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REQUIREMENT OF AND ASSISTANCE FOR USERS

(Submitted by Dr Miroslaw Mietus, chairman of ETMC)

Summary and Purpose of Document

This document contains a report by the chairman of the Expert Team on Marine Climatology regarding requirement of and assistance for users. The report reviews the history of MCSS and gives proposals on its future development.

ACTION PROPOSED

The Expert Team on Marine Climatology is invited to:

(a) Note and comment on the information provided as appropriate;

(b) Consider the proposals given in the document;

(c) Discuss and propose next steps to be taken.

Appendix: Report on MCSS, requirements of and assistance for users (submitted by ETMC chair)

DISCUSSION

Introduction

1. At the moment, users are requested to contact relevant Responsible Member(s) to obtain marine meteorological data collected under the Marine Climatological Summaries Scheme (MCSS). The JCOMM Data Management Coordination Group (DMCG), at its first session (Paris, May 2002) pointed out that there is a lack of a “route map” for users looking for data and assistance, while at the same time the group agreed that MCSS is a developed system of marine meteorological data management with a distributed structure.

2. The chairman of the Expert Team on Marine Climatology prepared a report on this issue (Appendix), in which he reviews the MCSS and gives proposals.

Action proposed

3 The Team is invited to note and comment on the information provided as appropriate. The Team is invited to consider the proposals given by the chairman mainly in paragraph 23 in his report (Appendix) and to discuss and propose next steps to be taken.

Appendix: 1

MCSS, requirements of and assistance for users

Submitted by Professor Dr Miroslaw Mietus (Poland), chairman of the ETMC

1. Meteorological observations from merchant ships have been used to define our knowledge of the marine climate for well over 150 years. This function continues within the Voluntary Observing Ships (VOS) programme as the Marine Climatological Summaries Scheme. However, the main emphasis of the VOS programme has traditionally been the provision of data required for atmospheric weather forecasting. Nowadays, the initialization of numerical weather prediction (NWP) models remains still an important application for VOS's weather reports.

2. The international agreement concerning a formalized recording of weather observations from the seas in ships' logbooks was made at the Maritime Conference held in Brussels in 1853. Traditional logbooks were only episodically digitized and exchanged through bilateral agreements. The digitalization and exchange of digitized meteorological journals were not formalized until 1960.

3. The Commission for Marine Meteorology on its third session in 1960 made several recommendations (Rec. 22-27, CMM-III), which formalized the preparation of the marine section of the World Climatic Atlas and created the basis of nowadays existing Marine Climatological Summaries Scheme. The Fourth World Meteorological Congress in 1963 finally decided on regular publication of marine climatological summaries and designated the 1st January 1964 as the start of an agreed procedure (Res. 35, Cg-IV). By this recommendation with the aim of preparing the marine climatological summaries and of collecting data with a view to the eventual preparation of a marine characteristics, the world ocean and the seas were divided into several areas of responsibility and several countries volunteered to act as Responsible Members, i.e. being responsible for collecting digitized marine meteorological data from the area of their responsibility, for preparation of marine climatological summary and for supporting society with high quality climatological information. Nowadays there are 8 active Responsible Members: Germany; Hong Kong, China; India; Japan; Netherlands; Russian Federation; United Kingdom and USA. Congress decided that all Responsible Members should prepare annual climatological summaries for their areas of responsibility and also for a number of selected representative sub-areas within the areas of responsibility, as well as for the fixed ship stations within them. Annual summaries should be prepared for individual years of the decade 1961-70, 10-year summaries should be prepared systematically starting with the period 1961-70. The scope and layout of summaries have been defined, as well as its form of publication. All Members (Contributing Members) operating fixed ship stations, selected, supplementary and auxiliary ship stations, should ensure that all available observations from the above-mentioned stations were digitized in accordance with the layout of the International Marine Meteorological Punch-Card, sorted half-yearly and dispatched to the Responsible Members according to their areas of responsibility.

4. The above system developed in the course of time. Several important changes have been introduced taking into account changing boundary conditions, e.g. technological progress etc.

5. Considering the increasing importance of the global marine data collection in support of global climate monitoring, research and prediction, the need to improve the timeliness and efficiency in data collection and archiving, the need to ensure uniform Minimum Quality Control Standards (MQCS) and finally to improve an appropriate backup of data collection and exchange procedures as well as to ensure continuous global availability of marine data the eleventh session of CMM recommended several changes within the MCSS. The main ones are as follows:

- Two of the Responsible Members (Germany and United Kingdom) to act as Global Collecting Centres (GCC) for marine climatological data as of 1 January 1994,

- Minimum quality control to be applied by the Contributing Members,
- All digitized marine climatological data to be sent by Contributing Members(CMs) directly to each of the GCCs on a quarterly basis,
- GCCs to ensure that Minimum Quality Control has been applied,
- GCCs to maximize data availability by bilateral exchange between themselves,
- GCCs to deliver complete (global) data set updates to all Responsible Members on a quarterly basis.

6. Taking into account the technological progress in data processing and the increasing scope of the VOS observing programme as well as in measuring techniques, the layout of the marine climatological record in form of the International Marine Meteorological Tape has been defined. The latest version of IMMT (IMMT-2, Rec. 8 JCOMM-I), taking into account the needs of the VOSClim Project, has been accepted by JCOMM-I.

7. The accuracy of data is of primary importance for MCSS and scientific research. It is important that marine climatological data are quality controlled before they are exchanged. To ensure the quality of marine climatological database Contributing Members should apply MQCS before dispatching data to GCCs. The reason for this procedure is the possibility to verify data with original logbooks and to introduce corrections to data instead of simply flagging them as wrong. GCCs can only mark wrong or suspicious data by flags. Requirements of the VOSClim Project caused changes in MQCS, and the latest version (MQCS v.4) has been accepted by JCOMM-I (Rec. 9, JCOMM-I).

8. The RMs prepare summaries in both tabular and graphical form (charts). They include air and sea temperature, dew-point temperature, visibility, weather, wind direction and speed, atmospheric pressure, clouds and waves. The necessary minimum number of observations is specified before the means can be calculated. The routine publication of annual summaries was stopped in 1981, but they are still available on request and could be published by the RMs if they wished. Decadal climatological summaries are prepared for each decade 1961-70, 1971-80, 1981-90, and 1991-2000. In the mid-1990s not yet all RMs had published the required Marine Climatological Summaries (i.e. annual summaries from 1961 to 1980, decadal summaries for 1961-70, 1971-80 and 1981-90).

9. Principally more than 40 countries are involved in different functions as CM, RM or GCC, however not all countries contribute to MCSS every year.

10. The growing need for higher quality data from a sub-set of the Voluntary Observing Ships (VOS) has been identified by, inter alia, the Ocean Observing System Development Panel (OOSDP, 1995), the Ocean Observations Panel for Climate (OOPC, 1998), and the JSC/SCOR Working Group on Air Sea Fluxes (WGASF, 2000). The justification for improved surface meteorological data was also discussed in detail at the Conference on the Ocean Observing System for Climate, OceanObs 99 as well as on the Workshop on Advances in Marine Climatology – CLIMAR-II (Brussels, November 2003).

11. There is an increasing interest in global marine climatological data due to global warming and intensification of investigations concerning the role of the ocean in global processes. Intensification of efforts to digitize the results of marine meteorological observations made before 1960 is highly recommended by the marine climatological research community, the accompanying metadata become an important issue. Many of these historical data (and contemporary as well) have been compiled into global collections such as the International Comprehensive Ocean-Atmosphere Data Set (ICOADS). The observations collected from different observational systems and pre-instrumental observations have been used, for example, to quantify global changes of sea and marine air temperature. Based on such studies, the recommendations of the Intergovernmental Panel on Climate Change (Houghton et al., 1990; IPCC, 1996, 2001) have led to politically important international agreements such as the UN

Framework Convention on Climate Change. But it should be pointed out that the detection of climate trends in the VOS data has only been possible following the careful correction, as far as it was possible, of varying observational biases due to the changing methods of observation and varying technical specifications of particular platforms (ships).

12. The availability of the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) and its blend with the UK Met Office Marine Data Bank (MDB) at the end of the 1990s may affect the operation of MCSS as the ICOADS contains more data than the data banks of individual RM, and statistics for particular grids can be readily calculated from ICOADS data with or without trimming. Given that the homogeneity issue still exists in ICOADS data and the presentation of data is catered for climate researchers, there is still a need for RM to perform data trimming/QC and compile Marine Climatological Summaries for other users in support of transportation, engineering and other offshore activities. Although a high percentage of marine data now comes through GTS, there is still a considerable amount of data coming from logbooks that require digitization. Hence, the role of the CMs in digitization of logbook data should remain.

13. MQC is applied to all non-real time VOS data by the CMs before they dispatch data to the GCCs. Minimum Quality Control is checked by the GCCs to eliminate wrong or to mark suspicious data. RMs usually apply dedicated quality control procedures as well which are more oriented to climatological characteristics of the area of their responsibility. For purpose of NWP the typical error of the heat fluxes is in range of ±10 Wm-2. It is about 10% of the typical interannual variability of the wintertime turbulent heat fluxes in mid to high latitudes. To achieve such accuracy, implies that the basic meteorological fields are known to about ±0.2°C for the SST, dry and wet bulb temperatures (or about 0.3 g/kg for specific humidity) and that the winds be estimated to ±10% or better, say about 0.5 m/s. These requirements are strict and often difficult to fulfil by individual ship observations.

14. Considering the longer term ocean heat balance even an accuracy of ±10 Wm-2 is not adequate. As it was demonstrated in many scientific papers a flux of 10 Wm-2 over one year would, if stored in the top 500m of the ocean, heat that entire layer by about 0.15ºC. Temperature changes on a decadal timescale are at most a few tenths of a degree so the global mean heat budget must be balanced to better than a few Wm-2. It is unlikely that such accuracy will ever be achieved using VOS data.

15. To fulfil these requirements the Voluntary Observing Ship Climate Project (VOSClim) was established. The main aim of this project is to provide a high-quality set of marine meteorological observations along with detailed information on how the data were obtained. The VOSClim dataset of good quality VOS surface meteorological reports will cover all ocean basins. Each VOS report will be associated not only with extensive metadata (including information about types of instrumentation, calibration history, observing practice, photographs of instrumentation sites and plans of the ship) but also with the output from the UK Met Office Numerical Weather Prediction (NWP). It should be noted that the VSOP-NA Project was a successful precursor of VOSClim. According to Liz Kent (UK) the VOSClim has three main scientific aims:

- The VOSClim dataset will allow the assessment of biases in the VOS weather reports.
- Assessment of best observing practice, instrumentation and calibration for the VOS.
- The VOSClim dataset will provide a global validation dataset for NWP output.

16. From the perspective of data flow, the VOSClim project is very well integrated into the overall VOS data streams. The question could be, how far the bulk of the VOS could be developed to VOSClim standards and what could be the overall improvements. Some things are done or are under permanent review and adaptation through the relevant bodies as SOT, ETMC or others. At present and with respect to a future JCOMM E2EDM it should be taken into account:

In case of data quality:

a. improvements with data generation through further step by step realization of agreed standards (instruments, methods - e.g. as identified by VOSClim)
b. standardized quality checks at observing site for each VOS (e.g. software aids)
c. all necessary metadata available with each observation
d. reliable maintenance conceptions in case of automated data acquisition

In case of data archiving:

a. all data available (e.g. as is the case in DAC for VOSClim project data); solution needs not necessarily be a centralized one
b. data tagging
c. transparent quality levels

17. However it should be taken into account that due to significant modernization and automation of observing procedures on many ships a growing proportion of the traditional man-made weather observations from the seas will be replaced by fully automated observations. So VOSClim is probably the last chance to verify what traditional VOS is really worth and what biases are contained in data sets collected under MCSS and products based on these data.

18. The possibility of upgrading the traditional VOS and MCSS products due to implementation of new modern technology happened several years ago when visual wave observations were supplemented by buoy instrumental registrations, as well as in the polar regions where due to lack of regular shipping routes meteorological buoys provide limited meteorological information.

19. Based on presentations given at CLIMAR-II and on the concluding discussion it is also clear that climatology of heat flux may be useful to some users. Indeed, the decadal Marine Climatological Summaries published by the German Weather Service included sensible heat flux and latent heat flux that are not required in the Manual on Marine Meteorological Services. However, this is not normally required by shipping companies and offshore oil rigs. The proposal to include 90 percentiles charts is agreed, as this is a useful mark for decision-making in statistics.

20. In the discussion which was carried out during CLIMAR-II the diagnosis formulated by DMCG-I concerning a lack of a so called “route map” for users looking for data and assistance has been confirmed. The same conclusions could be formulated on the basis of the questionnaire concerning MCSS and availability of marine climatological data stored under this scheme which was circulated by the chairman of the ETMC between: members of the Polish National Committee of Sea Research, maritime national authorities, and selected scientists. Extended discussion including consultations with users was also carried out by Dr W.T Wong (Hong Kong, China). An ad hoc working meeting was held in this respect in Hamburg, 10-12 May 2004. Apart from the staff of GCC, users from the university and the German Federal Maritime and Hydrographic Agency took part. During this meeting MCSS was presented and discussed in detail. It showed that currently the users are not sure how to efficiently supply themselves with the required MCSS data. As was stated, at the time being there is not sufficient knowledge about the locations or sites where the available data can be obtained.

21. In the German Global Marine Meteorological Archive the ship observations having entered via GTS are replaced by the corresponding observations when these become available via the non real-time branch. Thus for instance for the years in the 1980s and 1990s about 25% of the VOS data in the archive originate from the GTS, whereas the rest has entered via the logbooks. This is shown in Fig.1.

22. The age of the data within the real time branch are near to the observation time, with a

delay of a few hours at maximum. Modern assimilation schemes for numerical weather analysis include data within a time window of several hours. On the non real time branch data may be several years old. The GCCs experience data with an observation date 10 years back and more, although most of them are not older than 2 years. That is not ideal, but within the climatological time scale also old data are important as the general data base for the oceans, and that is about 70% of the earth, is principally sparse. Additional information on this question is presented in the report of the GCCs under the respective agenda item.

23. In conclusion it should be pointed out that:

a. There is very limited knowledge of MCSS (data as well as products) in the marine community. The information on the respective data bases is rather low, knowledge on products e.g. climatic maps is higher, mostly throughout the maps published in navigation's pilots.

b. The knowledge of MCSS and the corresponding data stored by the RMs should be enhanced between representatives of marine authorities, being responsible for safety of navigation and environmental protection of seas, especially coastal waters.

c. The scientific community has also limited knowledge on MCSS. Meteorologists, climatologists as well oceanographers in fact do not know very much about the scheme.

d. An important reason for this insufficient knowledge of MCSS is the lack of any information on the system available on the World Wide Web. It was stressed that several climatological global marine data sets are used by scientists in research or assessments because there is widely distributed information on these data sets and products provided by particular data holders. Data and some products are easily available, data quality and procedures for data processing are well documented. ICOADS, HadSST, Reynolds SST data sets were pointed out as the most popular products. Progress in use of COADS presented during Boulder's SST Workshop demonstrates the problem well.

e. Limited information presented on climatological maps prepared under MCSS was criticized. Consultants stressed relatively sparse spatial resolution of information presented on maps. In their opinion the spatial resolution of oceanic squares should increase (at least should be in the range of 2ºx2º). In regions where limited numbers of observations are available data from ships should be merged with buoy data.

f. The information on MCSS as well as on the data sets and products available in the system should be presented on the WWW. This includes information on RMs and their inventories concerning data, metadata, products and the respective quality standards.

g. All products should be available on the web and on CD-ROMs. The system integrating climatological maps for particular sub-regions into one global product should be available. RM Germany is finalizing the Summaries 1991-2000. They will be published on CD-ROM. Examples will be demonstrated at ETMC-I.

h. Maps prepared under MCSS should be available not later than 3 years after the end of the period which they concern. For climate monitoring purposes it could be an advantage that RMs publish 5-year climatological summaries for say 2001-2005, 2006-2010, 2011-2015, and 2016-2020. Having said that, we must note that 5-year climatology may be affected by the 3-7 years ENSO cycle which would limit the usefulness of the data. To avoid it moving 5-year periods can be used.

i. Information presented for each sub-area should be expanded to also display information concerning trend (e.g. below standard deviation the value of linear trend's coefficient should

be printed out).

j. There is some argumentation to expand the standard method of presentation by maps of isolines (for mean value, std., and trend coefficient). However it requires specific techniques for gridding and interpolation of data etc.

k. Taking into account a new, higher spatial resolution, the global summaries should be published (it means all RMs should publish summaries for the same periods, taking into account modifications introduced to the MCSS). These summaries should be accompanied by complete data sets allowing users to recognize the quality of products.

l. However, re-calculation of decadal summaries for 1961-70, 1971-80 and 1981-90 should not be of highest priority, as many users will be looking for the most recent decadal summaries i.e. 1991-2000 or 30-year summaries i.e. 1961-1990 rather than the older data.

m. Apart from the existing data products (Appendix I.8 *of Manual on Marine Meteorological Services* (WMO-No. 558)), wind rose charts, isotach charts of mean winds and maximum wind speeds, isotherm charts of mean sea surface temperatures, isobar charts of mean sea level pressure should be of use for many applications. The existing explanation given in climatological summaries published by various RMs is very brief while the discussions in the *Guide to the Applications of Marine Climatology* (WMO-No. 781) and *Advances in the Applications of Marine Climatology - the Dynamic part of the WMO Guide to Marine Climatology* (WMO/TD-No. 1081) (JCOMM Technical Report No. 13) are too elaborate. Some notes of about two pages on data limitation etc. should be appropriate for users of the summaries.

n. It should be mentioned, that the VOS observing system critically depends on the observers involved and as such the system cannot be handled as easy as any technical data acquisition system. The whole task would be easier if only automated systems were involved. On the other hand, when producing the summaries, the data, especially those from automated systems, have to be checked very carefully in order to avoid biases due to long dense time series generated while the ship is in port. The use of automatic weather stations indeed grows rapidly in the VOS fleet due to the fact that time and manpower of the nautical staff is absorbed more and more by increasing duties. The automatic stations can be designed to acquire basic elements necessary to run numerical weather forecast models with a wide spectrum of output variables. Nevertheless many applications under Marine Meteorological Services still need visual observations and also the model verification needs a reliable in situ "truth".

o. The postulated “route to data” should be created in form of a cascade of WWW pages starting from JCOMM home page with a description of the MCSS, metadata available in electronic version, completed documentation of decisions concerning MCSS e.g history of IMMT format, MQCS etc., annual reports of GCC and a list of published summaries through home pages (available from the main page in the form of links) of particular RMs and GCCs with detailed inventories of data stored according to areas of their responsibility, summaries for particular sub-periods available in the form of maps interactively selected by users, and information concerning data access and possibility to get professional advice.

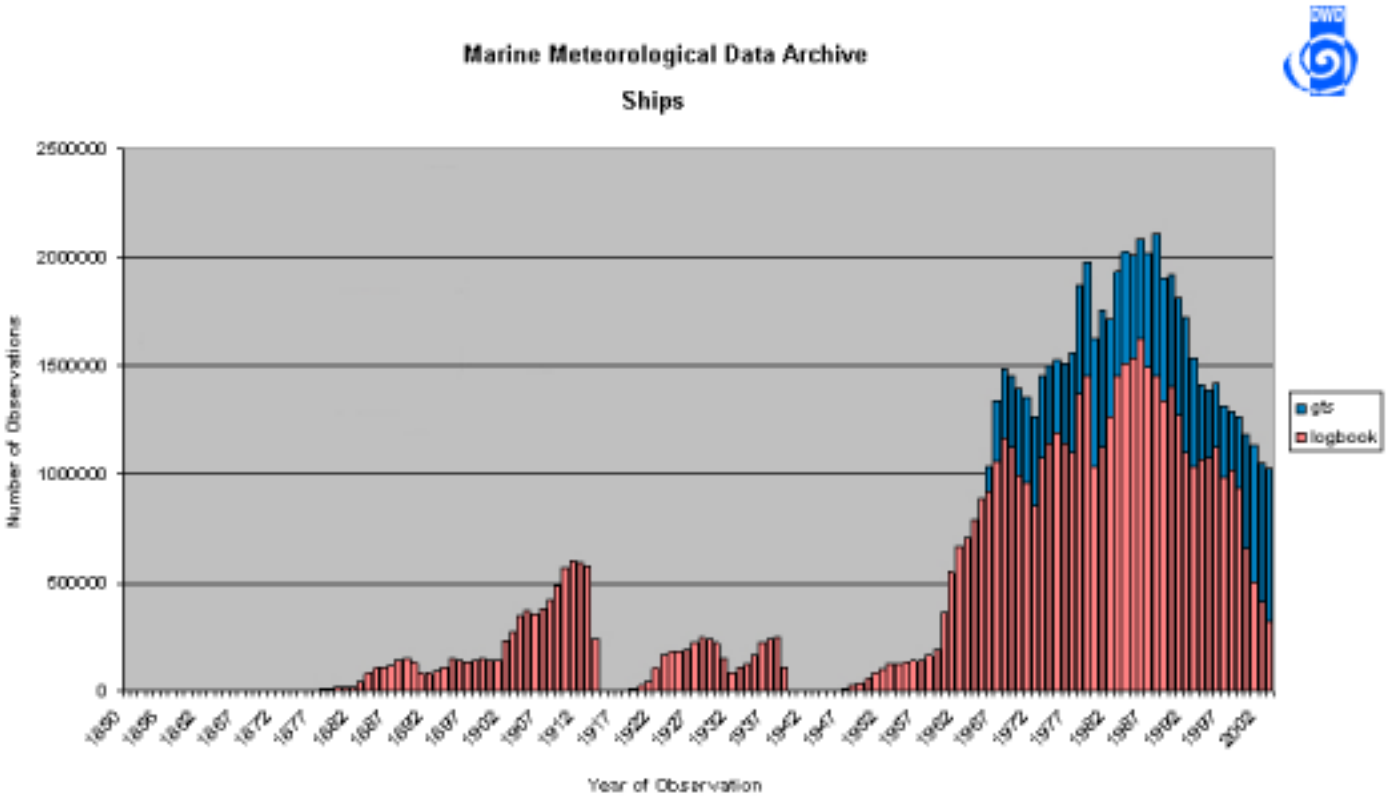
Marine Meteorological Data Archive
Ships
Number of Observations
2500000
2000000
1500000
1000000
500000
0
gts
logbook
Year of Observation

Fig.1