Panel (SOOPIP). It agreed that there were a number of issues, related for example to ship recruitment and servicing, telecommunications, etc., which were common to all three programmes. At the same time, there were considerable potential advantages in having SOOP and the Automated Shipboard Aerological Programme (ASAP) ships providing also high quality meteorological observations. The meeting recognized that there were indeed some potential advantages in this proposal, provided that the many distinct technical differences among the three observational programmes were also recognized and addressed. It therefore welcomed and supported the proposal and recommended its adoption to JCOMM-I.

3. REVIEW OF CONTRIBUTIONS AND REQUIREMENTS OF THE WORLD CLIMATE PROGRAMME AND OTHER WMO PROGRAMMES (agenda item 3)

3.1 The subgroup noted the information that the first session of the CCI/CLIVAR Joint Working Group on Climate Change Detection (Geneva, November 1999) expressed its concern about the archiving and future use of the data from automatic weather stations (AWSs), for climate change detection and climate variability studies on global and regional scales, in view of the inhomogeneities due to the use of automated sensors. The subgroup noted that this was a well-known problem also with marine data particularly with wind data, fortunately somewhat less important than expected with data from marine buoys but also of considerable concern for stations on board ships. For obvious reasons these were more difficult to maintain, with any malfunctions

taking a long time to be corrected. The subgroup agreed that this was a situation that should be carefully monitored.

3.2 The subgroup welcomed the information that a pilot project had just been initiated to replace the WMO Internet version of the Climate System Monitoring monthly Bulletin with a more interactive Access to Global CSM Products Web page.

3.3 The subgroup learned with pleasure that considerable progress had been made in implementing the Archival Climate History Survey (ARCHISS) Project, especially during 1996 and 1997 when valuable instrumental climate data were identified in the national archives of Mexico and retrieved in digital form. It noted also with pleasure that a bilateral agreement had been made between the Governments of Germany and the USA to scan and digitize more than 600 journals from the Maury collection.

4. REVIEW OF THE RECOMMENDATIONS OF VOSCLIM-I (agenda item 4)

4.1 The meeting noted with interest that the first session of the JCOMM Subgroup on the VOS (Athens, March 1999) had proposed the development of a project to establish (eventually as an operational programme) a subset of the VOS, to provide high quality data and metadata, to serve as a reference data set for air-sea flux computations, in particular in support of global climate studies. The subset would involve in particular the implementation of the recommendations of the Special VOS Observing Project for the North Atlantic (VSOP-NA) regarding VOS instrumentation, observing practices and metadata.

4.2 A first planning meeting for this project took place in Southampton, U.K., in November 1999, hosted by the Southampton Oceanography Centre. Participants included representatives of all VOS operators which had expressed provisional interest in participating, the chairman of the marine climate subgroup and representatives of the Ocean Observation Panel for Climate (OOPC). This meeting had agreed in principle to the project, as well as several specific details, a draft project document and an initial action plan. Capt. G. Mackie (U.K.) was appointed project leader, and national focal points were identified. A second project planning meeting will take place late 2000 in Asheville, USA, and implementation will begin in late 2000/early 2001. The objectives of VOSCLIM are given in **Annex IV**.

4.3 The meeting agreed that VOSCLIM is an important project for global climate studies, whose success will depend on the combined efforts of many people and institutions. These include in particular ships' officers and crew who are motivated, well trained and conscientious. In addition, it recognized that, for many studies, it might be extremely beneficial to be able to associate high quality surface meteorological observations with coincident (in space and time) upper ocean data. For these reasons, it supported the suggestion that existing SOOP ships might also be recruited to participate in this project, and urged both the project management committee and the IGOSS Ship of Opportunity Programme Implementation Panel (SOOPIP) to implement it to the extent possible.

4.4 The meeting noted with satisfaction that project implementation was proceeding according to the schedule given in the action plan in the project document. Specifically, in addition to the finalization of the project document itself, the following actions were completed or underway:

- (i) As noted above, the Data Assembly Centre (DAC) and Real Time Monitoring Centre (RTMC) had been identified, as NCDC/NOAA and the UK Met. Office, respectively;
- (ii) The proposed SHIP code changes had been submitted to the Commission for Basic Systems (CBS) expert team on codes and data representation, for review at its meeting in Geneva, 10-14 April 2000. This meeting, however, could not support any proposal for further modifications to character codes, including SHIP. Instead, it had recommended that the Character form for the Representation and EXchange of data (CREX) be implemented in the report compilation and transmission software for the project. To this end, it had prepared the necessary modification to CREX to

- include the additional data required, and also prepared the necessary CREX template, which could be used in developing the new software;
- (iii) VOS operators had been invited to formally agree to participate in the project, and several had already done so;
 - (iv) Work had begun on preparation of the reporting forms and publicity material.

4.5 With regard to the proposal to implement CREX as the real time reporting code for project ships, specifically so that the additional data required could be reported in real time, the meeting noted with concern a number of major practical difficulties associated with its implementation. These included the implementation of CREX encoders in shipboard message compilation software; the difficulties for ships' officers in dealing with CREX; and the problems for many National Meteorological Services (NMSs) in dealing with CREX messages on the Global Telecommunications System (GTS). The meeting expressed a strong preference for the real time messages from project ships to continue to be sent in SHIP code, with the additional information included only in the delayed mode data stream in International Maritime Meteorological Tape (IMMT) format. In this context, it questioned the necessity for the real time message to include the additional data, and requested the project management committee to re-examine this matter, with a view to simplifying report transmission and exchange procedures to the extent possible.

4.6 Finally, the meeting noted that, as detailed in the project document and the action plan, there are two specific action items referred to JCOMM, which in this case means the Subgroup on Marine Climatology. These are:

- (i) slightly revise the IMMT format, to include the additional information, required for the project, which is to be transmitted with each observation; details of this information are also given in **Annex IV**;
- (ii) work with the DAC and the Secretariat to design a supplement to the existing metadata catalogue (WMO-No. 47), specifically for ships participating in the project.

4.7 The meeting therefore addressed these two action items. Specifically, it requested the small team established to work on revising the IMMT format to also address the VOSclim Project requirements in this work (see report under agenda item 5.2 later). It also designated a small number of subgroup members to work with the project leader, DAC and Secretariat subsequent to the session, to develop the necessary enhancements to the ship catalogue format, to be completed in time for the second project meeting (see also report under agenda item 10). These members were Scott Woodruff and Joe Elms, with Joe Elms being task leader.

5. DATA QUALITY AND EXCHANGE (agenda item 5)

5.1 Review of quality control procedures for marine climatological data (agenda item 5.1)

5.1.1 The subgroup recalled that at CMM-XII (Havana, Cuba, 1997) the Global Collecting Centres (GCCs) proposed some revisions and clarifications to the set of minimum quality control standards (MQCS), to be applied by contributing Members prior to data submission, and which were given in the *Manual on Marine Meteorological Services*. Dr V. Wagner (Germany) had now proposed to the subgroup, on behalf of both GCCs, some additional minor revisions to the MQCS. The subgroup thanked Dr V. Wagner, for his revision of the standards and agreed both with the changes presented, mostly of an editorial nature, and with the proposal to put into use this new standard as soon as possible. The modified Annex 3.E to the *Guide to Marine Meteorological Services* is given in **Annex V**, where all corrections and modifications are indicated.

5.1.2 The subgroup also considered that the lack of a version identification for the MQCS, could have a negative effect in the data being archived, as well as in the metadata database and therefore approved the proposal that, as is done with the IMMT code, the MQCS carry an identification number, as indicated in the following table:

MQCS-I	=	Original version
MQCS-II	=	Version 2, May 1996
MQCS-III	=	Version 3, May 2000 (corrected Annex 3.E to the Guide to MMS)

5.2 Review of the IMMT and SHIP code (FM 13 - X) (agenda item 5.2)

5.2.1 The subgroup noted that new sea surface temperature sensors are being adopted for use aboard ships. The present SHIP code (FM13-X) only allows for intake, bucket, hull contact sensor and other to be reported including the positive or negative sign. The subgroup agreed on the need to review the code regarding the possible need for modifications to include other sensors and for better harmonization between the IMMT and the SHIP code.

5.2.2 The subgroup recognized that such a revision was too long a task to be undertaken during the session. It thanked Mr. F. Koek (Netherlands) for his presentation and initial evaluation of the situation. The subgroup decided that this issue should be undertaken by a small Task Group and accepted the offer of Mr V. Wagner, Mr J. Elms and Mr C. Hall with Mr F. Koek as convenor to participate in the group. The task group should also address the requirements of VOSClm, as noted in paragraph 4.7 above. The subgroup recommended to the Task Group that their proposals, to be addressed to JCOMM-I after approval of the Chairman of the SGMC, should contain no proposals for the modification of the SHIP code itself. It was recognized that CBS, particularly in view of the gradual conversion to BUFR and CREX format codes, had made it clear that proposals for changes to the existing character codes were not welcome. However, changes to existing character code tables were still acceptable, and could be implemented quickly.

5.3 Metadata of the marine ship codes (agenda item 5.3)

5.3.1 The subgroup considered the study conducted by Ms T. Manabe (Japan) to verify if all WMO publications documenting the history of the marine ship codes (i.e. SHIP code and IMMT format) are available and the feasibility of making this information available on the web.

5.3.2 Because the SHIP and International Maritime Meteorological Punch-Card (IMMPC)/IMMT codes and formats are approved through resolutions of the WMO Executive Council on the basis of recommendations by CSM/CBS and CMM, an historic table of changes was prepared based on past Executive Council (EC), CSM/CBS and CMM resolutions, recommendations and reports. In order to properly finalize this study, the subgroup agreed that it was required that:

- (a) past EC, CSM/CBS and CMM reports, and especially their Recommendations and Resolutions be digitized;
- (b) Technical Commissions develop and use systematic methods for naming titles of Recommendations;
- (c) attach key word(s) for each Recommendation and Resolution when they are digitized, allowing for the search of related subjects in Recommendations and Resolutions through the key words;
- (d) the full text of the revised "codes with notes and regulations" be included in the digitized Recommendations and Resolutions;
- (e) pages of amendments to Manual and other WMO publications indicate the date of entry into effect;
- (f) a list of the abolished FM numbers, their code, and EC Resolutions related to their amendments be included in the Manual on Codes (WMO-No.306), Section A;
- (g) code forms approved by extraordinary session of CBS (normally named FM-IX Ext. only) should also indicate the year of approval (i.e. FM-Ext (1990));
- (h) future changes to the BUFR codes be carefully and systematically recorded, so that the history of the changes can be traced;

5.3.3 The subgroup wished to thank Ms Manabe for the thorough study that was presented. It also agreed with her in that, while a substantial advance in this subject had been achieved, there were a number of tasks that remain, as follows:

- (a) It is necessary to confirm if Tables 1 and 2 in **Annex VI** are correct. It is also crucial to keep updating those tables.
- (b) All the past “code forms with notes and regulations” (extract from Manual on Codes (WMO-No.306), Section A, b. List of code forms with notes and regulations and its forerunners) and “layout for IMMT” (extract from Manual on Marine Meteorological Services (WMO-NO.558) and its forerunners) need to be digitized. Not only all the “code” changes which can be detected by change of a Roman numeral which identify the session of CSM/CBS but also all the changes in “notes” and/or “regulations” which do not affect Roman numerals after FM, need to be digitized.
- (c) The history of changes of code tables used in SHIP and IMMPC/IMMT needs to be traced and a table including the dates when the amendments come into effect and their relevant Recommendations and Resolutions;
- (d) All the code tables, not only those which are used at present and appear on Manual on Codes, Section C, b. Code tables, but those which were ever used, need to be digitized.

5.3.4 The subgroup requested the chairman to liaise with subgroup members and the Secretariat, with a view to establishing a pilot project along these lines, at least for IMMT. Finally, the subgroup agreed that efforts should continue to digitize previous versions of WMO Pub. 47, and thanked Joe Elms and Scott Woodruff for their agreement to investigate undertaking this work.

5.4 Requirements for and provision of marine climatological data and services (agenda item 5.4)

5.4.1 The subgroup considered the report prepared by Mr W.L. Chang (Hong Kong, China) on the availability and cost of accessing marine data at national web sites. It basically indicated that the “hit” rates of the search engines in locating marine data sites was low, that while on these sites the data were easy to locate, each had a different path, and that there was little, if any, information on the cost of data access.

5.4.2 The subgroup then considered recommendations on how this problem may be redressed. It agreed that the ideal of a uniform path for all sites would be difficult to achieve, but also agreed that the use of clearly identified key words would better direct search engines to marine data sites. The Secretariat representative informed the session that work was being done to update the WMO Marine Programme web page, which would contain direct links to marine sites, including those that had been identified in Mr Chang's report.

5.4.3 The subgroup also recommended that marine web sites should of course use their national language, but should do their utmost to also use English, particularly where the information provided was of international interest and could be picked up by various search engines on the Internet. Finally, the subgroup recognized that the provisions of Resolution 40 (Cg-XII) would apply in all provision of data and services.

5.5 Review and updating of the INFOCLIMA catalogue (agenda item 5.5)

5.5.1 The subgroup recalled that the purpose of the World Climate Data Programme (WCDP) is to ensure timely access to reliable climate data which are exchangeable in an acceptable format to support climate applications, impact studies and research. The provision of information about the availability of climate data is being pursued under the World Climate Programme (WCP) to meet the vast requirements of that programme. It is in this context that INFOCLIMA – The World Climate Data and Information Referral Service – was conceived as a common service of WMO Member countries, to provide information on data sources in a coordinated way. Information on data sets submitted to the WMO Secretariat by Members, international and national centres is

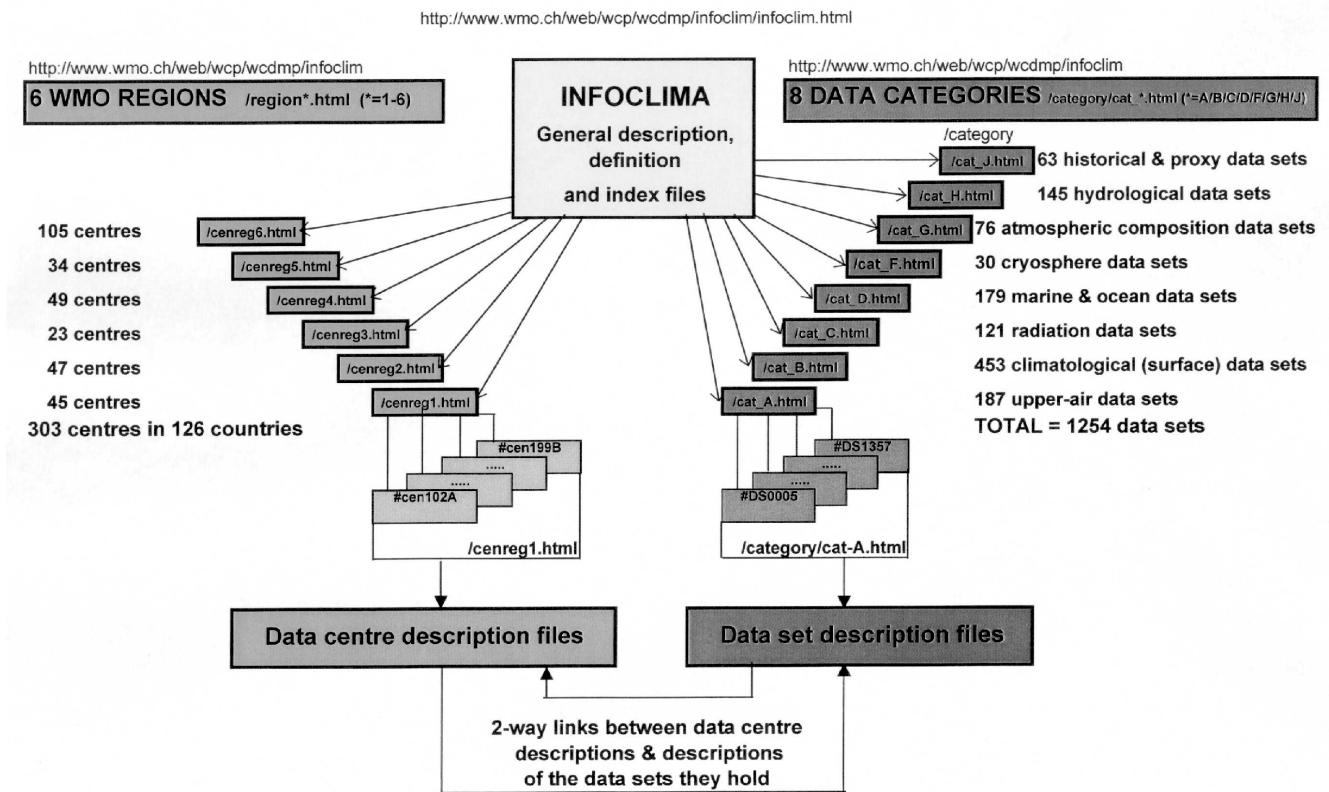
edited and entered into the INFOCLIMA database in a standardized format after verification with centres involved.

5.5.2. For practical purposes, climate system data have been divided into a number of categories. Cross-references are inserted where data sets could be included under more than one category. There are currently eight categories, and the fourth, Category D has been assigned for marine and ocean data sets. Category D, which contains 179 Marine and Ocean data sets and the 72 centres, that hold them, can be found via the WMO web page

http://www.wmo.ch/web/wcp/wcdmp/infoclim/category/cat_D.html

5.5.3 The following figure represents a schematic description of INFOCLIMA:

INFOCLIMA ON THE WORLD WIDE WEB



5.5.4 The subgroup noted the a proposal is being presented to the next WMO Executive Council, to establish closer collaboration among the World Climate Data and Monitoring Programme, World Weather Watch (WWW) and Global Climate Observing System (GCOS), with a view to providing interactive Internet access to an enlarged database listing of climate data sets that encompass the full range of climate system parameters. This would be based on the principle that *INFOCLIMA has been developed to provide information on climate data sets which are available in various services and institutions as well as in National Climate Centres and that one of the objectives of the Global Observing System Information Center (GOSIC) is to provide a registry of data sets and data products that are part of the G3OS (GOOS, GCOS and GTOS).*

5.5.5 The subgroup supported the above proposal, particularly because this opened INFOCLIMA to effect an integration with the oceanographic community, which is one of the objectives of JCOMM. In view of the subgroup's ongoing responsibility to review and, as necessary, update relevant parts of the INFOCLIMA catalogue on behalf of JCOMM, it also recommended the following actions to further activate and increase the number of data sets available in INFOCLIMA:

- (i) to place a hit counter in the web pages that give access to the catalogue in order to monitor its use and accessibility;
- (ii) To request Members to establish hyperlinks from their web pages to the INFOCLIMA pages;
- (iii) The Secretariat to inform each Member of their current individual entries for their possible updating. If available, the date of the last update should also be included.

5.6 Review of the operations of the Global Collecting Centres (agenda item 5.6)

5.6.1 The subgroup recalled that the modified Marine Climatological Summaries Scheme (MCSS) has been in operation since January 1994 (see **Annex VII**). GCC representatives provided a summary of the data received at the GCCs since then and indicated several of the reasons for a general decrease in the amount of data received.

5.6.2 Several actions in order to improve the present situation were discussed by the subgroup, which decided to recommend the following actions:

- (i) To urge all Members who provide data for later processing by the Responsible Members and the GCCs (i.e. all recruiting countries listed in WMO Pub. 47) to submit their data holdings to the MCSS;
- (ii) That in doing so, Members should provide all the elements allowed in the IMMT-I format;
- (iii) To request Members that during the implementation of the initial QC procedures, to do their utmost to correct the data rather than simply flagging it. In particular, it is very important to correct data such as call sign, date/time of the observation and the ship's position.

5.6.3 The issue of duplicate data was also discussed in detail by the subgroup. It was determined that the main reasons for such duplications were:

- (i) Logbooks (and/or copies) from one ship are given to two services;
- (ii) Incorrect use of the country code which identifies the country recruiting the ship;
- (iii) Extraction of ship observations from the GTS by one country where the same observations are extracted from logbooks by another country;
- (iv) Competition between countries to recruit the same ship.

5.6.4 To reduce the number of duplicate ship observations submitted to the GCCs, the subgroup made the following recommendations:

- (a) Contributing Members (CMs) should only provide data from their own recruited ships;
- (b) WMO should extract from WMO Pub 47 a list of all ships (by call sign) and their recruiting countries. By using this list, CMs are requested to ensure that data from any one ship are returned to only one country; and
- (c) Members should update WMO Pub 47 as frequently as possible and include all ships recruited by them, independently of the flag the ship navigates under.

5.7 Review of wind speeds reporting methods (agenda item 5.7)

5.7.1 The subgroup recalled the recent requirements made by Regional Association VI that all wind speeds be reported in meters per second. It agreed that this practice may introduce a bias into the wind speed climatological record and could also affect other RAs who are using Turbo 1 / Turbo Win or similar software.

5.7.2 In addition to the above, the subgroup agreed that the coding and recording of wind speed in m/s may cause:

- Disarray in the everyday recording and coding of meteorological observations on board of the ships, especially at the beginning of the implementation phase;
- Errors in the recording of the observation that may be difficult to correct (i.e. if no other ships are reporting in the vicinity);
- Systematic errors in archived climatological wind speed data due to the use of simplified methods of unit conversion and overestimation of values due to rounding procedures. Such practices might affect the results of climatic studies, i.e. on climate variability and climate change;
- Loss of data resolution by using m/s instead of knots, which is particularly important for operational forecasting models as well as for climate studies.

5.7.3 The subgroup also recognized that there exists a long tradition in the marine community for using non-metric units when making meteorological observations, like knots and the Beaufort wind force scale, both in observing and forecasting procedures.

5.7.4 The subgroup agreed that a solid list of arguments for the continuation in the use of knots as unit for wind speed in reporting from ships should be prepared for presentation to JCOMM-I. It accepted the kind offer of Dr. M. Mietus (Poland) to prepare such arguments.

6. DATA ARCHIVAL (agenda item 6)

6.1 Development of a comprehensive metadata database for ODAS (agenda item 6.1)

6.1.1 The subgroup recalled that it had been requested by CMM-XII (Havana, March 1997) to consider the development of a comprehensive metadata-base for Ocean Data Acquisition System (ODAS), including moored and drifting buoys, offshore platforms, etc. The Commission had requested that the Subgroup undertake a feasibility study for the project and, if that proved satisfactory, to proceed to implement it, in cooperation with the Secretariat, the DBCP, the IOC and interested Members.

6.1.2 The subgroup reviewed for content and structure a draft format (fourth version, **Annex VIII**) presented by Mr J. Elms (USA). After making some suggestions and minor modifications the subgroup recommended that this amended fourth version be circulated to members of the DBCP as well as to other national buoy centres and interested Members for additional comments.

6.1.3 The need for such metadata database received strong support from the subgroup, which expressed the hope that the project should be operational as soon as possible. It also recognized that, once all interested participants, institutions and organizations agreed with the final content and format, it will be necessary to find an appropriate centre to host the database. The administrators of such a centre would also have to agree to maintain and update the database.

6.2 Archival of WAVEOB data (agenda item 6.2)

6.2.1 The subgroup noted that there is already a significant amount of observed wave spectral data in circulation on the GTS in the FM 65-IX WAVEOB code and that this amount is likely to increase substantially in the future, not only with moored buoys as the main source but also from remote platforms such as aircraft or satellites. It was further noted that although a number of national agencies maintain archives of such data in a higher resolution format, no internationally agreed procedures and/or centres exist to undertake such archival on a global or regional basis, or to make the data available to users in accepted ways.

6.2.2 In view of the above, the subgroup considered that a pilot project should be undertaken in order to find out in a realistic manner the number of countries reporting such data via the GTS as well as its volume. Based on the results of the project, which should last for approximately one year, the subgroup would then re-examine this question with a view to determine if the users should contact individual providers to obtain the higher resolution information or if the data should

be archived in a central place. The group also requested the Secretariat to circulate a questionnaire to all members of JCOMM to enquire whether the need existed for archiving WAVEOB reports extracted from the GTS in a central location.

6.2.3 The subgroup kindly accepted the offer of Mr J. Elms (USA) to undertake the preparation of the questionnaire to be circulated by the Secretariat as soon as it is available, and for the extraction from the GTS of WAVEOB reports headed MMXX, for the period of one year. The subgroup also agreed that if sufficient information was available, a preliminary report should be prepared for consideration by JCOMM-I.

6.3 Archival of data other than in IMMT format (agenda item 6.3)

6.3.1 The subgroup was informed that, with increasing recognition of the importance of upgrading and maximizing the data available for analyses of the climate record, efforts have intensified to digitize additional historical ship data (and metadata) that exist in many national logbook collections. They are particularly focused on data during major gaps in the existing record, such as the two world wars, and adding 19th century and earlier data. At present, however, there is no effective, internationally agreed format for exchange of keyed historical data. The format needs flexibility to preserve crucial original data elements and metadata. This would help facilitate analyses of data biases and discontinuities arising from changes in instrumentation and observing practices. Moreover, the format should be expandable, to meet new requirements that are not presently anticipated, but also simple enough that it is practical to implement by Member countries.

6.3.2 The subgroup therefore considered a proposed International Maritime Meteorological Archive (IMMA) format meeting those requirements, and thanked Scott Woodruff for his work in preparing the proposal. The resulting format also has the potential flexibility to store modern marine data, and data from special projects (e.g. VOSclim). It was recalled that the IMMT-1 format was created to store contemporary marine data. As a result it lacks space for original data fields, e.g., fields whose conversion into modern units may be questionable. Other formats that were surveyed were also judged not suitable for technical or archival reasons.

6.3.3 A set of proposed "sub-record" types was outlined for the IMMA format, consisting of a "location" and "core" section, and a selection of "attachments." Each "record" consisted of the location and core sections of the format (including major climate elements common over the full period-of-record) followed optionally by one or more attachments. The historical attachment is only partly defined, but contains elements such as Beaufort wind codes and original cloud elements, and includes space for supplemental data fields (to be defined by Members). This approach was chosen since it would be impossible to predict in advance all the characteristics of early historical data. Some additional technical considerations were discussed, including the recommendation for a fixed-field rather than delimited format, and the use of blank as the uniform designation for missing data. Another important technical consideration i.e. for research applications, is the conversion of historical data elements into modern units, but needs to be accomplished by reliable and standardized methods.

6.3.4 The group agreed that, as suggested and with the input from Members, the development of a preliminary version of the IMMA format would require approximately one year. It was also agreed that it could be named, to mark its first version, IMMA-2001. The subgroup also noted that as the IMMA format is in ASCII, it may offer a solution and standardization for the Comprehensive Ocean-Atmosphere Data Set (COADS), and its blend with the UK Marine Data Bank (MDB), including improved near-real-time products.

6.3.5 Finally on this item the subgroup agreed that an updated IMMA be circulated to the eight Responsible Members for comments, a consultation process that should be ready in February 2001 for submission to JCOMM-1 (June, 2001) and possible insertion in the next version of the *Guide to MMS*.

6.4 Review of global tropical cyclone data (agenda item 6.4)

6.4.1 The subgroup was informed that the third Tropical Cyclone (TC) Regional Specialized Meteorological Centres (RSMCs) Technical Coordination Meeting, which was held at the RSMC La Réunion – Tropical Cyclone Centre from 5 to 11 November 1999, had considered a recommendation made by CMM-XI (Lisbon, April 1993) regarding possible improvements to the report format of the "Global tropical cyclone track and intensity data set". These included the inclusion of radius of tropical cyclone core and radius of maximum wind gust. It noted that the Coordination Meeting had also taken into account proposals made by the tropical cyclone research community through the International Workshop on Tropical Cyclones (IWTC)-IV (Haikou, China, April 1998). As a result, the subgroup was presented with an updated report format, which contained the following changes:

- (i) expansion and amendment of positions 1 – 10 to become 1 – 19 on cyclone identification code and name;
- (ii) positions old 39 – 41/new 48 – 50 : editorial change;
- (iii) position old 42/new 51 : provision for additional units;
- (iv) positions old 43 – 44/new 52 – 53 : editorial change;
- (v) positions new 54 – 58 and 63 – 108 : expansion (for data related to intensity, size, type);
- (vi) positions old 45 – 46/new 109 – 110 : correction (type 04);
- (vii) positions old 51 – 52/new 111 – 112 : updating and editorial changes;
- (viii) consequential changes to other position numbers, "Headings" and deletion of "expansion" positions (old 53 – 80) and foot "Note".

6.4.2 The subgroup reviewed and agreed with the updated "Report Format" which is given in **Annex IX** to this report. As proposed by the Tropical Cyclone Programme, it recommended that the appropriate mechanisms be used to obtain an early adoption of the format for possible application as from the year 2000. The subgroup also agreed that the "first level" information on tropical cyclones (i.e. information covering the tropical cyclone's present and forecast position, movement and intensity) should be provided to all users having a requirement for such information.

6.5 Review of the status of the catalogue of storm surge data holdings (agenda item 6.5)

6.5.1 The subgroup recalled that its seventh session (Geneva, April 1996) considered the preliminary results of a survey on this subject prepared by Dr E. Zaharchenko (Latvia). The results of the survey indicated that:

- there were substantial amounts of storm surge data archived in a number of countries;
- there was some interest in having a global catalogue of data holdings; and
- there was also interest in the eventual international exchange of these data, at least regionally.

6.5.2. At the same time the group had agreed to adopt the definition for "storm surge" as it appears in the International Meteorological Vocabulary (WMO No. 182) which has also been adopted by the five WMO regional tropical cyclone bodies and their members. The subgroup then adopted a draft catalogue outline, recognizing that both the structure and details of the catalogue needed to be further developed. It also considered that it would be both logical and practical if the catalogue could be incorporated or associated in some way to the INFOCLIMA catalogue.

6.5.3 The twelfth session of CMM (Havana, March 1997) supported this project and urged Members to contribute whenever possible, and accepted with appreciation the offer made by the Russian Federation for assistance of the World Data Centre-B in that work.

6.5.4 The subgroup now reconfirmed the findings produced by the survey and decided that in order to advance the project, the Chairman would write to Dr Zaharchenko and ask him for an update of the status of the catalogue. The information would also be made available to Dr Somova (Russian Federation) so that an early coordination could be made for the preparation and implementation of the catalogue, particularly if the offer for assistance made by the Russian Federation delegate at CMM-XII, namely to receive the help of the Global Data Centre-B, was to be taken up.

6.6 Results of the questionnaire on satellite-based ocean wave database (agenda item 6.6)

6.6.1 In view of the potential value of wave data holdings to global climate studies as well as to the provision of various marine services, the seventh session of the subgroup (Geneva, April-May, 1996), considered that it would be very useful if a catalogue of national, satellite-derived ocean wave databases was prepared. As a consequence a questionnaire prepared by Mr Val Swail (Canada) was circulated to CMM/JCOMM members.

6.6.2 The subgroup was informed that the response to the questionnaire was rather disappointing, but not unexpected. A total of 35 were received, of which 30 indicated that no such databases were in use by that Member. The five answers left, contained information which varied widely in level of detail and degree of coverage. The details of the databases reported, and access to them, is summarized and given in **Annex X**.

6.6.3 The subgroup agreed that even if the total information was limited it was valuable, and requested the Secretariat that those Members having answered the questionnaire be invited to provide their information to INFOCLIMA by completing and submitting the appropriate form.

7. ARCHIVAL OF OCEAN CURRENT DATA (agenda item 7)

7.1 The subgroup recognized that ocean currents may be measured by moored current meters, from the drift of ships or buoys, by acoustic doppler current profilers and, indirectly from satellite altimeter measurements. WMO codes FM 18-X (BUOY) and FM 64-IX (TESAC) allow for the reporting of currents at various depths while FM 63-IX (BATHY) and FM 62-VIII (TRACKOB) allow for the reporting of surface current. In practice few observations of ocean current are exchanged on the GTS in these codes formats at the present time. Almost all ocean current data are only available in non-real time.

7.2 The subgroup also recalled that the earliest regular observations of ocean currents were made by the measurement of a ship's set and drift, whereby the current is assumed to be equal to the vector difference between the dead reckoning position of the ship, taking due account of the wind on the ship's course, and an absolute measurement of the ship's position. Recognizing the importance of these measurements, internationally agreed procedures for the exchange and archiving of the data were proposed by the CMM Working Group on Marine Climatology in November 1977 and approved by CMM under Recommendation 20 (CMM-VII). It was also agreed that the UK Met. Office should act as the International Surface Current Data Centre (ISDC) having responsibility for the collection, quality control, archiving and exchange of ship set and drift data provided by member countries.

7.3 In the years following CMM-VII the role of the ISDC proved successful with many national centres contributing to the exchange of data. Today, the archive of data maintained at Bracknell consists of some 5m observations. However, changes have taken place in observing practices amongst the world's VOS, either as a result of manning reductions or automation of the methods of ship's navigation, which have led to a steep decline in the number of observations of ocean current by the set and drift method. In the case of the UK, VOS observations have fallen to no more than a few hundred per year having been in excess of 10,000 per year in the 1980s. At the same time the data received from other national centres has dried up completely. No ocean current data

have been sent to Bracknell as the ISCDC for about 10 years and no requests for archived data have been received for a similar period of time.

7.4 The subgroup, considering the complete decline in the role of the ISCDC, recommended that the procedures set up in Rec. 20 (CMM-VII) be discontinued and that, following consideration by JCOMM-I, the Manual and the Guide on MMS be modified accordingly. The subgroup also agreed with the proposal that the present archive of surface current data held by the UK Met. Office be copied to the World Data Centres for Oceanography to ensure completeness of their data holdings.

7.5 The Chairman, on behalf of the subgroup, of the former CMM (now JCOMM), its members and the marine meteorology community, expressed his thanks and appreciation for the considerable effort made by the staff of the UK Met. Office during more than twenty years, to create and maintain this database.

8. GUIDES AND GUIDANCE (agenda item 8)

8.1 Guide to the Applications of Marine Climatology: Results of CLIMAR99 (agenda item 8.1)

8.1.1 The subgroup recalled that, at the Twelfth Session of the CMM (Havana, Cuba, 10-20 March 1997), approval was given for WMO to organize a self-funding workshop, to serve primarily as a means for generating appropriate input to the dynamic part of the *Guide to the Applications of Marine Climatology* (WMO No. 781). Subsequently, the Government of Canada kindly offered to host the workshop, and named Mr. Val Swail to take the lead in its organization.

8.1.2 A Workshop Organizing Committee (WOC), consisting of Mr. Val Swail (Canada; Chair), Mr. Joe Elms (USA), Dr. Henry Diaz (USA) and Mr. Fernando Guzman (WMO Secretariat) was established to organize the workshop, which was named CLIMAR99 – WMO International Workshop on Advances in Marine Climatology. As a first step the Committee agreed that the workshop be scheduled to take place from 8 to 15 September 1999, in Vancouver, British Columbia, Canada.

8.1.3 The workshop was organized in conjunction with a workshop on the NOAA COADS Project. Sponsorship was obtained from WMO, NOAA's Office of Global Programs (OGP), the National Weather Service, NOAA, USA and the Meteorological Service of Canada.

8.1.4 The objectives of the workshop were defined as:

- To receive appropriate input for the dynamic part of the new version of *the WMO Guide to the Applications of Marine Climatology*, with particular emphasis on new technologies;
- To review the requirements of users for new marine climate products and enhanced climate information;
- To provide guidance and technical support for those National Meteorological Services with responsibilities under the Marine Climatological Summaries Scheme (MCSS); and
- To make a further contribution to the data and metadata of COADS.

8.1.5 A "Call for Papers" was distributed to WMO Members, and to the general marine climate community. The format of the Workshop called for selected invited presentations from experts in the respective fields. Shorter, relevant contributions were also accepted from the general scientific community. This resulted in more than 70 abstracts being submitted by experts from every Regional Association of WMO for consideration by the WOC. The final program was developed from these abstracts. The Workshop itself was a huge success, with more than 80 participants from 30 countries from all WMO Regional Associations, and generated a great deal of interest in

holding future meetings of this type. The subgroup welcomed the initiative of the Secretariat to publish the final version of all the papers both in the new JCOMM technical report series as well as in the new web page of the Marine Programme.

8.1.6 The subgroup was further informed that a subset of the papers which addressed the primary objectives of the workshop has now been identified; that these papers will be subjected to peer review, and will subsequently be published as the dynamic part of the *WMO Guide to the Applications of Marine Climatology*, hopefully before the end of the year 2000. A list of those papers is given in **Annex XI**.

8.1.7 Based on the success of CLIMAR99, the subgroup proposed that a second workshop, CLIMARxx, be held in the period prior to JCOMM-II, which is likely to take place during 2005. As for CLIMAR99, sponsors should be sought as early as possible. In the spirit of JCOMM, serious consideration should also be given to integrate the oceanographic community's interests in CLIMARxx. The subgroup also considered that a joint event with an initiative such as a future OceanObs should also be investigated.

8.2 Review of the Guide to Marine Meteorological Services in view of JCOMM (agenda item 8.2)

8.2.1 The subgroup considered the new Unedited Version of the Guide to Marine Meteorological Services on the basis of the recent establishment of JCOMM to replace CMM (see item 2 above). The subgroup carefully considered if any changes, and in particular those related to marine climatology (chapter 3), should be made to the Guide, and determined that suggested changes belonged to two categories: those of an editorial nature that could be implemented immediately so as not to delay the publishing of this version of the Guide, and those that required formal approval by JCOMM-I, as follows:

Editorial changes:

- Review the names of countries used in the text, maps and figures which may have changed since the preparation of this version of the Guide (i.e. USSR and Hong Kong);
- Change all references to CMM by JCOMM;
- Where references are made to particular magnetic media such as CD-ROMs, disks, magnetic tape, etc, to change then, in view of rapid technological advances, to a more generic term such as "computer readable media";
- Normalize the name of the Guide throughout the publication. Currently two different titles are used: "Guide to Applications..." and "Guide to the Applications....".
- To invert the order of the last two paragraphs under 3.2.4 and then move them to follow the paragraph under 3.2.3;
- 1st para. of 3.2.7: Delete: "If exchanged in magnetic tape... ..blocking factor 10";
- Under (a) of 3.2.9.1: replace "an automatic sensor" by "a sensor";
- 2nd para. of 3.3.3: delete the words "ground based";
- To improve the quality of Annex 3.B;
- Add a footnote to Annex 3.C that reads: "Blanks entered in a record represent missing data";
- 2nd para. under 2. of Annex 6.D replace: "The sea of currents..." by "The set of currents...."
- In Annex 6.H delete Monthly Bulletin, North Sea and add "Der Wetterlotse", 6, Germany, German.
- 3rd para. of 3.3.3: change "temperature at a depth of hundreds of centimetres" by "temperature from a few centimetres down to several metres";
- 2nd para of 3.4.3: replace: "Compact disk... ..CD-ROM) technology" by "modern computer technology".

Changes requiring approval by JCOMM-I

- Modify the last sentences of the first paragraph of 3.2.9.2 to indicate that while flagging data as doubtful was an accepted procedure, all efforts should be made first to correct those data;
- To delete all under 3.3.2 (see item 7 of this report). However, Annex 6.D also associated to this paragraph of the Guide, should be kept as metadata of the procedures;
- Under element 64 of Annex 3.C to add: 9 = FM 13-XI.

8.2.2 The subgroup recalled that under agenda item 5.1 it had made a review of the minimum quality control procedures currently in use. That review produced an amended Annex 3.E of the Guide (see **Annex V**). The subgroup also considered Chapter 3 as a whole, and found that many of the corrections were of an editorial nature but this was not the case for all of them. It recognized however, that all members of the group, including those with GCC responsibilities, had agreed with the proposed changes and with the requirement for their earliest possible implementation. The subgroup requested the Secretariat to find an accelerated and appropriate mechanism to include the required changes to Chapter 3 in the present edition of the Guide and which are given in **Annex XII** to this report.

8.2.3 The subgroup also noted that some examples, for Annexes 4.C, 4.D, 4.E, 4.J, 4.M, 5.A and 6.H of the Guide were missing. Several members of the subgroup offered to provide as soon as possible, relevant examples to complete the Guide.

8.3 Guide to Climatological Practices (agenda item 8.3)

8.3.1 The subgroup was provided with the status report of the revision presently being undertaken by the WMO Commission for Climatology (CCI) to produce the Third Edition of the Guide to Climatological Practices. An accelerated plan has been established to complete the Guide, and the Thirteenth WMO Congress noted the progress and urged CCI to complete the work in the near future.

8.3.2 The plan includes a series of Individual sections being drafted by a set of Lead Authors, each section being placed onto the CCI Internet Web site as soon it has been edited and approved. Comments and additional contributions on completed sections are welcome. A web-accessible facility called a "shared room" was established at an independent Internet Web site, which is being used to advance the assembly of the Guide from authors' drafts. The "shared room" is like a shared file cabinet, and is accessible only to authors and reviewers through ID and password control. At all times, authors and reviewers have access to the most current versions of the Guide chapters.

8.3.3 Following a review of the planned content of the Guide by the members of the subgroup, suggestions were made for the consideration of the CCI Guide Editorial Board (GEB). The subgroup proposed that in Part II of the Guide, and under 2.4, Statistical techniques, new sections should be established and devoted to the topics of:

- (i) "Spatial Statistical Techniques". This type of analysis is becoming more important as gridded data-bases are produced and the computer power increases. Often, these spatial statistics are those most easily related to large-scale circulation indices such as "El Niño Southern Oscillation" (ENSO), the Arctic Oscillation (AO), the North Atlantic Oscillation (NAO) and the Pacific Decadal Oscillation (PDO). The level of detail in the Guide should probably consist of a description of the various methodologies, their importance, examples of their application, and reference to detailed discussions in recent books and journal papers, e.g. Zwiers and von Storch (1999). Techniques which should be addressed include empirical orthogonal functions (EOF), canonical correlation analysis (CCA), redundancy analysis (RA) and reduced space optimal interpolation (RSOI); and

- (ii) "Statistical or Diagnostic Techniques" for studying the impact of short- and long-term climate changes. This should be a short section comprising a brief description of what the techniques (such as singular value decomposition (SVD) and singular spectral analysis (SSA)) set out to achieve; it should also indicate where the related software may be obtained as well as pertinent references.

8.3.4 The subgroup appreciated the offer made by Scott Woodruff (USA) to consult with his colleagues at the Climate Diagnostic Centre (CDC) regarding the possibility to help with topic (ii) above.

8.3.5 The subgroup also expressed its wish to be assured that in Part I of the layout of this Guide, section 1.5.1 includes marine data, section 2.4.5 includes marine metadata and that section 3.3.2 includes marine activities.

9. DEVELOPMENTS ON THE BEAUFORT EQUIVALENT SCALE (agenda item 9)

9.1 The subgroup noted with interest and appreciation a presentation by the JCOMM (formerly CMM) Rapporteur on Beaufort Equivalent Scales, Dr R. Lindau (Germany). Dr Lindau stressed that, to assess the quality of Beaufort equivalent scales, the applied driving technique is of fundamental importance. Most historical scales are based on one-sided regressions where one parameter, the Beaufort estimate or the measured wind speed, is regarded as independent. Such one-sided regressions are only suited to predict individual values. However, especially for climate study purposes, it is essential that the characteristics of entire data sets are conserved when Beaufort estimates are converted into metric wind speed. Since both parameters are subject to errors, a correct equivalent scale lies between the one-sided regressions. The scale derived by Lindau (1995) takes into account both the different error variances and the effects of the natural variability. This procedure guarantees a correct determination of the common relationship between Beaufort force and wind speed. For that reason, this scale was recommended by Dr Lindau to be used in the future for scientific purposes.

9.2 The subgroup agreed with this recommendation, at the same time emphasising that there should be no change to the scale presently recommended by WMO to be used for observations and in the archival records. In addition, the subgroup considered that the written report by Dr Lindau was a significant contribution, which would be of value to everyone concerned with global climate studies and the applications of marine climatology. It therefore agreed that the report should be published in the new Part 2 to the *Guide to the Applications of Marine Climatology*, along with the papers selected for inclusion from those presented at CLIMAR99.

10. REVIEW OF PUBLICATION WMO-No. 47 (agenda item 10)

10.1 Proposed revised specifications for database fields

10.1.1 The subgroup noted with interest a report on the status of implementation by the WMO Secretariat of the agreed new format and specifications for the ship metadata catalogue (WMO-No. 47). It welcomed the news that the fully updated catalogue, in the new format, would be online through the WMO web page in a very short time, hopefully before the end of May. It also expressed appreciation for the fact that the catalogue would include a full search facility, which would allow the rapid extraction of information on individual ships and their instrumentation. This would include a capability to extract, for example, a list of the ships equipped with specific instruments, such as hull contact sensors for SST. The meeting considered that this facility would be enhanced if this capability were extended to include combinations of instruments. The combination recommended as being of most potential value included instruments for measuring the significant variables for air-sea flux computations: wind speed, air temperature, humidity and SST. In addition, the subgroup recommended that the search engine should be able to easily

identify duplicates in the catalogue; i.e. the same ship recruited by more than one country (see 5.6.4 (c)). It also strongly supported the use of the IMO ship number as a unique ship identifier.

10.1.2 The subgroup recalled the requirement from the VOSCLim project for a special ship catalogue supplement to be developed, to include the additional metadata required by this project (see agenda item 4). It reiterated its agreement to support the project by working with the DAC and WMO Secretariat to design the supplement format, and requested the task team leader to ensure that this work was completed before the second project meeting in late 2000.

10.2 Requirements for vessel digital image data

10.2.1 The subgroup noted with interest a report on this topic by Dr Lothar Kaufeld (Germany). It agreed with Dr Kaufeld that the inclusion of such data in the ship catalogue would be very useful, in particular for those involved in climate studies. It noted that such imagery was certainly to be included in the ship catalogue supplement being prepared for the VOSCLim project, and agreed that this would provide a valuable pilot study and introduction to the eventual inclusion of such imagery for the whole VOS. The subgroup therefore recommended:

- (i) that the WMO Secretariat prepare the necessary format and entries for inclusion of vessel digital imagery in No. 47, on the basis of recommendations regarding the catalogue supplement for VOSCLim;
- (ii) that a ship side view was the preferred image, showing deck line, deck cargo and superstructure; however, several different images could be included if these were available;
- (iii) that photographic images should be obtained where possible; PMOs submitting such images should use digital cameras; if this was not possible, other images sources could be used, such as scanning of ship photographs or construction plans in shipping company catalogues or files;
- (iv) that, while VOS operators should be able to submit their imagery (for example by email) to the Secretariat in any common digital image format (e.g. .gif, .tif, .jpeg), the catalogue product should be in a single standard format, with an associated reader if appropriate.

10.2.2 The Secretariat was requested to make a formal call to VOS operators for the submission of imagery once all the necessary formats and catalogue entries had been established.

11. FUTURE ACTIVITIES (agenda item 11)

11.1 The subgroup recalled its agreement to the proposal that, in the new JCOMM substructure, its work should be integrated with oceanographic data management activities under the Expert Team on Data Assembly, within the Data Management Programme Area (see agenda item 2). In this context, it requested its chairman and the Secretariat to ensure that the existing subgroup terms of reference (see **Annex XIII**) should be incorporated into the terms of reference for the expert team as follows:

- a, b, c, e, f, and h to be included within generic terms for the expert team;
- d and g to be included specifically.

In addition, the subgroup requested that the following items also be included as activities for the new expert team:

- (i) Keep under review and encourage the use of advanced information technology in marine data management;
- (ii) Encourage and assist countries to identify, digitise and archive historical marine meteorological and oceanographic data.

11.2 The subgroup recalled that, as a result of its deliberations during the present meeting, formal recommendations were required to be prepared for adoption by JCOMM-I on the following topics:

- (a) modifications to the recommended minimum QC procedures;
- (b) modifications to the IMMT format, in particular for VOSCLim;
- (c) revisions to the *Guide to the Applications of Marine Climatology*, to include selected CLIMAR99 papers as Part 2;
- (d) the ODAS metadata format;
- (e) a format for historical data exchange and archival;
- (f) some further substantive (non-editorial) modifications to the *Guide to Marine Meteorological Services*.

The subgroup requested the chairman to liaise with group members and the Secretariat to ensure that the work to prepare the necessary information to be included in these recommendations was completed by the end of 2000 at the latest, for submission to the Secretariat for the preparation of JCOMM-I documentation.

11.3 The subgroup recalled that, in addition to these draft JCOMM recommendations, it had identified during the session a number of other actions, for subgroup members and the Secretariats, to be completed by JCOMM-I. These are listed for convenience in **Annex XIV**. In addition, it considered that an internet mailing list of subgroup members would be a valuable tool for the distribution of information and exchange of ideas and suggestions within the group. It therefore requested the Secretariat to implement such a list on the WMO server and to inform subgroup members accordingly.

12. CLOSURE OF THE SESSION (agenda item 12)

12.1 In closing the session, the chairman Joe Elms thanked all participants for their contributions to what had been a very successful meeting, both before and during the session. He noted that the subgroup had already accomplished a large part of its work plan since CMM-XII, and that it would have substantial recommendations to make to the forthcoming JCOMM-I. He recognized that the work of the subgroup would continue in the future within the new JCOMM structure, assuming even greater significance as JCOMM moved towards a fully integrated marine data management system. He concluded by wishing all participants success in the future and a safe trip home.

12.2 Speaking on behalf of all participants, the WMO Secretariat representative expressed his thanks once more to NCDC, its Director Mr T. Karl and to Joe Elms, for hosting the meeting and for providing such impressive facilities, support and hospitality. He also expressed his appreciation to the chairman for his excellent chairing of the session and for his substantial support for and work on behalf of the subgroup over many years, and expressed the hope that he would continue to support JCOMM in the future.

12.3 The eighth session of the JCOMM Subgroup on Marine Climatology closed at 1130 hours on Friday, 14 April 2000.

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