ROYAL OBSERVATORY, HONG KONG

Technical Note (Local) No. 60

PREPARATION OF MARINE CLIMATOLOGICAL SUMMARY CHARTS USING A PERSONAL COMPUTER

by

S.F. Ip

Published November 1991

Prepared by

Royal Observatory
134A Nathan Road
Kowloon
Hong Kong

681.3+551.582.3

CONTENTS

TABLE

FIGURES

1. INTRODUCTION

The Royal Observatory Hong Kong (RO) is one of the eight centres in the world designated by the World Meteorological Organization (WMO) to collect marine meteorological data and to compile marine climatological summaries (MCS). The area of responsibility for Hong Kong is the South China Sea from Equator to 30°N and from 100°E to 120°E [1]. From 1955 till now, a total of 1.6 million ship weather observations have been collected, quality checked and stored on magnetic tapes by the RO.

Since 1977, annual and decadal MCS in table form have been prepared and published by the RO for the years 1961 to 1970 [2]. At its Eighth Session held in 1981, the WMO Commission for Marine Meteorology (CMM) recommended that marine climatological summaries be prepared in the form of charts instead of tables (Rec 6 (CMM-VIII)). The proposal was endorsed by the Executive Committee in 1982. Accordingly the annual and decadal MCS for Hong Kong's area of responsibility from 1971 [3] and onwards have been prepared by the RO in chart form following the guidelines given in the Annex to Recommendation 6 of CMM-VIII [4]. A list of the MCS published or expected to be published by the RO is shown in Table 1.

Hitherto, the tables and charts in the MCS have been generated by FORTRAN programs run on RO's mini-computer. These tables and charts were then overlaid by a transparency of the coastline for the area, and then photographed table by table or chart by chart to produce the masters for printing.

To circumvent this laborious process, and to take advantage of the increasing power and the decreasing costs of personal computers (PC), as well as the ready availability of database software and the rapid advances in desktop publishing techniques, the RO began experimenting with preparing MCS on a PC in late 1990.

This paper describes RO's successful application of a PC in the preparation of MCS.

2. DATA SOURCES AND DATA PROCESSING

Weather observations recorded in the meteorological logbooks of Hong Kong's voluntary observing ships (VOS) were first scrutinized by the human eye to eliminate obvious instrumental, positional and coding errors before they were transferred and stored in IMMT format on magnetic tapes. Weather observations made by other ships while in Hong Kong's area of responsibility and sent to Hong Kong by other WMO Members were merged into the Hong Kong marine data bank and examined by a quality control program in FORTRAN to check for punching errors and internal consistency. Duplicate observations were removed. Observations rejected by the quality control program were examined and where it was possible to do so corrected and re-injected into the data bank. All quality control indicators for elements of each report in the data bank were set according to the specification given in the Annex IV of WMO No. 584 [4].

3. PRESENTATION OF DATA

Hong Kong's area of responsibility was divided into 36 smaller areas or grids, with due regard being given to data density. Statistics of meteorological and oceanographic elements evaluated for each grid were plotted in each grid on the chart. Monthly and annual charts were produced following the specification in the Annex to Recommendation 6 of CMM-VIII. The exceptions were charts for similar elements were grouped together for ease of reference, and that charts and tables for sea ice were discarded and replaced by additional data for wave periods since there was no sea ice in Hong Kong's area of responsibility. The total number of charts for each month or whole year remained at 18. A table showing the number of observations contributed by the WMO members was appended to each sequence of these charts.

4. PREPARING MCS ON PC

In order to overcome manual work from master preparation and other problems with a mini-computer such as limited availability of character fonts, a PC was used to compile MCS. The type of PC in use was 386 SX with a speed of 16 MHz. Peripherals and accessories included 1 MB (megabytes) conventional memory, 3 MB additional extended memory, two 40 MB hard disks, a 80387SX co-processor, a 14 inch VGA monitor , a 5.25 inch 1.2 MB floppy disk drive, a 3.5 inch 1.4 MB floppy disk drive, a 40 MB tape drive, a mouse and a 101 key enhanced keyboard. The PC was connected to a bubble jet printer which had two emulation modes and could accommodate paper of width up to 17 inches. The disk operating system in use was MS-DOS version 3.3.

Figure 1 shows the flow of MCS preparation. Processes after quality control had been done were performed with a PC. The three main components involved were:

(1) the design and development of a database;

(2) the processing of data for the generation of the required statistics;

(3) the generation of the appropriate summary charts.

The software developed should therefore be able to

(1) create, update or list information of charts to be prepared: the information required for each chart included title, heading, output sequence, elements to be processed, name of files and field numbers containing the data to be shown, presentation format of the data, legends for data being presented.

(2) create, update or list information of maps in the MCS: the information include reference numbers of the maps, boundaries of each map and number of grids contained in each map.

(3) create, update or list information of grids of each map: the required information included boundaries and the positions allocated for printing data in a chart for each grid.

(4) process the ship reports and to generate database files storing raw and derived parameters of data to be presented: process can be performed for specified months in a year or in a span of years.

(5) combine generated results and statistics of individual years to a specified span of years (useful for decadal or normal summaries compilation).

(6) amend or list the generated results and statistics for masters.

(7) list ship reports with specific condition, such as position, recruiting countries, particular values of meteorological or oceanographic elements.

(8) prepare the text part of masters of charts.

(9) print the prepared text part of masters of charts with or without an overlaying base map.

(10) maintain other related parameters or information files.

In order to have a better throughput and to achieve the above required functions, the following design criteria were decided upon:

(1) The database structure should be simple and easy to create and modify. Database files should contain raw or generated data from same or similar elements as far as possible.

(2) The database management system must be simple to use and easily installed on a PC.

(3) The database management system is supplied with sufficient built-in functions and procedures.

(4) The execution speed (generally at the expense of compilation) of the developed programs must be fast enough.

(5) The programs can handle voluminous data.

(6) The programs are mainly menu-driven so that users can simply choose the process to be performed or the record to be assessed as shown in pull-down or pop-up menus; unnecessary keyboard entries should be avoided.

(7) The programs can print coastline together with text using an appropriate printer.

(8) The programs can manage all files automatically.

(9) The database and programs should require as little storage space as possible.

All these needs having been considered, the FoxBASE+ relational database management system was selected and a package of programs called Marine Climatological Summary Charts (MCSC) package was developed to manage and process the database which was a relational database for holding ship reports in IMMT format and related information such as names of countries of WMO members. The layout of the files in this database is shown in Appendix 1. The MCSC package was mainly coded and compiled in FoxBASE+ language and would provide the aforesaid functions. An inventory of the programs contained in the package is listed in Appendix 2.

In the MCSC package, a PASCAL (Turbo PASCAL 5.5) program was engaged in printing the masters. This program was tailored to be used with the bubble jet printer for producing a graphic output of the coastline. In fact attempts had been made to utilize existing word processing software to merge print the text with the map image obtained by a scanner but a fine resolution of the printout of the map was not attained. The current base map was coded by another PASCAL program. Although it took some time to code the map, efforts of making masters by overlaying transparency on top of the text printout were no longer required resulting in a full automatic preparation process. Time spent was thus reduced to a great extent.

About 600 KB (kilobytes) of disk space was required for the (compiled and executable) programs. Of these, the FoxBASE+ relation database management system took up about 400 KB while the MCSC package and the map coding program took up the rest. Other fixed amounts of disk space required were 950 KB for the database and associated index files, 380 KB for the base map for the South China Sea and 20 KB for the editorial notes of the MCS. Altogether a total of 1,950 KB for the basic information and programs was needed. Noticeably, the space occupied by the raw data and the generated results and statistics files varied from month to month depending on the actual number of reports received. For a month, the space required for holding about 4,500 weather observations was around 550 KB and that for the results and statistics database and index files around 330 KB. Another 60 KB was needed for the masters of the charts.

A trial run using ship observations for the month of January 1986 showed that about 1 hour (connected time) was needed to process about 4,500 observations for that month. Another 10 minutes was needed for preparing the text. Other processing times were negligible. The text was printed together with the base map. A copy of the chart 1.I Air Temperature for January 1986 is shown in Figure 2. The problem of the relatively long operation time for compiling summary charts of a year was overcome by the flexibility of the MCSC package which allowed the compilation to be performed in different runs month by month instead of in a single run for a complete year.

5. ADVANTAGES OF USING A PC

Using a PC for compiling summary charts has the following advantages:

(1) Cost-effective

The increasing popularity of the PC should place it more and more within the financial reach of all services. Furthermore, with the advances in desk-top publishing techniques, printouts of good enough quality are easily made with much less manual involvement.

(2) Easy to set up

PCs are easy to set up, uncomplicated to use, and though a clean and cool environment is preferred, can also work in non-ideal conditions.

(3) Availability of software

With ample packages available from the computer market, one can choose the appropriate software for managing the database, developing the programs and printing the charts. There is no need to develop software from scratch or to resort to the more scientifically oriented FORTRAN.

(4) Friendliness

Software that is run in PC environment is generally designed to be user friendly. Pull-down or pop-up menus are always employed for the user to select items. The screen displays are more attractive and indicative. It also gives the user psychological advantage that he/she is really in touch with and having sole control of the computer.

(5) Flexibility

The MCSC package like other PC programs is quite flexible in handling data. Processing of data may be done month by month or even year by year.

(6) Variability

The MCSC package fetches from database files information for processing at run time. Users can choose to modify the data in these files to suit their purpose, such as changing sequence of the charts to be presented, re-defining the grid (sub-area) boundaries, etc. For PC printers, there are options for fonts, pitch, and so on for printing characters. Graphic images can also be printed.

(7) Compatibility

It is quite common to transfer a system from one PC to another because they are generally designed to be compatible with one another. There should not be any serious difficulty in running the MCSC package on any PC which is IBM PC/AT compatible (or even XT though much slower in speed).

6. CONCLUSION

The experiment reported above shows that marine climatological summaries can be conveniently prepared on a PC. Like any new venture, an initial effort in creating the database, the necessary programs and so on is needed, but thereafter the process is to a large extent automated and simple to operate.

References

1.	Manual on Marine Meteorological Services	WMO No. 558, World Meteorological Organization, 1981.
2.	Marine Climatological Summaries for Areas 20057 and 21156 in the South China Sea, 1964	Royal Observatory, Hong Kong, 1970
3.	Marine Climatological Summary Charts for the South China Sea, 1971	Royal Observatory, Hong Kong, 1986
4.	Commission for Marine Meteorology, Abridged Final Report of the Eighth Session	WMO No. 584, World Meteorological Organization, 1981.

Table 1 Marine Climatological Summaries published by Hong Kong

Year	Type of Summary	Form of Presentation	Date published
1961	Annual	Table	22 Aug 1977
1962	Annual	Table	16 May 1978
1963	Annual	Table	16 May 1978
1964	Annual	Table	19 Mar 1970
1965	Annual	Table	21 Mar 1979
1966	Annual	Table	23 Jul 1979
1967	Annual	Table	9 Jul 1980
1968	Annual	Table	19 Feb 1981
1969	Annual	Table	21 Feb 1983
1970	Annual	Table	21 Feb 1983
1961 - 1970	Decadal	Table	24 May 1985
1971	Annual	Chart	1 Oct 1986
1972	Annual	Chart	15 Jan 1987
1973	Annual	Chart	4 Feb 1987
1974	Annual	Chart	5 May 1987
1975	Annual	Chart	21 Jul 1987
1976	Annual	Chart	8 Jun 1987
1977	Annual	Chart	21 Jul 1987
1978	Annual	Chart	21 Jul 1987
1979	Annual	Chart	9 Sep 1987
1980	Annual	Chart	12 Oct 1987
1971 - 1980	Decadal	Chart	13 Jan 1988
1981	Annual	Chart	1 Dec 1987
1982	Annual	Chart	12 Feb 1988
1983	Annual	Chart	3 May 1988
1984	Annual	Chart	16 Mar 1989
1985	Annual	Chart	3 Aug 1989
1986	Annual	Chart	1 Apr 1990
1987	Annual	Chart	Jul 1991*
1988	Annual	Chart	Jun 1992*
1989	Annual	Chart	May 1993*
1990	Annual	Chart	Apr 1994*
1981 - 1990	Decadal	Chart	Jul 1994*
1961 - 1990	Normal	Chart	Nov 1994*
1991	Annual	Chart	Oct 1995*
1992	Annual	Chart	Oct 1996*
1993	Annual	Chart	Oct 1997*
1994	Annual	Chart	Oct 1998*
1995	Annual	Chart	Oct 1999*
1996	Annual	Chart	Oct 2000*
1997	Annual	Chart	Oct 2001*
1998	Annual	Chart	Oct 2002*
1999	Annual	Chart	Oct 2003*
2000	Annual	Chart	Oct 2004*
1991 - 2000	Decadal	Chart	Jul 2004*

* Expected publication date

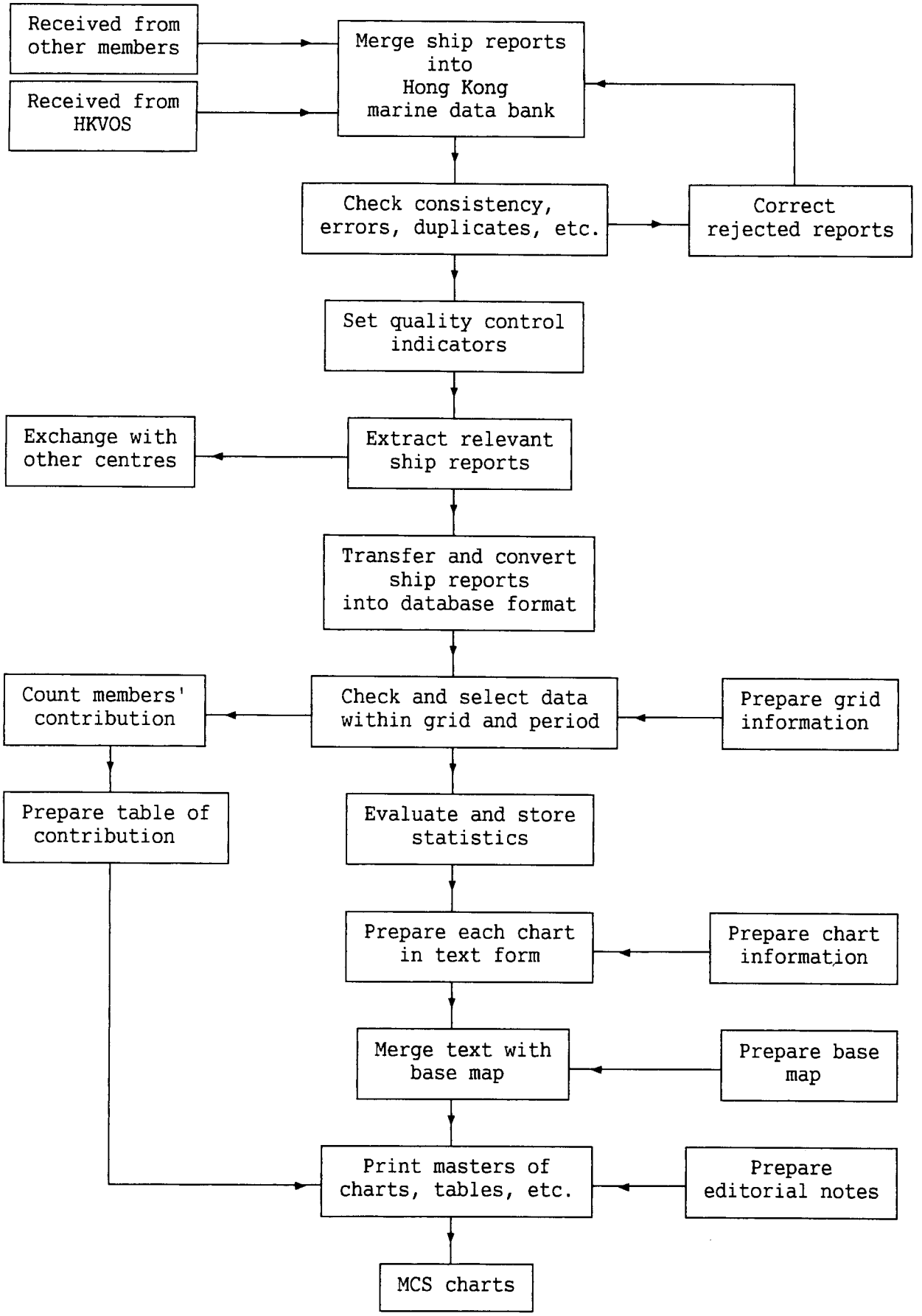
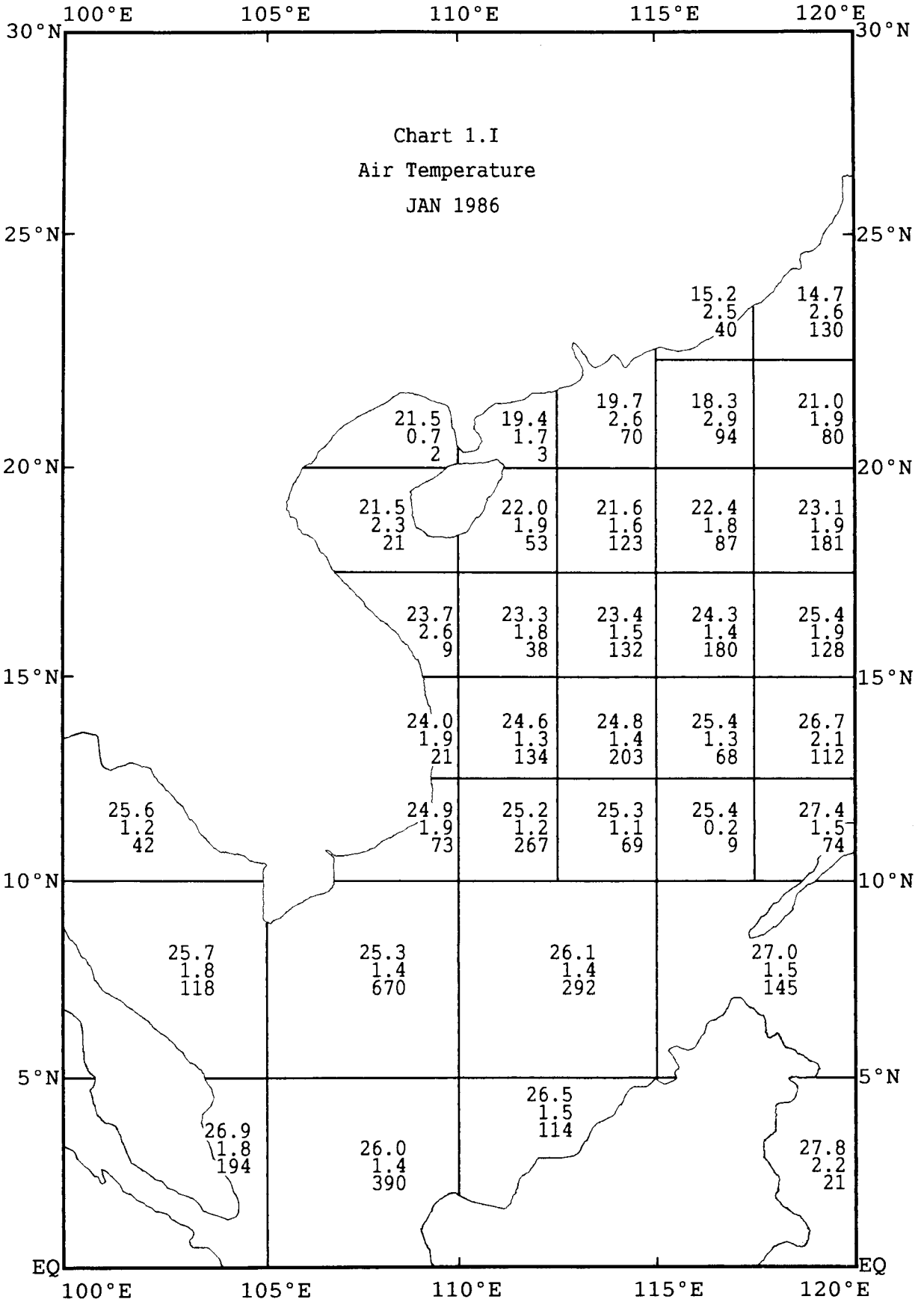


Figure 1 Preparation of MCS charts



The figures in each delineated sea area represent the summary of the elements in the following order:

1 Mean (degrees Celsius)
2 Standard deviation (degrees Celsius)
3 Number of observations

Figure 2 Sample of a chart prepared by PC

Appendix 1 Layout of files in the database

Convention used throughout this appendix:

Field type:

C = Character
N = Numeric

File name:

m_0m_0 = Month, two digits; e.g. 01
mmm = Map number, three digits; e.g. 001
y_0y_0 = Year, last two digits; e.g. 90
y_1y_1 = Year to begin, last two digits; e.g. 90
y_2y_2 = Year to end, last two digits; e.g. 90

Abbreviation:

obs = observation(s)
QCI = Quality control indicator
S.D. = Standard deviation
sec = second(s)

		Content
File name:	Cmmm$y_1y_1y_2y_2$.TXT	Text for charts and tables for the map mmm in the years y_1y_1 to y_2y_2 (to be used for preparing masters with map)
	Cmmm$y_1y_1y_2y_2$.CHT	Text for charts only for the map mmm in the years y_1y_1 to y_2y_2 (to be used for preparing masters with map)
	Cmmm$y_1y_1y_2y_2$.TBL	Text for tables only for the map mmm in the years y_1y_1 to y_2y_2 (to be used for preparing masters with map)
	LSTmmmy_0y_0.TXT	Run time report for evaluating statistics from ship weather observations for the map mmm in the year y_0y_0
	Ommm$y_1y_1y_2y_2$.TXT	Run time report for extracting relevant statistics for each grid and contribution of each member for the map mmm in the years y_1y_1 to y_2y_2
	Tmmm$y_1y_1y_2y_2$.TXT	Run time report for preparing text of charts and/or tables for the map mmm in the years y_1y_1 to y_2y_2

Appendix 1 Layout of files in the database (Cont'd)

File name	Content
: AIRmmmy_0y_0	Statistics and processed results of air temperature for each grid of the map mmm in the year y_0y_0
Ammm$y_1y_1y_2y_2$	Statistics and processed results of air temperature for each grid of the map mmm in the years y_1y_1 to y_2y_2
ASDmmmy_0y_0	Statistics and processed results of air-sea temperature difference for each grid of the map mmm in the year y_0y_0
DEWmmmy_0y_0	Statistics and processed results of dew-point temperature for each grid of the map mmm in the year y_0y_0
Dmmm$y_1y_1y_2y_2$	Statistics and processed results of dew-point temperature for each grid of the map mmm in the years y_1y_1 to y_2y_2
Pmmm$y_1y_1y_2y_2$	Statistics and processed results of mean sea level pressure for each grid of the map mmm in the years y_1y_1 to y_2y_2
PPPmmmy_0y_0	Statistics and processed results of mean sea level pressure for each grid of the map mmm in the year y_0y_0
Smmm$y_1y_1y_2y_2$	Statistics and processed results of sea surface temperature for each grid of the map mmm in the years y_1y_1 to y_2y_2
SSTmmmy_0y_0	Statistics and processed results of sea surface temperature for each grid of the map mmm in the year y_0y_0
Xmmm$y_1y_1y_2y_2$	Statistics and processed results of air-sea temperature difference for each grid of the map mmm in the years y_1y_1 to y_2y_2

No. of fields : 61
Size of 1 record: 310 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	OBS	N	6	No. of obs with the element
4	SUM	N	10	Sum of the element in 0.1 °C for temperatures or 0.1 hPa for pressures
5	SQSUM	N	12	Sum of squares of the element in 0.01 degree^2 C for temperatures or 0.01 hPa^2 for pressures
6	MEAN	N	5	Mean of the element in 0.1 °C for temperatures or 0.1 hPa for pressures
7	STDEV	N	3	S.D. of the element in 0.1 °C for temperatures or 0.1 hPa for pressures
8	MAX	N	5	Maximum value of the element in 0.1 °C for temperatures or 0.1 hPa for pressures
9	MIN	N	5	Minimum value of the element in 0.1 °C for temperatures or 0.1 hPa for pressures

File: AIRmmmy$_0$y$_0$ (cont'd)
Ammmy$_1$y$_1$y$_2$y$_2$ (cont'd)
ASDmmmy$_0$y$_0$ (cont'd)
DEWmmmy$_0$y$_0$ (cont'd)
Dmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)
Pmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)
PPPmmmy$_0$y$_0$ (cont'd)
Smmmy$_1$y$_1$y$_2$y$_2$ (cont'd)
SSTmmmy$_0$y$_0$ (cont'd)
Xmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
10	FIRST	N	3	Value of the element for counter 1: -15.0 °C for temperatures or 985.0 hPa for pressures
11	COUNT1	N	5	Counter 1 for the element (i.e. the counter for temperatures ≤ -15.0 °C or pressures ≤ 985.0 hPa)
12	COUNT2	N	5	Counter 2 for the element
13	COUNT3	N	5	Counter 3 for the element
14	COUNT4	N	5	Counter 4 for the element
15	COUNT5	N	5	Counter 5 for the element
16	COUNT6	N	5	Counter 6 for the element
17	COUNT7	N	5	Counter 7 for the element
18	COUNT8	N	5	Counter 8 for the element
19	COUNT9	N	5	Counter 9 for the element
20	COUNT10	N	5	Counter 10 for the element
21	COUNT11	N	5	Counter 11 for the element
22	COUNT12	N	5	Counter 12 for the element
23	COUNT13	N	5	Counter 13 for the element
24	COUNT14	N	5	Counter 14 for the element
25	COUNT15	N	5	Counter 15 for the element
26	COUNT16	N	5	Counter 16 for the element
27	COUNT17	N	5	Counter 17 for the element
28	COUNT18	N	5	Counter 18 for the element
29	COUNT19	N	5	Counter 19 for the element
30	COUNT20	N	5	Counter 20 for the element
31	COUNT21	N	5	Counter 21 for the element
32	COUNT22	N	5	Counter 22 for the element
33	COUNT23	N	5	Counter 23 for the element
34	COUNT24	N	5	Counter 24 for the element
35	COUNT25	N	5	Counter 25 for the element
36	COUNT26	N	5	Counter 26 for the element
37	COUNT27	N	5	Counter 27 for the element
38	COUNT28	N	5	Counter 28 for the element
39	COUNT29	N	5	Counter 29 for the element
40	COUNT30	N	5	Counter 30 for the element
41	COUNT31	N	5	Counter 31 for the element
42	COUNT32	N	5	Counter 32 for the element
43	COUNT33	N	5	Counter 33 for the element
44	COUNT34	N	5	Counter 34 for the element
45	COUNT35	N	5	Counter 35 for the element
46	COUNT36	N	5	Counter 36 for the element

File: AIRmmmy$_0$y$_0$ (cont'd)
Ammmy$_1$y$_1$y$_2$y$_2$ (cont'd)
ASDmmmy$_0$y$_0$ (cont'd)
DEWmmmy$_0$y$_0$ (cont'd)
Dmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)
Pmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)
PPPmmmy$_0$y$_0$ (cont'd)
Smmmy$_1$y$_1$y$_2$y$_2$ (cont'd)
SSTmmmy$_0$y$_0$ (cont'd)
Xmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
47	COUNT37	N	5	Counter 37 for the element
48	COUNT38	N	5	Counter 38 for the element
49	COUNT39	N	5	Counter 39 for the element
50	COUNT40	N	5	Counter 40 for the element
51	COUNT41	N	5	Counter 41 for the element
52	COUNT42	N	5	Counter 42 for the element
53	COUNT43	N	5	Counter 43 for the element
54	COUNT44	N	5	Counter 44 for the element
55	COUNT45	N	5	Counter 45 for the element
56	COUNT46	N	5	Counter 46 for the element
57	COUNT47	N	5	Counter 47 for the element
58	COUNT48	N	5	Counter 48 for the element
59	COUNT49	N	5	Counter 49 for the element
60	COUNT50	N	5	Counter 50 for the element
61	COUNT51	N	5	Counter 51 for the element (i.e. the counter for air, dew-point and sea surface temperatures ≥ 35.0 °C, air-sea temperature differences ≥ 10.0 °C or pressures ≥ 1035.0 hPa)

Note:

Counters are differed by 1.0 °C for air, dew-point and sea surface temperatures, by 0.5 °C for air-sea temperature differences and by 1.0 hPa for mean sea level pressures.

Appendix 1 Layout of files in the database (Cont'd)

Content

File name : Bmmm$y_1y_1y_2y_2$ — Inventory of weather reports used for the map mmm in the years y_1y_1 to y_2y_2

No. of fields : 14
Size of 1 record : 83 bytes

Structure

Field	Field Name	Type	Width	
1	YEAR	N	2	Year of the reports (last 2 digits)
2	OBS1	N	6	No. of reports in January of the year
3	OBS2	N	6	No. of reports in February of the year
4	OBS3	N	6	No. of reports in March of the year
5	OBS4	N	6	No. of reports in April of the year
6	OBS5	N	6	No. of reports in May of the year
7	OBS6	N	6	No. of reports in June of the year
8	OBS7	N	6	No. of reports in July of the year
9	OBS8	N	6	No. of reports in August of the year
10	OBS9	N	6	No. of reports in September of the year
11	OBS10	N	6	No. of reports in October of the year
12	OBS11	N	6	No. of reports in November of the year
13	OBS12	N	6	No. of reports in December of the year
14	OBS13	N	8	No. of reports in the year

Appendix 1 Layout of files in the database (Cont'd)

		Content
File name	: CVWmmmy$_0$y$_0$	Statistics and processed results of cloud amount, weather, precipitation, visibility, icing and ship position for each grid of the map mmm in the year y$_0$y$_0$
	Rmmmy$_1$y$_1$y$_2$y$_2$	Statistics and processed results of cloud amount, weather, precipitation, visibility, icing and ship position for each grid of the map mmm in the years y$_1$y$_1$ to y$_2$y$_2$

No. of fields : 47
Size of 1 record : 261 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	WXOBS	N	6	No. of obs with present weather
4	PPT1OBS	N	6	No. of obs with rain or drizzle
5	PPT2OBS	N	6	No. of obs with other forms of precipitation
6	CLDOBS	N	6	No. of obs reporting cloud amount
7	CLD0	N	5	No. of obs with no cloud
8	CLD1	N	5	No. of obs with cloud amount of 1 okta
9	CLD2	N	5	No. of obs with cloud amount of 2 oktas
10	CLD3	N	5	No. of obs with cloud amount of 3 oktas
11	CLD4	N	5	No. of obs with cloud amount of 4 oktas
12	CLD5	N	5	No. of obs with cloud amount of 5 oktas
13	CLD6	N	5	No. of obs with cloud amount of 6 oktas
14	CLD7	N	5	No. of obs with cloud amount of 7 oktas
15	CLD8	N	5	No. of obs with cloud amount of 8 oktas
16	SKYOBSC	N	5	No. of obs with sky obscured
17	VISOBS	N	6	No. of obs reporting visibility
18	VISXX	N	5	No. of obs with visibility not reported due to fog (code = 53)
19	VIS90	N	5	No. of obs with visibility code = 90
20	VIS91	N	5	No. of obs with visibility code = 91
21	VIS92	N	5	No. of obs with visibility code = 92
22	VIS93	N	5	No. of obs with visibility code = 93
23	VIS94	N	5	No. of obs with visibility code = 94
24	VIS95	N	5	No. of obs with visibility code = 95
25	VIS96	N	5	No. of obs with visibility code = 96
26	VIS97	N	5	No. of obs with visibility code = 97
27	VIS98	N	5	No. of obs with visibility code = 98
28	VIS99	N	5	No. of obs with visibility code = 99
29	WAOBS	N	6	No. of obs reporting wind speed and air temperature
30	WAOBS1	N	6	No. of obs with wind speed ≥ 11 m/s and air temperature ≤ 2 °C
31	ICEOBS	N	6	No. of obs with icing
32	SHIPOBS	N	6	No. of obs

File: CVWmmmy$_0$y$_0$ (cont'd)
Rmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
33	LATSUM	N	10	Sum of displacements of latitudes from the southern latitude of the grid in 0.1 degree
34	LATSQSUM	N	12	Sum of squares of displacements of latitudes from the southern latitude of the grid in 0.1 degree^2
35	LATMEAN	N	5	Mean latitude of obs* in 0.1 degree
36	LATSTDEV	N	4	S.D. of latitudes of obs in 0.1 degree
37	LONSUM	N	12	Sum of displacements of longitudes from the western longitude of the grid in 0.1 degree
38	LONSQSUM	N	15	Sum of squares of displacements of longitudes from the western longitude of the grid in 0.1 degree^2
39	LONMEAN	N	6	Mean longitude of obs* in 0.1 degree
40	LONSTDEV	N	4	S.D. of longitudes of obs in 0.1 degree
41	PPT1	N	4	Percentage of obs with rain or drizzle in 0.1 %
42	PPT2	N	4	Percentage of obs with other forms of precipitation in 0.1 %
43	CLOUD1	N	4	Percentage of obs with cloud amount ≤ 2 oktas in 0.1 %
44	CLOUD2	N	4	Percentage of obs with cloud amount ≥ 6 oktas in 0.1 %
45	VIS1	N	4	Percentage of obs with visibility ≤ 1 Km in 0.1 %
46	VIS2	N	4	Percentage of obs with visibility ≥ 10 Km in 0.1 %
47	ICE1	N	4	Percentage of obs with potential moderate or severe superstructure icing in 0.1 %

* Negative values indicate °S or °W.

Appendix 1 Layout of files in the database (Cont'd)

Content

File name : HAPmmmy_0y_0 Statistics and processed results of wave for each grid of the map mmm in the year y_0y_0

Hmmm$y_1y_1y_2y_2$ Statistics and processed results of wave for each grid of the map mmm in the years y_1y_1 to y_2y_2

No. of fields : 124
Size of 1 record : 610 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	WOBS	N	6	No. of obs reporting waves
4	HSUM	N	8	Sum of wave heights in 0.5 m
5	HSQSUM	N	10	Sum of squares of wave heights in 0.25 m^2
6	HMEAN	N	4	Mean wave height (to the nearest 0.5 m) in 0.1 m
7	HSTDEV	N	3	S.D. of wave heights in 0.1 m
8	HMAX	N	3	Maximum wave height (to the nearest 0.5 m) in 0.1 m (unconditional)
9	POFHMAX	N	3	Period of wave of maximum height in sec (unconditional)
10	H0	N	5	Counter for calm sea
11	H1	N	5	Counter for wave height = 0.5 m
12	H2	N	5	Counter for wave height = 1.0 m
13	H3	N	5	Counter for wave height = 1.5 m
14	H4	N	5	Counter for wave height = 2.0 m
15	H5	N	5	Counter for wave height = 2.5 m
16	H6	N	5	Counter for wave height = 3.0 m
17	H7	N	5	Counter for wave height = 3.5 m
18	H8	N	5	Counter for wave height = 4.0 m
19	H9	N	5	Counter for wave height = 4.5 m
20	H10	N	5	Counter for wave height = 5.5 m
21	H11	N	5	Counter for wave height = 5.5 m
22	H12	N	5	Counter for wave height = 6.0 m
23	H13	N	5	Counter for wave height = 6.5 m
24	H14	N	5	Counter for wave height = 7.0 m
25	H15	N	5	Counter for wave height = 7.5 m
26	H16	N	5	Counter for wave height = 8.0 m
27	H17	N	5	Counter for wave height = 8.5 m
28	H18	N	5	Counter for wave height = 9.0 m
29	H19	N	5	Counter for wave height = 9.5 m
30	H20	N	5	Counter for wave height = 10.0 m
31	H21	N	5	Counter for wave height = 10.5 m
32	H22	N	5	Counter for wave height = 11.0 m
33	H23	N	5	Counter for wave height = 11.5 m
34	H24	N	5	Counter for wave height = 12.0 m
35	H25	N	5	Counter for wave height = 12.5 m
36	H26	N	5	Counter for wave height = 13.0 m
37	H27	N	5	Counter for wave height = 13.5 m

File: HAPmmmy$_0$y$_0$ (cont'd)
Hmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
38	H28	N	5	Counter for wave height = 14.0 m
39	H29	N	5	Counter for wave height = 14.5 m
40	H30	N	5	Counter for wave height = 15.0 m
41	H31	N	5	Counter for wave height = 15.5 m
42	H32	N	5	Counter for wave height = 16.0 m
43	H33	N	5	Counter for wave height = 16.5 m
44	H34	N	5	Counter for wave height = 17.0 m
45	H35	N	5	Counter for wave height = 17.5 m
46	H36	N	5	Counter for wave height = 18.0 m
47	H37	N	5	Counter for wave height = 18.5 m
48	H38	N	5	Counter for wave height = 19.0 m
49	H39	N	5	Counter for wave height = 19.5 m
50	H40	N	5	Counter for wave height = 20.0 m
51	H41	N	5	Counter for wave height = 20.5 m
52	H42	N	5	Counter for wave height = 21.0 m
53	H43	N	5	Counter for wave height = 21.5 m
54	H44	N	5	Counter for wave height = 22.0 m
55	H45	N	5	Counter for wave height = 22.5 m
56	H46	N	5	Counter for wave height = 23.0 m
57	H47	N	5	Counter for wave height = 23.5 m
58	H48	N	5	Counter for wave height = 24.0 m
59	H49	N	5	Counter for wave height = 24.5 m
60	H50	N	5	Counter for wave height = 25.0 m
61	H51	N	5	Counter for wave height ≥ 25.5 m
62	HMEDIAN	N	3	Median wave height (to the nearest 0.5 m) in 0.1 m
63	HEIGHT1	N	4	Percentage of obs with wave heights ≤ 1.5 m in 0.1 %
64	HEIGHT2	N	4	Percentage of obs with wave heights ≥ 4.0 m in 0.1 %
65	HEIGHT3	N	4	Percentage of obs with wave heights ≥ 6.0 m in 0.1 %
66	PSUM	N	8	Sum of wave periods in sec
67	PSQSUM	N	10	Sum of squares of wave periods in sec^2
68	PMEAN	N	3	Mean wave period in sec
69	PSTDEV	N	3	S.D. of wave periods in 0.1 sec
70	PMAX	N	3	Maximum wave period in sec
71	HOFPMAX	N	3	Height of wave of maximum period (to the nearest 0.5 m) in 0.1 m
72	P1	N	5	Counter for wave period = 1 sec
73	P2	N	5	Counter for wave period = 2 sec
74	P3	N	5	Counter for wave period = 3 sec
75	P4	N	5	Counter for wave period = 4 sec
76	P5	N	5	Counter for wave period = 5 sec
77	P6	N	5	Counter for wave period = 6 sec
78	P7	N	5	Counter for wave period = 7 sec
79	P8	N	5	Counter for wave period = 8 sec
80	P9	N	5	Counter for wave period = 9 sec

File: HAPmmmy$_0$y$_0$ (cont'd)
Hmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
81	P10	N	5	Counter for wave period = 10 sec
82	P11	N	5	Counter for wave period = 11 sec
83	P12	N	5	Counter for wave period = 12 sec
84	P13	N	5	Counter for wave period = 13 sec
85	P14	N	5	Counter for wave period = 14 sec
86	P15	N	5	Counter for wave period = 15 sec
87	P16	N	5	Counter for wave period = 16 sec
88	P17	N	5	Counter for wave period = 17 sec
89	P18	N	5	Counter for wave period = 18 sec
90	P19	N	5	Counter for wave period = 19 sec
91	P20	N	5	Counter for wave period = 20 sec
92	P21	N	5	Counter for wave period = 21 sec
93	P22	N	5	Counter for wave period = 22 sec
94	P23	N	5	Counter for wave period = 23 sec
95	P24	N	5	Counter for wave period = 24 sec
96	P25	N	5	Counter for wave period = 25 sec
97	P26	N	5	Counter for wave period = 26 sec
98	P27	N	5	Counter for wave period = 27 sec
99	P28	N	5	Counter for wave period = 28 sec
100	P29	N	5	Counter for wave period = 29 sec
101	P30	N	5	Counter for wave period = 30 sec
102	P31	N	5	Counter for wave period = 31 sec
103	P32	N	5	Counter for wave period = 32 sec
104	P33	N	5	Counter for wave period = 33 sec
105	P34	N	5	Counter for wave period = 34 sec
106	P35	N	5	Counter for wave period = 35 sec
107	P36	N	5	Counter for wave period = 36 sec
108	P37	N	5	Counter for wave period = 37 sec
109	P38	N	5	Counter for wave period = 38 sec
110	P39	N	5	Counter for wave period = 39 sec
111	P40	N	5	Counter for wave period = 40 sec
112	P41	N	5	Counter for wave period = 41 sec
113	P42	N	5	Counter for wave period = 42 sec
114	P43	N	5	Counter for wave period = 43 sec
115	P44	N	5	Counter for wave period = 44 sec
116	P45	N	5	Counter for wave period = 45 sec
117	P46	N	5	Counter for wave period = 46 sec
118	P47	N	5	Counter for wave period = 47 sec
119	P48	N	5	Counter for wave period = 48 sec
120	P49	N	5	Counter for wave period = 49 sec
121	P50	N	5	Counter for wave period = 50 sec
122	P51	N	5	Counter for wave period ≥ 51 sec
123	PMEDIAN	N	3	Median wave period in sec
124	PERIOD1	N	4	Percentage of obs with wave periods ≥ 6.0 sec in 0.1 %
125	MAXWAVE	N	3	Maximum wave height (to the nearest 0.5 m) in 0.1 m (conditional)
126	POFMAXWAVE	N	3	Period of highest wave in sec (conditional)

		Content
File name	: $Lmmmy_1y_1y_2y_2$	Statistics and processed results of swell for each grid of the map mmm in the years y_1y_1 to y_2y_2
	$SWLmmmy_0y_0$	Statistics and processed results of swell for each grid of the map mmm in the year y_0y_0

No. of fields : 40
Size of 1 record: 195 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	SOBS	N	6	No. of obs reporting swell
4	S1	N	5	Counter for swell direction from 010°
5	S2	N	5	Counter for swell direction from 020°
6	S3	N	5	Counter for swell direction from 030°
7	S4	N	5	Counter for swell direction from 040°
8	S5	N	5	Counter for swell direction from 050°
9	S6	N	5	Counter for swell direction from 060°
10	S7	N	5	Counter for swell direction from 070°
11	S8	N	5	Counter for swell direction from 080°
12	S9	N	5	Counter for swell direction from 090°
13	S10	N	5	Counter for swell direction from 100°
14	S11	N	5	Counter for swell direction from 110°
15	S12	N	5	Counter for swell direction from 120°
16	S13	N	5	Counter for swell direction from 130°
17	S14	N	5	Counter for swell direction from 140°
18	S15	N	5	Counter for swell direction from 150°
19	S16	N	5	Counter for swell direction from 160°
20	S17	N	5	Counter for swell direction from 170°
21	S18	N	5	Counter for swell direction from 180°
22	S19	N	5	Counter for swell direction from 190°
23	S20	N	5	Counter for swell direction from 200°
24	S21	N	5	Counter for swell direction from 210°
25	S22	N	5	Counter for swell direction from 220°
26	S23	N	5	Counter for swell direction from 230°
27	S24	N	5	Counter for swell direction from 240°
28	S25	N	5	Counter for swell direction from 250°
29	S26	N	5	Counter for swell direction from 260°
30	S27	N	5	Counter for swell direction from 270°
31	S28	N	5	Counter for swell direction from 280°
32	S29	N	5	Counter for swell direction from 290°
33	S30	N	5	Counter for swell direction from 300°
34	S31	N	5	Counter for swell direction from 310°
35	S32	N	5	Counter for swell direction from 320°
36	S33	N	5	Counter for swell direction from 330°
37	S34	N	5	Counter for swell direction from 340°
38	S35	N	5	Counter for swell direction from 350°
39	S36	N	5	Counter for swell direction from 360°
40	SPREVAIL	C	3	Prevailing swell direction (to the nearest 10°) in degrees

Appendix 1 Layout of files in the database (Cont'd)

Content

File name : MCSCHART — Information on charts of MCS

No. of fields : 24
Size of 1 record: 465 bytes

Structure

Field	Field Name	Type	Width	
1	CHART	C	5	Chart no.
2	TITLE	C	40	Chart title
3	DATA1A	C	58	Line 1 for legend of element 1
4	DATA1B	C	58	Line 2 for legend of element 1
5	FILE1A	C	3	File 1 prefix for element 1
6	FILE1B	C	1	File 2 prefix for element 1
7	RECORD1	N	3	Record no. in file 1 or 2 for element 1
8	FMT1	C	10	Format for coding element 1
9	SKIP1	C	6	Value of element 1 to skip coding
10	DATA2A	C	58	Line 1 for legend of element 2
11	DATA2B	C	58	Line 2 for legend of element 2
12	FILE2A	C	3	File 1 prefix for element 2
13	FILE2B	C	1	File 2 prefix for element 2
14	RECORD2	N	3	Record no. in file 1 or 2 for element 2
15	FMT2	C	10	Format for coding element 2
16	SKIP2	C	6	Value of element 2 to skip coding
17	DATA3A	C	58	Line 1 for legend of element 3
18	DATA3B	C	58	Line 2 for legend of element 3
19	FILE3A	C	3	File 1 prefix for element 3
20	FILE3B	C	1	File 2 prefix for element 3
21	RECORD3	N	3	Record no. in file 1 or 2 for element 3
22	FMT3	C	10	Format for coding element 3
23	SKIP3	C	6	Value of element 3 to skip coding
24	SEQ	N	2	Sequence of this chart to be presented

Content

File name : MCSGRID — Information on grids of maps of MCS

No. of fields : 8
Size of 1 record : 31 bytes

Structure

Field	Field Name	Type	Width	
1	MAP	N	3	Map no.
2	GRID	N	3	Grid no. of the map
3	NLAT	N	4	Northern latitude* of the grid in 0.1°
4	SLAT	N	4	Southern latitude* of the grid in 0.1°
5	WLONG	N	5	Western longitude* of the grid in 0.1°
6	ELONG	N	5	Eastern longitude* of the grid in 0.1°
7	ROWGO	N	3	The topmost row no. relative to the north-western corner of the map for printing data of the elements
8	COLGO	N	3	The leftmost column no. relative to the north-western corner of the map for printing data of the elements

* Negative values indicate °S or °W.

Content

File name : MCSMAP — Information on maps of MCS

No. of fields : 20
Size of 1 record : 64 bytes

Structure

Field	Field Name	Type	Width	
1	MAP	N	3	Map no.
2	NLAT	N	4	Northern latitude* of the map in 0.1°
3	SLAT	N	4	Southern latitude* of the map in 0.1°
4	WLONG	N	5	Western longitude* of the map in 0.1°
5	ELONG	N	5	Eastern longitude* of the map in 0.1°
6	GRIDS	N	4	No. of grids in this map
7	ROWS	N	3	Total no. of rows in this map
8	COLS	N	3	Total no. of columns in this map
9	HAROW	N	3	The topmost row no. for the lines of heading relative to the north-western corner of this map
10	HACOL	N	3	The leftmost column no. for the lines of heading relative to the north-western corner of this map (maximum 40 columns)
11	HAMODE	C	1	Mode for aligning lines of heading (L: left justified; C: centred; R: right justified)
12	HALINE	N	1	No. of blank lines between each line of heading (0 if no embedded blank lines)
13	LAROW	N	3	The topmost row no. for the lines of legend for elements relative to the north-western corner of this map
14	LACOL	N	3	The leftmost column no. for the lines of legend for elements relative to the north-western corner of this map
15	AROW1	N	3	Row no. relative to the north-western corner of this map for the first alignment mark (┐)
16	ACOL1	N	3	Column no. relative to the north-western corner of this map for the first alignment mark
17	AROW2	N	3	Row no. relative to the north-western corner of this map for the second alignment mark (┤)
18	ACOL2	N	3	Column no. relative to the north-western corner of this map for the second alignment mark
19	AROW3	N	3	Row no. relative to the north-western corner of this map for the third alignment mark (┘)
20	ACOL3	N	3	Column no. relative to the north-western corner of this map for the third alignment mark

* Negative values indicate °S or °W.

Appendix 1 Layout of files in the database (Cont'd)

Content

File name : MEMBERS — WMO members recruiting VOS

No. of fields : 3
Size of 1 record: 85 bytes

Structure

Field	Field Name	Type	Width	
1	CODE	C	2	Code of WMO member
2	SAMEAS	C	2	Equivalent code of this member
3	NAME	C	80	Name of WMO member

Content

File name : Mmmm$y_1y_1y_2y_2$

Statistics of all elements to be presented in the charts of the MCS for each grid of the map mmm in the years y_1y_1 to y_2y_2

No. of fields : 56
Size of 1 record: 330 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	C01D1	C	6	Data 1 for chart 1
4	C01D2	C	6	Data 2 for chart 1
5	C01D3	C	6	Data 3 for chart 1
6	C02D1	C	6	Data 1 for chart 2
7	C02D2	C	6	Data 2 for chart 2
8	C02D3	C	6	Data 3 for chart 2
9	C03D1	C	6	Data 1 for chart 3
10	C03D2	C	6	Data 2 for chart 3
11	C03D3	C	6	Data 3 for chart 3
12	C04D1	C	6	Data 1 for chart 4
13	C04D2	C	6	Data 2 for chart 4
14	C04D3	C	6	Data 3 for chart 4
15	C05D1	C	6	Data 1 for chart 5
16	C05D2	C	6	Data 2 for chart 5
17	C05D3	C	6	Data 3 for chart 5
18	C06D1	C	6	Data 1 for chart 6
19	C06D2	C	6	Data 2 for chart 6
20	C06D3	C	6	Data 3 for chart 6
21	C07D1	C	6	Data 1 for chart 7
22	C07D2	C	6	Data 2 for chart 7
23	C07D3	C	6	Data 3 for chart 7
24	C08D1	C	6	Data 1 for chart 8
25	C08D2	C	6	Data 2 for chart 8
26	C08D3	C	6	Data 3 for chart 8
27	C09D1	C	6	Data 1 for chart 9
28	C09D2	C	6	Data 2 for chart 9
29	C09D3	C	6	Data 3 for chart 9
30	C10D1	C	6	Data 1 for chart 10
31	C10D2	C	6	Data 2 for chart 10
32	C10D3	C	6	Data 3 for chart 10
33	C11D1	C	6	Data 1 for chart 11
34	C11D2	C	6	Data 2 for chart 11
35	C11D3	C	6	Data 3 for chart 11
36	C12D1	C	6	Data 1 for chart 12
37	C12D2	C	6	Data 2 for chart 12
38	C12D3	C	6	Data 3 for chart 12
39	C13D1	C	6	Data 1 for chart 13
40	C13D2	C	6	Data 2 for chart 13
41	C13D3	C	6	Data 3 for chart 13
42	C14D1	C	6	Data 1 for chart 14
43	C14D2	C	6	Data 2 for chart 14

File: $Mmmmy_1y_1y_2y_2$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
44	C14D3	C	6	Data 3 for chart 14
45	C15D1	C	6	Data 1 for chart 15
46	C15D2	C	6	Data 2 for chart 15
47	C15D3	C	6	Data 3 for chart 15
48	C16D1	C	6	Data 1 for chart 16
49	C16D2	C	6	Data 2 for chart 16
50	C16D3	C	6	Data 3 for chart 16
51	C17D1	C	6	Data 1 for chart 17
52	C17D2	C	6	Data 2 for chart 17
53	C17D3	C	6	Data 3 for chart 17
54	C18D1	C	6	Data 1 for chart 18
55	C18D2	C	6	Data 2 for chart 18
56	C18D3	C	6	Data 3 for chart 18

		Content
File name	: NATmmmy_0y_0	WMO members' contribution for the map mmm in the year y_0y_0
	Nmmm$y_1y_1y_2y_2$	WMO members' contribution for the map mmm in the years y_1y_1 to y_2y_2

No. of fields : 3
Size of 1 record: 11 bytes

Structure

Field	Field Name	Type	Width	
1	CODE	C	2	Code of WMO member
2	MONTH	N	2	Month of the year
3	NUMBER	N	6	No. of obs contributed by this member

Appendix 1 Layout of files in the database (Cont'd)

		Content
File name	: SHIP$y_0y_0m_0m_0$	Ship weather reports in IMMT format for the year y_0y_0 and the month m_0m_0

No. of fields : 81
Size of 1 record : 125 bytes

Structure

Field	Field Name	Type	Width	
1	ITEMP	C	1	Format and temperature indicator
2	YEAR	C	2	Year, last two digits
3	MONTH	C	2	Month
4	DAY	C	2	Day
5	HOUR	C	2	Hour (00 - 23) GMT
6	IWIND	C	1	Indicator for wind speed
7	OCTANT	C	1	Octant of the globe
8	LAT	N	3	Latitude in 0.1 degree
9	LONG	N	3	Longitude (less 100.0 for longitudes in the range of 100.0 to 180.0 °E or °W) in 0.1 degree
10	ICAV	C	1	Indicator for cloud height and visibility
11	BASE	C	1	Height of lowest cloud
12	VV	C	2	Visibility
13	CLDAMT	C	1	Total cloud amount
14	DD	C	2	True wind direction in 10°
15	FF	C	2	Wind speed
16	SAIR	C	1	Sign of air temperature
17	DRY	C	3	Air temperature in 0.1 °C
18	SWD1	C	1	Sign of reported wet-bulb or dew-point temperature
19	WD1	C	3	Wet-bulb/dew-point temperature in 0.1 °C
20	MSLP	C	4	Mean sea level pressure (less 1000.0 for pressures ≥ 1000.0 hPa) in 0.1 hPa
21	PRESENT	C	2	Present weather
22	PAST1	C	1	Past weather 1
23	PAST2	C	1	Past weather 2
24	LOWAMT	C	1	Amount of lowest cloud in oktas
25	LOW	C	1	Genus of low clouds
26	MEDIUM	C	1	Genus of medium clouds
27	HIGH	C	1	Genus of high clouds
28	SSEA	C	1	Sign of sea temperature
29	SST	C	3	Sea surface temperature in 0.1 °C
30	ISST	C	1	Indicator for sea surface temperature measurement
31	IWAVE	C	1	Indicator for wave measurement
32	PW	C	2	Period of wave in sec
33	HW	C	2	Height of wave in 0.5 m
34	DW1	C	2	Direction of predominant swell in 10°
35	PW1	C	2	Period of predominant swell in sec
36	HW1	C	2	Height of predominant swell in 0.5 m
37	ICE	C	1	Type of ice accretion on ship
38	ICETHICK	N	2	Thickness of ice accretion in cm
39	ICERATE	C	1	Rate of ice accretion

File: SHIP$y_0y_0m_0m_0$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
40	SOURCE	C	1	Source of observation
41	PLATFORM	C	1	Observation platform
42	CALLSIGN	C	7	Ship identifier (callsign)
43	MEMBER	C	2	Country which has recruited the ship
44	IQC	C	1	QCI
45	NUSE1	C	1	Weather group indicator (national use)
46	NUSE2	C	1	National use
47	IPPT	C	1	Indicator for precipitation
48	PPTAMT	N	3	Rainfall amount
49	PPTIME	C	1	Rainfall duration in units of 6 hours
50	SWD2	C	1	Sign of computed wet-bulb or dew-point temperature
51	WD2	C	3	Computed wet-bulb or dew-point temperature in 0.1 °C
52	PCHA	C	1	Pressure change characteristic
53	PPP	N	3	Pressure changed in 0.1 hPa
54	COURSE	C	1	Ship's course
55	SPEED	C	1	Ship's average speed
56	DW2	C	2	Direction of second swell in 10°
57	PW2	C	2	Period of second swell in sec
58	HW2	C	2	Height of second swell in 0.5 m
59	ICECON	C	1	Concentration or arrangement of sea ice
60	ICEDEV	C	1	Stage of development of sea ice
61	ICELAND	C	1	Ice of land origin
62	ICEDGE	C	1	Principal ice edge bearing
63	ICETREND	C	1	Ice situation and trend
64	Q1	C	1	QCI for height of lowest cloud base
65	Q2	C	1	QCI for visibility
66	Q3	C	1	QCI for clouds
67	Q4	C	1	QCI for wind direction
68	Q5	C	1	QCI for wind speed
69	Q6	C	1	QCI for air temperature
70	Q7	C	1	QCI for wet-bulb and dew-point temperature
71	Q8	C	1	QCI for mean sea level pressure
72	Q9	C	1	QCI for weather
73	Q10	C	1	QCI for sea surface temperature
74	Q11	C	1	QCI for wave period
75	Q12	C	1	QCI for wave height
76	Q13	C	1	QCI for swell
77	Q14	C	1	QCI for precipitation
78	Q15	C	1	QCI for pressure change characteristics
79	Q16	C	1	QCI for pressure changed
80	Q17	C	1	QCI for ship's course
81	Q18	C	1	QCI for ship's speed

Appendix 1 Layout of files in the database (Cont'd)

Content

File name : Ummmy$_1$y$_1$y$_2$y$_2$ Statistics and processed results of wind (part 2) for each grid of the map mmm in the years y$_1$y$_1$ to y$_2$y$_2$

WD2mmmy$_0$y$_0$ Statistics and processed results of wind (part 2) for each grid of the map mmm in the year y$_0$y$_0$

No. of fields : 123
Size of 1 record: 545 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	LIGHT	N	4	Percentage of obs with light winds (wind speeds ≤ 3 m/s) in 0.1 %
4	STRONG	N	4	Percentage of obs with strong winds (wind speeds ≥ 11 m/s) in 0.1 %
5	STRONG1	N	5	Counter for strong winds with direction from 010°
6	STRONG2	N	5	Counter for strong winds with direction from 020°
7	STRONG3	N	5	Counter for strong winds with direction from 030°
8	STRONG4	N	5	Counter for strong winds with direction from 040°
9	STRONG5	N	5	Counter for strong winds with direction from 050°
10	STRONG6	N	5	Counter for strong winds with direction from 060°
11	STRONG7	N	5	Counter for strong winds with direction from 070°
12	STRONG8	N	5	Counter for strong winds with direction from 080°
13	STRONG9	N	5	Counter for strong winds with direction from 090°
14	STRONG1O	N	5	Counter for strong winds with direction from 100°
15	STRONG11	N	5	Counter for strong winds with direction from 110°
16	STRONG12	N	5	Counter for strong winds with direction from 120°
17	STRONG13	N	5	Counter for strong winds with direction from 130°
18	STRONG14	N	5	Counter for strong winds with direction from 140°
19	STRONG15	N	5	Counter for strong winds with direction from 150°
20	STRONG16	N	5	Counter for strong winds with direction from 160°
21	STRONG17	N	5	Counter for strong winds with direction from 170°

File: Ummmy$_1$y$_1$y$_2$y$_2$ (cont'd)
WD2mmmy$_0$y$_0$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
22	STRONG18	N	5	Counter for strong winds with direction from 180°
23	STRONG19	N	5	Counter for strong winds with direction from 190°
24	STRONG20	N	5	Counter for strong winds with direction from 200°
25	STRONG21	N	5	Counter for strong winds with direction from 210°
26	STRONG22	N	5	Counter for strong winds with direction from 220°
27	STRONG23	N	5	Counter for strong winds with direction from 230°
28	STRONG24	N	5	Counter for strong winds with direction from 240°
29	STRONG25	N	5	Counter for strong winds with direction from 250°
30	STRONG26	N	5	Counter for strong winds with direction from 260°
31	STRONG27	N	5	Counter for strong winds with direction from 270°
32	STRONG28	N	5	Counter for strong winds with direction from 280°
33	STRONG29	N	5	Counter for strong winds with direction from 290°
34	STRONG30	N	5	Counter for strong winds with direction from 300°
35	STRONG31	N	5	Counter for strong winds with direction from 310°
36	STRONG32	N	5	Counter for strong winds with direction from 320°
37	STRONG33	N	5	Counter for strong winds with direction from 330°
38	STRONG34	N	5	Counter for strong winds with direction from 340°
39	STRONG35	N	5	Counter for strong winds with direction from 350°
40	STRONG36	N	5	Counter for strong winds with direction from 360°
41	GALES	N	4	Percentage of gales (wind speeds ≥ 17 m/s) in 0.1 %
42	GALES1	N	5	Counter for gales with direction from 010°
43	GALES2	N	5	Counter for gales with direction from 020°
44	GALES3	N	5	Counter for gales with direction from 030°
45	GALES4	N	5	Counter for gales with direction from 040°
46	GALES5	N	5	Counter for gales with direction from 050°
47	GALES6	N	5	Counter for gales with direction from 060°
48	GALES7	N	5	Counter for gales with direction from 070°
49	GALES8	N	5	Counter for gales with direction from 080°
50	GALES9	N	5	Counter for gales with direction from 090°

File: Ummmy$_1$y$_1$y$_2$y$_2$ (cont'd)
WD2mmmy$_0$y$_0$ (cont'd)

Field	Field Name	Type	Width	Content
51	GALES10	N	5	Counter for gales with direction from 100°
52	GALES11	N	5	Counter for gales with direction from 110°
53	GALES12	N	5	Counter for gales with direction from 120°
54	GALES13	N	5	Counter for gales with direction from 130°
55	GALES14	N	5	Counter for gales with direction from 140°
56	GALES15	N	5	Counter for gales with direction from 150°
57	GALES16	N	5	Counter for gales with direction from 160°
58	GALES17	N	5	Counter for gales with direction from 170°
59	GALES18	N	5	Counter for gales with direction from 180°
60	GALES19	N	5	Counter for gales with direction from 190°
61	GALES20	N	5	Counter for gales with direction from 200°
62	GALES21	N	5	Counter for gales with direction from 210°
63	GALES22	N	5	Counter for gales with direction from 220°
64	GALES23	N	5	Counter for gales with direction from 230°
65	GALES24	N	5	Counter for gales with direction from 240°
66	GALES25	N	5	Counter for gales with direction from 250°
67	GALES26	N	5	Counter for gales with direction from 260°
68	GALES27	N	5	Counter for gales with direction from 270°
69	GALES28	N	5	Counter for gales with direction from 280°
70	GALES29	N	5	Counter for gales with direction from 290°
71	GALES30	N	5	Counter for gales with direction from 300°
72	GALES31	N	5	Counter for gales with direction from 310°
73	GALES32	N	5	Counter for gales with direction from 320°
74	GALES33	N	5	Counter for gales with direction from 330°
75	GALES34	N	5	Counter for gales with direction from 340°
76	GALES35	N	5	Counter for gales with direction from 350°
77	GALES36	N	5	Counter for gales with direction from 360°
78	STRONGPRE	C	3	Prevailing direction of strong winds (to the nearest 10°) in degrees
79	GALESPRE	C	3	Prevailing direction of gales (to the nearest 10°) in degrees
80	COMPOBS	N	6	No. of obs reporting wind excluding variable winds (i.e. no. of winds resolving into components)
81	SSUM	N	14	Sum of sine components of winds in 0.0001 m/s
82	CSUM	N	14	Sum of cosine components of winds in 0.0001 m/s
83	VSPEED	N	5	Vector mean wind speed in m/s
84	VDIR	C	3	Vector mean wind direction (to the nearest 10°) in degrees
85	STEADY	N	4	Steadiness of winds in 0.1 %
86	MAXSPEED	N	3	Maximum wind speed in m/s
87	MAXDIR1	N	3	Counter for maximum winds from 010°
88	MAXDIR2	N	3	Counter for maximum winds from 020°
89	MAXDIR3	N	3	Counter for maximum winds from 030°
90	MAXDIR4	N	3	Counter for maximum winds from 040°
91	MAXDIR5	N	3	Counter for maximum winds from 050°
92	MAXDIR6	N	3	Counter for maximum winds from 060°

File: Ummmy$_1$y$_1$y$_2$y$_2$ (cont'd)
WD2mmmy$_0$y$_0$ (cont'd)

Structure				Content
Field	Field Name	Type	Width	
93	MAXDIR7	N	3	Counter for maximum winds from 070°
94	MAXDIR8	N	3	Counter for maximum winds from 080°
95	MAXDIR9	N	3	Counter for maximum winds from 090°
96	MAXDIR10	N	3	Counter for maximum winds from 100°
97	MAXDIR11	N	3	Counter for maximum winds from 110°
98	MAXDIR12	N	3	Counter for maximum winds from 120°
99	MAXDIR13	N	3	Counter for maximum winds from 130°
100	MAXDIR14	N	3	Counter for maximum winds from 140°
101	MAXDIR15	N	3	Counter for maximum winds from 150°
102	MAXDIR16	N	3	Counter for maximum winds from 160°
103	MAXDIR17	N	3	Counter for maximum winds from 170°
104	MAXDIR18	N	3	Counter for maximum winds from 180°
105	MAXDIR19	N	3	Counter for maximum winds from 190°
106	MAXDIR20	N	3	Counter for maximum winds from 200°
107	MAXDIR21	N	3	Counter for maximum winds from 210°
108	MAXDIR22	N	3	Counter for maximum winds from 220°
109	MAXDIR23	N	3	Counter for maximum winds from 230°
110	MAXDIR24	N	3	Counter for maximum winds from 240°
111	MAXDIR25	N	3	Counter for maximum winds from 250°
112	MAXDIR26	N	3	Counter for maximum winds from 260°
113	MAXDIR27	N	3	Counter for maximum winds from 270°
114	MAXDIR28	N	3	Counter for maximum winds from 280°
115	MAXDIR29	N	3	Counter for maximum winds from 290°
116	MAXDIR30	N	3	Counter for maximum winds from 300°
117	MAXDIR31	N	3	Counter for maximum winds from 310°
118	MAXDIR32	N	3	Counter for maximum winds from 320°
119	MAXDIR33	N	3	Counter for maximum winds from 330°
120	MAXDIR34	N	3	Counter for maximum winds from 340°
121	MAXDIR35	N	3	Counter for maximum winds from 350°
122	MAXDIR36	N	3	Counter for maximum winds from 360°
123	MAXWIND	C	4	Maximum wind in ddff (dd = direction in 10°; ff = speed in m/s)

		Content
File name	: WD1mmmy_0y_0	Statistics and processed results of wind (part 1) for each grid of the map mmm in the year y_0y_0
	Wmmm$y_1y_1y_2y_2$	Statistics and processed results of wind (part 1) for each grid of the map mmm in the years y_1y_1 to y_2y_2

No. of fields : 98
Size of 1 record: 494 bytes

Structure

Field	Field Name	Type	Width	
1	MONTH	N	2	Month of the year
2	GRID	N	3	Grid no. of the map
3	WINDOBS	N	6	No. of obs reporting wind including variable winds
4	MEASURED	N	6	No. of obs with measured wind speed
5	SPEEDSUM	N	8	Sum of wind speeds in m/s
6	SPEEDSQSUM	N	10	Sum of squares of wind speeds in $(m/s)^2$
7	SCALAR	N	5	Scalar mean wind in m/s
8	SPEEDSTDEV	N	5	S.D. of wind speeds in 0.1 m/s
9	SPEED1	N	5	Counter for wind speed = 0 m/s
10	SPEED2	N	5	Counter for wind speed = 1 m/s
11	SPEED3	N	5	Counter for wind speed = 2 m/s
12	SPEED4	N	5	Counter for wind speed = 3 m/s
13	SPEED5	N	5	Counter for wind speed = 4 m/s
14	SPEED6	N	5	Counter for wind speed = 5 m/s
15	SPEED7	N	5	Counter for wind speed = 6 m/s
16	SPEED8	N	5	Counter for wind speed = 7 m/s
17	SPEED9	N	5	Counter for wind speed = 8 m/s
18	SPEED10	N	5	Counter for wind speed = 9 m/s
19	SPEED11	N	5	Counter for wind speed = 10 m/s
20	SPEED12	N	5	Counter for wind speed = 11 m/s
21	SPEED13	N	5	Counter for wind speed = 12 m/s
22	SPEED14	N	5	Counter for wind speed = 13 m/s
23	SPEED15	N	5	Counter for wind speed = 14 m/s
24	SPEED16	N	5	Counter for wind speed = 15 m/s
25	SPEED17	N	5	Counter for wind speed = 16 m/s
26	SPEED18	N	5	Counter for wind speed = 17 m/s
27	SPEED19	N	5	Counter for wind speed = 18 m/s
28	SPEED20	N	5	Counter for wind speed = 19 m/s
29	SPEED21	N	5	Counter for wind speed = 20 m/s
30	SPEED22	N	5	Counter for wind speed = 21 m/s
31	SPEED23	N	5	Counter for wind speed = 22 m/s
32	SPEED24	N	5	Counter for wind speed = 23 m/s
33	SPEED25	N	5	Counter for wind speed = 24 m/s
34	SPEED26	N	5	Counter for wind speed = 25 m/s
35	SPEED27	N	5	Counter for wind speed = 26 m/s
36	SPEED28	N	5	Counter for wind speed = 27 m/s
37	SPEED29	N	5	Counter for wind speed = 28 m/s
38	SPEED30	N	5	Counter for wind speed = 29 m/s
39	SPEED31	N	5	Counter for wind speed = 30 m/s

File: WD1mmmy$_0$y$_0$ (cont'd)
Wmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Field	Field Name	Type	Width	Content
40	SPEED32	N	5	Counter for wind speed = 31 m/s
41	SPEED33	N	5	Counter for wind speed = 32 m/s
42	SPEED34	N	5	Counter for wind speed = 33 m/s
43	SPEED35	N	5	Counter for wind speed = 34 m/s
44	SPEED36	N	5	Counter for wind speed = 35 m/s
45	SPEED37	N	5	Counter for wind speed = 36 m/s
46	SPEED38	N	5	Counter for wind speed = 37 m/s
47	SPEED39	N	5	Counter for wind speed = 38 m/s
48	SPEED40	N	5	Counter for wind speed = 39 m/s
49	SPEED41	N	5	Counter for wind speed = 40 m/s
50	SPEED42	N	5	Counter for wind speed = 41 m/s
51	SPEED43	N	5	Counter for wind speed = 42 m/s
52	SPEED44	N	5	Counter for wind speed = 43 m/s
53	SPEED45	N	5	Counter for wind speed = 44 m/s
54	SPEED46	N	5	Counter for wind speed = 45 m/s
55	SPEED47	N	5	Counter for wind speed = 46 m/s
56	SPEED48	N	5	Counter for wind speed = 47 m/s
57	SPEED49	N	5	Counter for wind speed = 48 m/s
58	SPEED50	N	5	Counter for wind speed = 49 m/s
59	SPEED51	N	5	Counter for wind speed ≥ 50 m/s
60	DIR0	N	5	Counter for variable winds
61	DIR1	N	5	Counter for wind direction = 010°
62	DIR2	N	5	Counter for wind direction = 020°
63	DIR3	N	5	Counter for wind direction = 030°
64	DIR4	N	5	Counter for wind direction = 040°
65	DIR5	N	5	Counter for wind direction = 050°
66	DIR6	N	5	Counter for wind direction = 060°
67	DIR7	N	5	Counter for wind direction = 070°
68	DIR8	N	5	Counter for wind direction = 080°
69	DIR9	N	5	Counter for wind direction = 090°
70	DIR10	N	5	Counter for wind direction = 100°
71	DIR11	N	5	Counter for wind direction = 110°
72	DIR12	N	5	Counter for wind direction = 120°
73	DIR13	N	5	Counter for wind direction = 130°
74	DIR14	N	5	Counter for wind direction = 140°
75	DIR15	N	5	Counter for wind direction = 150°
76	DIR16	N	5	Counter for wind direction = 160°
77	DIR17	N	5	Counter for wind direction = 170°
78	DIR18	N	5	Counter for wind direction = 180°
79	DIR19	N	5	Counter for wind direction = 190°
80	DIR20	N	5	Counter for wind direction = 200°
81	DIR21	N	5	Counter for wind direction = 210°
82	DIR22	N	5	Counter for wind direction = 220°
83	DIR23	N	5	Counter for wind direction = 230°
84	DIR24	N	5	Counter for wind direction = 240°
85	DIR25	N	5	Counter for wind direction = 250°
86	DIR26	N	5	Counter for wind direction = 260°
87	DIR27	N	5	Counter for wind direction = 270°
88	DIR28	N	5	Counter for wind direction = 280°

File: WD1mmmy$_0$y$_0$ (cont'd)
Wmmmy$_1$y$_1$y$_2$y$_2$ (cont'd)

Field	Field Name	Type	Width	Content
	Structure			Content
89	DIR29	N	5	Counter for wind direction = 290°
90	DIR30	N	5	Counter for wind direction = 300°
91	DIR31	N	5	Counter for wind direction = 310°
92	DIR32	N	5	Counter for wind direction = 320°
93	DIR33	N	5	Counter for wind direction = 330°
94	DIR34	N	5	Counter for wind direction = 340°
95	DIR35	N	5	Counter for wind direction = 350°
96	DIR36	N	5	Counter for wind direction = 360°
97	SPMEDIAN	N	5	Median wind speed in m/s
98	PREVAIL	C	3	Prevailing direction of all winds excluding variable winds (to the nearest 10°) in degrees

Content

File name : ZZZZGRID

Information on record numbers for each grid, each month and each file of statistics of the elements (temporary file).

No. of fields : 15
Size of 1 record : 84 bytes

Structure

Field	Field Name	Type	Width	
1	GRID	N	3	Grid no.
2	FILE_SEQ	N	2	Sequence no. of the file of statistics
3	MONTH1	N	6	Record no. in the file for statistics of the grid in January
4	MONTH2	N	6	Record no. in the file for statistics of the grid in February
5	MONTH3	N	6	Record no. in the file for statistics of the grid in March
6	MONTH4	N	6	Record no. in the file for statistics of the grid in April
7	MONTH5	N	6	Record no. in the file for statistics of the grid in May
8	MONTH6	N	6	Record no. in the file for statistics of the grid in June
9	MONTH7	N	6	Record no. in the file for statistics of the grid in July
10	MONTH8	N	6	Record no. in the file for statistics of the grid in August
11	MONTH9	N	6	Record no. in the file for statistics of the grid in September
12	MONTH10	N	6	Record no. in the file for statistics of the grid in October
13	MONTH11	N	6	Record no. in the file for statistics of the grid in November
14	MONTH12	N	6	Record no. in the file for statistics of the grid in December
15	MONTH13	N	6	Record no. in the file for statistics of the grid for the whole year

Appendix 2 List of programs in the MCSC package

Name of Program	Function of Program
ARCTAN10	Look up table for arctangent
BOXES	Draw boxes
CHARTS	Control processing of information for charts
CODEMAP	Prepare and code a map
COMBINE	Combine statistics for a span of years
COS10	Look up table for cosine
COUNTRY	Control processing of list of countries with VOS
ENCODE	Convert a number to characters
EXAMINE	Check and edit derived statistics and other results
EXTRACT	Extract relevant statistics for appropriate charts
FILES	Maintain database and associated index files
FORMAT	Display instructions or warnings
GETKEY	Get a pressed key
GETOPT	Display a menu of option and get the selection
GRID1	Enumerate data of elements for a month
GRID2	Derive statistics for a month
GRID3	Derive statistics for a year
GRIDS	Control processing of information for grids
JOINMAPS	Join two or more coded maps in one page
KEYCHAR	Accept an allowed key entry
MAPS	Control processing of information for maps
MASTERS	Prepare text of masters
MAXCLASS	Find the class of largest value
MCSMAIN	Main program of the MCSC package
MEDIAN	Locate the median of a sample
NATIONS	Enumerate contribution of each member
ODD	Check if the number is odd
PAUSE	Pause for a specific time
PRINTMCS	Print the master using the bubble jet printer
PRINTOUT	Print the master (without map) using any printer
PROCESS	Control processing of ship data
RING	Ring a bell
SHIPAREA	Set filter for searching ships within specified area
SIN10	Look up table for sine
STAT1	Calculate means, standard deviation, etc.
TOPRINT	Check if printout is required
USEPRINT	Check if printer is ready
WHICHOBS	Fetch relevant ship reports with specific conditions
WINDPREV	Find the prevailing wind direction