

Manual on Marine Meteorological Services

Volume I – Global Aspects

2012 edition



**World
Meteorological
Organization**

WMO-No. 558

Weather • Climate • Water

Manual on Marine Meteorological Services

Volume I

(Annex VI to WMO Technical Regulations)

Global Aspects

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**World
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Organization**
Weather • Climate • Water

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EDITORIAL NOTE

The following typographical practice has been followed: Standard practices and procedures have been printed in semi-bold roman. Recommended practices and procedures have been printed in light face roman. Notes have been printed in smaller type, light face roman, and preceded by the indication Note.

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INTRODUCTION

1. GENERAL

1.1 The *Manual on Marine Meteorological Services* (WMO-No. 558) is issued in accordance with a decision of the Eighth World Meteorological Congress.

1.2 This Manual is designed:

- (a) To facilitate cooperation in respect of the international coordination of marine meteorological services (MMS);
- (b) To specify obligations of Members in the implementation of MMS;
- (c) To ensure uniformity in the practices and procedures employed in achieving (a) and (b) above;
- (d) To facilitate the development of adequate support from World Weather Watch (WWW) to MMS.

1.3 The Manual is composed of Volumes I and II, dealing with global and regional aspects, respectively. Volume I is composed of four parts that contain the regulatory material dealing essentially with international obligations of Members to provide MMS for the high seas, coastal and off-shore areas, harbour approaches and ports. Additional obligations, if any, for national marine activities should be met according to local practices and procedures.

1.4 The regulatory material stems from recommendations of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the former Commission for Marine Meteorology (CMM), and resolutions of regional associations, as well as from decisions taken by Congress and the Executive Council.

1.5 Volume I of the Manual – Global Aspects forms part of the World Meteorological Organization (WMO) *Technical Regulations* (WMO-No. 49) and is referred to as Annex VI to the *Technical Regulations*.

1.6 Volume II of the Manual – Regional Aspects – does not form part of the WMO *Technical Regulations*.

2. TYPES OF REGULATION

Volume I of the Manual comprises both standard and recommended practices and procedures. The definitions of these two types of practices and procedures in the Manual are as described in 2.1 and 2.2.

2.1 The standard practices and procedures:

- (a) Shall be the practices and procedures that it is necessary for Members to follow or implement;
- (b) Shall have the status of requirements in a technical resolution in respect of which Article 9(b) of the Convention of WMO is applicable;
- (c) Shall invariably be distinguished by the use of the term “shall” in the English text, and by suitable equivalent terms in the French, Russian and Spanish texts.

2.2 The recommended practices and procedures:

- (a) Shall be the practices and procedures that it is desirable for Members to follow or implement;
- (b) Shall have the status of recommendations to Members to which Article 9(b) of the Convention shall not be applied;
- (c) Shall be distinguished by the use of the term “should” in the English text (except where specifically otherwise provided by decision of Congress) and by suitable equivalent terms in the French, Russian and Spanish texts.

2.3 In accordance with the above definitions, Members shall do their utmost to implement the standard practices and procedures. In accordance with Article 9(b) of the Convention and in conformity with the provision of Regulation 124 of the General Regulations, Members shall formally notify the Secretary-General, in writing, of their intention to apply the “standard practices and procedures” of the Manual except those for which they have lodged specific deviation. Members shall also inform the Secretary-General, at least three months in advance, of any change in the degree of their implementation of a “standard practice or procedure” as previously notified and of the effective date of the change.

2.4 With regard to recommended practices and procedures, Members are urged to comply with these, but it is not necessary to notify the Secretary-General of non-observance.

2.5 In order to clarify the status of the various regulatory material, the standard practices and procedures are distinguished from the recommended practices and procedures by a difference in typographical practice, as indicated in the editorial note.

3. NOTES AND APPENDICES

Certain notes are included in the Manual for explanatory purposes. They do not have the status of the annexes to the *Technical Regulations* (WMO–No. 49).

3.1 Texts that are appended to the Manual are called “appendices” and have the same status as the procedures to which they refer.

3.2. The words “shall” and “should” in the appendices, notes and Volume II have their dictionary meanings and do not have the regulatory character mentioned in 2 above.

4. PURPOSE OF AND PROCEDURES FOR AMENDING THE MANUAL ON MARINE METEOROLOGICAL SERVICES

The purpose of MMS shall be to make available to marine users at sea or on the coast marine meteorological and related geophysical information that they require, to the extent technically possible.

4.1 General validation and implementation procedures

4.1.1 Amendments to the *Manual on Marine Meteorological Services* and to the *Guide to Marine Meteorological Services* (WMO-No. 471) must be proposed in writing to the WMO Secretariat. The proposal shall specify the needs, purposes and requirements and include information on a contact point for technical matters.

4.1.2 The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology has several Expert Teams (ETs) supporting provision of MMS (see note 1 below). The Expert Team on Maritime Safety Services (ETMSS), the Expert Team on Marine Climatology (ETMC) or the Ship Observations Team (SOT) (depending on the nature of the change),¹ supported by the WMO Secretariat, shall validate the stated requirements (unless it is consequential to an amendment to the WMO *Technical Regulations*) and develop a draft

recommendation to respond to these requirements, as appropriate.

4.1.3 A draft recommendation of ETMSS, ETMC or SOT must be validated. The draft must be endorsed by the respective Programme Area (PA) Coordination Group. The date of implementation should be defined by ETMSS, ETMC or SOT to give sufficient time to the WMO Members to implement the amendments after the date of notification. ETMSS should document the reasons if a time span of less than three months is proposed.

4.1.4 Depending on the type of amendments, ETMSS, ETMC or SOT may select one of the following procedures for the approval of the amendments:

- (a) The fast-track procedure (see 4.2);
- (b) The procedure for the adoption of amendments between JCOMM sessions (see 4.3);
- (c) The procedure for the adoption of amendments during JCOMM sessions (see 4.4).

4.1.5 Once amendments to the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services* are adopted, an updated version of the relevant part of the Manual and/or the Guide shall be issued in the four languages: English, French, Russian and Spanish. The WMO Secretariat will inform all WMO Members of the availability of a new updated version of the respective part at the date of notification mentioned in 4.3.

4.2 Fast-track procedure

4.2.1 The fast-track mechanism can be used for additions or changes to the WMO Global Maritime Distress and Safety System (GMDSS) Marine Broadcast System or to address requirements for maritime safety services expressed by the International Maritime Organization (IMO).

4.2.2 A draft recommendation of ETMSS, ETMC or SOT must be validated in accordance with the procedures given in 4.6. Draft recommendations developed by ETMSS, ETMC or SOT must be endorsed by the chair of the respective PA. The filling of reserved and unused entries in the existing international maritime meteorological tape (IMMT) format and minimum quality control standards (MQCS) are considered as minor adjustments, and will be done by the Secretary-General of WMO in consultation with the co-presidents of JCOMM. For other types of amendments, the English version of the draft recommendation, including a date of implementation, should be distributed to the

¹ The current bodies dealing with marine meteorological services within JCOMM are ETMSS, ETMC and SOT: maritime safety services, marine climatological formats and voluntary observing ships (VOS), respectively. If they were replaced by other bodies performing the same function, the same rules would apply, by replacing the names of the entities as appropriate.

GMDSS focal points for comments, with a deadline of two months for the reply. It should then be submitted to the co-presidents of JCOMM for its adoption on behalf of the WMO Executive Council.

4.2.3 The implementation of amendments approved through the fast-track procedure shall normally be limited to one per year. If the chair of ETMSS, ETMC or SOT and the coordinator of the respective PA agree that an exceptional situation exists, a second fast-track implementation can be initiated.

4.3 **Procedures for the adoption of amendments between JCOMM sessions**

4.3.1 For the direct adoption of amendments between JCOMM sessions, as a first step, ETMSS, ETMC or SOT submits a recommendation, including a date of implementation of the amendments, to the chair of the respective PA and co-presidents of JCOMM. In a second step, upon approval by the co-presidents of JCOMM, the WMO Secretariat will send the recommendation in the four languages (English, French, Russian and Spanish), including a date of implementation of the amendments, to all WMO Members for comments within two months. Members of WMO are invited to designate a focal point to be responsible for discussions concerning any comments/disagreements with ETMSS, ETMC or SOT. If the discussions between ETMSS, ETMC or SOT and the focal point do not result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by ETMSS, ETMC or SOT. Those WMO Members that have not

replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments. In a third step, once amendments are agreed by WMO Members, and after consultation with the chair of the respective PA and co-presidents of JCOMM, the WMO Secretariat will notify at the same time the WMO Members and the members of the WMO Executive Council of the approved amendments and of the date of their implementation.

4.4 **Procedures for the adoption of amendments during JCOMM sessions**

4.4.1 For the adoption of amendments during JCOMM sessions, ETMSS, ETMC or SOT will submit a recommendation, including a date of implementation of the amendments, to the respective PA. The recommendation is then submitted to a JCOMM session and then to an Executive Council session.

4.5 **Procedures for the correction of existing entries in IMMT format and MQCS**

4.5.1 If an erroneous specification of an entry is found in an operational IMMT format and MQCS element descriptor, a new descriptor should preferably be added to or changed in the appropriate table through the fast-track procedure or the procedure for adoption of amendments between JCOMM sessions. An appropriate explanation shall be added to the notes of the table to clarify the practice together with the date of the change. This situation is considered to be a minor adjustment according to 4.2.2, above.

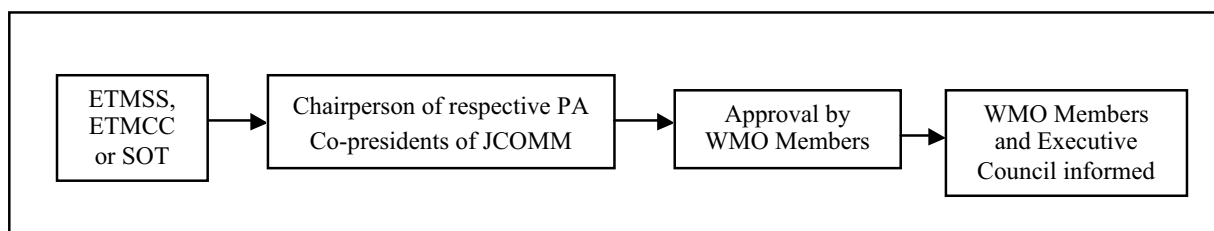


Figure 1. Adoption of amendments between JCOMM sessions

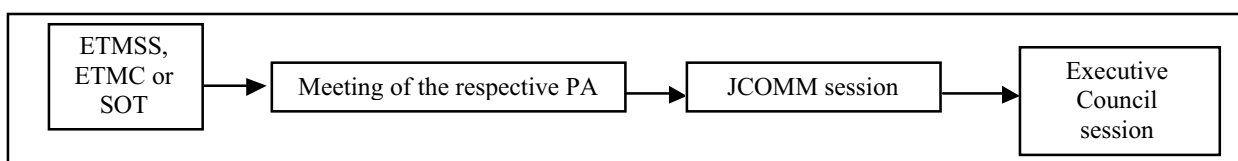


Figure 2. Adoption of the amendments during a JCOMM session

4.6 **Validation procedures**

4.6.1 The need for, and the purpose of the proposal for changes should be documented.

4.6.2 This documentation must include the results of validation testing of the proposal.

5. **PRINCIPLES OF MARINE METEOROLOGICAL SERVICES**

Principle 1

Marine meteorological services are provided to satisfy the requirements for information on marine environmental conditions and phenomena, established by national practices and international conventions in relation to marine operations.

Principle 2

Marine meteorological services are designed for the safety of marine operations and to promote, wherever possible, the efficiency and economy of marine activities.

Principle 3

Marine meteorological services include guidance on the use and interpretation of meteorological and related oceanographic information.

Principle 4

Marine meteorological services include assistance to and guidance for marine users in the

provision of observational data of a high standard to permit an equally high standard of services.

6. **ORGANIZATION**

Marine meteorological services shall be organized to provide, to the extent possible, shipping, fishing and other marine activities with the meteorological and related oceanographic information (warnings, forecasts, charts, expert advice and climatological data) required for the safe conduct and high efficiency of operations, utilizing adequate modes of dissemination. The services shall perform functions with regard to guidance and training in a coherent manner.

Marine meteorological services shall comprise the following main components:

- (a) Services for the high seas;
- (b) Services for coastal and offshore areas;
- (c) Services for main ports and harbour areas;
- (d) Training in marine meteorology.

Notes:

1. In this context, the term "high seas" applies to open ocean or sea areas for which Members have accepted the responsibility for issuing Group A weather and sea bulletins, governed by the procedures under Part I, 2.2 of this Manual.
2. In this context, the term "coastal and offshore areas" applies to areas for which Members issue Group B weather and sea bulletins, governed by the procedures under Part II, 2.2 of this Manual.
3. In this context, the term "main ports and harbour areas" applies to areas for which Members issue port weather and sea bulletins, governed by the procedures under Part III, 2.2 of this Manual.

PART I

SERVICES FOR THE HIGH SEAS

1. GENERAL

1.1 Marine meteorological services for the high seas shall include:

- (a) Provision of warnings, and weather and sea bulletins;
- (b) Marine meteorological support for maritime search and rescue;
- (c) Marine climatological summaries schemes;
- (d) Provision of special marine climatological information;
- (e) Provision of marine meteorological information and expert advice.

1.2 Marine meteorological services for the high seas should include provision of information by radio facsimile or other means for the receipt of graphical data on board ship.

2. PROVISION OF WARNINGS, AND WEATHER AND SEA BULLETINS (GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM APPLICATION)

The application of GMDSS is compatible with and required by the radio communication provisions of the 1988 International Convention for the Safety of Life at Sea (SOLAS) amendments through the Navigational Text Messages (NAVTEX), the International SafetyNET and high-frequency Maritime Safety Information (MSI) services. (See Appendix I.1 for a glossary of terms.)

2.1 Principles

The principles for the preparation and issuing of warnings and weather and sea bulletins are as follows:

Principle 1

For the purpose of the preparation and issuing of meteorological warnings and the regular preparation and issuing of weather and sea bulletins, the oceans and seas are divided into areas for which National Meteorological Services (NMSs) assume responsibility.

Principle 2

The areas of responsibility together provide complete coverage of oceans and seas by meteorological information contained in warnings, and weather and sea bulletins for the high seas.

Principle 3

The issue of meteorological warnings, and routine weather and sea bulletins for areas not covered by NAVTEX shall be by the International SafetyNET Service for the reception of MSI in compliance with SOLAS, Chapter IV – Radiocommunications.

Notes:

1. In addition, NMSs may have to prepare and/or issue warnings and routine forecasts for transmission by a high frequency direct-printing telegraphy maritime safety information service for areas where such a service is provided for ships engaged exclusively on voyages in those areas.
2. The *International SafetyNET Manual* and *International NAVTEX Manual* provide detailed information about safety broadcasts provided under GMDSS. These manuals are obtainable from the International Maritime Organization (IMO).

Principle 4

The preparation and issue of warnings, and weather and sea bulletins for areas of responsibility are coordinated in accordance with the procedures mentioned in Part I, 2.2.

Principle 5

The efficiency and effectiveness of the provision of warnings, and of weather and sea bulletins are monitored by obtaining opinions and reports from marine users.

Principle 6

Maritime safety information broadcasts are monitored by the originating issuing service to ensure the accuracy and integrity of the broadcast.

2.2 Procedures

2.2.1 Definitions

2.2.1.1 A preparation service is an NMS that has accepted responsibility for the preparation of forecasts and warnings for a designated area (Metarea), either in part or in entirety, within the WMO system for the dissemination of meteorological forecasts and warnings to shipping under GMDSS, and for the transfer of these forecasts and warnings to the relevant issuing service for broadcast.

2.2.1.2 An issuing service is an NMS that has accepted responsibility for ensuring that meteorological forecasts and warnings for shipping are disseminated through the International Maritime Satellite System (INMARSAT) SafetyNET Service to the designated area for which the Service has accepted responsibility under GMDSS broadcast requirements. The forecasts and warnings for broadcasts may have been prepared solely by the issuing service, by another preparation service, by a combination of both on the basis of negotiations between the services concerned, or otherwise as appropriate. The issuing service is responsible for composing a complete broadcast bulletin on the basis of information input from the relevant preparation services. It is responsible for inserting the appropriate enhanced group call (EGC) header, as specified in Appendices I.1 and I.2 of this Manual and Annex 4(b) of the *International SafetyNET Manual*. Procedures for any modifications by issuing services to information provided by preparation services, and for the choice of appropriate C_1 , C_2 and C_3 codes for the broadcast of this information, should be developed by bilateral agreement between the services concerned. The issuing service is also responsible for monitoring the broadcasts of information to its designated area of responsibility.

Notes:

1. For some Metareas there may be only one preparation service, which will be the same NMS as the issuing service (for example, France for area II, the United States for area IV, and Argentina for area VI).
2. An appropriate format for the attribution of the origins of the forecast and warning information contained in a broadcast bulletin may be developed on the basis of negotiations among the services concerned.
3. In situations where appropriate information, data or advice from other designated preparation services for a given Metarea is not available, it is the responsibility of the issuing service for that area to ensure that complete broadcast coverage for the area is maintained.

2.2.2 Areas of responsibility (all correspondence relating to areas of responsibility is addressed to the Secretary-General)

2.2.2.1 Areas of responsibility and the responsible services for the preparation and issue of warnings, and weather and sea bulletins through the International SafetyNET Service for the high seas shall be as given in Appendix I.2.

Notes:

1. The areas of responsibility given in Appendix I.2 are reviewed by JCOMM to ensure complete area coverage and adequacy of services.
2. A broadcast area may be subdivided in the text of the EGC message into sub-areas to meet the requirements of the NMS concerned.
3. The areas of responsibility defined in Appendix I.2 represent a minimum requirement for issuing and preparation services. Both issuing and preparation services may extend the area of coverage for the preparation and issue of warnings, and weather and sea bulletins beyond these areas of responsibility, if they so wish, to meet national requirements. In this case, the area of coverage should be specified in the text of each broadcast.
4. In the case that forecast areas between adjacent Metareas overlap, the respective issuing services are strongly encouraged to:
 - (a) Initiate the redefinition of the sub-areas used by countries serving adjacent Metareas to conform to the limits of the Metareas;
 - (b) Coordinate their forecasts and warnings in these overlapping areas to ensure as far as possible that conflicting information is not transmitted to users.

2.2.2.2 Any amendments to the area of responsibility, or any proposal for the introduction of a change in responsibilities of NMSs for an area shall have the approval of the Executive Council based on a recommendation by JCOMM.

2.2.2.2.1 Before drawing up any recommendation on the proposed amendment for submission to the Executive Council, JCOMM shall receive the comments of NMSs directly concerned with the proposed amendment, as well as the comments of the president(s) of the regional association(s) concerned.

2.2.2.3 Whenever an NMS responsible for the preparation and/or issue of warnings, and weather and sea bulletins for a given area is no longer able to provide this service, NMS should inform the Secretary-General at least six months in advance of the intended termination date.

2.2.3 Preparation and issue of weather and sea bulletins for the high seas

2.2.3.1 Weather and sea bulletins for the high seas shall include, in the order given hereafter:

Part I: Warnings;

Part II: Synopsis of major features of the surface weather chart and, to the extent possible, significant characteristics of corresponding sea-surface conditions;

Part III: Forecasts.

2.2.3.2 Weather and sea bulletins for the high seas may, in addition, include the following parts:

Part IV: Analyses and/or prognoses in International Analysis Code (IAC) FLEET code form;

Part V: Selections of reports from sea stations;

Part VI: Selections of reports from land stations.

Notes:

1. The reports included in Part VI should be for a fixed selection of stations in a fixed order.
2. Parts IV, V and VI may be issued at separate, scheduled times.

2.2.3.3 Major changes in form and content of warnings, synopses and forecasts should be announced at least six months prior to the effective date of the change.

2.2.3.4 Information on broadcast schedules for routine forecasts and contents of bulletins shall be notified to the WMO Secretariat for inclusion in *Weather Reporting, Volume D – Information for Shipping* (WMO-No. 9).

2.2.3.5 For an area or areas for which an issuing service has assumed responsibility, the service shall select the appropriate Land Earth Station (LES) to service that area.

Notes:

1. As there are several LESs that can serve an ocean region and hence an area of broadcast responsibility, issuing services may negotiate directly with the various LES operators to obtain the most favourable conditions of tariff and service.
2. In order to ensure reception of unscheduled broadcasts by shipping in an area that is served by more than one satellite, and recognizing that NMSs will not know to which of these satellites the ship's equipment is tuned, the following procedures shall be adopted by issuing services. For unscheduled broadcasts, these shall be issued for broadcast under the International SafetyNET Service through all INMARSAT ocean region satellites covering the issuing service's area of responsibility. The broadcast requirement for unscheduled broadcasts has been determined by IMO

Resolution A.701(17). For scheduled forecasts, these shall be issued for broadcast over at least a single nominated satellite, in accordance with a prearranged schedule coordinated by WMO.

2.2.3.6 The issuing service shall select the method by which the transfer of information to LES shall be effected.

Note: The transfer of information may be accomplished in several ways. Refer to Appendix I.3 for details.

2.2.3.7 Weather and sea bulletins shall be prepared and issued at least twice daily.

2.2.3.7.1 The issue of the weather and sea bulletins shall be at a scheduled time and in the sequence Part I, followed immediately by Part II and then Part III. A schedule of transmission start times for these bulletins has been compiled for all Metareas and LESs that serve the areas. The schedule takes into consideration, inter alia, the existing WMO synoptic times for observations, data analysis and forecast production. Additionally, as these broadcast schedules for the International SafetyNET Service have to be coordinated, under the aegis of WMO, with other organizations, issuing services should not independently change or request WMO to arrange frequent alterations to these coordinated and published schedules (see also 2.2.3.4).

2.2.3.7.2 All weather and sea bulletins shall be preceded by the word "SECURITE", except urgent warnings (Beaufort force 12 and above), which shall be preceded by "PAN PAN".

2.2.3.7.3 Issuing services must ensure that the correct EGC formats are adhered to for all warning and forecast messages intended for broadcast by an LES. (Refer to the IMO *International SafetyNET Manual* regarding message addressing and operational guidance. The manual is available from IMO.)

2.2.3.7.4 All weather and sea bulletins shall include, following the words "SECURITE" or "PAN PAN", clear information on the Metarea being addressed and also the issuing service, for example: "SECURITE, Marine weather bulletin for Metarea II issued by Météo-France".

2.2.3.8 Warnings, synopses and forecasts shall be given in plain language.

2.2.3.8.1 Warnings, synopses and forecasts intended for the International SafetyNET Service shall be broadcast in English.

Note: Additionally, if an NMS wishes to issue warnings and forecasts to meet national obligations under SOLAS, broadcasts may be made in other languages. These broadcasts will be part of a National SafetyNET Service.

2.2.3.8.2 To ensure the integrity of the warnings and forecasts being received by mariners, it is essential that issuing services monitor the broadcasts that originate from them. Monitoring is especially important in a highly automated system that is dependent on careful adherence to procedure and format. This may be accomplished by the installation of an EGC receive capability at the issuing service's facility.

Note: Each issuing service may use the EGC receiver to check the following:

- (a) The message has been broadcast;
- (b) The message has been received correctly;
- (c) The cancellation messages are properly executed;
- (d) The existence of any unexplained delay in the message being broadcast.

2.2.3.8.3 The language of the synopsis should be as free as possible from technical phraseology.

2.2.3.8.4 The terminology used in weather and sea bulletins should be in accordance with the multilingual list of terms used in weather and sea bulletins, which is given in Annex 2.B of the WMO *Guide to Marine Meteorological Services* and in Appendix I.4 of this Manual.

2.2.3.9 **Wind direction shall be given in points of the compass and not in degrees.**

2.2.3.9.1 **Wind force shall be given in Beaufort notation or in wind speed in metres per second or in knots. If metres per second or knots are used, the words "metres per second" or "knots" shall be included in the text of the message.**

Note: The criteria for the Beaufort notation of wind force can be consulted in a Beaufort scale table.

2.2.4 Warnings

2.2.4.1 **Warnings shall be given for gales (Beaufort force 8 or 9) and storms (Beaufort force 10 or over), and for tropical cyclones (hurricanes in the North Atlantic and eastern North Pacific, typhoons in the western Pacific, cyclones in the Indian Ocean and cyclones of similar nature in other regions).**

Notes:

1. Warnings to circular areas require a specific address code – C₂ code = 24 (for details refer to the IMO *International SafetyNET Manual*, available from IMO).

2. Warnings may be addressed for reception by shipping either in a circular area within the main Metarea (C₂ code = 24), or within the entire Metarea (C₂ code = 31). This is at the discretion of the issuing services in consultation with the preparation service responsible for the warning. If a circular area address is chosen, only ships within that area, as defined by the C₃ circular address, will receive the warning.
3. Definition of a tropical cyclone is contained in the *International Meteorological Vocabulary* (WMO-No. 182) and classification of tropical cyclones is left to the Regions concerned.

2.2.4.2 The issue of warnings for near gales (Beaufort force 7) is optional.

2.2.4.3 Warnings for gales, storms and tropical cyclones should have the following content and order of items:

- (a) Type of warning;
- (b) Date and time of reference in universal time coordinated (UTC);
- (c) Type of disturbance (for example, low, hurricane, and the like) with a statement of central pressure in hectopascals;
- (d) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;
- (e) Direction and speed of movement of disturbances;
- (f) Extent of affected area;
- (g) Wind speed or force, and direction in the affected areas;
- (h) Sea and swell conditions in the affected area;
- (i) Other appropriate information such as indications of future positions of disturbances.

2.2.4.3.1 **Items (a), (b), (d), (f) and (g) listed in 2.2.4.3 shall always be included in the warnings.**

2.2.4.4 In addition to indicating the positions of pressure disturbances in terms of latitude and longitude, or with reference to well-known landmarks, the boundaries of the existing and forecast storm-wind area and areas of high waves (including swell) should be indicated.

Note: The usual practice for warnings is to indicate boundaries with reference to the centre of the pressure disturbance, or to divide the disturbance into sectors for which prevailing and forecast conditions are described.

2.2.4.4.1 When warnings are included for more than one pressure disturbance or system, the systems should be described in descending order of threat.

2.2.4.4.2 **Warnings shall be as brief as possible and, at the same time, clear and complete.**

2.2.4.5 The time of the last location of each tropical cyclone or extra-tropical storm shall be indicated in the warning.

2.2.4.6 A warning shall be issued immediately after the need becomes apparent and broadcast immediately on receipt, followed by a repeat after six minutes (repetition code 11), when issued as an unscheduled broadcast.

2.2.4.6.1 When no warnings for gales, storms or tropical cyclones are to be issued, that fact shall be positively stated in Part I of each weather and sea bulletin.

2.2.4.6.2 Warnings shall be updated whenever necessary and then issued immediately.

2.2.4.6.3 Warnings shall remain in force until amended or cancelled.

2.2.4.6.4 Warnings issued as Part I of a scheduled bulletin do not need to be repeated after six minutes.

2.2.4.7 Warnings for other severe conditions such as poor visibility, severe sea states (swell), ice accretion and other ice conditions shall also be issued, as necessary. Phenomena such as breaking seas, cross seas and abnormal or rogue waves could also be included if feasible.

2.2.5 Synopses

2.2.5.1 The synopses given in Part II of weather and sea bulletins shall have the following content and order of items:

- (a) Date and time of reference in UTC;
- (b) Synopsis of major features of the surface weather chart;
- (c) Direction and speed of movement of significant pressure systems and tropical disturbances;
- (d) Ice conditions where applicable.

2.2.5.1.1 Significant characteristics of corresponding wave conditions (sea and swell) should be included in the synopsis whenever this information is available, as well as characteristics of other sea-surface conditions (for example, drifting ice and currents).

2.2.5.2 Significant low-pressure systems and tropical disturbances that affect, or are expected to affect, the area within or near the valid period of the forecast should be described. The central pressure and/or intensity, location, movement and

changes of intensity should be given for each system. Significant fronts, high-pressure centres, troughs and ridges should be included whenever this helps to clarify the weather situation.

2.2.5.3 Direction and speed of movement of significant pressure systems and tropical disturbances should be indicated in compass points and metres per second or knots, respectively.

2.2.5.3.1 Units used for speed of movement of systems shall be indicated.

2.2.5.4 Concise descriptions of ice conditions should be included in the synopsis (for example, position of the ice edge, total concentration, stages of ice development).

2.2.6 Forecasts

2.2.6.1 The forecasts given in Part III of weather and sea bulletins shall have the following content and order of items:

- (a) The valid period of forecast;
- (b) The name or designation of forecast area or areas within the main MSI area;
- (c) A description of:
 - (i) Wind speed or force, and direction;
 - (ii) Sea state (significant wave height, total sea);
 - (iii) Visibility when forecast is less than 6 nautical miles (10 kilometres);
 - (iv) Ice accretion, where applicable;
 - (v) Ice conditions, where applicable.

2.2.6.1.1 The forecasts should include expected significant changes during the forecast period, significant meteors such as freezing precipitation, snowfall or rainfall, and an outlook for a period beyond 24 hours. In addition, phenomena such as breaking seas, cross seas and abnormal or rogue waves could also be included.

2.2.6.1.2 The forecasts should also include waves (wind sea and/or swell) where possible.

2.2.6.2 The valid period shall be indicated either in terms of the number of hours from the time of issue of the forecast or in terms of dates and times in UTC of the beginning and end of the period.

2.2.6.3 Visibility shall be indicated in descriptive terms or explicitly (distance). The units of distance are denoted in 2.2.6.3.1. Descriptive terms are denoted in 2.2.9.

2.2.6.3.1 Units used for visibility shall be indicated as nautical miles for kilometres.

2.2.7 Selection of reports from sea stations

2.2.7.1 When included in weather and sea bulletins for the high seas, reports from ships and other sea stations should be selected to give a reasonable geographical distribution, taking into account the important synoptic features.

2.2.7.2 The information should include the position of ships and other sea stations, time of observation, wind, visibility, atmospheric pressure and, if possible, cloudiness, present and past weather, air and sea-surface temperatures, and waves.

2.2.8 Selection of reports from land stations

2.2.8.1 Reports included should be for selected land stations in a fixed order.

2.2.8.2 The reports should include the same elements as those listed in 2.2.7.2, when applicable.

2.2.9 Use of descriptive terms for visibility

For visibility, the following descriptive terms should be used:

Very poor: Less than 0.5 nautical miles;
 Poor: 0.5 to 2 nautical miles;
 Moderate: 2 to 5 nautical miles;
 Good*: Greater than 5 nautical miles (*not mandatory).

2.2.10 Issue of sea-ice information

Sea-ice terminology shall be in accordance with WMO Sea-ice Nomenclature (WMO-No. 259).

3. MARINE METEOROLOGICAL SUPPORT FOR MARITIME SEARCH AND RESCUE

3.1 Principles

The principles for the purpose of marine meteorological support for maritime search and rescue (SAR) are as follows:

For the purpose of marine meteorological support for maritime SAR, a meteorological forecast centre may serve more than one Rescue Coordination Centre (RCC). Likewise, an RCC may make requests for information from more than one meteorological

forecast centre depending on the nature of the maritime SAR operation.

3.2 Procedures

3.2.1 Marine meteorological services for SAR: MMS for SAR shall be provided in accordance with the national overall coordination procedures for SAR and taking into account the international recommendations and the requirements in force.

Notes:

1. Requirements for SAR services, including meteorology, are contained in Annex 12 to the International Civil Aviation Organization (ICAO) *Convention on International Civil Aviation Search and Rescue*. Regional SAR plans are available for ICAO Regions and can be obtained from ICAO.
2. Additional requirements for maritime SAR services are contained in the joint IMO/ICAO *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*, obtainable from IMO and ICAO.

3.2.1.1 Requests from RCCs shall be dealt with as expeditiously as possible and shall be given highest priority when an SAR operation is in progress.

3.2.1.2 On receiving formal notification from an RCC that a ship or aircraft or survival craft is in distress, every effort shall be made to meet the requirements of the RCC.

3.2.2 Provision of information to an RCC: Information on the following parameters and phenomena, as may be requested by or be of value to an RCC, should be provided:

- (a) Atmospheric pressure;
- (b) Surface winds;
- (c) Sea and swell;
- (d) Surface visibility;
- (e) Ice accretion;
- (f) Sea ice;
- (g) Icebergs;
- (h) Precipitation and cloud cover, including height of cloud base;
- (i) Air temperature;
- (j) Humidity;
- (k) Sea-surface temperature;
- (l) Surface currents;
- (m) Tidal current deviation;
- (n) Bar conditions;
- (o) Surf and breakers;
- (p) Storm surge;
- (q) Water discolouration.

Notes:

1. Special weather forecasts covering periods of up to 24 hours and possibly beyond may be required for maritime

SAR operations on a continental shelf and slightly beyond. Ships of all sizes, helicopters and fixed-wing aircraft may be involved in these operations.

2. Medium-range forecasts may be required in the event of SAR operations taking place over large ocean areas where ocean-going ships and fixed-wing aircraft may be involved for considerable periods of time and may possibly be searching for relatively small objects on the sea surface.
3. Some of the information to be provided may be the responsibility of more than one authority and should be coordinated nationally.

3.2.3 Notification of SAR operations: Notification of SAR operations and all subsequent communications between an RCC and the weather forecast centre should be by telephone, telex or other medium designed for rapid transmission or reception.

3.2.3.1 When communicating with RCCs or when providing weather forecasts, the terminology should be similar to that used in weather bulletins and warnings to shipping.

3.2.3.2 A permanent record of all communications should be maintained, showing the times of origin, transmission and reception of the information provided.

3.2.3.3 Weather forecast centres should not attempt to communicate either directly or through coastal radio stations with ships or aircraft involved in the SAR operation unless specifically requested by an RCC.

3.2.3.4 National Meteorological Services should encourage ships operating under their national flag, when taking part in any medium- or long-term SAR operation, or in the vicinity of an SAR operation but not necessarily participating, to make weather observations at main and intermediate standard times. The observations should be for surface synoptic observations and should be transmitted, either in the international SHIP code form or in plain language, immediately either to the appropriate coastal radio station for onward transmission, or through an LES directly to a meteorological service.

4. PROVISION OF INFORMATION BY RADIO FACSIMILE

4.1 Principle

The principle for the provision of information by radio facsimile is as follows:

Radio facsimile transmissions have the capability of providing marine users with comprehensive marine environmental information, both in pictorial form and in the form of texts, and thus provide marine users with an efficient service.

4.2 Procedures

4.2.1 Types of chart: Radio facsimile charts likely to be of use to marine users are as follows:

- (a) Surface-weather analyses;
- (b) Surface-weather prognoses;
- (c) Surface wind-field analyses;
- (d) Wave analyses;
- (e) Wave prognoses;
- (f) Sea-surface temperature analyses;
- (g) Sea-surface temperature prognoses;
- (h) Sea-ice information;
- (i) Significant weather depiction;
- (j) Upper-air analyses;
- (k) Upper-air prognoses.

4.2.2 Projections and scales: Charts intended for radio facsimile transmission should be prepared with projections and scales prescribed in 4.2.2.1 and 4.2.2.2, following.

4.2.2.1 The following projections should be used, as appropriate:

- (a) The stereographic projection on a plane cutting the sphere at the standard parallel of latitude 60°;
- (b) Lambert's conformal conic projection, the cone cutting the sphere at the standard parallels of either latitudes 10° and 40° or latitudes 30° and 60°;
- (c) Mercator's projection true at latitude 22.5°.

4.2.2.2 The scales along the standard parallels should be as follows for each chart:

- (a) Covering the world: 1:40 000 000;
Alternative: 1:60 000 000;
- (b) Covering the hemisphere: 1:40 000 000;
Alternatives: 1:30 000 000;
1:60 000 000;
- (c) Covering a large part of a hemisphere or hemispheres: 1:20 000 000;
Alternatives: 1:30 000 000;
1:40 000 000;
- (d) Covering a portion of a continent or an ocean, or both: 1:10 000 000;
Alternatives: 1:20 000 000;
1:15 000 000;
1:7 500 000;
1:5 000 000.

4.2.2.3 The name of the projection, the scale at the standard parallels and the scales for other latitudes should be indicated on every chart.

4.2.3 Preparation of the original chart: When preparing charts for facsimile transmission, the following basic considerations for the preparation of the original copy should be followed:

- (a) The minimum line thickness should be sufficiently large to ensure clear reproduction;
- (b) Lines that are required to be reproduced uniformly should be of uniform width and intensity;
- (c) Special marking in heavy print (two or three crosses) of intersections of lines of latitude and longitude will facilitate the use of facsimile charts during periods of poor reception;
- (d) The minimum separations of detail in letters, figures, symbols and the like should be sufficient to avoid the unwanted filling of spaces in the reproduction;
- (e) Letters, figures, symbols and the like should be drawn as simply as possible;
- (f) Models employed in plotting should be as simple as possible.

4.2.4 Legends of charts: Each chart prepared for facsimile transmission should bear a bold legend including:

- (a) Name of issuing meteorological forecast centre in plain language;
- (b) Type of chart;
- (c) The date and time to which the data refer or, in the case of forecast charts, the time to which the forecast is applicable;
- (d) Date projection transmitted;
- (e) Unit of wind speed;
- (f) Special symbols or isopleths.

4.2.5 Symbols used on charts: The symbols used for pictorial representation of observational data, analyses and forecasts are those given in Appendix I.6. While individual countries may use other symbols, particularly for specialized depictions, these should not conflict with those given in Appendix I.6.

4.2.6 Model surface charts (model S charts): Isobars should be drawn as continuous lines labelled in hectopascals. Centres of high and low pressure, fronts, convergence zones and significant weather phenomena should be marked using symbols from the *Manual on the Global Data-processing and Forecasting System (GDPFS)* (WMO-No. 485) and from Appendix I.6 of this Manual. Pressure centres on analysis charts should

be marked with an open arrow showing the direction of the expected movement of the centre with a figure indicating mean speed of movement in knots.

4.2.7 Model wave charts (model W charts): The considerations described in 4.2.7.1 and 4.2.7.2 apply.

4.2.7.1 The average values of the wave heights from the larger well-formed waves, thus the significant wave heights, should be drawn as continuous lines labelled in metres. Similarly, swell heights should be drawn as dashed lines. The centres of maximum and minimum wave heights should be marked "MAX" and "MIN", respectively. The direction of sea waves should be indicated by solid arrows. The direction of swell waves should be indicated by wavy arrows.

4.2.7.2 In the case where only composite wave heights including both sea waves and swell waves are drawn, they should be depicted in the same way as sea waves uniquely, that is, as continuous lines labelled in metres.

4.2.8 Model sea-surface temperature charts (model SST charts): For these charts sea-surface temperatures should be drawn as solid lines labelled in degrees Celsius, using intervals that are suitable to the geographical areas.

4.2.9 Model sea-ice information charts (model SI charts): The documents *WMO Sea-ice Nomenclature*, Volume III – International System of Sea-ice Symbols (WMO-No. 259) and *SIGRID-3: A Vector Archive Format for Sea-ice Charts* (WMO/TD-No. 1214) should be referred to. Sea-ice climatological information should be provided using SIGRID gridded and vector archive formats for sea-ice charts (WMO-No. 716, WMO-No. 792 and WMO/TD-No. 1214).

4.2.10 Transmission schedules: Transmission schedules indicating times of transmission, radio frequencies, areas covered, chart projections used and index of associated cooperation and amendments should be published and made available to marine users as far in advance as possible and by the most expeditious means.

4.2.11 Notification of WMO: The information specified in 4.2.10 shall be conveyed to the WMO Secretariat for inclusion in *Weather Reporting, Volume D – Information for Shipping* (WMO-No. 9).

5. MARINE CLIMATOLOGICAL SUMMARIES SCHEME

Note: The international arrangements regarding the Marine Climatological Summaries Scheme are based on Resolution 35 (Cg-IV), Recommendation 36 (68-CMM), Recommendation 6 (CMM-VI), Recommendation 15 (CMM-VII), Recommendation 35 (79-CMM), Recommendation 6 (CMM-VIII), Recommendation 8 (CMM-VIII), Recommendation 12 (CMM-X), Recommendation 11 (CMM-XI), Recommendations 8 and 9 (JCOMM-I), Recommendation 9 (JCOMM-II) and Recommendation 9 (JCOMM-III).

5.1 Principles

The principles of the Marine Climatological Summaries Scheme (MCSS) are as follows:

Principle 1

The oceans and seas are divided into eight areas of responsibility for the purpose of preparing the marine climatological summaries and with a view to continued international cooperation regarding the collection, archiving and exchange of marine data.

Principle 2

Members having assumed responsibility for the respective areas as shown in Appendix I.2, hereinafter called Responsible Members, prepare climatological summaries for their area of responsibility. The preferred method of producing summaries is the chart form. However, Members may prepare, without cost to WMO, climatological summaries in tabular form for selected representative areas. The tabular form of the summaries is to be used for fixed ship stations. The procedures are specified in 5.3.

Principle 3

Two Responsible Members operate Global Collecting Centres (GCCs) as shown in Appendix I.8. Members operating fixed ship stations or selected, supplementary and auxiliary ship stations make available all surface observations from these stations to both GCCs, in accordance with the procedures specified in the agreed plan. The cost of this work is borne by the Member operating the ship stations.

Principle 4

Global Collecting Centres ensure that minimum quality control has been applied to the data, and exchange the data collected with each other, to ensure that both have a complete dataset. Global

Collecting Centres ensure that one copy of the global (updated) data is sent quarterly to those Responsible Members that wish to maintain a global dataset, otherwise a dataset for their area of responsibility is sent to the remaining Responsible Members. The cost of this work is borne by the Responsible Members operating GCCs.

Principle 5

Responsible Members make available, on request, copies of marine climatological data on magnetic tape in the agreed international exchange format, IMMT. The Member making the request may be asked to bear the cost of copying the data. Other formats may be agreed between the requesting Member and the Responsible Member, provided that the requesting Member undertakes to bear the additional expenditure involved.

5.2 Areas of responsibility

Each Responsible Member shall prepare climatological summaries of observations made after 1960 in accordance with the agreed plan (Appendix I.10). These shall be in chart form for the Responsible Member's area of responsibility, in tabular form for a number of selected representative areas in its area of responsibility, or in tabular form for a number of fixed ship stations within its area, and for fixed ship stations operated solely by the Responsible Member in the area of another Responsible Member.

5.2.1 Boundaries of areas of responsibility

5.2.1.1 The areas of responsibility shall be as given in Appendix I.7.

5.2.1.2 Examination of the boundaries of areas of responsibility with a view to making recommendations for adjustment shall be the responsibility of the Commission for Marine Meteorology (CMM) (WMO). Such adjustments may become necessary if other Members wish to become Responsible Members. Alternatively, existing Responsible Members may find that it is necessary to adjust boundaries.

5.2.1.3 Adjustments of boundaries of areas of responsibility should be kept to a minimum.

5.2.2 Polar and extra-polar regions

For the purpose of marine climatological summaries, polar regions are defined as extending poleward from latitude 60°N and latitude 50°S, respectively.

5.2.3 Selected representative areas

Note: Section 5.2.3 applies only if the tabular form of summaries is produced.

5.2.3.1 Each Responsible Member shall propose a number of selected representative areas from within its assigned area of responsibility. These areas should be chosen to achieve a good density of data or because of other requirements, such as climatic gradients and related factors.

5.2.3.2 Responsible Members shall submit the list of areas selected to the president of CMM who will ensure that the final choice of the selected representative areas, proposed by the Responsible Members, provides a reasonable distribution throughout all areas of responsibility.

5.2.3.3 The indices system, which is given in Appendix I.9, shall be used to code the extent and location of the selected representative areas.

5.2.3.4 The selected representative areas shall remain fixed in their size, shape and position for as many years as possible.

Note: The recommended maximum size of a selected area in polar regions is 50 one-degree squares.

5.2.3.5 A map or maps showing the distribution of the selected representative areas in each area of responsibility shall be included in the summaries for that area.

5.2.4 Fixed ship station areas, ocean island stations, moored buoys and fixed platforms

5.2.4.1 The "on station" area should be defined for each fixed station. This area should consist of the smallest number of adjacent one-degree squares, centred on the nominal fixed position and containing at least 95 per cent of the observations from the fixed station.

5.2.4.2 It should be left to the discretion of the Responsible Members to publish data from ocean island stations located in data-sparse areas as supplements to the marine climatological summaries. The island data summaries should not be combined with summaries of ocean data and a warning to this effect must be included in the supplements. Data from ocean island stations should be published in the same form as used for fixed ship stations.

5.3 Procedures for preparing marine climatological summaries

5.3.1 General plan

The plan for the production of marine climatological summaries is shown in Appendix I.10.

5.3.2 Layout of marine climatological summaries

5.3.2.1 Chart form: The layout of the marine climatological summary in chart form is given in Appendix I.11.

5.3.2.2 Tabular form: The parameters to be included in the tabular form of marine climatological summaries are given in Appendices I.12, I.13 and I.14.

5.3.3 Period of marine climatological summaries

5.3.3.1 Annual summaries: The routine publication of annual summaries ceased in 1981 (Recommendation 6 (CMM-VIII)). However, annual climatological summaries may be published by the Responsible Members on an optional basis, preferably in chart form. The processing of data shall be continued so that the original observations will be readily available upon request.

5.3.3.2 Decadal summaries: Decadal climatological summaries shall be prepared for the periods 1961–1970, 1971–1980, 1981–1990, 1991–2000, 2001–2010 and 2011–2020.

5.4 Minimum number of observations for the preparation of the marine climatological summaries

5.4.1 General

All available data shall be used in the preparation of annual and decadal summaries.

5.4.2 Annual summaries

5.4.2.1 The annual mean for any unit area or selected representative area should not be calculated if there are less than 10 observations from the area in any individual month.

5.4.2.2 Statistics for chart areas and frequency tables should not be prepared if there are less than 10 observations from a unit area of a chart or selected representative area or tabulation in any individual month.

5.4.2.3 For tabular summaries, the data should be listed if there are less than 40 observations from a selected representative area in any individual month and those observations have been made on less than 10 different days of the month.

5.4.2.4 For tabular summaries, the data should be summarized if there are less than 40 observations from a selected representative area in any individual month and those observations have been made on 10 or more different days of the month.

5.4.2.5 The data should be summarized in charts or tabulations if there are less than 40 observations from a selected representative area in any individual month.

5.4.3 Decadal summaries

5.4.3.1 Summaries are prepared for decadal periods and not for individual years if there are fewer than 40 observations from a selected representative area in any individual month.

5.4.3.2 In preparing a climatological summary for a decade or longer period, the summary for each month should be prepared by combining all available observations from that particular month for all years during the period of the summary.

5.4.3.3 It must be clearly stated to that effect in the text of the summary when data are summarized that are known to be irregularly distributed over the 10-year period.

5.5 Parameters to be included in the marine climatological summaries and their form

5.5.1 Fixed ship stations

Annual and decadal summaries for fixed ship stations shall be produced in tabular form and shall contain the parameters listed in Appendix I.12.

5.5.2 Polar and extra-polar regions

5.5.2.1 Data for annual summaries shall be prepared either in a format suitable for publication of charts or alternatively in a format suitable for publication of tables. The type of output required in any individual year is specified in Appendix I.10.

5.5.2.2 Decadal summaries shall be published either in chart form (preferred) or in tabular form as indicated in Appendix I.10.

5.5.2.3 Parameters to be included in the summaries that are produced in chart form are listed in Appendix I.9.

5.5.2.4 Parameters to be included in the summaries are listed in Appendices I.12, I.13 and I.14.

5.5.3 Inventory of marine climatological summaries

During the first quarter of each year, Responsible Members shall send a list of marine climatological summaries that have been produced during the previous year to the Secretary-General.

5.6 Marine climatological data

5.6.1 Collection and exchange of data

5.6.1.1 Members operating fixed ship stations or selected supplementary and auxiliary ship stations should transfer all surface observations from these stations onto magnetic tape. It is recommended that the data be arranged in the agreed IMMT format as described in Appendix I.15. The data should be dispatched to both GCCs at three-monthly intervals.

5.6.1.2 The Member from which the data originate should notify GCCs of the dispatch of the quarterly collection of data. The notification should contain details of the order in which the records are sorted.

5.6.1.3 Members may use the alternative format for maritime meteorological tapes that is given in Appendix I.16. Any alternative format must only be used by mutual agreement between the two Members that are exchanging data.

5.6.1.4 Members should ensure that magnetic tapes are 9 track and written at a density of 1600 or 6250 bits per inch (BPI). The tapes should be unlabelled and written in EBCDIC or ASCII with blocking factor 10.

5.6.1.5 The Responsible Member should indicate clearly in the summary the extent to which auxiliary ship data have been used.

5.6.2 Inventory of marine climatological data

Global Collecting Centres shall keep an inventory of all marine climatological data received from Members.

5.6.3 Quality control of data

5.6.3.1 All Members should make every effort to apply the minimum quality control procedures detailed in Appendix I.17 before dispatching the data to GCCs. These centres should ensure that this minimum quality control has been applied before making the data available to Responsible Members.

5.6.3.2 Quality control of marine data by Members and Responsible Members should be continued and improved. Details of national quality control schemes should be made available to Responsible Members.

5.6.4 Period before 1961

5.6.4.1 The Historical Sea-surface Temperature Data (HSSTD) project provides for the collection and summarizing of marine climatological data for the period from 1861 to 1960. The participants in the HSSTD project have agreed to exchange any additional digitized historical data as they become available.

5.6.4.2 Members possessing historical data that are not yet included in the HSSTD project should send the data to the appropriate participating Member. The data should be converted into the IMMT format, or another mutually agreed format, before dispatch to the participating Member. The cost of conversion should be borne by the Member supplying the data.

6. SPECIAL MARINE CLIMATOLOGICAL INFORMATION

6.1 Principles

The principles for collection, storage and processing of special marine climatological information are as follows:

Principle 1

International cooperative arrangements for the collection of special observations from mobile ship stations, that is, other than those that comprise MCSS, as well as for the storage and eventual processing of the observations, include the designation of (preferably) one international centre suitably equipped for marine data storage and retrieval functions.

Principle 2

To ensure the combined use of stored ocean data obtained from special observations at mobile ship stations on the one hand, and similar data obtained from measurements at oceanographic stations on the other, arrangements for the ultimate archiving of relevant data include the World Data Centres for Oceanography.

6.2 Procedures

6.2.1 Reports of freak waves

Notes:

1. A freak wave may be defined as a wave of very considerable height ahead of which there is a deep trough. Thus, it is the unusual steepness of the wave that is its outstanding feature and that makes it dangerous to shipping. Reports so far available suggest that such waves usually occur where a strong current flows in the opposite direction to a heavy sea and especially when this occurs near the edge of the continental shelf.
2. International procedures are based on Recommendation 22 (75-CMM).

6.2.1.1 Members operating fixed ship stations or selected supplementary and auxiliary ship stations should encourage marine observers to enter detailed information on freak waves in meteorological logs, including a full description of the phenomenon (indicating height and horizontal distance between crest and trough, if possible), weather conditions, state of the sea and any other factors that may have influenced the state of the sea, as well as any damage sustained by the ship.

Note: A layout of a freak-wave report is contained in Annex 6.C to the *Guide to Marine Meteorological Services* (WMO-No. 471).

6.2.1.2 When received, freak-wave reports should be sent to the Member that has assumed the responsibility for accepting reports from other Members on freak waves, in order that reports of special interest will be published and data analysis and subsequent publications will be presented in due time.

6.2.1.3 When measurements of sea-surface current are obtained through observations of a ship's set and drift, the Exchange Format for Sea Surface Current Data should be used to record and transmit the information. This exchange format is described in Appendix I.19.

7. **PROVISION OF MARINE
METEOROLOGICAL INFORMATION
AND EXPERT ADVICE**

the use and interpretation of data should be arranged according to national practices.

7.1 **Principle**

The principle for the provision of marine meteorological information and expert advice is as follows:

One of the important purposes for which marine meteorological data are preserved is their use in special applications in activities such as engineering design studies, planning of marine operations, expertise in insurance claims or official investigations regarding marine accidents, cargo ventilation studies, and the like.

7.2.2 **Preservation of marine
meteorological data**

Marine meteorological data should be preserved by Members in a form that renders these data easily accessible for use in applications requiring expert advice.

7.2 **Procedures**

7.2.3 **Assistance for expert advice**

Members should assist each other in questions requiring marine meteorological expert advice by providing, as far as possible, the requested information in a convenient form.

7.2.1 **The provision of marine
meteorological and related
oceanographic information**

The provision of marine meteorological and related oceanographic information and expert advice on

7.2.4 **Supply of marine meteorological data**

Supply of marine meteorological data for special application purposes should be governed by the provisions on exchanges of climatological data contained in Volume I, Section B, Chapter [B.I.]3 of *Technical Regulations* (WMO-No. 49).

APPENDIX I.1

OCEAN AND SEA AREAS OF RESPONSIBILITY FOR THE ISSUE OF WEATHER AND SEA BULLETINS FOR THE HIGH SEAS (GROUP A)

GLOSSARY

In 1973, the IMO Assembly adopted a recommendation on the development of the maritime distress systems that laid down IMO policy for improved distress and safety communications at sea based on the most up-to-date techniques. This policy foresaw, as an essential element, the advent of satellite and automatic terrestrial communications. To achieve the former, in 1976 IMO adopted an international convention establishing the INMARSAT organization. The terrestrial element was achieved by the development of the necessary techniques for digital selective calling and direct-printing telegraphy. This was accomplished with the assistance of the International Telecommunication Union (ITU) International Radio Consultative Committee (CCIR) and the World Administrative Radio Conference (WARC).

In 1983 and 1987, the necessary frequencies were allocated to test and prove the equipment and this facilitated the establishment of GMDSS. The GMDSS Conference of 1988 adopted amendments to SOLAS 1974 to introduce GMDSS. SafetyNET provides shipping with navigational and meteorological warnings, meteorological forecasts, shore-to-ship alerts and other urgent information in accordance with the requirements of SOLAS 1974. It is suitable for use in all sizes and types of surface craft. SafetyNET is a service of the INMARSAT EGC system and was specifically designed for promulgation of MSI as part of GMDSS. SafetyNET meets international requirements for broadcasting area, regional or local navigational warnings, meteorological warnings and forecasts and shore-to-ship distress alerts. It is designed with the capacity to provide services within the coverage areas of geostationary maritime communications satellites, that is in sea area A3 of GMDSS. In addition to providing service to ships operating in sea area A3, it also provides the means of disseminating MSI to coastal waters not covered by NAVTEX. SafetyNET messages can originate from a registered provider (for example, a WMO Member) anywhere in the world and broadcast to the appropriate ocean area via an INMARSAT-C LES. Messages are broadcast according to priority, that is, distress, urgent, safety and routine.

Atlantic Ocean Region (west) (AOR (W)), Atlantic Ocean Region (east) (AOR (E)), Indian Ocean Region (IOR), Pacific Ocean Region (POR): Ocean areas within the footprints (zero elevation) of the INMARSAT satellites located at 55.5°W, 18.5°W, 63°E and 180°E, respectively.

Enhanced group call (EGC): The system for broadcasting messages via the mobile satellite communications system operated by INMARSAT. EGC is a part of the INMARSAT-C system and currently supports two services: SafetyNET and FleetNET. FleetNET is a commercial service for the broadcast and automatic receipt of fleet management and general public information by means of direct printing through the EGC system of INMARSAT.

INMARSAT-A: A satellite communications system for transmission of voice, telex, facsimile or data using directional antennae in the INMARSAT satellite system.

INMARSAT-C: A satellite communications system for telex or data messaging using small terminals and omni-directional antennae in the INMARSAT satellite system.

International NAVTEX Service: The system for the broadcast and automatic reception of maritime safety information by means of narrow-band direct printing on 518 kHz, using the English language. NAVTEX-receiving capability is part of the mandatory equipment that is required to be carried in certain vessels under the provisions of the revised Chapter IV of SOLAS 1974.

International SafetyNET Services: The coordinated broadcast and automated reception of MSI via the INMARSAT EGC system using the English language to meet the requirements of SOLAS.

Land Earth Station (LES): A land station in the INMARSAT satellite communications system that provides interconnection between the satellite and shore systems such as telex and telephone.

Maritime Safety Information (MSI): Navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships.

National SafetyNET Services: The broadcast and automated reception of MSI via the INMARSAT EGC system using languages as decided by the administration concerned.

Network Coordination Station (NCS): A land station in the INMARSAT mobile satellite communications system that controls channel assignments and other communications functions through a satellite for an entire ocean region.

Registered provider: An authorized provider of MSI that has an agreement with one or more LES for providing SafetyNET broadcast information.

Rescue Coordination Centre (RCC): A unit responsible for promoting efficient organization of search and rescue services to coordinate the conduct of search and rescue operations within a search and rescue region.

SafetyNET: A service for the broadcast and automatic reception of maritime safety information by means of direct printing through the INMARSAT EGC system.

Scheduled broadcasts: The regular single transmission of weather and sea bulletins for the high seas, including gale and storm warnings as necessary. Each bulletin is broadcast at least twice daily, in accordance with a pre-arranged and published schedule coordinated by WMO and in the prescribed high seas bulletin format, as described in the present Manual. The EGC priority code (C_1) for messages intended for scheduled broadcast, " $C_1 = 1$ ", denotes "Standard SAFETY priority", and repetition code (C_4), " $C_4 = 1$ " denotes "Broadcast once only". Scheduled broadcasts should be made within

15 minutes of the published schedule. If this is not possible, a repetition should be used to ensure maximum receipt.

Sea area A1: An area within the radio telephone coverage of at least one very high frequency coast station in which continuous digital selective calling (DSC) alerting is available, as may be defined by a SOLAS contracting government.

Sea area A2: An area, excluding sea area A1, within the radio telephone coverage of at least one medium frequency coast station in which continuous DSC alerting is available, as may be defined by a contracting government.

Sea area A3: An area, excluding sea areas A1 and A2, within the coverage of an INMARSAT geostationary satellite in which continuous alerting is available.

Sea area A4: An area outside sea areas A1, A2 and A3.

Ship Earth Station (SES): A mobile Earth station in the maritime mobile-satellite service located aboard a ship, or elsewhere.

Unscheduled broadcasts: The contingent broadcast, with a six-minute repetition, of urgent meteorological information that is intended for immediate delivery to shipping. When such urgent information comprises or includes tropical cyclone warnings, the EGC priority code (C_1) " $C_1 = 2$ " denotes "URGENT" and the repetition code (C_4) " $C_4 = 11$ " denotes "Repeat once after six minutes". All other warnings (for example, gale and storm) will have " $C_1 = 1$ ", denoting "Standard SAFETY priority" and " $C_4 = 11$ " denoting "Repeat once after six minutes".

APPENDIX I.2

AREAS OF RESPONSIBILITY AND DESIGNATED NATIONAL METEOROLOGICAL SERVICES FOR THE ISSUE OF WARNINGS AND WEATHER AND SEA BULLETINS FOR THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM

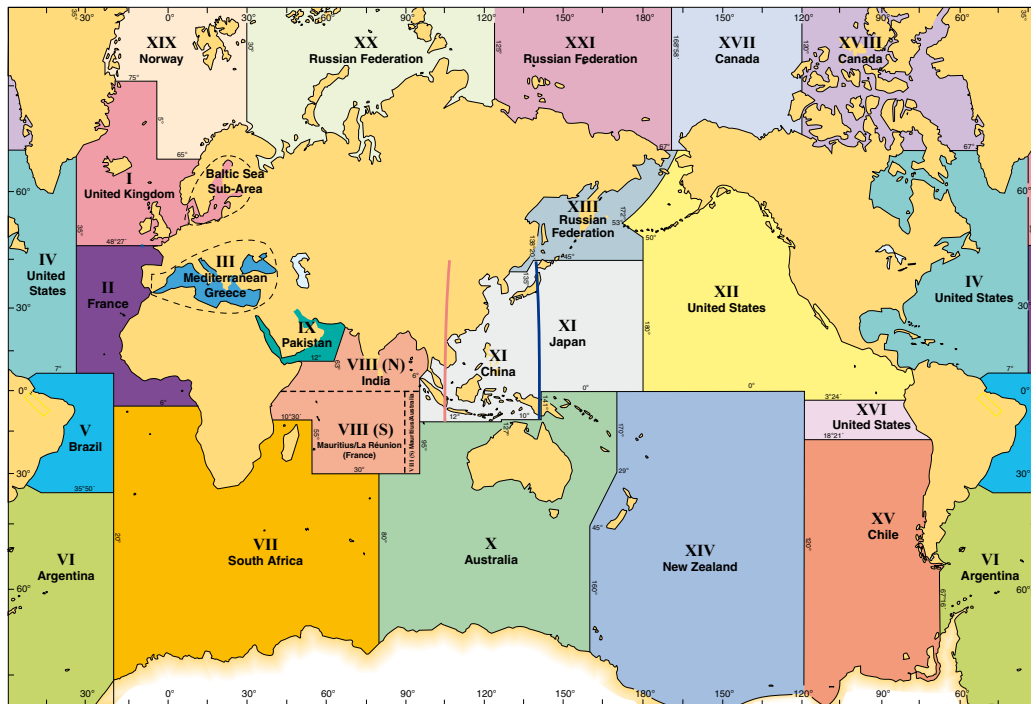


Figure App-I.2.1. Map of Metarea limits

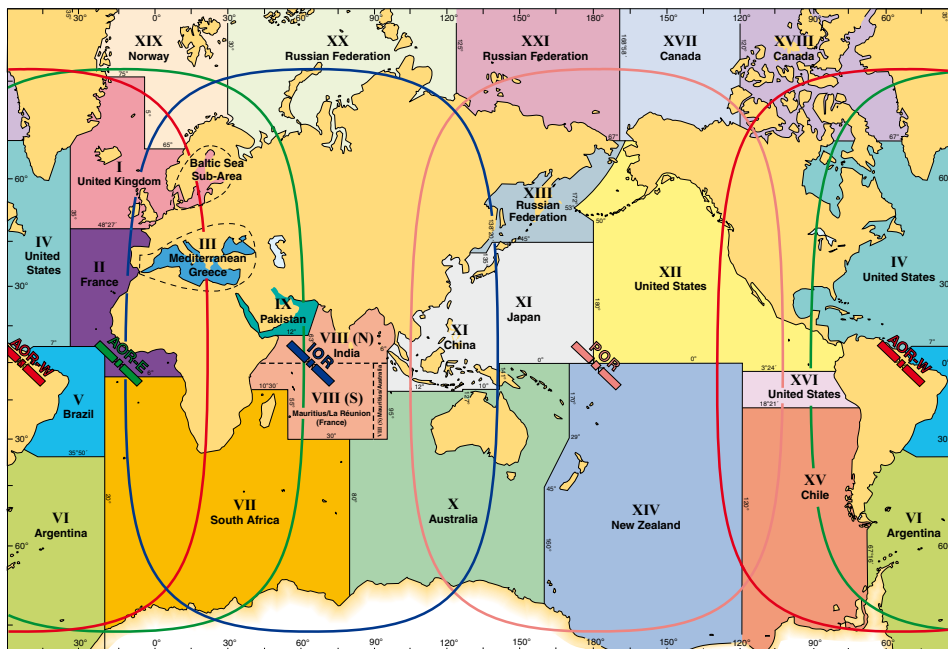


Figure App-I.2.2. Map of GMDSS service coverage by INMARSAT satellites

Note: Services provided in high latitudes are intended to apply within waters only up to the edge of navigable Arctic or Antarctic waters at that time.

AREAS OF RESPONSIBILITY FOR HIGH SEAS (GMDSS)

<i>Metarea</i>	<i>Issuing service*/Metarea coordinator^x</i>	<i>Area for the issue of scheduled broadcasts (see 2.2.3.5)</i>	<i>Preparation Service</i>	<i>Remarks</i>
I	United Kingdom	AOR (W)	United Kingdom; Norway	1, 3
II	France	AOR (E) & (W)	France	1, 3
III	Greece ^x ; France	AOR (E)	Greece; France	1, 3
IV	United States	AOR (E) & (W)	United States	1, 3
V	Brazil	AOR (E) & (W)	Brazil	1, 3
VI	Argentina	AOR (W)	Argentina	1, 3
VII-AOR	South Africa	AOR (E) & (W)	South Africa	1, 3
VII-IOR	South Africa	IOR & AOR (E)	South Africa; La Réunion (France)	1, 3
VIII (N)	India	IOR	India	1, 3
VIII (S)	Mauritius; La Réunion (France) ^{***} ; Australia ^{****}	IOR	Mauritius; La Réunion (France)	2
IX	Pakistan	IOR	Pakistan	2
X-IOR	Australia	IOR	Australia; Mauritius; La Réunion (France)	2
X-POR	Australia	IOR & POR	Australia; Fiji; New Zealand	2
XI-IOR	China	IOR	China; Hong Kong, China	1, 3
XI-POR	Japan	POR	Japan; Hong Kong, China; Australia	1, 3
XII	United States	POR, AOR (E) & (W)	United States	1, 3
XIII	Russian Federation	POR	Russian Federation	3
XIV	New Zealand	POR	New Zealand; Fiji	2
XV	Chile	AOR (W)	Chile	1, 3
XVI	United States	POR, AOR (E) & (W)	United States	4
XVII	Canada	POR	Canada	1, 3, 5
XVIII	Canada	AOR (W)	Canada, Denmark	1, 3, 5
XIX	Norway	AOR (E)	Norway	1, 3, 5
XX	Russian Federation	IOR	Russian Federation	1, 2, 3
XXI	Russian Federation	POR	Russian Federation	1, 2, 3

1 = Full coverage via SafetyNET for areas not covered by NAVTEX

2 = No NAVTEX coverage

3 = Partial NAVTEX coverage

4 = Full coastal coverage via SafetyNET

5 = HF NBDP

Notes:

* It is the responsibility of the issuing service to ensure that data are available to provide input for its entire area of broadcast responsibility and to develop appropriate procedures to rectify any data deficiency.

** Tropical cyclone warnings prepared and issued by La Réunion (France) (area west of 90°E) are also included in the regular bulletins issued by Mauritius.

*** Tropical cyclone warnings prepared and issued by Perth (area east of 90°E) are also included in the regular bulletins issued by Mauritius.

x Indicates country is not a Metarea coordinator

COORDINATES FOR GMDSS METAREAS

Area I: The North Atlantic Ocean east of 35°W, from 48°27'N to 75°N, including the North Sea and Baltic Sea sub-area;

Area II: Atlantic waters east of 35°W, from 7°N to 48°27'N, and east of 20°W from 7°N to 6°S, including the Strait of Gibraltar;

Area III: The Mediterranean and Black Seas, east of the Strait of Gibraltar;

Area IV: The western part of the North Atlantic Ocean east of the North American coast to 35°W, from 7°N to 67°N, including the Gulf of Mexico, the Caribbean Sea and the sea area between 7°N and the South American coastline eastward to the Guyana/Brazil frontier at 4°30'N;

Area V: Atlantic waters west of 20°W from 35°50'S to 7°N, narrowing in the coastal strips at the extremities to the Uruguay/Brazil frontier at 33°45'S and the Guyana/Brazil frontier at 4°30'N;

Area VI: The South Atlantic and Southern Oceans south of 35°50'S, and from 20°W to the longitude of Cape Horn, 67°16'W, including the coastal strip to the Uruguay/Brazil frontier at 33°45'S;

Area VII: The South Atlantic and Southern Oceans south of 6°S from 20°W to the coast of Africa, thence southward to the Cape of Good Hope and the South Indian Ocean and Southern Oceans south of 10°30'S from the Cape to 55°E, thence south of 30°S to 80°E;

Area VIII (N): The area of the Indian Ocean enclosed by lines from the India/Pakistan frontier at 23°45'N 68°E to 12°N 63°E, thence to Cape Gardafui and from the east African coast southward to the Equator, thence to 95°E, to 6°N, thence north east to the Myanmar/ Thailand frontier at 10°N 98°30'E;

Area VIII (S): The east African coast from the Equator southward to 10°30'S, thence to 55°E, to 30°S, to 95°E, to the Equator and to the east African coast;

Area IX: The Red Sea, Gulf of Aden, Arabian Sea and Persian Gulf, north of Area VIII;

Area X: The South Indian Ocean and Southern Oceans east of 80°E and south of 30°S, to 95°E, to 12°S, to 127°E and thence to the Timor Sea, South Pacific and Southern Oceans south of 10°S to 141°E, to the Equator, to 170°E, to 29°S, thence

south-westward to 45°S at 160°E and then to the meridian at 160°E;

Area XI: The Indian Ocean, China Sea and North Pacific Ocean north of Area X and on the Equator to longitude 180°, east of Area VIII and the Asian continent, to the Democratic People's Republic of Korea/Russian Federation frontier at 42°30'N 130°E, and thence to 135°E, north east to 45°N 138°20'E, to 45°N longitude 180°;

Area XII: The eastern part of the Pacific Ocean, west of the North and South American coasts and east of 120°W, from 3°24'S to the Equator, thence to 180°, to 50°N thence north-westward to 53°N 172°E, north-eastward following the marine frontier between the United States and Russian Federation waters to 67°N;

Area XIII: Sea areas enclosed north of Area XI and west of Area XII; also all Arctic waters from 170°W westward to 20°E;

Area XIV: The South Pacific and Southern Oceans south of the Equator, bounded by Area X to the west, Area XII to the north and Area XV to the east;

Area XV: The South Pacific and Southern Oceans south of 18°21'S following the coast of Chile to the longitude of Cape Horn at 67°16'W, and 120°W;

Area XVI: The South Pacific Ocean between 18°21'S and 3°24'S bounded by the coast of Peru and 120°W;

Area XVII: The Arctic Ocean bounded by 67°N and 168°58'W to 90°N 168°58'W, 90°N 120°W, southward to the Canadian coastline along the 120°W meridian;

Area XVIII: The Arctic Ocean bounded by a position on the Canadian coastline at the 120°W meridian to 90°N 120°W, 90°N and 35°W, 67°N 35°W;

Area XIX: From a position on the Norwegian coastline at 65°N to 65°N 5°W, 75°N 5°W, westward to a position on the Greenland coastline; from the border between Norway and Russia (inland) to 69°47'68''N 30°49'16''E, 69°58'48''N 31°06'24''E, 70°22'N 31°43'E, 71°N 30°E; from this coordinate (71°N 30°E) further north along the 30°E meridian to 90°N 30°E, 90°N 35°W, southward to the Greenland coastline along the 35°W meridian;

Area XX: From the border between Norway and Russia (inland) to 69°47'68''N 30°49'16''E,

69°58'48"N 31°6'24"E, 70°22'N 31°43'E, 71°N 30°E; from this coordinate (71°N 30°E) further north along the 30°E meridian to 90°N 30°E, 90°N 125°E, then south to the Russian Federation coastline along the 125°E meridian;

Area XXI: From a position on the Russian Federation coastline at the 125°E meridian to 90°N 125°E, 90°N 168°58'W, 67°N 168°58'W, westward to a position on the Russian Federation coastline along the 67°N parallel.

APPENDIX I.3

TRANSFER OF INFORMATION FROM AN ISSUING SERVICE TO A LAND EARTH STATION PROVIDING INMARSAT-C SERVICES*

The transfer of warnings and forecasts by the issuing service to an LES may be accomplished by the following means:

- (a) Telex link from the issuing service directly to LES;
- (b) X.25 packet switching networks**;
- (c) A dedicated landline;
- (d) The Global Telecommunication System (GTS) to another NMS whose country hosts the relevant LES, thence by either (a) or (b), above, by the cooperating NMS to LES;
- (e) From an INMARSAT-C SES direct to LES. (The approval of the national licensing authority has to be obtained for this method.) Such an approach to message transfer could prove particularly attractive to those issuing services located in countries without an LES, as potential delays and problems in the international terrestrial telecommunications networks could be avoided. It could also serve as an emergency backup to normal terrestrial communications systems for urgent messages;
- (f) Other means, as appropriate to national requirements and facilities.

A full explanation of messaging protocols and technical details for transmission of these messages via INMARSAT LES is available in the IMO *International SafetyNET Manual*, which is available from IMO.

* Access to the SafetyNET Service for the broadcast of meteorological data will be granted only to message originators authorized by WMO and registered with one or more INMARSAT-C LES operators.

** Such networks, which operate at transmission speeds higher than telex, may attract lower charges for the land-line portion of the transmission.

APPENDIX I.4

MULTILINGUAL LIST OF TERMS USED IN WEATHER AND SEA BULLETINS

LISTE MULTILINGUE DES TERMES UTILISÉS DANS LES BULLETINS DE
MÉTÉOROLOGIE MARITIME

LISTA MULTILINGUE DE TÉRMINOS UTILIZADOS EN LOS BOLETINES
METEOROLOGICOS Y MARINOS

МНОГОЯЗЫЧНЫЙ ПЕРЕЧЕНЬ ТЕРМИНОВ, ИСПОЛЬЗУЕМЫХ
В МЕТЕОРОЛОГИЧЕСКИХ И МОРСКИХ БЮЛЛЕТЕНЯХ

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
<i>Standards of time</i>	<i>Unités de temps</i>	<i>Unidades de tiempo</i>	<i>Единица времени</i>
Universal time coordinated (UTC)	Temps universel coordonné (UTC)	Tiempo universal coordinado (UTC)	международное скоординированное время (МСВ)
Zone time	Heure du fuseau	Hora zona	поясное время
Summer time	Heure d'été	Hora de verano	летнее время
Local time	Heure locale	Hora local	местное время

<i>Periods of time</i>	<i>Périodes de temps</i>	<i>Períodos de tiempo</i>	<i>Периоды времени</i>
Six hours	Six heures	Seis horas	шесть часов
Twelve hours	Douze heures	Doce horas	двенадцать часов
Eighteen hours	Dix-huit heures	Dieciocho horas	восемнадцать часов
Twenty-four hours	Vingt-quatre heures	Veinticuatro horas	двадцать четыре часа
Thirty-six hours	Trente-six heures	Treinta y seis horas	тридцать шесть часов
Forty-eight hours	Quarante-huit heures	Cuarenta y ocho horas	сорок восемь часов
Today	Aujourd'hui	Hoy	сегодня
Tomorrow	Demain	Mañana	завтра
Next few days	Les prochains jours	Los próximos días	следующие несколько дней
Morning	Matin	Mañana	утро
Evening	Soir	Tarde, noche	вечер
MIDDAY	Midi	Mediodía	полдень
Afternoon	Après-midi	Tarde	после полудня
Day	Jour	Día	день
Night	Nuit	Noche	ночь
Sunrise	Lever du soleil	Orto	восход
Sunset	Coucher du soleil	Ocaso	заход

<i>Preliminary terms</i>	<i>Termes préliminaires</i>	<i>Términos preliminares</i>	<i>Предварительные термины</i>
Forecast	Prévision	Previsión, pronóstico	прогноз
Further outlook	Évolution ultérieure probable	Evolución probable	вероятная эволюция, дальнейшие перспективы
General inference	Situation générale et évolution	Perspectivas futuras	общий вывод
General statement	Situation générale	Situación general	общее описание положения
Long-range forecast	Prévision à longue échéance	Previsión a largo plazo	долгосрочный прогноз
Medium-range forecast	Prévision à moyenne échéance	Previsión a medio plazo	прогноз средней заблаговременности

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
Short-range forecast	Prévision à courte échéance	Previsión a corto plazo	краткосрочный прогноз
Synoptic situation	Situation synoptique	Situación sinóptica	синоптическое положение, синоптическая ситуация
Warning	Avis	Aviso	предупреждение
<i>Terms of position</i>	<i>Termes de position</i>	<i>Términos de posición</i>	<i>Термины положения</i>
Degrees	Degrés	Grados	градусы
Latitude	Latitude	Latitud	широта
Longitude	Longitude	Longitud	долгота
Quadrant	Quadrant	Cuadrante	квадрант
Hemisphere	Hémisphère	Hemisferio	полушарие
North	Nord	Norte	север
South	Sud	Sur	юг
East	Est	Este	восток
West	Ouest	Oeste	запад
District	District	Distrito	район
Parallel	Parallèle	Paralelo	параллель
Meridian	Méridien	Meridiano	меридиан
Square	Carré	Cuadrado	квадрат
Bearing	Relèvement	Rumbo	пеленг
Direction	Direction	Dirección	направление
Track	Trajectoire, route	Trayectoria	путь, траектория
Area	Zone	Área, zona	область, район
Line	Ligne	Línea	линия
<i>Storm warnings</i>	<i>Avis de tempête</i>	<i>Avisos de temporales</i>	<i>Штормовые предупреждения</i>
Gale warning	Avis de coup de vent	Aviso de viento duro	штормовое предупреждение
Storm warning	Avis de tempête	Aviso de temporal	штормовое предупреждение
Hurricane warning	Avis d'ouragan	Aviso de huracán	предупреждение об урагане
Blizzard	Blizzard	Blizzard, ventisca	близзард
<i>Tropical storms</i>	<i>Cyclones tropicaux</i>	<i>Ciclones tropicales</i>	<i>Тропические штормы</i>
Tropical cyclone	Cyclone tropical	Ciclón tropical	тропический циклон
Hurricane	Ouragan	Huracán	ураган
Tornado	Tornado	Tornado	торнадо
Typhoon	Typhon	Tifón	тайфун
Baguio	Baguio	Baguio	багуйо
Willy-willy	Willy-willy	Willy-willy	вилли-вилли
<i>Pressure systems</i>	<i>Systèmes de pression</i>	<i>Sistemas de presión</i>	<i>Барические системы</i>
Area of low pressure	Zone de basses pressions	Área de bajas presiones	область пониженного давления
Low	Dépression	Depresión barométrica	циклон

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
Trough	Creux barométrique	Vaguada	ложбина
Area of high pressure	Zone de hautes pressions	Área de altas presiones	область высокого давления
High	Anticyclone	Anticiclón	антициклон
Ridge of high pressure	Dorsale, crête barométrique	Cresta de alta presión	гребень высокого давления
Belt of high pressure	Ceinture de hautes pressions	Cinturón de altas presiones	пояс высокого давления
Belt of low pressure	Ceinture de basses pressions	Cinturón de bajas presiones	пояс низкого давления
Col	Col barométrique	Collado	седловина
Hyperbolic point	Point hyperbolique	Punto hiperbólico	гиперболическая точка
Cyclolysis	Cyclolyse	Ciclólisis	циклолиз
Cyclogenesis	Cyclogénèse	Ciclogénesis	циклогенез
Anticyclolysis	Anticyclolyse	Anticiclólisis	антициклолиз
Anticyclogenesis	Anticyclogénèse	Anticiclogénesis	антициклогенез

<i>Air mass nomenclature</i>	<i>Nomenclature des masses d'air</i>	<i>Nomenclatura de las masas de aire</i>	<i>Классификация воздушных масс</i>
Air mass	Masse d'air	Masa de aire	воздушная масса
Stable air mass	Masse d'air stable	Masa de aire estable	устойчивая масса
Unstable air mass	Masse d'air instable	Masa de aire inestable	неустойчивая масса
Cold air	Air froid	Aire frío	холодная масса
Arctic air	Air arctique	Aire ártico	арктический воздух
Antarctic air	Air antarctique	Aire antártico	антарктический воздух
Polar air	Air polaire	Aire polar	полярный воздух
Warm air	Air chaud	Aire caliente, aire cálido	теплый воздух
Tropical air	Air tropical	Aire tropical	тропический воздух
Subtropical air	Air subtropical	Aire subtropical	субтропический воздух
Equatorial air	Air équatorial	Aire ecuatorial	экваториальный воздух
Maritime air	Air maritime	Aire marítimo	морской воздух
Continental air	Air continental	Aire continental	континентальный воздух
Winter monsoon	Mousson d'hiver	Monzón de invierno	зимний муссон
Summer monsoon	Mousson d'été	Monzón de verano	летний муссон

<i>Front nomenclature</i>	<i>Nomenclature des fronts</i>	<i>Nomenclatura de los frentes</i>	<i>Классификация фронтов</i>
Front	Front	Frente	фронт
Polar front	Front polaire	Frente polar	полярный фронт
Cold front	Front froid	Frente frío	холодный фронт
Secondary cold front	Front froid secondaire	Frente frío secundario	вторичный холодный фронт
Warm front	Front chaud	Frente caliente	теплый фронт
Occlusion	Occlusion	Oclusión	окклюзия
Cold occlusion	Occlusion à caractère de front froid	Oclusión fría	окклюзия по типу холодного фронта
Warm occlusion	Occlusion à caractère de front chaud	Oclusión caliente	окклюзия по типу теплого фронта
Upper front	Front en altitude	Frente en altura	верхний фронт

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
Intertropical front	Front intertropical	Frente intertropical	внутритропический фронт
Frontal wave	Onde frontale	Onda frontal	фронтальная волна
Frontogenesis	Frontogenèse	Frontogénesis	фронтогенез
Frontolysis	Frontolyse	Frontólisis	фронтотлиз
<i>Weather</i>	<i>Temps</i>	<i>Tiempo</i>	<i>Погода</i>
<i>Precipitation</i>	<i>Précipitation</i>	<i>Precipitación</i>	<i>Осадки</i>
Rain	Pluie	Lluvia	дождь
Freezing rain	Pluie se congelant	Lluvia engelante	переохлажденный дождь
Rain and snow	Pluie et neige mêlées	Lluvia y nieve mezcladas	дождь со снегом
Supercooled rain	Pluie surfondue	Lluvia subfundida	переохлажденный дождь
Snow	Neige	Nieve	снег
Snow pellets	Neige roulée	Nieve granulada	снежная крупа
Snow grains	Neige en grains	Cinarra, gragea	снежные зерна
Drizzle	Bruine	Llovizna	морось
Hail	Grêle	Granizo	град
Diamond dust	Poudrin de glace	Polvillo de hielo	алмазная пыль
Ice pellets	Granules de glace	Gránulos de hielo	ледяной дождь
Small hail	Grésil	Granizo menudo	ледяная крупа
Shower	Averse	Chubasco	ливень
<i>Visibility</i>	<i>Visibilité</i>	<i>Visibilidad</i>	<i>Видимость</i>
Fog	Brouillard	Niebla	туман
Mist	Brume	Neblina	дымка
Haze	Brume sèche	Calima	мгла
Dust storm	Tempête de poussière	Tempestad de polvo	пыльная буря
Sandstorm	Tempête de sable	Tempestad de arena	песчаная буря
Spray	Embruns	Rociones	водяная пыль
Drifting snow	Chasse-neige basse	Ventisca baja	поземок
Blowing snow	Chasse-neige élevée	Ventisca alta	низовая метель
<i>Miscellaneous</i>	<i>Divers</i>	<i>Misceláneos</i>	<i>Дополнительные термины</i>
Cloud	Nuage	Nube	облако
Clearing up	Se dissipant	Despejando(se)	прояснение
Line squall	Grain en ligne	Turbonada en línea	линейный шквал
Whirlwind	Tourbillon de vent	Remolino de viento	вихрь
Water spout	Trombe marine	Tromba marina	смерч
Frost, freezing	Gelée, gel	Helada	мороз, заморозок
Rime	Givre blanc	Cencellada blanca	изморозь
Glaze	Givre transparent	Cencellada transparente	ледяной налет
Smoke	Fumée	Humo	дым
Thunderstorm	Orage	Tormenta	гроза
Thunder	Tonnerre	Trueno	гром
Lightning	Éclair	Relámpago	молния

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
<i>Wind</i>	<i>Vent</i>	<i>Viento</i>	<i>Ветер</i>
<i>General terms</i>	<i>Termes généraux</i>	<i>Términos generales</i>	<i>Общие термины</i>
Beaufort scale	Échelle de Beaufort	Escala Beaufort	шкала Бофорта
Calm	Calme	Calma	штиль
Light air	Très légère brise	Ventolina	очень слабый ветер
Light breeze	Légère brise	Flojito (viento), brisa muy débil	слабый ветер
Gentle breeze	Petite brise	Flojo (viento), brisa débil	ветер от слабого до умеренного
Moderate breeze	Jolie brise	Bonancible (viento), brisa moderada	умеренный ветер
Fresh breeze	Bonne brise	Fresquito (viento), brisa fresca	свежий ветер
Strong breeze	Vent frais	Fresco (viento), brisa fuerte	сильный ветер
Near gale	Grand frais	Frescachón, viento fuerte	очень сильный ветер
Gale	Coup de vent	Viento duro	штормовой ветер
Strong gale	Fort coup de vent	Viento muy duro	шторм
Storm	Tempête	Tormenta, tempestad, temporal	сильный шторм - буря
Violent storm	Violente tempête	Temporal duro, orrasca	жестокий шторм
Hurricane	Ouragan	Huracán	ураган
Gust	Rafale	Ráfaga, racha	порыв
Squall	Grain	Turbonada	шквал
Sea breeze	Brise de mer	Brisa de mar	морской бриз
Land breeze	Brise de terre	Brisa de tierra	береговой бриз
Prevailing wind	Vent dominant	Viento dominante	господствующий ветер
Shift of wind	Saute de vent	Salto de viento	поворот ветра
Veering (clockwise change in direction)	Rotation du vent (dans le sens des aiguilles d'une montre)	Cambio de dirección (en el sentido de las agujas del reloj)	менять направление по часовой стрелке
Backing (anticlockwise change in direction)	Rotation du vent (dans le sens contraire des aiguilles d'une montre)	Cambio de dirección (en el sentido contrario de las agujas de reloj)	менять направление против часовой стрелки
<i>Local names</i>	<i>Noms locaux</i>	<i>Nombres locales</i>	<i>Местные названия</i>
Trade winds (trades)	Alizés	Vientos alisios (alisios)	пассаты
Bora	Bora	Bora	бора
Mistral	Mistral	Mistral	мистраль
Sirocco	Sirocco	Sirocco	сирокко
Gregale	Grégal	Gregal	грегаль
Levanter	Levante	Levante	левантин, южный ветер
Norther	Norther	Nortada	северный ветер

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
<i>Ice</i>	<i>Glace</i>	<i>Hielo</i>	<i>Лед</i>
(See: <i>Sea-ice Nomenclature</i> (WMO-No. 259) for a complete glossary)			
Bergy bit	Fragment d'iceberg	Tempanito	обломок айсберга
Brash ice concentration	Concentration en brash (sarrasins)	Concentración de escombros de hielo	ледяная каша - сплоченность
Past ice	Banquise côtière	Hielo fijo	припай
First-year ice	Glace de première année	Hielo del primer año	однолетний лед
Flaw	Brèche de séparation	Grieta	полоса тертого льда
Floe	Floe	Bandejón	ледяное поле
Frazil	Frasil	Cristales de hielo	иглы
Grease ice	Sorbet	Hielo grasoso	ледяное сало
Grey ice	Glace grise	Hielo gris	серый лед
Grey-white ice	Glace blanchâtre	Hielo gris blanco	серо-белый лед
Growler	Bourguignon	Gruñón	кусок айсберга
Hummocked ice	Glace hummockée	Hielo amonticulado	торосистый лед
Iceberg	Iceberg	Témpano	айсберг
Ice boundary	Ligne de démarcation de glaces	Frontera del hielo	ледовая граница
Ice edge	Lisière de glace	Borde del hielo	кромка льда
Ice field	Champ de glace	Campo de hielo	скопление дрейфующего льда
Ice limit	Limite des glaces	Límite del hielo	крайняя граница льда
Ice patch	Banc de glace	Manchón de hielo	пятно льда
Ice rind	Glace vitrée	Costra de hielo	склянка
Ice shelf	Plateau de glace	Meseta de hielo	шельфовый ледник
Level ice	Glace plane	Hielo plano	ровный лед
New ice	Nouvelle glace	Hielo nuevo	начальные виды льда
Nilas	Nilas	Nilas	нилас
Pack ice	Banquise	Hielo a la deriva	дрейфующий лед
Pancake ice	Glace en crêpes	Hielo panqueque	блинчатый лед
Polynya	Polynie	Polinia	полынья
Rafted ice	Glace entassée ou empilée	Hielo sobreescurrecido	наслоенный лед
Shore lead	Chenal côtier	Canal costero	прибрежная прогалина
Shuga	Shuga	Shuga	шуга
Slush	Gadoue	Pasta o grumo	снежура
Young ice	Jeune glace	Hielo joven	молодой лед
<i>Miscellaneous nautical terms</i>	<i>Termes nautiques divers</i>	<i>Términos náuticos diversos</i>	<i>Разные морские термины</i>
Sea	Mer	Mar	море
Sea level	Niveau de la mer	Nivel del mar	уровень моря
Horizon	Horizon	Horizonte	горизонт

<i>English</i>	<i>Français</i>	<i>Español</i>	<i>Русский</i>
Tsunami	Tsunami	Tsunami	цунами
Swell	Houle	Mar de fondo	зыбь
Tide	Marée	Marea	морской прилив и отлив
Surge	Lame de fond	Oleada	крутое волнение
Surf	Déferlement	Resaca	прибой
Breakers	Brisants	Rompientes	буруны
Wave	Vague	Ola	волна
Wavelet	Vaguelette	Ola pequeña	небольшая волна

<i>General descriptive terms</i>	<i>Termes descriptifs généraux</i>	<i>Términos descriptivos generales</i>	<i>Общие описательные термины</i>
Slight	Faible (léger)	Leve	незначительный
Moderate	Modéré	Moderado	умеренный
Violent	Violent	Violento	жестокий
Heavy	Fort (gros)	Fuerte	тяжелый
Strong	Fort	Fuerte	сильный
Dry	Sec	Seco	сухой
Damp	Humide	Húmedo	влажный
In patches	Par plaques, en bancs	En bancos	в кусках, разрывной
Extensive	Étendu	Extenso	обширный, пространный
Low	Bas	Baja	низкий
High	Haut, élevé	Alta	высокий
Rough	Forte	Duro	бурный
Recurve	Se recourber	Recurvarse	поворачивать
Quickly	Rapidement	Rápidamente	скоро
Slowly	Lentement	Lentamente	медленно
Filling up	Se comblant	Llenándose	заполнение
Increasing	Croissant, augmentant	Aumentando	увеличение
Decreasing	Décroissant, diminuant	Disminuyendo	уменьшение
Breaking up	Se dissolvant	Disipándose	разрушение
Poor	Mauvais	Malo	плохой
Good	Bon	Bueno	хороший
Spreading	S'étendant	Extendiéndose	распространение
Occasional	Occasionnel	Ocasional	случайный
Continuous	Continu	Continuo	непрерывный, продолжительный
Intermittent	Intermittent	Intermitente	прерывистый
At times	De temps à autre	A veces	иногда, по временам
Immediately	Immédiatement	Inmediatamente	немедленно, непосредственно
Early	Tôt	Temprano	рано
Late	Tard	Tarde	поздно
Later	Plus tard, par la suite	Luego, más tarde	позже

APPENDIX I.5

BEAUFORT SCALE OF WIND FORCE

<i>Beaufort number</i>	<i>Descriptive term</i>	<i>Wind speed equivalents</i>		<i>Specifications for observations on board ship (open sea)</i>
		<i>Metres/second</i>	<i>Knots</i>	
0	Calm	0–0.2	<1	Sea like a mirror
1	Light air	0.3–1.5	1–3	Ripples with the appearance of scales are formed, but without foam crests
2	Light breeze	1.6–3.3	4–6	Small wavelets, still short but more pronounced; crests have a glassy appearance and do not break
3	Gentle breeze	3.4–5.4	7–10	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses
4	Moderate breeze	5.5–7.9	11–16	Small waves, becoming longer; fairly frequent white horses
5	Fresh breeze	8.0–10.7	17–21	Moderate waves, taking a more pronounced long form; many white horses are formed (chance of some spray)
6	Strong breeze	10.8–13.8	22–27	Large waves begin to form; the white foam crests are more extensive everywhere (probably some spray)
7	Near gale	13.9–17.1	28–33	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind
8	Gale	17.2–20.7	34–40	Moderately high waves of greater length; edges of crests begin to break into the spindrift; the foam is blown in well-marked streaks along the direction of the wind
9	Strong gale	20.8–24.4	41–47	High waves; dense streaks of foam along the direction of the wind; crests of waves begin to topple, tumble and roll over; spray may affect visibility
10	Storm	24.5–28.4	48–55	Very high waves with long overhanging crests; the resulting foam, in great patches, is blown in dense white streaks along the direction of the wind; on the whole, the surface of the sea takes a white appearance; the tumbling of the sea becomes heavy and shock-like; visibility affected
11	Violent storm	28.5–32.6	56–63	Exceptionally high waves (small and medium-sized ships might be for a time lost to view behind the waves); the sea is completely covered with long white patches of foam flying along the direction of the wind; everywhere the edges of the wave crests are blown into front; visibility affected
12	Hurricane	32.7 and over	64 and over	The air is filled with foam and spray; sea completely white with driving spray; visibility very seriously affected

APPENDIX I.6

SYMBOLS AND DEPICTIONS USED ON RADIO-FACSIMILE CHARTS FOR MARINE PURPOSES

1. Typical symbols used for marine meteorological purposes:

(a) Selections from the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485):

	Cold front at the surface
	Warm front at the surface
	Occluded front at the surface
	Quasi-stationary front at the surface
	Convergence line
	Inter-tropical convergence zone (ITCZ)
	Centre of tropical cyclonic circulation (maximum winds 34–63 knots)
	Centre of tropical cyclonic circulation (maximum winds of 64 knots or more)
	Fog

(b) Additional symbols:

<i>Ice accretion</i>	
	Ice building slowly
	Ice building rapidly


2. Depiction of lines and systems on specific charts:

(a) Model S – surface – chart:

Continuous lines	Isobars labelled in hectopascals
Crossed-line segments	Position of centre of high or low pressure given in hectopascals
*L	Low pressure
*H	High pressure
	Direction of movement of centres and fronts with speed in knots

* The appropriate letter from the alphabet of the issuing country may be used, provided that the chart contains explicit correspondence to the appropriate English letters.

(b) Model W – wave – chart:

Continuous lines	Significant wind wave height (sea), or composite wind wave and swell height, where so drawn, labelled in metres
Dashed lines	Significant swell height labelled in metres
MAX	Centre of maximum wave height
MIN	Centre of minimum wave height
	Direction of sea waves/direction of swell waves

(c) Model SST – sea-surface temperature – chart:

Continuous lines	Isotherms labelled in degrees Celsius
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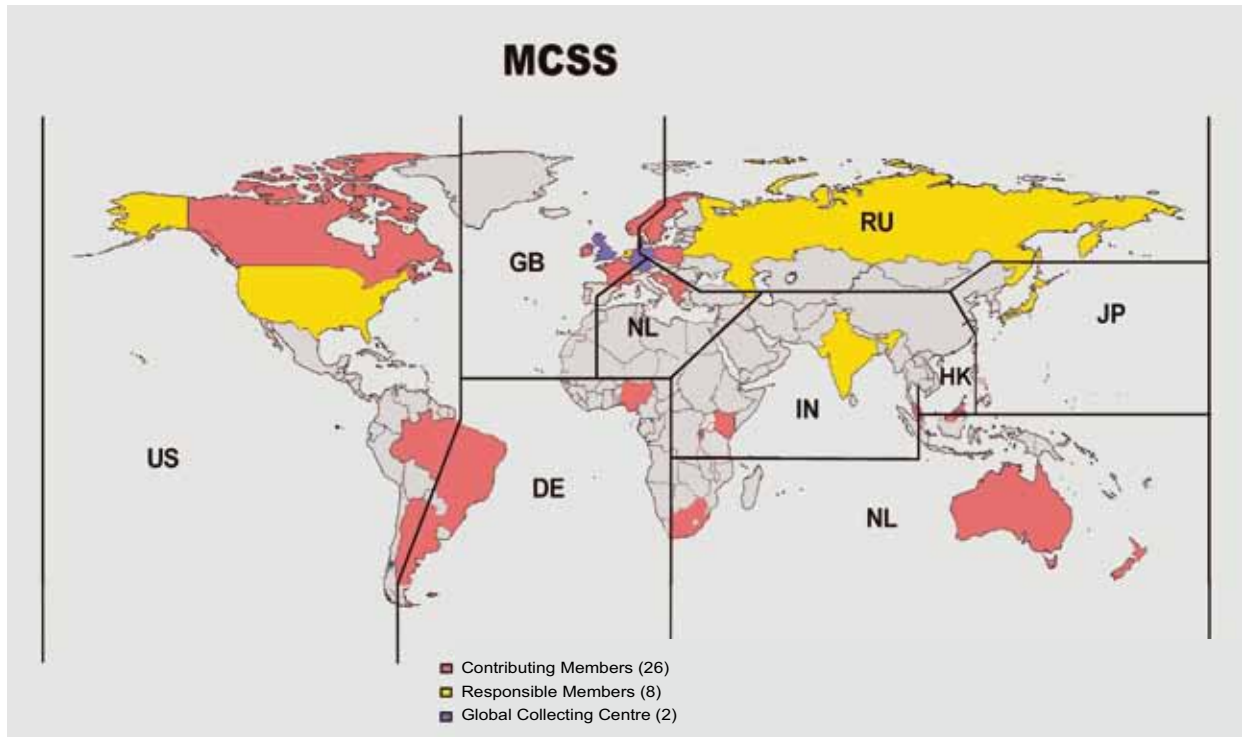
Note: Broken lines may be used to avoid confusion with other analysed parameters.

(d) Model SI – sea-ice information – chart:

The international system of sea-ice symbols adopted by WMO should be used.

APPENDIX I.7

AREAS OF RESPONSIBILITY AND RESPONSIBLE MEMBERS FOR MARINE CLIMATOLOGICAL SUMMARIES



Note: The Russian Federation is responsible for the compilation of a complete dataset and the preparation of the summaries for sea areas south of 50°S.

APPENDIX I.8

GLOBAL COLLECTING CENTRES FOR THE MARINE CLIMATOLOGICAL SUMMARIES SCHEME

GCC Germany

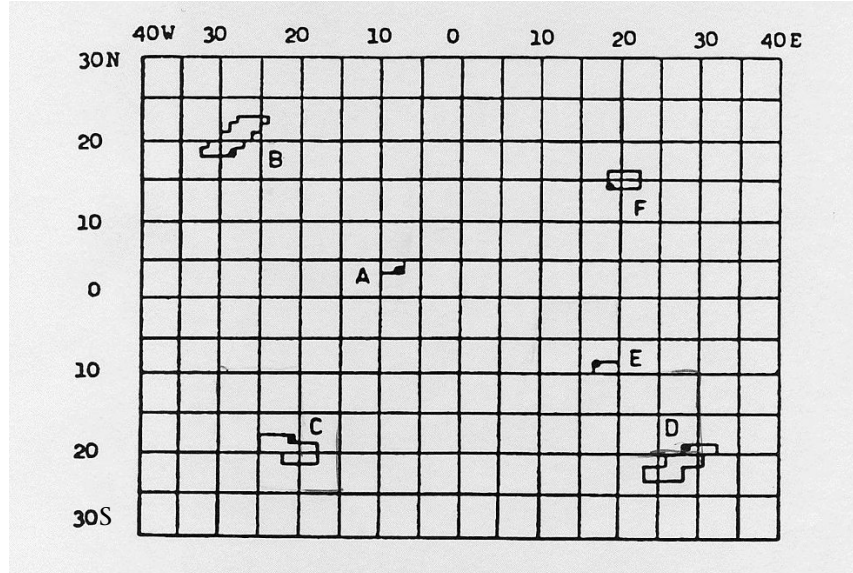
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Fax.: +44 131 528 7345
Email: gcc@metoffice.gov.uk
Website: [http://www.metoffice.gov.uk/science/
creating/working_together/gcc.html](http://www.metoffice.gov.uk/science/creating/working_together/gcc.html)

APPENDIX I.9

AREA INDICES SYSTEM FOR MARINE CLIMATOLOGICAL SUMMARIES



<i>Representative area:</i>	<i>Shall be coded:</i>
A	00037
B	01288
C	51281
D	81288
E	80187
F	31149

The following area indices systems shall be used:

- (a) A selected representative area shall be indicated with reference to the position in the area of the 1-degree square corner that is nearest (1) to the Equator and (2) to the Greenwich meridian, in that order;
- (b) A five-figure code shall be used for "area index";
- (c) The first figures of the code – QL_aL_o – shall indicate the 10-degree square in which this 1-degree square is situated, where:
 - (i) The first figure shall be octant (code 3300);
 - (ii) The second figure shall be tens of the latitude of the 10-degree square;
 - (iii) The third figure shall be the tens of the longitude of the 10-degree square;
- (d) The fourth and fifth figures of the code shall be the number of the 1-degree square within the 10-degree square as indicated in the above figure.

APPENDIX I.10

**PLAN FOR THE PRODUCTION OF MARINE CLIMATOLOGICAL SUMMARIES
OVER THE PERIOD 1961–2020**

<i>Period</i>	<i>Fixed stations^a</i>	<i>Representative area/Area of responsibility^b</i>		
	<i>Tables^c</i>	<i>Tables^c</i>	<i>Charts^{b, d}</i>	<i>Isopleths^{b, d, e}</i>
1961–1970 annual, decadal	X, X	X, O ^g	O ^f , O ^g	O, O
1971–1980 annual, decadal	O, X	O, O ^g	O ^f , O ^g	O, O
1981–1990 annual, decadal	O, X	O, O ^g	O, O ^g	O, O
1991–2000 annual, decadal	O, X	O, O ^g	O, O ^g	O, O
2001–2010 annual, decadal	O, X	O, O ^g	O, O ^g	O, O
2011–2020 annual, decadal	O, X	O, O ^g	O, O ^g	O, O

KEY:

X – Recommended

O – Optional

NOTES:

(a) Ocean weather stations and other fixed stations;

(b) Total area of responsibility;

(c) Summary tables (existing regulations);

(d) Numerical data on charts of sea areas (marine climatological summary charts);

(e) In addition to charts;

(f) Recommended instead of tables for Responsible Members who have not yet published annual summaries;

(g) Published in chart or tabular form or both at the option of Responsible Members.

APPENDIX I.11

LAYOUT FOR MARINE CLIMATOLOGICAL SUMMARY CHARTS FOR REPRESENTATIVE AREAS

1. **General**

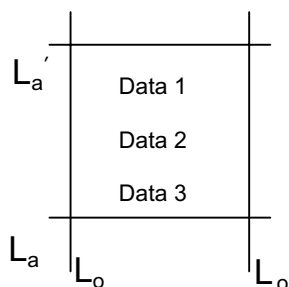
For each area of responsibility charts will be prepared in accordance with the specifications detailed in the points that follow.

2. **Projection**

The recommended projection for all areas except the polar regions is the Mercator projection. For the polar regions, the polar stereographic projection is recommended. If charts are produced by typewriter or line-printer systems other projections may be used.

3. **Unit areas**

Data will be plotted on unit areas, preferably rectangular, as shown below:



Data 1-3 are specified according to the element summarized.

4. **Dimensions of the unit areas**

The unit areas containing relevant numerical data should, as far as possible, have a uniform size. In data-sparse regions, unit areas as large as $5^\circ \times 10^\circ$ may be necessary. For most parts of the oceans $5^\circ \times 5^\circ$ squares will be suitable. In the vicinity of coasts or in semi-enclosed seas, $2^\circ \times 2^\circ$ or even $1^\circ \times 1^\circ$ squares may be appropriate. The selection of unit areas will be undertaken by each Responsible Member and will be a compromise between the available number of observations and the expected climatic gradients. The unit areas, once chosen, should be retained in all subsequent annual and decadal charts.

5. **Specification of elements to be presented on summary charts**

<i>Chart</i>	<i>Data</i>	<i>Element (resolution/unit)</i>
I	1	Mean air temperature (\bar{T} , 0.1°C)
	2	Standard deviation of air temperature ¹ (σ_T , 0.1°C)
	3	Number of observations of air temperature (N_T)
II	1	Mean sea-surface temperature (\bar{T}_W , 0.1°C)
	2	σ_{TW} (0.1°C)
	3	N_{Td}

<i>Chart</i>	<i>Data</i>	<i>Element (resolution/unit)</i>
III	1	Mean dew-point temperature (\bar{T}_{d^r} , 0.1°C)
	2	σ_{Td} (0.1°C)
	3	N_{Td}
IV	1	Mean air-sea temperature difference ($\bar{T} - \bar{T}_w$) ($\Delta\bar{T}$, 0.1°C)
	2	$\sigma_{\Delta T}$ (0.1°C)
	3	$N_{\Delta T}$
V	1	Mean sea-level pressure (\bar{P} , 0.1 hPa)
	2	σ_p (0.1 hPa)
	3	N_p
VI	1	Median wind speed (f_{50^r} , 0.1 m s ⁻¹)
	2	Standard deviation of wind speed (σ_v , 0.1 m s ⁻¹)
	3	Steadiness of wind ²
VII	1	Prevailing wind direction ³
	2	Number of wind-speed observations (N_f)
	3	Number of measured wind-speed observations
VIII	1	% of light winds (≤ 3 m s ⁻¹ , \leq Beaufort 2) (0.1%)
	2	% of strong winds (≥ 11 m s ⁻¹ , \geq Beaufort 6) (0.1%)
	3	Prevailing direction ³ of strong winds (1°)
IX	1	% gales (≥ 17 m s ⁻¹ , \geq Beaufort 8) (0.1%)
	2	Prevailing direction ³ of gales (1°)
	3	–
X	1	Median wave height ⁴ (H_{50^r} , 0.5 m)
	2	σ_H (0.1 m)
	3	N_H
XI	1	% waves ≤ 1.5 m (0.1%)
	2	% waves ≥ 4 m (0.1%)
	3	% waves ≥ 6 m (0.1%)
XII	1	% wave periods ⁴ ≥ 6 s (1 s)
	2	Prevailing swell direction ³ (1°)
	3	Number of swell observations
XIII	1	% observations with rain or drizzle ⁵ (0.1%)
	2	% observations with other forms of precipitation ⁶ (0.1%)
	3	Number of present weather observations
XIV	1	% total cloud amount $\leq 2/8$ (0.1%)
	2	% total cloud amount $\leq 6/8$ ⁷ (0.1%)
	3	Number of total cloud observations
XV	1	% visibility < 1 km (VV = 90–93) (0.1%)
	2	% visibility ≥ 10 km (VV = 97–99) (0.1%)
	3	Number of visibility observations
XVI	1	Mean latitude of observations (\bar{L}_a , 0.1°)
	2	Mean longitude of observations (\bar{L}_l , 0.1°)
	3	Total number of observations

Chart	Data	Element (resolution/unit)
XVII	1	σ_{La} (0.1°)
	2	σ_{Lo} (0.1°)
	3	Total number of observations
XVIII	1	Number of reports of icing
	2	% potential moderate or severe superstructure icing ⁸ (0.1%)
	3	Number of observations containing air temperature and wind speed

Notes:

1.
$$= \left\{ \frac{\left[\sum_{i=1}^N x_i - \bar{x} \right]^2}{N-1} \right\}^{1/2}$$
 where x is the value of an individual observation;

vector average,

2. Steadiness = or
scalar average;

3. A resultant vector mean direction with each speed set equal to 1;

4. Height of sea or swell;

5. ww = 50–67, 80–82;

6. ww = 68–99 except 80–82, 98;

7. N = 6, 7, 8, 9;

8. ff \geq 11 m s⁻¹, TTT \leq 2°C.

6. Production of charts

Monthly and annual charts will be produced as specified above. Mean values and standard deviations are to be computed from the total numbers of observations in all cases (that is, for the annual charts, the annual means and standard deviations will be computed from the sums of the individual observed values). Parameters for decadal charts will be computed in the same manner.

APPENDIX I.12

PARAMETERS TO BE INCLUDED IN MARINE CLIMATOLOGICAL SUMMARIES FOR FIXED SHIP STATIONS

Table 1 Mean position of all observations

This table is not included in summaries for fixed ship stations.

Table 2 Air temperature

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Extremes with dates and hours of occurrence and 5, 25, 50, 75 and 95 percentile values for each month;
- (d) Number of observations.

Table 3 Dewpoint temperature

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Extremes with dates and hours of occurrence and 5, 25, 50, 75 and 95 percentile values for each month;
- (d) Number of observations.

Table 4 Sea-surface temperature

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Extremes with dates and hours of occurrence and 5, 25, 50, 75 and 95 percentile values for each month;
- (d) Number of observations.

Table 5 Air-sea temperature difference

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Extremes with dates and hours of occurrence and 5, 25, 50, 75 and 95 percentile values for each month;
- (d) Number of observations.

Table 6 Visibility

- (a) Percentage frequency for each month for each code figure 90–99 inclusive (WMO Code table 4377);

- (b) Annual percentage frequency for each code figure 90–99 inclusive;
- (c) Number of days for each month and for the year with VV = 90–93 and/or W = 4;
- (d) Number of observations.

Table 7 Weather

- (a) Number of days for each month with precipitation, that is, days when one or more of the ww or W code figures (WMO Codes tables 4500 and 4677) listed in (b) to (e) were reported (excluding ww = 17 or 98);
- (b) Number of days for each month with rain and/or drizzle (ww = 20, 21, 24, 25, 50–67, 80–82; W = 5, 6, 8);
- (c) Number of days for each month with snow, or snow and rain (ww = 22, 23, 26, 68–79, 83–86; W = 7);
- (d) Number of days for each month with hail (ww = 27, 87–90);
- (e) Number of days for each month with thunderstorms (ww = 17, 29, 91–99; W = 9);
- (f) Number of days for each month with:
 - (i) Gales (Beaufort force ≥ 8);
 - (ii) Storms (Beaufort force ≥ 10);
 - (iii) Hurricane force winds (Beaufort force = 12);
- (g) Number of complete observing days for each of (a) to (f);
- (h) Total number of days annually for each of (a) to (f);
- (i) Monthly percentage frequency of occurrence of precipitation at the time of observation (ww = 50–97, 99);
- (j) Annual percentage frequency of occurrence of precipitation at the time of observation (ww = 50–97, 99);
- (k) Number of observations for items (i) and (j);
- (l) Monthly and annual amount of precipitation, if measured;
- (m) Annual percentage frequency of occurrence of each individual ww code figure 50–97, 99.

NOTE: It is recommended that observations of the number of days with precipitation and other phenomena be recorded by making appropriate entries in a logbook at the end of each day, as shown in the following example:

<i>Precipitation</i>	<i>Rain or drizzle</i>	<i>Snow or rain and snow</i>	<i>Hail</i>	<i>Thunder</i>	<i>Fog</i>	<i>Gale</i>	<i>Storm</i>	<i>Hurricane</i>
√	√			√	√			

In order to facilitate the computation of the monthly and annual totals, these entries can be punched in fixed columns as "I" on a "day-card". If this is done, the sorting of the international maritime punch cards by the various combinations of ww and W is avoided and an accurate total obtained.

Table 8 Wind direction and speed

- (a) Monthly percentage frequencies for the following ranges of speed, in knots:
 - (i) 0–4;
 - (ii) 5–9;
 - (iii) 10–14;
 - (iv) 15–19;
 - (v) 20–24;
 - (vi) 25–29;
 - (vii) 30–39;
 - (viii) 40–49, and so on;
 and for directions by sectors of 30°, true north bisecting the first sector;
- (b) Monthly total of observations for each sector irrespective of speed;
- (c) Monthly percentage frequency of occurrence of observations for each range of speed irrespective of direction;
- (d) Mean monthly wind speed in knots, derived from all wind-speed observations;
- (e) Mean wind speed for the year, computed from monthly means;
- (f) Number of observations corresponding to (d);
- (g) Highest wind speed for each month and for the year, with dates and hours of occurrence;
- (h) Vector mean wind for each month and its components (directions W to E and S to N being taken as positive).

Table 9 Sea-level pressure

- (a) Monthly mean for each month of observation;
- (b) Monthly means for all hours of observation;
- (c) Mean for the year, computed from monthly means;
- (d) Number of observations;
- (e) Extremes, with dates and hours, of occurrence and 5, 25, 50, 75 and 95 percentile values for each month.

Table 10 Cloud

- (a) Monthly mean total amount for each hour of observation;
- (b) Monthly mean for all hours of observation;
- (c) Monthly mean for all hours of observation in respect of low cloud only (defined as cloud for which "h" is any code figure (WMO Code table 1600) from 0 to 8 inclusive);
- (d) Monthly percentage frequency of observations in the following ranges of total cloud amount (all hours of observing combined) in oktas:
 - (i) 2 or less;
 - (ii) 3–5 inclusive;
 - (iii) 6–7 inclusive;
 - (iv) 8;
- (e) As for (d), but for low cloud only;
- (f) Percentage frequency of height of low cloud for each month, subdivided into ranges corresponding to WMO Code table 1600;
- (g) Identical observations as those of (a) to (f) for the year, computed from the monthly means or frequencies;
- (h) Number of observations.

Table 11 Waves

- (a) Seasonal tables, with the first-mentioned parameter arranged along the vertical, containing:
 - (i) Number of observations of any combination of wave height and period, irrespective of direction;
 - (ii) Number of observations of any combination of wave direction and height, irrespective of period;
 - (iii) Number of observations of any combination of wave direction and period, irrespective of height;
 - (iv) Number of observations of any wave height, irrespective of period and direction;
 - (v) Number of observations of any wave period, irrespective of height and direction;
 - (vi) Number of observations of any wave direction, irrespective of height and period;
 - (vii) Total number of observations;
- (b) The following seasons shall be used:
 - (i) December (of the previous year), January, February, March;
 - (ii) April, May;

- (iii) June, July, August, September;
- (iv) October, November;
- (c) Starting with data for 1971, wave data should be provided in sets of three tables: direction versus height, direction versus period and height versus period, with a line or column "undetermined" with respect to wave period and direction, respectively;
- (d) Only waves with greatest height should be selected. If two waves in the same observation have equal height, the one with the largest period should be selected. If the periods are also equal or undetermined, the direction of the second wave reported should be used;
- (e) In ten-year summaries, the tables as indicated under (a) to (c) above should be included on a monthly basis and, in addition, as seasonal tables. For formal and ongoing use, the format of the tables will be advised by JCOMM-IV.

Note: A revised tabulation will be adopted for use in recording wave data for climatological purposes at JCOMM-IV with guidance from ETMC.

APPENDIX I.13

PARAMETERS TO BE INCLUDED IN MARINE CLIMATOLOGICAL SUMMARIES FOR SELECTED REPRESENTATIVE AREAS IN EXTRA-POLAR REGIONS

Table 1 Mean position of all observations

- (a) Monthly mean position of all observations;
- (b) Mean position for the year as calculated from the monthly mean positions.

Table 2 Air temperature

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Frequency table in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values) or -0.1°C to -1.0°C (negative values), for example, 9.0°C to 9.9°C or -1.1°C to -2.0°C;
- (d) Monthly and annual total number of observations.

Note: The unused higher and lower ranges need not be printed; all intervals between the extreme annual ranges should be retained.

Table 3 Dewpoint temperature

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Frequency table in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values) or -0.1°C to -1.0°C (negative values), for example, 9.0°C to 9.9°C or -1.1°C to -2.0°C;
- (d) Monthly and annual total number of observations.

Note: See note under Table 2.

Table 4 Sea-surface temperature

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Frequency table in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values) or -0.1°C to -1.0°C (negative values), for example, 9.0°C to 9.9°C or -1.1°C to -2.0°C;
- (d) Monthly and annual total number of observations.

Note: See note under Table 2.

Table 5 Air-sea temperature differences

- (a) Monthly means;
- (b) Mean for the year, computed from monthly means;
- (c) Frequency table in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values) or -0.1°C to -1.0°C (negative values), for example, 9.0°C to 9.9°C or -1.1°C to -2.0°C;
- (d) Monthly and annual total number of observations.

Note: See note under Table 2.

Table 6 Visibility

- (a) Number of observations for each month for each code figure 90-99 (WMO Code table 4377);
- (b) Total number of observations for the year for each code figure 90-99;
- (c) Monthly and annual total of observations.

Table 7 Weather

- (a) Monthly number of occasions with rain or drizzle at the time of observation (ww = 50-67, 80-82 (WMO Code table 4677));
- (b) Monthly number of occasions with snow, or snow and rain at the time of observation (ww = 68-79, 83-86);
- (c) Monthly number of occasions with hail at the time of observation (ww = 87-90);
- (d) Monthly number of occasions with thunderstorms at the time of observation (ww = 17, 91-99);
- (e) Monthly number of observations with (at the time of observation):
 - (i) Gales (Beaufort force > 8);
 - (ii) Storms (Beaufort force > 10);
 - (iii) Hurricane force winds (Beaufort force = 12);
- (f) Monthly number of occasions of precipitation at the time of observation (ww = 50-97, 99);
- (g) Annual number of occasions for each of (a) to (f);

- (h) Monthly and annual total number of observations.

Notes:

1. A column "VIS < 1 km" (visibility less than 1 km) should be added between the "precipitation" column and the "total number of observations" column.
2. Responsible Members may include additional non-standard tables for those phenomena that are of importance for particular climatic regions as an appendix to the summary.

Table 8 Wind direction and force

- (a) Monthly number of observations for each month for each Beaufort number 0, 1, 2, and so on, and for directions by sectors of 30°, true north bisecting the first sector;
- (b) Monthly total of observations for each sector irrespective of wind force;
- (c) Monthly number of observations for each Beaufort number irrespective of direction;
- (d) Mean monthly wind force according to the Beaufort scale, derived from all wind observations;
- (e) Mean wind force for the year, computed from monthly means;
- (f) Monthly and annual total number of observations.

Note: The column "mean force in Beaufort" should be left blank until an appropriate method of representing such a mean is determined.

Table 9 Sea-level pressure

- (a) Monthly means for all hours of observation;
- (b) Mean for the year, computed from monthly means;
- (c) Frequency table in:
 - (i) Steps of 2 hPa between 0° and 30° latitude, based on the intervals 0.0 hPa to 1.9 hPa, for example 990.0 hPa to 991.9 hPa;

- (ii) Steps of 4 hPa north of 30°N and south of 30°S, based on the intervals 0.0 hPa to 3.9 hPa, for example 996.0 hPa to 999.9 hPa;

- (d) Monthly and annual total number of observations.

Notes:

1. At the bottom of the table, lines should be added showing pressure averages by hour for the UTC observations of 0000, 0600, 1200 and 1800; an account of the number of observations should be included under each list of pressure averages.
2. See note under Table 2.

Table 10 Cloud

- (a) Monthly mean of total cloud amount;
- (b) Monthly mean amount for low cloud only (defined as cloud for which "h" is any code figure from 0 to 8 inclusive (WMO Code table 1600));
- (c) Monthly and annual number of observations in the following ranges of total cloud amount, in oktas:
 - (i) 2 or less;
 - (ii) 3 to 5 inclusive;
 - (iii) 6 to 7 inclusive;
 - (iv) 8.
- (d) Mean for the year for (a) and (b), computed from monthly means;
- (e) Monthly and annual total of observations.

Note: The table should include the following note: "Mean low cloud" means amount for low cloud only (defined as cloud for which "h" is any code figure from 0 to 8 inclusive (WMO Code table 1600)).

Table 11 Waves

Tables should be as for fixed stations.

APPENDIX I.14

PARAMETERS TO BE INCLUDED IN MARINE CLIMATOLOGICAL SUMMARIES FOR SELECTED REPRESENTATIVE AREAS IN POLAR REGIONS

Table 1 Mean position of all observations

- (a) Monthly mean position of all observations;
- (b) Mean position for the year as calculated from the monthly mean positions.

Table 2 Air temperature

- (a) Monthly means;
- (b) Frequency table in steps of 3°C based on the intervals 0.0°C to 2.9°C (positive values), -0.1°C to -3.0°C (negative values), or when and where necessary in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values), -0.1°C to -1.0°C (negative values);
- (c) Extreme values should be included when 3°C steps are used under (b);
- (d) Standard deviations, if the number of observations is sufficiently large;
- (e) Monthly number of observations.

Table 3 Dewpoint temperature

This table is not included.

Table 4 Sea-surface temperature

- (a) Monthly means;
- (b) Frequency table in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values), -0.1°C to -1.0°C (negative values), for example 9.0°C to 9.9°C or -1.1°C to -2.0°C;
- (c) Monthly number of observations.

Table 5 Air-sea temperature difference

- (a) Monthly means;
- (b) Frequency table in steps of 1°C based on the intervals 0.0°C to 0.9°C (positive values), -0.1°C to -1.0°C (negative values), for example 9.0°C to 9.9°C or -1.1°C to -2.0°C;
- (c) Monthly number of observations.

Table 6 Visibility

- (a) Number of observations for each month for each code figure 90-99 (WMO Code table 4377);
- (b) Monthly number of observations.

Table 7 Weather

- (a) Monthly number of occasions with rain or drizzle at the time of observation (ww = 50-67, 80-82 (WMO Code table 4677));
- (b) Monthly number of occasions with snow, or snow and rain at the time of observation (ww = 68-79, 83-86);
- (c) Monthly number of occasions with hail at the time of observation (ww = 87-90);
- (d) Monthly number of occasions with current or recent thunderstorms, with or without precipitation at the time of observation (ww = 17, 91-99);
- (e) Monthly number of observations with:
 - (i) Gales (Beaufort force ≥ 8);
 - (ii) Storms (Beaufort force ≥ 10);
 - (iii) Hurricane force winds (Beaufort force = 12);
- (f) Monthly number of occasions of precipitation at the time of observation (ww = 50-97, 99);
- (g) Monthly number of occasions of visibility less than 1 km;
- (h) Monthly number of observations.

Table 8 Wind direction and force

- (a) Monthly number of observations for each month for each Beaufort number 0, 1, 2, and so on, and for direction by sectors of 30°, true north bisecting the first sector;
- (b) Monthly total of observations for each sector irrespective of wind force;
- (c) Monthly total of observations for each Beaufort number irrespective of direction;
- (e) Monthly number of observations.

Table 9 Sea-level pressure

- (a) Monthly means and extremes for all hours of observation;
- (b) Frequency table in steps of 4 hPa, based on the intervals 0.0 hPa to 3.9 hPa, for example 996.0 hPa to 999.9 hPa;
- (c) Standard deviations, if the number of observations is sufficiently large;
- (e) Monthly number of observations.

Table 10 Cloud

- (a) Monthly mean of total cloud amount;
- (b) Monthly mean amount for low cloud only (defined as cloud for which "h" is any code figure from 0 to 8 inclusive (WMO Code table 1600));
- (c) Monthly number of observations in the following ranges of total cloud amount, in oktas:
 - (i) 2 or less;
 - (ii) 3 to 5;

- (iii) 6 to 7;

- (iv) 8;

- (d) Monthly number of observations.

Table 11 Waves

Tables should be a list of original observations or, where the number of observations is sufficient, in the form of seasonal tables as for fixed ship stations.

APPENDIX I.15

LAYOUT FOR THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT) FORMAT (VERSION IMMT-4)

Notes:

1. The representation for missing data in any field is a blank area.
2. Many of the codes in IMMT format match “symbolic letters”, as defined in the *Manual on Codes* (WMO–No. 306) for the traditional alphanumeric (FM 13-XIV) SHIP code. However, as an example, the elements added for the VOSClm project (introduced for IMMT-2), did not appear in WMO–No. 306.

Thus, an effort has been made to select unique new codes to avoid conflicts in meaning between symbolic letter groups in document WMO–No. 306 and codes defined only in IMMT.

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
1	1	i_T	Format/temperature indicator	3: Temperatures in tenths of °C 4: Temperatures in halves of °C 5: Temperatures in whole °C Note: codes 1–2 were previously used to refer to the obsolete IMMPC format; current codes all refer to the IMMT format.
2	2–5	AAAA	Year UTC	Four digits
3	6–7	MM	Month UTC	01–12 January to December
4	8–9	YY	Day UTC	01–31
5	10–11	GG	Time of observation	Nearest whole hour UTC, WMO specifications
6	12	Qc	Quadrant of the globe	WMO Code table 3333
7	13–15	$L_a L_a L_a$	Latitude	Tenths of degrees, WMO specifications
8	16–19	$L_o L_o L_o L_o$	Longitude	Tenths of degrees
9	20		Cloud height h and visibility VV measuring indicator	0: h and VV estimated 1: h measured, VV estimated 2: h and VV measured 3: h estimated, VV measured
10	21	h	Height of clouds	WMO Code table 1600
11	22–23	VV	Visibility	WMO Code table 4377
12	24	N	Cloud amount	Oktas, WMO Code table 2700; show 9 where applicable
13	25–26	dd	True wind direction	Tens of degrees, WMO Code table 0877; show 00 or 99 where applicable
14	27	i_w	Indicator for wind speed	WMO Code table 1855

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
15	28–29	ff	Wind speed	Tens and units of knots or $m s^{-1}$ (hundreds omitted); values in excess of 99 knots are to be indicated in units of $m s^{-1}$ and i_w encoded accordingly; the method of estimation or measurement and the units used (knots or $m s^{-1}$) are indicated in element 14. Wind is at observation height or anemometer height (that is, it is not reduced to 10 m).
16	30	s_n	Sign of temperature	WMO Code table 3845
17	31–33	TTT	Air temperature	Tenths of °C
18	34	s_t	Sign of dew-point temperature	0: Positive or zero measured dew-point temperature 1: Negative measured dew-point temperature 2: Iced measured dew-point temperature 5: Positive or zero computed dew-point temperature 6: Negative computed dew-point temperature 7: Iced computed dew-point temperature
19	35–37	$T_d T_d T_d$	Dew-point temperature	Tenths of °C
20	38–41	PPPP	Air pressure	Tenths of hPa
21	42–43	ww	Present weather	WMO Code table 4677 or 4680
22	44	W_1	Past weather	WMO Code table 4561 or 4531
23	45	W_2	Past weather	WMO Code table 4561 or 4531
24	46	N_h	Amount of lowest clouds	As reported for C_L or, if no C_L cloud is present, for C_M in oktas; WMO Code table 2700
25	47	C_L	Genus of C_L clouds	WMO Code table 0513
26	48	C_M	Genus of C_M clouds	WMO Code table 0515
27	49	C_H	Genus of C_H clouds	WMO Code table 0509
28	50	s_n	Sign of sea-surface temperature	WMO Code table 3845
29	51–53	$T_W T_W T_W$	Sea-surface temperature	Tenths of °C
30	54		Indicator for sea-surface temperature measurement	0: Bucket thermometer 1: Condenser inlet 2: Trailing thermistor 3: Hull contact sensor 4: "Through hull" sensor 5: Radiation thermometer 6: Bait tanks thermometer 7: Others

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
31	55		Indicator for wave measurement	Ship-borne wave recorder 0: Wind sea and swell estimated 1: Wind sea and swell measured 2: Mixed wave measured, swell estimated 3: Other combinations measured and estimated
				Buoy 4: Wind sea and swell measured 5: Mixed wave measured, swell estimated 6: Other combinations measured and estimated
				Other measurement system 7: Wind sea and swell measured 8: Mixed wave measured, swell estimated 9: Other combinations measured and estimated
32	56–57	$P_W P_W$	Period either of wind waves or of measured waves	Whole seconds; show 99 where applicable in accordance with Note (3) under specification of $P_W P_W$ in WMO–No. 306
33	58–59	$H_W H_W$	Height of wind waves or of measured waves	Half-metre values Examples: Calm or less than $\frac{1}{4}$ m to be encoded 00; $3\frac{1}{2}$ m to be encoded 07; 7 m to be encoded 14; $11\frac{1}{2}$ m to be encoded 23
34	60–61	$d_{W1} d_{W1}$	Direction of predominant swell waves	Tens of degrees, WMO Code table 0877 encoded 00 or 99 where applicable Blanks = no observation of waves attempted
35	62–63	$P_{W1} P_{W1}$	Period of predominant swell waves	Whole seconds; encoded 99 where applicable (see under element 32)
36	64–65	$H_{W1} H_{W1}$	Height of predominant swell waves	Half-metre values (see under element 33)
37	66	I_S	Ice accretion on ships	WMO Code table 1751
38	67–68	$E_S E_S$	Thickness of ice accretion	In cm
39	69	R_S	Rate of ice accretion	WMO Code table 3551
40	70		Source of observation	0: Unknown 1: Logbook (paper) 2: National telecommunication channels 3: National publications 4: Logbook (electronic) 5: Global telecommunication channels, GTS 6: International publications Note: Formerly (usage now discontinued) codes 1–3 also referred to “national data exchange,” and codes 4–6 also referred to “international data exchange”; distinction added between paper and electronic logbook.

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>	
41	71		Observation platform	0: Unknown 1: Selected ship 2: Supplementary ship 3: Auxiliary ship 4: Registered VOSclim ship 5: Fixed sea station (for example, rig or platform) 6: Coastal station Note: 7: Reserved Note: 8: Reserved 9: Others/data buoy Note: Formerly (usage now discontinued) code 4 referred to "automated station/data buoy", and codes 7 and 8 referred to "aircraft" and "satellite", respectively.	
42	72–78		Ship's call sign	Ship's call sign stored left-justified (with right-blank fill) as follows: 7-character call sign: columns 72–78 6-character call sign: columns 72–77 5-character call sign: columns 72–76 4-character call sign: columns 72–75 3-character call sign: columns 72–74	
43	79–80		Country that has recruited the ship	According to the 2-character alphabetical codes assigned by the International Organization for Standardization (ISO)	
44	81		National use		
45	82		Quality control (QC) indicator	0: No QC has been performed 1: Manual QC only 2: Automated QC only (MQC, no time-sequence checks) 3: Automated QC only (including time-sequence checks) 4: Manual and automated QC (superficial, no time sequence checks) 5: Manual and automated QC (superficial, with time-sequence checks) 6: Manual and automated QC (intensive, including time-sequence checks) (Note: 7 and 8 – reserved) 9: National system of QC (information to be furnished to WMO)	
46	83	i_x	Weather data indicator	1: Manual	
				4: Automatic	If present and past weather data included, WMO Code tables 4677 and 4561 used
				7: Automatic	If present and past weather data included, WMO Code tables 4680 and 4531 used
47	84	i_R	Indicator for inclusion or omission of precipitation data	WMO Code table 1819	
48	85–87	RRR	Amount of precipitation that has fallen during the period preceding the time of observation, as indicated by t_R	WMO Code table 3590	

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
49	88	t_R	Duration of period of reference for amount of precipitation, ending at the time of the report	WMO Code table 4019
50	89	s_W	Sign of wet-bulb temperature	0: Positive or zero measured wet-bulb temperature 1: Negative measured wet-bulb temperature 2: Iced measured wet-bulb temperature 5: Positive or zero computed wet-bulb temperature 6: Negative computed wet-bulb temperature 7: Iced computed wet-bulb temperature
51	90–92	$T_b T_b T_b$	Wet-bulb temperature	In tenths of °C, sign given by element 50
52	93	a	Characteristic of pressure tendency during the three hours preceding the time of observation	WMO Code table 0200
53	94–96	ppp	Amount of pressure tendency at station level during the three hours preceding the time of observation	In tenths of hPa
54	97	D_S	True direction of resultant displacement of the ship during the three hours preceding the time of observation	WMO Code table 0700
55	98	v_S	Ship's average speed made good during the three hours preceding the time of observation	WMO Code table 4451
56	99–100	$d_{W2} d_{W2}$	Direction of secondary swell waves	Tens of degrees, WMO Code table 0877, encoded 00 or 99 where applicable Blanks – no observation of waves attempted
57	101–102	$P_{W2} P_{W2}$	Period of secondary swell waves	Whole seconds, encoded 99 where applicable (see under element 32)
58	103–104	$H_{W2} H_{W2}$	Height of secondary swell waves	Half-metre values (see under element 33)
59	105	c_i	Concentration or arrangement of sea ice	WMO Code table 0639
60	106	S_i	Stage of development	WMO Code table 3739
61	107	b_i	Ice of land origin	WMO Code table 0439
62	108	D_i	True bearing of principal ice edge	WMO Code table 0739
63	109	z_i	Present ice situation and trend of conditions over the preceding three hours	WMO Code table 5239

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
64	110		FM code version	0: Previous to FM 24-V 1: FM 24-V 2: FM 24-VI Ext. 3: FM 13-VII 4: FM 13-VIII 5: FM 13-VIII Ext. 6: FM 13-IX 7: FM 13-IX Ext. 8: FM 13-X 9: FM 13-XI A: FM 13-XII Ext. Note: And so forth for future configurations
65	111		IMMT version	0: IMMT (version just prior to version number being included) 1: IMMT-1 (in effect from 2 November 1994) 2: IMMT-2 (in effect from January 2003) 3: IMMT-3 (in effect from January 2007) 4: IMMT-4 (this version, in effect from January 2011) Note: And so forth for future configurations
66	112	Q ₁	QC indicator for h	0: No QC has been performed on this element 1: QC performed, element appears correct 2: QC performed, element appears inconsistent with other elements 3: QC performed, element appears doubtful 4: QC performed, element appears erroneous 5: QC performed, element changed (possibly missing) as a result 6: The flag as received by GCCs was set to "1" (correct), but the element was judged by their MQCS as either inconsistent, dubious, erroneous or missing 7: The flag as received by GCCs was set to "5" (amended), but the element was judged by their MQCS as either inconsistent, dubious, erroneous or missing (Note: 8 – reserved) 9: Element is missing
67	113	Q ₂	QC indicator for V V	- idem -
68	114	Q ₃	QC indicator for clouds: elements 12, 24–27	- idem -
69	115	Q ₄	QC indicator for dd	- idem -
70	116	Q ₅	QC indicator for ff	- idem -
71	117	Q ₆	QC indicator for TTT	- idem -
72	118	Q ₇	QC indicator for s _t and T _d T _d T _d	- idem -
73	119	Q ₈	QC indicator for PPPP	- idem -
74	120	Q ₉	QC indicator for weather: elements 21–23	- idem -
75	121	Q ₁₀	QC indicator for s _n and T _w T _w T _w	- idem -

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
76	122	Q ₁₁	QC indicator for P _W P _W	- idem -
77	123	Q ₁₂	QC indicator for H _W H _W	- idem -
78	124	Q ₁₃	QC indicator for swell: elements 34–36, 56–58	- idem -
79	125	Q ₁₄	QC indicator for i _R RRRt _R	- idem -
80	126	Q ₁₅	QC indicator for a	- idem -
81	127	Q ₁₆	QC indicator for ppp	- idem -
82	128	Q ₁₇	QC indicator for D ₅	- idem -
83	129	Q ₁₈	QC indicator for v ₅	- idem -
84	130	Q ₁₉	QC indicator for s _w and T _b T _b T _b	- idem -
85	131	Q ₂₀	QC indicator for ships' position	- idem -
86	132	Q ₂₁	Version identification for MQCS	1: MQCS-1 (original version, February 1989) CMM-X 2: MQCS-2 (Version 2, March 1997) CMM-XII 3: MQCS-3 (Version 3, April 2000) SGMC-VIII 4: MQCS-4 (Version 4, June 2001) JCOMM-I 5: MQCS-5 (Version 5, July 2004) ETMC-I 6: MQCS-6 (Version 6, November 2009) JCOMM-III Note: And so forth for future configurations

Additional requirements for VOSClm

87	133–135	HDG	Ship's heading: the direction to which the bow is pointing, referenced to true north	000–360, for example: 360 = north 000 = no movement 090 = east
88	136–138	COG	Ship's ground course: the direction the vessel actually moves over the fixed earth and referenced to true north	000–360, for example: 360 = north 000 = no movement 090 = east
89	139–140	SOG	Ship's ground speed: the speed the vessel actually moves over the fixed earth	00–99, rounded to nearest whole knot
90	141–142	SLL	Maximum height in metres of deck cargo above summer maximum load line (reference level)	00–99, rounded to nearest whole metre
91	143	s _L	Sign of departure of reference level	0 = positive or zero, 1 = negative

<i>Element number</i>	<i>Character code number</i>		<i>Element</i>	<i>Coding procedure</i>
92	144–145	hh	Departure of reference level (summer maximum load line) from actual sea level	Difference to the nearest whole metre (00–99) between the summer maximum load line and the sea level (water line): positive when the summer maximum load line is above the level of the sea and negative if below the water line.
93	146–148	RWD	Relative wind direction in degrees off the bow	Relative wind direction: for example 000 = no apparent relative wind speed (calm conditions on deck). Reported direction for relative wind = 001–360 degrees in a clockwise direction off the bow of the ship. When directly on the bow, RWD = 360.
94	149–151	RWS	Relative wind speed indicated by i_w (knots or $m\ s^{-1}$)	Reported in either whole knots or whole $m\ s^{-1}$ (for example, 010 knots or 005 $m\ s^{-1}$). Units are established by i_w (element 14). Note: RWS is a 3-character field to store values of RWS larger than ff (if i_w indicates knots), for example, ff = 98 knots, RWS = 101 knots. See also element 15.
95	152	Q ₂₂	QC indicator for HDG	Note: coding as for element 66
96	153	Q ₂₃	QC indicator for COG	- idem -
97	154	Q ₂₄	QC indicator for SOG	- idem -
98	155	Q ₂₅	QC indicator for SLL	- idem -
	156		Blank	Note: Formerly (usage now discontinued) QC indicator for s_L ; now Q ₂₇ serves as the indicator for both s_L and hh.
99	157	Q ₂₇	QC indicator for s_L and hh	- idem -
100	158	Q ₂₈	QC indicator for RWD	- idem -
101	159	Q ₂₉	QC indicator for RWS	- idem -

Fields new for IMMT-IV.

102	160–163	RH	Relative humidity	Tenths of percentage
103	164	RHi	Relative humidity indicator	0: Relative humidity in tenths of percentage, measured and originally reported 1: Relative humidity in whole percentage, measured and originally reported Note: 2: Reserved 3: Relative humidity in tenths of percentage, computed 4: Relative humidity in whole percentage, computed
104	165	AWSi	Automated weather station (AWS) indicator	1: AWS 2: AWS plus manual observation
105	166–172	IMOno	IMO number	Seven digits (or left-justified with right-blank fill)

APPENDIX I.16

LAYOUT FOR MARITIME METEOROLOGICAL TAPE FOR POSSIBLE USE IN
NATIONAL AND BILATERAL DATA EXCHANGE

<i>Element number</i>	<i>Element</i>	<i>Character number</i>
1	Format and temperature indicator (i_T) (same as column 1 of IMMPC)	1
2	AA	2-3
3	MM	4-5
4	YY	6-7
5	GG	8-9
6	i_w	10
7	Q	11
8	$L_a L_a L_a$	12-14
9	$L_o L_o L_o$	15-17
10	Indicator for h and W	18
11	h, Q_1	19, 20
12	W, Q_2	21-22, 23
13	N, Q_3	24
14	dd, Q_4	25-26, 27
15	ff, Q_5	28-29, 30
16	S_n	31
17	TTT, Q_6	32-34, 35
18	Sign of reported wet-bulb or dewpoint temperature	36
19	Wet-bulb/dewpoint temperature, Q_7	37-39, 40
20	PPPP, Q_8	41-44, 45
21	ww	46-47
22	W_1	48
23	W_{2r} , Q_9	49, 50
24	N_h	51
25	C_L	52
26	C_M	53
27	C_{Hr} , Q_3	54, 55
28	S_n	56
29	$T_w T_w T_w$, Q_{10}	57-59, 60
30	Indicator for SST measurement	61
31	Indicator for wave measurement	62
32	$P_W P_W$, Q_{11}	63-64, 65
33	$H_W H_W$, Q_{12}	66-67, 68
34	$d_{W1} d_{W1}$	69-70

<i>Element number</i>	<i>Element</i>	<i>Character number</i>
35	$P_{W1}P_{W1}$	71–72
36	$H_{W1} H_{W1}, Q_{13}$	73–74
37	i_s	75
38	E_sE_s	76–77
39	R_s	78
40	Source of observation	79
41	Observation platform	80
42	Ship identifier	81–87
43	Country that has recruited ship	88–89
44	Quality control indicator	90
45	i_x	91
46	National use	92
47	i_R	93
48	RRR, Q_{14}	94–96, 97
49	t_R	98
50	Sign of computed wet-bulb or dewpoint temperature	99
51	Computed wet-bulb or dewpoint temperature	100–102
52	a, Q_{15}	103, 104
53	ppp, Q_{16}	105–107, 108
54	D_s, Q_{17}	109, 110
55	v_s, Q_{18}	111, 112
56	$d_{w2} d_{w2}$	113–114
57	$P_{w2}P_{w2}$	115–116
58	$H_{w2}H_{w2}, Q_{13}$	117–118, 119
59	c_i	120
60	s_i	121
61	b_i	122
62	D_i	123
63	z_i	124

Quality control indicators (Q_1 to Q_{18}) for elements indicated in brackets:

Q_1 (h):	20	Q_{10} ($T_W T_W T_W$):	60
Q_2 (W):	23	Q_{11} ($P_W P_W$):	65
Q_3 (clouds: elements 13, 24–27):	55	Q_{12} ($H_W H_W$):	68
Q_4 (dd):	27	Q_{13} (swell: elements 34–36, 56–58):	119
Q_5 (A):	30	Q_{14} ($i_R RRR t_R$):	97
Q_6 (TTT):	35	Q_{15} (a):	104
Q_7 (wet bulb/dewpoint):	40	Q_{16} (PPP):	108
Q_8 (PPPP):	45	Q_{17} (D_s):	110
Q_9 (weather: elements 21, 22, 23):	50	Q_{18} (V_s):	112

Specifications for quality control indicators Q_1 to Q_{18} :

- 0: No QC has been performed on this element;
 - 1: QC has been performed, element appears to be correct;
 - 2.: QC has been performed, element appears to be inconsistent with other element;
 - 3: QC has been performed, element appears to be doubtful;
 - 4: QC has been performed, element appears to be erroneous;
 - 5: The value has been changed as a result of QC;
 - 6–8: Reserve;
 - 9: The value of the element is missing.
-

APPENDIX I.17

MINIMUM QUALITY CONTROL STANDARDS
MQCS-VI (VERSION 6, NOVEMBER 2009)

Notes:

1. See specification for quality control indicators Q1 to Q29 at the end of this Appendix;
2. Δ = space (ASCII 32).

<i>Element</i>	<i>Error</i>	<i>Action</i>
1	$i_T \neq 3-5, \Delta$	Correct manually, otherwise = Δ
2	AAAA ≠ valid year	Correct manually, otherwise reject
3	MM ≠ 01-12	Correct manually, otherwise reject
4	YY ≠ valid day of month	Correct manually, otherwise reject
5	GG ≠ 00-23	Correct manually, otherwise reject
6	$Q \neq 1, 3, 5, 7$	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$Q = \Delta$	$Q_{20} = 2$
7	$L_a L_a L_a \neq 000-900$	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$L_a L_a L_a = \Delta\Delta\Delta$	$Q_{20} = 2$
8	$L_o L_o L_o L_o \neq 0000-1800$	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$L_o L_o L_o L_o = \Delta\Delta\Delta\Delta$	$Q_{20} = 2$
	$L_a L_a L_a = L_o L_o L_o L_o = \Delta\Delta\Delta(\Delta)$	Correct manually, otherwise reject
	<i>Time sequence checks:</i>	
	Change in latitude > 0.7° per hour	Correct manually, otherwise $Q_{20} = 3$
	Change in longitude > 0.7° per hour when latitude 00-39.9	Correct manually, otherwise $Q_{20} = 3$
	Change in longitude > 1.0° per hour when latitude 40-49.9	Correct manually, otherwise $Q_{20} = 3$
	Change in longitude > 1.4° per hour when latitude 50-59.9	Correct manually, otherwise $Q_{20} = 3$
	Change in longitude > 2.0° per hour when latitude 60-69.9	Correct manually otherwise $Q_{20} = 3$,
	Change in longitude > 2.7° per hour when latitude 70-79.9	Correct manually, otherwise $Q_{20} = 3$
9	Indicator ≠ 0-3, Δ	Correct manually, otherwise Δ
10	$h \neq 0-9$	Correct manually and $Q_1 = 5$, otherwise $Q_1 = 4$
	$h = \Delta$	$Q_1 = 9$
11	$V V \neq 90-99$	Correct manually and $Q_2 = 5$, otherwise $Q_2 = 4$
	$V V = \Delta\Delta$	$Q_2 = 9$
12	$N \neq 0-9, \Delta$	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 4$
	$N < Nh$	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 2$
13	$dd \neq 00-36, 99$	Correct manually and $Q_4 = 5$, otherwise $Q_4 = 4$

<i>Element</i>	<i>Error</i>	<i>Action</i>
	dd = $\Delta\Delta$	Q ₄ = 9
	<i>dd versus ff:</i>	
	dd = 00, ff \neq 00	Correct manually and Q ₄ or Q ₅ = 5, otherwise Q ₄ = Q ₅ = 2
	dd \neq 00, ff = 00	Correct manually and Q ₄ or Q ₅ = 5, otherwise Q ₄ = Q ₅ = 2
14	i _w \neq 0, 1, 3, 4	Correct manually, otherwise Q ₅ = Q ₂₉ = 4
15	ff > 80 knots	Correct manually and Q ₅ = 5, otherwise Q ₅ = 3
	ff = $\Delta\Delta$	Q ₅ = 9
16	s _n \neq 0, 1	Correct manually, otherwise Q ₆ = 4
17	TTT = $\Delta\Delta\Delta$	Q ₆ = 9
	<i>If -25 > TTT > 40 then, when latitude < 45.0:</i>	
	TTT < -25	Q ₆ = 4
	TTT > 40	Q ₆ = 3
	<i>When latitude \geq 45.0:</i>	
	TTT < -25	Q ₆ = 3
	TTT > 40	Q ₆ = 4
	<i>TTT versus humidity parameters:</i>	
	TTT < WB (wet bulb)	Correct manually and Q ₆ = 5, otherwise Q ₆ = Q ₁₉ = 2
TTT < DP (dew point)	Correct manually and Q ₆ = Q ₇ = 5, otherwise Q ₆ = Q ₇ = 2	
18	s _t \neq 0, 1, 2, 5, 6, 7	Correct manually, otherwise Q ₇ = 4
19	DP > WB	Correct manually and Q ₇ = 5, otherwise Q ₇ = Q ₁₉ = 2
	DP > TTT	Correct manually and Q ₇ = 5, otherwise Q ₇ = Q ₆ = 2
	WB = DP = $\Delta\Delta\Delta$	Q ₇ = 9
20	930 > PPPP > 1050 hPa	Correct manually and Q ₈ = 5, otherwise Q ₈ = 3
	870 > PPPP > 1070 hPa	Correct manually and Q ₈ = 5, otherwise Q ₈ = 4
	PPPP = $\Delta\Delta\Delta\Delta$	Q ₈ = 9
21	ww = 22-24, 26, 36-39, 48, 49, 56, 57, 66-79, 83-88	Correct manually and Q ₉ = 5, otherwise Q ₉ = 4
	93-94 and latitude < 20°	Correct manually and Q ₉ = 5, otherwise Q ₉ = 3
	<i>If i_x = 7:</i>	
	w _a w _a = 24-25, 35, 47-48, 54-56, 64-68, 70-78, 85-87 and latitude < 20°	Correct manually and Q ₉ = 5, otherwise Q ₉ = 4
22, 23	W ₁ or W ₂ = 7 and latitude < 20° Δ	Correct manually and Q ₉ = 5, otherwise Q ₉ = 4

<i>Element</i>	<i>Error</i>	<i>Action</i>
	$W_1 < W_2$	Correct manually and $Q_9 = 5$, otherwise $Q_9 = 2$
	$W_1 = W_2 = ww = \Delta\Delta\Delta\Delta$	$Q_9 = 9$
24-27	$N = 0$ and $N_h C_L C_M C_H \neq 0000$	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 2$
	$N = \Delta$ and $N_h C_L C_M C_H \neq \Delta\Delta\Delta\Delta$	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 2$
	$N = 9$ and not ($N_h = 9$ and $C_L C_M C_H = \Delta\Delta\Delta$)	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 2$
	$N = \Delta$ and $N_h C_L C_M C_H = \Delta\Delta\Delta\Delta$	$Q_3 = 9$
28	$s_n \neq 0, 1$	Correct manually, otherwise $Q_{10} = 4$
29	$T_w T_w T_w = \Delta\Delta\Delta$	$Q_{10} = 9$
	<i>If $-2.0 > T_w T_w T_w > 37.0$ then when latitude < 45.0:</i>	
	$T_w T_w T_w < -2.0$	Control manually and $Q_{10} = 5$, otherwise $Q_{10} = 4$
	$T_w T_w T_w > 37.0$	Control manually and $Q_{10} = 5$, otherwise $Q_{10} = 3$
	<i>When latitude ≥ 45.0:</i>	
	$T_w T_w T_w < -2.0$	Control manually and $Q_{10} = 5$, otherwise $Q_{10} = 3$
	$T_w T_w T_w > 37.0$	Control manually and $Q_{10} = 5$, otherwise $Q_{10} = 4$
30	Indicator $\neq 0-7, \Delta$	Correct manually, otherwise Δ
31	Indicator $\neq 0-9, \Delta$	Correct manually, otherwise Δ
32	$20 < P_w P_w < 30$	$Q_{11} = 3$
	$P_w P_w \geq 30$ and $\neq 99$	$Q_{11} = 4$
	$P_w P_w = \Delta\Delta$	$Q_{11} = 9$
33	$35 < H_w H_w < 50$	$Q_{12} = 3$
	$H_w H_w \geq 50$	$Q_{12} = 4$
	$H_w H_y = \Delta\Delta$	$Q_{12} = 9$
34	$d_{w1} d_{w1} \neq 00-36, 99$	Correct manually and $Q_{13} = 5$, otherwise $Q_{13} = 4$
	$swell_1 = swell_2 = \Delta$	$Q_{13} = 9$
35	$25 < P_{w1} P_{w1} < 30$	$Q_{13} = 3$
	$P_{w1} P_{w1} \geq 30$ and $\neq 99$	$Q_{13} = 4$
36	$35 < H_{w1} H_{w1} < 50$	$Q_{13} = 3$
	$H_{w1} H_{w1} \geq 50$	$Q_{13} = 4$
37	$l_s \neq 1-5, \Delta$	Correct manually, otherwise Δ

<i>Element</i>	<i>Error</i>	<i>Action</i>
38	$E_5E_5 \neq 00-99, \Delta\Delta$	Correct manually, otherwise $\Delta\Delta$
39	$R_5 \neq 0-4, \Delta$	Correct manually, otherwise Δ
40	Source $\neq 0-6$	Correct manually, otherwise Δ
41	Platform $\neq 0-9$	Correct manually, otherwise Δ
42	No call sign	Insert manually, mandatory entry
43	No country code	Insert manually
44		No quality control
45	$Q \neq 0-6, 9$	Correct manually, otherwise Δ
46	$i_x \neq 1-7$	Correct manually, otherwise Δ
47	$i_R = 0-2$ and $RRR = 000, \Delta\Delta\Delta$	Correct manually, otherwise $Q_{14} = 4$
	$i_R = 3$ and $RRR \neq \Delta\Delta\Delta$	Correct manually, otherwise $Q_{14} = 2$
	$i_R = 4$ and $RRR \neq \Delta\Delta\Delta$	Correct manually, otherwise $Q_{14} = 2$
	$i_R \neq 0-4$	Correct manually, otherwise $Q_{14} = 4$
48	$RRR \neq 001-999$ and $i_R = 1, 2$	Correct manually and $Q_{14} = 5$, otherwise $Q_{14} = 2$
49	$t_R \neq 0-9, \Delta$	Correct manually and $Q_{14} = 5$, otherwise $Q_{14} = 4$
50	$s_w \neq 0, 1, 2, 5, 6, 7$	Correct manually, otherwise $Q_{19} = 4$
51	$WB < DP$	Correct manually and $Q_{19} = 5$, otherwise $Q_{19} = Q_7 = 2$
	$WB = \Delta\Delta$	$Q_{19} = 9$
	$WB > TTT$	Correct manually and $Q_{19} = 5$, otherwise $Q_{19} = Q_6 = 2$
52	$a \neq 0-8$	Correct manually and $Q_{15} = 5$, otherwise $Q_{15} = 4$
	$a = 4$ and $ppp \neq 000$	Correct manually and Q_{15} or $Q_{16} = 5$, otherwise $Q_{15} = Q_{16} = 2$
	$a = 1, 2, 3, 6, 7, 8$ and $ppp = 000$	Correct manually and Q_{15} or $Q_{16} = 5$, otherwise $Q_{15} = Q_{16} = 2$
	$a = \Delta$	$Q_{15} = 9$
53	$250 \geq ppp > 150$	Correct manually and $Q_{16} = 5$, otherwise $Q_{16} = 3$
	$ppp > 250$	Correct manually and $Q_{16} = 5$, otherwise $Q_{16} = 4$
	$ppp = \Delta\Delta\Delta$	$Q_{16} = 9$
54	$D_5 \neq 0-9, \Delta$	Correct manually and $Q_{17} = 5$, otherwise $Q_{17} = 4$

<i>Element</i>	<i>Error</i>	<i>Action</i>
	$D_S = \Delta$	$Q_{17} = 9$
55	$V_S \neq 0-9, \Delta$	Correct manually and $Q_{18} = 5$, otherwise $Q_{18} = 4$
	$V_S = \Delta$	$Q_{18} = 9$
56	$d_{W2}d_{W2} \neq 00-36, 99, \Delta\Delta$	Correct manually and $Q_{13} = 5$, otherwise $Q_{13} = 4$
57	$25 < P_{W2}P_{W2} < 30$	$Q_{13} = 3$
	$P_{W2}P_{W2} \geq 30$ and $\neq 99$	$Q_{13} = 4$
58	$35 < H_{W2}H_{W2} < 50$	$Q_{13} = 3$
	$H_{W2}H_{W2} \geq 50$	$Q_{13} = 4$
59	$c_i \neq 0-9, \Delta$	Correct manually, otherwise Δ
60	$S_i \neq 0-9, \Delta$	Correct manually, otherwise Δ
61	$b_i \neq 0-9, \Delta$	Correct manually, otherwise Δ
62	$D_i \neq 0-9, \Delta$	Correct manually, otherwise Δ
63	$z_i \neq 0-9, \Delta$	Correct manually, otherwise Δ
64	Version $\neq 0-9, A, \Delta$	Correct manually, otherwise Δ
65	Version $\neq 0-9, \Delta$	Correct manually, otherwise Δ
86	Version identification for MQCS	1 = MQCS-I (original version, February 1989) CMM-X
		2 = MQCS-II (version 2, March 1997) CMM-CII
		3 = MQCS-III (version 3, April 2000) SGMC-VIII
		4 = MQCS-IV (version 4, June 2001) JCOMM-I
		5 = MQCS-V (version 5, July 2004) ETMC-I
		6 = MQCS-VI (Version 6, November 2009) JCOMM-III
87	HDG $\neq 000-360$	Correct manually and $Q_{22} = 5$, otherwise $Q_{22} = 4$
	HDG = $\Delta\Delta\Delta$	$Q_{22} = 9$
88	COG $\neq 000-360$	Correct manually and $Q_{23} = 5$, otherwise $Q_{23} = 4$
	COG = $\Delta\Delta\Delta$	$Q_{23} = 9$

<i>Element</i>	<i>Error</i>	<i>Action</i>
89	SOG \neq 00–99	Correct manually and $Q_{24} = 5$, otherwise $Q_{24} = 4$
	SOG = $\Delta\Delta$	$Q_{24} = 9$
	SOG > 33	Correct manually and $Q_{24} = 5$, otherwise $Q_{24} = 3$
90	SLL \neq 00–99	Correct manually and $Q_{25} = 5$, otherwise $Q_{25} = 4$
	SLL = $\Delta\Delta$	$Q_{25} = 9$
	SLL > 40	Correct manually and $Q_{25} = 5$, otherwise $Q_{25} = 3$
91	$s_L \neq 0, 1$	Correct manually and $Q_{27} = 5$, otherwise $Q_{27} = 4$
	$s_L = \Delta$	$Q_{26} = 9$
	hh \neq 00–99	Correct manually and $Q_{27} = 5$, otherwise $Q_{27} = 4$
	hh = $\Delta\Delta$	$Q_{27} = 9$
	hh ≥ 13	Correct manually and $Q_{27} = 5$, otherwise $Q_{27} = 3$
	hh < -01	Correct manually and $Q_{27} = 5$, otherwise $Q_{27} = 4$
92	RWD \neq 000–360, 999	Correct manually and $Q_{28} = 5$, otherwise $Q_{28} = 4$
	RWD = $\Delta\Delta\Delta$	$Q_{28} = 9$
93	RWS \neq 000–999	Correct manually and $Q_{29} = 5$, otherwise $Q_{29} = 4$
	RWS = $\Delta\Delta\Delta$	$Q_{29} = 9$
	RWS > 110 knots	Correct manually and $Q_{29} = 5$, otherwise $Q_{29} = 3$
	<i>RWD versus RWS:</i>	
	RWD = 000, RWS \neq 000	Correct manually and Q_{28} or $Q_{29} = 5$, otherwise $Q_{28} = Q_{29} = 2$
	RWD \neq 000, RWS = 000	Correct manually and Q_{28} or $Q_{29} = 5$, otherwise $Q_{28} = Q_{29} = 2$

Specifications for quality control (QC) indicators Q_1 to Q_{29} :

- 0: No QC has been performed on this element;
- 1: QC has been performed, element appears to be correct;
- 2: QC has been performed, element appears to be inconsistent with other elements;
- 3: QC has been performed, element appears to be doubtful;
- 4: QC has been performed, element appears to be erroneous;
- 5: The value has been changed as a result of QC;
- 6: The original flag is set to "1" (correct) and the value will be classified by MQCS as inconsistent, dubious, erroneous or missing;
- 7: The original flag is set to "5" (amended) and the value will be classified by MQCS as inconsistent, dubious, erroneous or missing;
- 8: Reserve;
- 9: The value of the element is missing.

APPENDIX I.18

HISTORICAL SEA-SURFACE TEMPERATURE DATA EXCHANGE FORMAT

CD	MSQ	Q	LAT	LON	YR	MO	DA	HR	WIND DIRECT	WIND SPEED	AIR TEMP	SEA TEMP	AREA
XXX	XXX	X	XXX	XXXX	XXX	XX	XX	XX	iXX	iXXX	XXX	XXX	XXXX

<i>Field</i>	<i>Column</i>	<i>Element *</i>
001	1-3	Card deck number in TDF-11
002	4-6	Marsden 10° square
003	7	Quadrant
004	8-10	Latitude
005	11-14	Longitude
006	15-17	Year (last three digits, for example 927 = 1927)
007	18-19	Month
008	20-21	Day
009	22-23	Hour (UTC)
010	24-26	Wind direction and indicator
011	27-30	Wind speed and indicator
012	31-33	Air temperature
013	34-36	Sea-surface temperature
014	37-40	Area

* TDF-11 describes elements;
 Logical rec. = 40;
 Blocking factor = 100.

HSSTD – Extended format for Atlantic and Indian Oceans and Mediterranean data

<i>Character – United Kingdom/ United States</i>	<i>Notation – NL/DL</i>	<i>Record identifier</i>		
1		H	Historical marine data	
2		M		
3		D		
4			Identifies the origin of the tape	
5				
6	1		Octant	
7	2		Square number	
8	3			
9	4			
10	5		Month	
11	6		Year	
12	7			
13	8			
14	9			
15	10		Position, unit and tenths	Latitude
16	11			Longitude
17	12			
18	13			
19	14		Day of month	
20	15			
21	16		Hour of day (00–23 UTC)	
22	17			
23	18	+, –	Sea temperature (tenths of °C)	
24	19			
25	20			
26	21			
27	22	+, –	Air temperature (tenths of °C)	
28	23			
29	24			
30	25			
31	26	+, –, e	Wet-bulb temperature (tenths of °C)	e = ice
32	27			
33	28			
34	29			
35	30		Wind direction (whole degrees)	000 = calm 990 = variable 999 = missing
36	31			
37	32			
38	33		Wind speed (tenths of metres per second)	
39	34			
40	35			
41	36			
42	37		Barometric pressure (tenths of hPa)	
43	38			
44	39			
45	40			
46	41			
47	42		Flags for sea temperature	
48	43		Flags for air temperature	
49	44		Flags for wind	
50	45	F sus 1 F sus 2	Flags for suspect values	
51	46			

Codes for flag characters*Flags for sea temperatures and state of wet bulb:**F sea:*

0	Sea temperature measured to 0.1°F accuracy
1	Sea temperature measured to 0.1°C accuracy
2	Sea temperature measured to 0.5°F accuracy
3	Sea temperature measured to 0.5°C accuracy
4	Sea temperature measured to 1°F or 1°C accuracy
5	
6	As for codes 0–4, but also the wet bulb is not frozen, even when showing temperature below freezing point.
7	
8	
9	

Flags for wind observations:

0	360-point compass	Wind speed measured
1	36-point compass	
2	32-point compass	
3	16-point compass	
4	8-point compass	
5		
6	As for codes 0–4, but wind speed estimated or converted from Beaufort force, or method of observation unknown.	
7		
8		
9		

*Flags for dry-bulb and wet-bulb temperatures:**F air:*

0	Air temperatures measured to 0.1°F accuracy
1	Air temperatures measured to 0.1°C accuracy
2	Air temperatures measured to 0.5°F accuracy
3	Air temperatures measured to 0.5°C accuracy
4	Air temperatures measured to 1°F or 1°C accuracy
5	
6	As for codes 0–3, but temperatures were measured by an aspirated or whirling psychrometer.
7	
8	
9	Original units of temperature or accuracy unknown

*Flags for suspect values of sea temperature, air temperature and wind:**F sus 1:*

0	No suspect element
+1	Sea temperatures > 97°F (36.1°C)
+2	Dry bulb or wet bulb not in range –5°F to 99.9°F (–20.5°C to 37.7°C) or wet bulb > dry bulb
+4	Wind direction 990 (variable) and wind speed > 5 knots

*Flags for suspect values of pressure and cloud amount:
F sus 2:*

0	No suspect pressure or cloud amount
+1	Pressure < 940 or > 1050 (pressures < 800 or > 1080 have been rejected)
+2	Cloud amount not reported
+4	Additional observation at the same time in the same 1° square, though not identical

The values of "F sus 1" and "F sus 2" may also be 3, 5, 6 or 7. This signifies that more than one value is suspect and the code figures have been added together for the suspect values.

APPENDIX I.19

EXCHANGE FORMAT FOR SEA-SURFACE CURRENT DATA OBTAINED FROM SHIP'S SET AND DRIFT

Table App-I.19.1. Exchange format for sea-current data

<i>Columns</i>	<i>Item</i>	<i>Code figure</i>	<i>Code definition</i>	<i>Remarks</i>
1-2	Year	00-99	Last two figures of year	Of mid-position
3-4	Month	01-12	January-December	Of mid-position
5-15	Mid-position		Midpoint between "from" and "to" positions	
5-6	Day	01-31	Day of month	
7	Octant	0-3, 5, 8	WMO Code table 3300	
8-11	Latitude	0000-9000	Degrees and minutes	
12-15	Longitude	0000-9959	Degrees and minutes	Without hundreds
16-21	Current			
16-18	Direction	000-360	Whole degrees, true	000 - no current
19-21	Rate	000-999	Tenths of knots	
22-37	Position "from"			
22-23	Day	01-31	Day of month	
24-47	Time	0000-2359	Hours and minutes (UTC)	
28	Octant	0-3, 5-8	WMO Code table 3300	
29-32	Latitude	0000-9000	Degrees and minutes	
33-36	Longitude	0000-9959	Degrees and minutes	Without hundreds
37	Method of position fix	0-9	(see Table App-I.19.3, below)	
38-55	Distance run through water			
38-43	First part			
38-40	Course, allowing for leeway	000-360	Whole degrees, true	000 = ship stopped
41-43	Distance	000-999	Whole nautical miles	
44-49	Second part			
44-46	Course, allowing for leeway	000-360	Whole degrees, true	000 = ship stopped
47-49	Distance	000-999	Whole nautical miles	
50-55	Third part			
50-52	Course, allowing for leeway	000-360	Whole degrees, true	000 = ship stopped
53-55	Distance	000-999	Whole nautical miles	
56-71	Position "to"			
56-57	Day	01-31	Day of month	
58-61	Time	0000-2359	Hours and minutes (UTC)	
62	Octant	0-3, 5-8	WMO Code table 3300	

<i>Columns</i>	<i>Item</i>	<i>Code figure</i>	<i>Code definition</i>	<i>Remarks</i>
63–66	Latitude	0000–9000	Degrees and minutes	
67–70	Longitude	0000–9959	Degrees and minutes	Without hundreds
71	Method of position fix	0–9	(see Table App-I.19.3, below)	
72	Ship's draught	0–9	(see Table App-I.19.3, below)	
73–74	Country	00–99	Country that recruited the ship	As for IMMPC
75	Indicator	0, 1, 2	(see Table App-I.19.3, below)	Concerning columns 76–80
76–80	Ship number			Or call sign, or logbook number

Table App-I.19.2. Magnetic tape standards for exchange of sea surface current data obtained from ship's set and drift :

Tape width	½ inch
Density	800 bits per inch
Recording mode	EBCDIC
Tracks tape label	9
Record length	Unlabelled
Record type	80 bytes
Blocking factor	Fixed block 10

Table App-I.19.3. Code specifications for columns 37, 71, 72 and 75 of the sea-surface current data exchange format

<i>Column</i>	<i>Item</i>	<i>Specification</i>	
37 and 71	Method of position fix	0	(Not allocated)
		1	Land fix
		2	Running land fix
		3	Astro fix (two or more simultaneous bodies)
		4	Running solar fix
		5	(Not allocated)
		6	Radio fix (D/F)
		7	Radar fix
		8	Electronic fix (accurate at short range)
9	Electronic fix (accurate at long range)		
72	Ship's draught	0	0–4 m
		1	5–9 m
		2	10–14 m
		3	15–19 m
		4	20–24 m
		5	25–29 m
		6	30–34 m
		7	35–39 m
		8	40–44 m
9	45 m or more		
75	Indicator for columns 76–80	0	Ship number
		1	Call sign
		2	Logbook number

PART II

SERVICES FOR COASTAL AND OFFSHORE AREAS

1. GENERAL

1.1 Marine meteorological services requirements

Marine meteorological services for coastal and offshore areas shall include both general and specialized services to meet the requirements of:

- (a) International shipping in harbour approaches and convergence zones;
- (b) Coastal community activities;
- (c) Coastal protection, including coastal engineering works;
- (d) Marine SAR operations;
- (e) Special transport in coastal areas;
- (f) Fishing;
- (g) Fixed or floating installations at sea;
- (h) Pollution monitoring and clean-up operations;
- (i) Recreational boating.

Note: Provision of services relating to oceanographic and hydrographic information may be the responsibility of more than one national agency or authority.

1.2 Dissemination of information

For each of the user applications, a rapid dissemination of information, in particular warnings, should be ensured by means appropriate to the application.

1.3 Coordination with neighbouring countries

Services for coastal and offshore areas should be coordinated, wherever possible, with those of neighbouring countries.

1.4 Coordination with services for the high seas

Services provided in accordance with the procedures of Part II of this Manual shall not conflict but be coordinated nationally and internationally with the services provided for the high seas in accordance with the procedures of Part I of this Manual.

2. GENERAL SERVICES

2.1 Principles

The principles for the provision of general services are as follows:

Principle 1

Services for unspecified general coastal and offshore activities are those as for the high seas but modified according to local conditions and requirements.

Principle 2

General marine meteorological services for coastal and offshore areas include the issue of Group weather and sea bulletins.

Principle 3

The issue of meteorological warnings, and routine weather and sea bulletins prepared for GMDSS for areas not covered by NAVTEX shall be by the International SafetyNET Service for the reception of MSI in compliance with SOLAS, Chapter IV – Radiocommunications.

Note: The *International SafetyNET Manual* and *International NAVTEX Manual* provide detailed information about safety broadcasts provided under GMDSS. These manuals are obtainable from IMO.

2.2 Procedures

2.2.1 Types of services

General services for coastal and offshore areas shall include:

- (a) Issue of coastal weather and sea bulletins;
- (b) Sea-ice bulletins, where appropriate;
- (c) Data information services;
- (d) Climatological services;
- (e) Marine meteorological expert advice.

2.2.2 Issue of weather and sea bulletins for coastal and offshore areas

2.2.2.1 Coastal and offshore areas for which Members issue weather and sea bulletins (called Group B bulletins) shall be clearly defined.

2.2.2.2 Information on broadcast schedules, and the content and forecast areas of Group B weather and sea bulletins, shall be conveyed to the WMO Secretariat for inclusion in *Weather Reporting*, Volume D – Information for Shipping (WMO-No. 9).

2.2.2.3 Weather and sea bulletins for coastal and offshore areas shall include:

- (a) Warnings;
- (b) Synopses;
- (c) Forecasts.

Note: Weather and sea bulletins for coastal and offshore areas may, in addition, include meteorological reports from selected coastal stations, ships and other sea stations.

2.2.2.4 Additional procedures for the issue of weather and sea bulletins for coastal and offshore areas shall include those specified for bulletins for the high seas as follows:

2.2.2.4.1 Announcement of bulletin content: Major changes in form and content of warnings, synopses and forecasts should be announced at least six months prior to the effective date of the change.

2.2.2.4.2 Broadcast by radio: Weather and sea bulletins shall be issued by radio at least twice daily. In fixing the time of broadcast of weather and sea bulletins, Members shall take into consideration the watchkeeping periods of the radio operators in all the areas to which these bulletins apply, as well as the transmission times of weather reports by ships.

2.2.2.4.3 Issues concerning language and terminology are outlined as follows in 2.2.2.4.3.1–2.2.2.4.3.5.

2.2.2.4.3.1 Warnings, synopses and forecasts shall be given in plain language.

2.2.2.4.3.2 Warnings, synopses and forecasts should be broadcast in the language of the issuing Member and in English.

2.2.2.4.3.3 Where bulletins are being transmitted by radiotelegraph and English cannot be used, the MAFOR code form shall be used as a substitute for the forecast in English.

2.2.2.4.3.4 The language of the synopsis should be as free as possible from technical phraseology.

2.2.2.4.3.5 The terminology in weather and sea bulletins should be in accordance with the

multilingual list of terms used in weather and sea bulletins (see note, following).

Note: The multilingual list of terms used in weather and sea bulletins is given in Annex 2.B of the *Guide to Marine Meteorological Services* (WMO-No. 471) and in Appendix I.4 of this Manual.

2.2.2.4.4 Issues concerning indication of wind are detailed in 2.2.2.4.1–2.2.2.4.2.

2.2.2.4.4.1 Wind direction shall be given in points of the compass and not in degrees.

2.2.2.4.4.2 Wind force should be given in Beaufort notation or wind speed in metres per second or in knots. If metres per second or knots are used, the words “metres per second” or “knots” shall be included in the text of the message.

Notes:

1. The criteria of the Beaufort notation of wind force are given in Appendix I.5 of this Manual.
2. Various modes of radio broadcast are possible: telegraphy, telephony, facsimile and/or public radio; they may be chosen taking into account the needs and capabilities of marine users in the area covered by the bulletin.

2.2.3 Warnings

2.2.3.1 When included, warnings shall be placed at the beginning of the bulletin.

2.2.3.2 Warnings shall be given for the following phenomena:

- (a) Tropical cyclones and associated phenomena;
- (b) Gales and storms;
- (c) Ice accretion;
- (d) Restricted visibility (one nautical mile or less);
- (e) Unusual and hazardous sea-ice conditions;
- (f) Storm-induced water-level changes.

Note: Warnings for phenomena (e) and (f) may be the responsibility of more than one national agency or authority.

2.2.3.3 Warnings should include, whenever possible, the times when unfavourable weather and sea conditions are expected to begin and end.

2.2.3.4 Additional procedures for the issue of warnings for coastal and offshore areas shall include those specified for warnings for the high seas as follows:

2.2.3.4.1 The issue of warnings for near gales (Beaufort force 7) should be an optional service.

2.2.4 Content of warnings and order of items

2.2.4.1 Warnings for gales, storms and tropical cyclones should have the following content and order of items:

- (a) Type of warning;
- (b) Date and time of reference in UTC;
- (c) Type of disturbance (for example, low, hurricane, and the like) with a statement of central pressure in hectopascals;
- (d) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;
- (e) Direction and speed of movement of disturbances;
- (f) Extent of affected area;
- (g) Wind speed or force and direction in the affected areas;
- (h) Sea and swell conditions in the affected area;
- (i) Other appropriate information, such as future positions of disturbances.

2.2.4.2 Items (a), (b), (d), (f) and (g) listed under 2.2.4.1 shall always be included in the warnings.

2.2.4.3 Boundaries of areas of storms or high waves: In addition to indicating the positions of pressure disturbances in terms of latitude and longitude, or with reference to well-known landmarks, the boundaries of the existing and forecast storm-wind area or areas of high waves should be indicated.

Note: The usual practice when issuing warnings is to indicate boundaries with reference to the centre of the pressure disturbance, or to divide the disturbance (low, tropical cyclone) into sectors for which prevailing and forecast conditions are described.

2.2.4.4 Descriptions of more than one system: When warnings are included for more than one pressure disturbance or system, the systems should be described in a descending order of threat.

2.2.4.5 Brevity and clarity of warnings: Warnings shall be as brief as possible and, at the same time, clear and complete.

2.2.4.6 Location of tropical cyclones or other storms: The time of the last location of each tropical cyclone or extra-tropical storm shall be indicated in the warning.

2.2.5 Issue of warnings

2.2.5.1 A warning shall be issued immediately the need becomes apparent.

2.2.5.2 When no warnings for gales, storms or tropical cyclones are to be issued, that fact shall be positively stated in Part I of each weather and sea bulletin.

2.2.5.3 Updating of warnings: Warnings shall be updated whenever necessary and then issued immediately.

2.2.5.4 Members establishing a new visual warning signal should select the appropriate one from the International System of Visual Storm Warning Signals (see note following).

Note: The International System of Visual Storm Warning Signals is given in Appendix II.2 to this Manual.

2.2.6 Synopses and forecasts

2.2.6.1 Date and time of reference in UTC shall be added to the synopsis of major features of the surface weather chart.

2.2.6.2 The forecasts should have the following content:

- (a) The valid period of forecast;
- (b) Name and designation of forecast area(s);
- (c) A description of:
 - (i) Wind speed or force and direction;
 - (ii) Visibility when it is forecast to be less than 6 nautical miles (10 km);
 - (iii) Ice accretion, where applicable;
 - (iv) Sea and swell.

2.2.6.3 Additional procedures for the inclusion of synopses and forecasts in bulletins for coastal and offshore areas shall include those specified for bulletins for the high seas as follows:

2.2.6.3.1 Significant low-pressure systems and tropical disturbances that affect, or are expected to affect, the area within or near to the valid period of the forecast should be described; the central pressure and/or intensity, location, movement and changes of intensity should be given for each system; significant fronts, high-pressure centres, troughs and ridges should be included whenever this helps to clarify the weather situation.

2.2.6.3.2 The forecasts given in Part III of weather and sea bulletins shall have the following content and order of items:

- (a) The valid period of forecast;
- (b) Name or designation of forecast area(s);
- (c) A description of:
 - (i) Wind speed or force and direction;
 - (ii) Visibility – when less than 6 nautical

miles (10 kilometres) visibility is forecast;

- (iii) Ice accretion, where applicable;
- (iv) Waves (sea and swell).

2.2.6.3.3 The forecasts should include expected significant changes during the forecast period, significant meteors such as freezing precipitation, snowfall or rainfall, and an outlook for a period beyond that normally covered by the forecast.

2.2.6.3.4 Indication of movement of systems: Direction and speed of movement of significant pressure systems and tropical disturbances should be indicated in compass points and in metres per second or knots respectively.

2.2.6.3.5 **Indication of valid period: The valid period shall be indicated either in terms of number of hours from the time of issue of the forecast or in terms of dates and times in UTC of the beginning and end of the period.**

2.2.6.3.6 Visibility should be indicated in nautical miles or kilometres, or given in descriptive terms.

2.2.6.3.7 **Indication of units: The units used for both speed of movement of systems and also visibility shall be indicated.**

2.2.7 Sea-ice bulletins

2.2.5.1 **Sea-ice bulletins shall be issued during the ice season.**

Note: The issue of sea-ice bulletins may be the responsibility of more than one national agency or authority.

2.2.5.2 **Sea-ice terminology, codes and symbols used in sea-ice bulletins shall not be in conflict with the document *WMO Sea-ice Nomenclature* (WMO-No. 259).**

2.2.8 Data information services

Data from observing stations established for the specific purpose of marine meteorological services for coastal and offshore areas should be preserved and stored in an easily retrievable form.

Note: Some stations may be the responsibility of more than one national agency or authority.

2.2.9 Climatological services

2.2.9.1 The network of climatological stations, established in accordance with *Technical Regulations*,

[A.1.1.] 3.2.1 and [A.1.1.] 3.2.2 (WMO-No. 49), should give a satisfactory representation of the climate characteristics of the coasts as well as of the coastal and offshore areas for which the Member concerned is providing marine meteorological services.

Note: The network may include special observing stations operating over periods of less than 10 years.

2.2.9.2 If data from special observing stations are used for marine climatological purposes, an up-to-date directory of these stations should be maintained, giving the following information for each station:

- (a) Geographical coordinates;
- (b) Elevation of station;
- (c) A brief description of the local topography;
- (d) Category of station and details of observing programme;
- (e) Exposure of instruments, including height above ground or above sea level of thermometers, rain gauges and anemometers;
- (f) Method of measurement of sea parameters, such as water elevation, waves, sea-surface temperatures and currents;
- (g) Datum level to which atmospheric pressure data of the station refer;
- (h) A station history (dates of beginning of record, changes of site, closure or interruption of records, important changes in the observing programme);
- (i) Name of the supervising organization or institution.

2.2.9.3 Climatological statistics prepared for general applications should be made in accordance with the climatological practices specified in the document *Technical Regulations*, [A.2.4.] (WMO-No. 49), as appropriate.

2.2.10 Marine meteorological expert advice

The procedures for the provision of marine meteorological expert advice shall be those specified under Part I, 7 of this Manual.

3. SPECIALIZED SERVICES

3.1 Principle

The principle for the provision of specialized services is as follows:

Services for specified coastal and offshore activities are provided in consultation with the user requesting the service.

3.2 Procedures

Note: Procedures for services of a purely national nature, distinct from those at the international level, are described in Part I, Chapter 4 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

3.2.1 Sendees for international shipping in harbour approaches and shipping convergence zones

3.2.1.1 Services for international shipping in harbour approaches and shipping convergence zones should include the issue of weather and sea bulletins, including local warnings.

3.2.1.2 **Warnings, synopses and forecasts shall contain all the elements necessary to ensure the safe navigation of ships through the heavy traffic convergence zones and harbour approach channels.**

3.2.2 Services for coastal community activities

3.2.2.1 Members should endeavour to provide special warnings of meteorological conditions likely to lead to flooding or other damage to coastal communities.

3.2.2.2 At the request of the appropriate authorities, special information pertaining to the extent and movement of oil spills that may affect activities along coasts should be prepared and supplied to the authority concerned.

3.2.3 Services for coastal protection, including coastal engineering works

The services for coastal protection, including coastal engineering works, should include gale and storm warnings and warnings of high waves, and in addition the provision of meteorological information to assist the prediction of abnormal water levels (storm surges, flooding) due to meteorological and other conditions.

3.2.4 Services for SAR operations

3.2.4.1 **The procedures for the provision of marine meteorological support to maritime SAR in coastal and offshore areas shall be as those specified under Part I, 3.2 of this Manual.**

3.2.4.2 Terminology used should follow that acceptable to the layman.

3.2.5 Services for special transport in coastal areas

Members should endeavour to provide forecasts necessary for safe movement, in coastal areas, of unusual equipment such as dynamically supported craft, oil drilling rigs or large engineering structures.

3.2.6 Services for fishing

3.2.6.1 In addition to the basic information specified under 2 – General Services, above, the specialized services should also include critical wind and wave information and sea-surface temperature data.

3.2.6.2 Fishing vessels should be encouraged to make and record at fixed hours observations of weather and sea conditions, and to transmit them expeditiously to local coastal radio stations for onward transmission to meteorological centres.

3.2.7 Services for fixed or floating installations at sea

3.2.7.1 The attention of owners and operators of fixed or floating installations should be drawn to warnings and bulletins that may be available within the area of operation.

3.2.7.2 The cooperation of operators should be sought in connection with obtaining meteorological data from offshore installations.

3.2.8 Services for pollution monitoring and clean-up operations

3.2.8.1 Specialized services should be provided on a request basis.

3.2.8.2 In coordination with appropriate national authorities, the following information should be provided:

- (a) Forecasts of wind;
- (b) Analyses and forecasts of state of the sea;
- (c) Forecasts of visibility, both vertical and horizontal;
- (d) If available, predictions of tide, sea currents and other oceanographic information.

3.2.9 Services for recreational boating

3.2.9.1 Special attention should be given to the safety requirements of small pleasure-craft operators when issuing bulletins for their use and for that of recreational boating.

3.2.9.2 The special information intended for recreational boating should be broadcast or displayed as frequently as possible, so as to cover the entire coastal and inland waters where recreational activities are taking place.

Note: Suggested methods of communication are given in Part I, Chapter 4 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

4. **SPECIFIC GUIDELINES FOR NAVTEX SERVICES**

4.1 **General**

4.1.1 NAVTEX is a narrow-band, direct-printing telegraphy service for the promulgation of Maritime Safety Information (MSI) known as coastal warnings (navigational and meteorological warnings, meteorological forecasts and other urgent information to ships). The transmission coverage/service area for coastal warnings, defined in SOLAS, extends from the Fairway Buoy/Pilot Station to 250 nautical miles from the transmitter, or to the range declared by an administration in the IMO GMDSS Master Plan. In particular, NAVTEX cannot be considered as a reliable system to receive meteorological information in port: other systems should be made available for end-users to receive meteorological information in harbour.

4.1.2 According to WMO vocabulary, NAVTEX broadcasts shall include weather information for offshore and coastal waters.

4.1.3 The International NAVTEX Service is the coordinated broadcast and automatic reception service on the frequency 518 kHz of MSI using the English language. It forms part of GMDSS developed by IMO and, since 1 August 1993, a capability for receiving NAVTEX has become part of the mandatory equipment that is required to be carried in certain vessels under the provisions of SOLAS, 1974, as amended in 1988.

4.1.4 The frequencies 490 kHz and 4209.5 kHz are available to administrations for national NAVTEX broadcasts using their national language, or English.

4.1.5 As NAVTEX is a single frequency system, each NAVTEX station and content provider must take measures to prevent mutual interference with other stations. To avoid such mutual

interference, each NAVTEX station is assigned specific time slots, which are 10 minutes in length every 4 hours. Stations that share common time slots are arranged to be geographically distant. When a NAVTEX broadcast may exceed the assigned broadcast period, or broadcast a warning at an unscheduled time, the NAVTEX station must make scheduling arrangements with nearby stations to prevent potential mutual interference. Such rescheduling of broadcasts may result in an undesirable cascade effect, inhibiting the fundamental purpose of the NAVTEX system. Therefore, unscheduled broadcasts and excessive MSI that may exceed scheduled time slots should be avoided.

4.1.6 Responsibility for coordinating the establishment of the Global NAVTEX Service has been vested by IMO in its coordinating panel on NAVTEX (see note following 4.5.1, below).

4.1.7 The operational and technical characteristics of the NAVTEX system are contained in Recommendation ITU-R M.540-2 and in the *NAVTEX Manual* (IMO, sale number IC951E).

4.1.8 The user at sea may experience reception problems caused by a variety of factors, for example:

- (a) Excessive transmitter power output: The optimum power output for a NAVTEX transmitter by day is 1 kW. This should achieve a maximum range of approximately 400 nautical miles, with guaranteed reception out to 250 nautical miles. Power of greater than 1 kW may cause the transmission to follow the curvature of the earth to a significantly greater distance. In addition, such power may also create a sky wave that could well be received in excess of 1 000 nautical miles from the transmitter.
- (b) Overrunning time slots: At the end of the time allotted to each NAVTEX transmission, the next transmitter will commence its transmission. If the first transmitter continues beyond its allocated transmission period, its ongoing transmission will mask the phasing signal from the second transmitter if this latter is within range of the first one. It is this phasing signal that enables the receiver to lock onto the correct transmitter. Therefore, when transmitters continue beyond the allotted time limit, the receiver will not be able to lock onto the following station and it will seem to the user as though the second station is off the air. The receiving vessel could consequently miss vital safety information, for example a storm warning.

- (c) "Night effect": This is the term used to describe the fact that, for a given power output, the range of a medium frequency transmission is significantly increased at night. For example, where 1 kW will give a range of approximately 400 nautical miles by day, that same signal at night could achieve a range of as much as 1 000 nautical miles. Accordingly, it is imperative that NAVTEX transmitters reduce power at night. Thus, a power of approximately 300 watts is required to achieve the optimum range of 250 nautical miles.

4.1.9 Criteria for the GMDSS receivers have been defined to ensure that corrupted messages are not recorded. These criteria are as follows:

- (a) Only message identifications that have been satisfactorily received should be stored. A message is satisfactorily received if the character error rate is below 4 per cent.
- (b) **When the error rate is greater than 33 per cent during a period longer than 5 seconds, the printing of the message shall be forbidden because of bad reception, and the identification of the message shall not be memorized.**

4.2 Procedures

4.2.1 The time-shared nature of NAVTEX imposes the need for strict discipline in controlling the information flow of the broadcast. Into the 10-minute time slots must be fitted navigational warnings, meteorological warnings, weather forecasts, SAR Initial Distress Alerts, pilot information and radio navigational aids information such as GPS errors. It is important that forecasts are dedicated only to the specific area covered by the NAVTEX transmitter, and that all measures possible are taken to ensure that messages are no longer than necessary. In particular, short concise formats, which have been agreed universally, should be used.

4.2.1.1 Warnings of gales, storms, hurricanes and other severe meteorological phenomena should be broadcast under B2 character B (Meteorological Warning), once upon receipt and then at the next scheduled broadcast times only.

4.2.1.2 Routine forecasts should be broadcast at scheduled broadcast time under B2 character E (Meteorological Forecast) at least twice daily.

4.3 Specific guidelines for the provision of meteorological information

4.3.1 It is essential for meteorological messages to be as short as possible, whilst still transferring the necessary information to the mariners at sea. Only the responsible NMS shall prepare such messages. Manual modifications by NAVTEX coordinators shall be kept to a minimum, and shall only be made if approved by the appropriate NMS according to precise procedures and criteria.

4.3.2 For the reasons stated in 4.3.1, additional guidelines for meteorological messages prepared for the NAVTEX Service are required. Specific ways for NMS to shorten NAVTEX messages, if needed, are as follows:

- (a) Use of abbreviations: this is the most effective and efficient method to shorten meteorological messages. It is essential to use only strictly selected and approved abbreviations. The abbreviations list for GMDSS MSI (to be used for the International NAVTEX Service), in accordance with the multilingual list of terms used in weather and sea bulletins, is included in Appendix II.2 of this Manual. For the National NAVTEX Service, administrations should also define an abbreviation list for their native language. When neighbouring countries use the same native language, a common list should be considered, at least on a regional basis (this then being included in Volume II of this Manual). Abbreviations should be used, as appropriate (in some situations forecasters may prefer to use plain language), in most parts of meteorological messages, except for **warnings (included or not in scheduled bulletins), that shall remain in plain language.** The International NAVTEX Service is in English, but care should be taken to use the recommended abbreviations, otherwise confusion may arise to users whose native language is not English. Where additional abbreviations better meet local or regional needs, these may be used as required.
- (b) Split bulletins: All warnings, subject to higher priority, should always be issued as separate messages under B2 character B for NAVTEX. In scheduled bulletins, Part I should then be very short, referring either to a list of sub-areas or to a numbering system. This method generates a reduction in the size of single messages (for example, a lower risk of rejection). The slight increase of the global volume

of information transmitted (because of the redundancy needed for single messages to be self-supporting) can be considered as insignificant.

- (c) **Mandatory information only: The provision of non-mandatory information (such as analyses or prognoses in code form, selections of reports from sea or land stations, medium-range forecasts, and the like), shall not be broadcast over the International NAVTEX System. These should be issued as separate messages, with lower priority if needed, using a national system, to reduce risks that messages are rejected that include mandatory Parts II and III (synopsis and forecasts).**
- (d) Consolidate information: As the final message is available in written form onboard, one single phrase (such as "squalls in all areas") included either in the synopsis (Part II) or in the forecasts (Part III), could adequately replace words (for example, "squalls") repeated for each sub-area, this requiring that the expected conditions are homogeneous in the whole domain or a large part of it. This could be particularly useful when expected wind and sea-state conditions are severe.
- (e) Remove verbiage: NAVTEX is a text system and should not be in flowing prose (messages are printed). Superfluous words should be omitted.
- (f) Consistency between bulletins and transmitter coverage: It should be ensured by NMSs that the information broadcast is pertinent only to the transmitter coverage/service area.

The selection of an NMS as meteorological coordination centre may be governed by its proximity to the majority of forecasting areas in the region and its existing involvement in the provision of NAVTEX services.

- (c) The meteorological coordination centre should submit its forecasts and warnings to the NAVTEX station operators for dissemination on a 24-hour daily operational basis. If necessary, the provision of weather bulletins from other countries could be included for waters not already covered by the coordination centre.
- (d) Every NMS serving the area concerned should have access to the meteorological coordination centre to deliver, by GTS, its warnings and forecasts for the areas for which it intends to have responsibility.
- (e) The meteorological coordination centre should decide which warning is sent to the NAVTEX operator for dissemination by the system. The criteria for such decisions are based on warnings with the highest wind speed. In cases of significant differences between warnings or serious doubts concerning their content, the centre should ask the service that prepared the message in question for additional confirmation (for example, via the GTS link).
- (f) The meteorological bulletins and additional warnings that have been sent to the NAVTEX station operators for dissemination should be copied, by the meteorological coordination centre via GTS, to all NMSs serving the area.

4.4 GENERAL PRINCIPLES FOR COORDINATION

4.4.1 Where there is a requirement for coordination of meteorological information via NAVTEX, the following principles should be adopted:

- (a) It is assumed that there is an existing exchange, using GTS, of weather warnings and some weather forecasts (once or twice daily) for mariners between all NMSs working in an area.
- (b) There should be one NMS working as meteorological coordination centre that is responsible for the provision of weather bulletins for mariners via the NAVTEX system in the area concerned.

4.5 COORDINATION ARRANGEMENTS


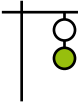

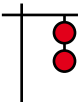

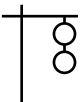

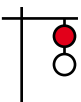

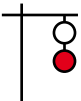



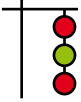
4.5.1 Specific international coordination arrangements for NAVTEX broadcasts of meteorological information, whenever established, are detailed in the relevant section of Volume II of this Manual.

Note: The NAVTEX Coordinating Panel can be contacted at the following address:

The Chairperson
Coordinating Panel on NAVTEX
International Maritime Organization
4, Albert Embankment
London SE1 7SR
UNITED KINGDOM

APPENDIX II.1

INTERNATIONAL SYSTEM OF VISUAL STORM WARNING SIGNALS

<i>Day signals</i>	<i>Description of wind force</i>	<i>Night signals</i>	<i>Remarks</i>
	Near gale any direction		This signal applies to wind Beaufort force 7 (28–33 knots) (see Note 2(b))
	Gale or storm starting in the north-west quadrant		The cones apply to winds of Beaufort force 8 (34–40 knots) or more (see Note 2(c))
	Gale or storm starting in the south-west quadrant		
	Gale or storm starting in the north-east quadrant		
	Gale or storm starting in the south-east quadrant		
	Wind is expected to veer (clockwise change in direction)		
	Wind is expected to back (counter-clockwise change in direction)		Flags may be of any suitable colour
	Hurricane (or local synonym) with winds of Beaufort force 12 (64 knots) and above from any direction		

Notes:

- One or more day signals may be hoisted simultaneously if desired, for example:
 - (a) To indicate a gale starting in the south-west quadrant and veering (in this case, the original direction is indicated by the cones);
 - (b) To indicate the direction of an expected near gale (in this case, the ball is hoisted together with the appropriate cones).
2. Additional signals may be used to meet local requirements:
- (a) Provided their appearance and specifications are distinct from those of the international signals;
 - (b) To Beaufort force 6 (22–27 knots) if local circumstances, for example fishing activities, require such a lower limit;
 - (c) To Beaufort force 7 (28–33 knots) if local circumstances necessitate the indication of wind direction.

<i>General descriptive terms</i>	<i>Abbreviation</i>
Decreasing	DECR
Increasing	INCR
Variable	VRB
Becoming	BECMG
Locally	LOC
Moderate	MOD
Occasionally	OCNL
Scattered	SCT
Temporarily/temporary	TEMPO
Isolated	ISOL
Frequent/frequency	FRQ
Showers	SHWRS or SH
Cold front	C-FRONT or CFNT
Warm Front	W-FRONT or WFNT
Occlusion Front	O-FRONT or OFNT
Weakening	WKN
Building	BLDN
Filling	FLN
Deepening	DPN
Intensifying/intensify	INTSF
Improving/improve	IMPR
Stationary	STNR
Quasi-stationary	QSTNR
Moving/move	MOV or MVG
Veering	VEER
Backing	BACK
Slowly	SLWY
Quickly	QCKY
Rapidly	RPDY
Knots	KT
Kilometres per hour	KMH
Nautical miles	NM
Metres	M
Hectopascal	HPA
Meteo...	MET
Forecast	FCST
Further outlooks	TEND
Visibility	VIS
Slight	SLGT or SLT
Quadrant	QUAD
Possible	POSS
Probability/probable	PROB
Significant	SIG

APPENDIX II.2

COMMON ABBREVIATIONS FOR INTERNATIONAL NAVTEX SERVICE

<i>General descriptive terms</i>	<i>Abbreviation</i>
No change	NC
No significant change	NOSIG
Following	FLW
Next	NXT
Heavy	HVY
Severe	SEV or SVR
Strong	STRG
From	FM
Expected	EXP
Latitude/longitude	LAT/LONG

<i>Wind directions</i>	<i>Abbreviation</i>
North or northerly	N
North-east or north-easterly	NE
East or easterly	E
South-east or south-easterly	SE
South or southerly	S
South-west or south-westerly	SW
West or westerly	W
North-west or north-westerly	NW

Notes:

1. The overall savings by the use of the above abbreviations in the meteorological content of the International NAVTEX Service broadcasts could reduce transmission times by more than 20 per cent.
2. Whenever possible the terms "expected" and "latitude/longitude" should be omitted in the messages.
3. The use of the above abbreviations could reduce the length of bulletins drafted for the International NAVTEX Service by approximately 6–8 per cent.
4. Further advice concerning relevant operational aspects of the International NAVTEX Service can be obtained from the WMO JCOMM Website for GMDSS – <http://weather.gmdss.org/>. The *International NAVTEX Manual* provides detailed information about NAVTEX broadcasts provided under GMDSS. It can be obtained from IMO.

PART III

SERVICES FOR MAIN PORTS AND HARBOUR AREAS

1. GENERAL

1.1 Marine meteorological services for main ports and harbour areas should meet the requirements of:

- (a) Ships entering or leaving the port;
- (b) Cargo handling, cargo safety and warehousing;
- (c) Loading of barges;
- (d) Dredging and cleaning operations;
- (e) Shipbuilding and other construction work;
- (f) Port engineering projects;
- (g) Ice-breaking services in ports and port entrances;
- (h) Marine pollution-combating operations in the port area;
- (i) Industries, commerce, judicial process and insurance;
- (j) Waterborne recreational activities.

Note: Provision of services relating to oceanographic and hydrographic information may be the responsibility of more than one national agency or authority.

1.2 Marine meteorological services for main ports and harbour areas shall preferably be provided by forecasting offices located in port or by the port meteorological officer (PMO) or, if this is not possible, by a forecasting office located outside the port.

Note: The services provided by PMOs under this section are in addition to those duties listed in Volume I, Chapter [C.1.] 4.2.2 of *Technical Regulations* (WMO-No. 49).

1.3 The information provided should be representative of the environmental conditions in the areas concerned, including the fairways and harbour approaches.

1.4 The office or unit(s) designated for the provision of marine meteorological services for main ports and harbour areas should have a rapid and reliable means of communication with port and harbour authorities and other users of the information.

1.5 The services provided under the provisions of Part III of this Manual shall not conflict with the services provided for the coastal and offshore areas in accordance with the provisions of Part II of this Manual and shall be coordinated nationally and internationally.

2. GENERAL SERVICES

2.1 Principles

The principles for the provision of general marine meteorological services for main ports and harbour areas are as follows:

Principle 1

Marine meteorological services for main ports and harbour areas are provided both as general advice and to meet specific demand operations in these areas, in the interests of their safety, efficiency and economy and in support of short- and extended-range planning.

Principle 2

Marine meteorological services for main ports and harbour areas take into account the kind of operations involved and the marine environment of the area. Close consultation with port and harbour authorities and other users of the port and harbour facilities is essential to ascertain the type of information to be included in these services.

Principle 3

Marine meteorological services for main ports and harbour areas are designed to include information on phenomena critical to the safety and efficiency of operations. The criteria for such phenomena are established in consultation with the appropriate port and harbour authorities, also taking into account any criteria established by national practices and international conventions.

Principle 4

Adequate forecasting methods and observational data are the basis for providing effective marine meteorological and, when possible, related oceanographic information.

2.2 Procedures

2.2.1 Types of services

Marine meteorological services provided for main ports and harbour areas should include the provision of:

- (a) PMO facilities;
- (b) Port weather and sea bulletins comprising warnings and, when possible, synopses and forecasts;

- (c) Information on actual and climatological conditions, on request;
- (d) Marine meteorological advice;
- (e) Oral briefing to shipping and other users;
- (f) Display of information for the benefit of users and the public.

Note: Guidance on PMO facilities is given in Part I, Chapter 5 and Part II, Chapter 1 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

2.2.2 Issue of port weather and sea bulletins

2.2.2.1 Port weather and sea bulletins shall have the following content and order of items:

- (a) Date and local time of reference;
- (b) Name of port and harbour area;
- (c) Warnings, if any.

2.2.2.2 In addition to warnings, the port weather and sea bulletins should include:

- (a) Synopses of major features of the weather and sea conditions;
- (b) Forecasts of marine environmental conditions;
- (c) Selected observational data.

Note: It may be advantageous to include the local times of high and low water that are frequently pertinent to local sea conditions in open harbour areas.

2.2.2.3 The format used for warnings for a given port or harbour area should be, as far as possible, on the same lines as that adopted for the high seas, but adjusted to meet local operational requirements taking into account the particular environmental phenomena affecting activities in the area.

Note: Examples of formats used for warnings for port and harbour areas, based on national practices, are given in Part I, Chapter 5 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

2.2.2.4 The actual environmental information from fixed observing stations should be included in a fixed order.

2.2.2.5 Port weather and sea bulletins, where provided, shall be issued at least once daily at a fixed time taking into account the time of actual operations in the port and harbour area.

2.2.2.6 Port weather and sea bulletins intended for international use should be provided

in the language of the issuing Member and in English.

2.2.2.7 The language used in port weather and sea bulletins should be as free as possible from technical phraseology.

2.2.2.8 The terminology used in port weather and sea bulletins should be in accordance with the multilingual list of terms used in weather and sea bulletins given in Annex 2.B of the *Guide to Marine Meteorological Services* (WMO-No. 471) and in Appendix I.4 of this Manual.

2.2.2.9 Members providing marine meteorological services for main ports and harbour areas shall make available to port and harbour authorities, shipping agents and other users concerned, the relevant particulars of services provided and transmission details, in addition to furnishing this information to the WMO Secretariat.

Note: The information is included in *Weather Reporting*, Volume D – Information for Shipping (WMO-No. 9). The particulars to be furnished include the name of the port, types of services provided, method(s) used for dissemination, times of broadcast and radio frequencies used, as well as the address and telephone number of the meteorological office responsible for the provision of services.

2.2.2.10 All changes dealing with the provision of international marine meteorological services for main ports and harbours areas should be conveyed to the WMO Secretariat for inclusion in *Weather Reporting*, Volume D – Information for Shipping (WMO-No. 9), at least six months in advance.

2.2.3 Warnings

2.2.3.1 Warnings shall have the following content and order of items:

- (a) Type of warning;
- (b) Date and time of issue (local time);
- (c) Extent of the affected area, if appropriate;
- (d) Further indications, if any.

2.2.3.1.1 Warnings should be as clear and concise as possible.

2.2.3.2 Warnings should be issued for the following elements and phenomena when exceeding critical values:

- (a) Wind;
- (b) Sea and swell;
- (c) Visibility, with special mention of the phenomenon affecting it;

- (d) Heavy precipitation;
- (e) Ice accretion;
- (f) Water-level anomalies including storm surges;
- (g) Harbour seiches;
- (h) Tsunami.

Note: Warnings for items (f), (g) and (h) may be the responsibility of more than one national agency or authority.

2.2.3.3 A warning shall be issued immediately the need becomes apparent.

2.2.3.4 Warnings should include, whenever possible, the times when unfavourable weather and sea conditions are expected to begin and end.

2.2.3.5 Warnings shall be updated as required by changes in weather and sea conditions affecting the port and harbour area.

2.2.3.6 Warnings shall be provided to all concerned in the port or harbour area by the most rapid communication means available.

Note: Various modes of radio broadcasts are possible: telegraphy, telephony, facsimile and/or public radio; they may be chosen taking into account the needs and capabilities of marine users in the area covered by the bulletin.

2.2.4 Synopses and forecasts

2.2.4.1 Synopses and forecasts, if included in the bulletin, shall be given for environmental conditions of importance to the efficient conduct of operations in the port and harbour area.

2.2.4.2 Synopses, when included in the bulletins, shall include data and time of reference (local time) and a description of the meteorological situation and sea conditions that affect, or are likely to affect, the port and harbour area within or close to the valid period of the forecast.

2.2.4.3 Synopses shall be as brief as possible.

2.2.4.4 The forecasts shall have the following content and order of items:

- (a) The valid period of forecast;
- (b) A description of the expected state of elements of local importance to port and harbour activities, with indication of expected significant changes, if any.

Note: The range of information given may be wide. Examples are given in the *Guide to Marine Meteorological Services* (WMO-No. 471), Part I, Chapter 5.

2.2.4.5 The valid period shall be indicated, either in terms of number of hours from the time of issue of forecast, or in terms of dates and times (local time) of the beginning and end of the period.

2.2.5 Briefing

2.2.5.1 In addition to warnings, synopses and forecasts, facilities for oral briefing should be established, if possible.

2.2.5.2 Briefing provided to the recipients should include complete environmental information essential for the planning and execution of daily operations in the port and harbour area as well as for the ships leaving and entering the port.

Note: Advice regarding oral briefing is contained in Part I, Chapter 5 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

2.2.6 Display of information

2.2.6.1 Arrangements should be made for the regular display of meteorological information in a prominent place on the port premises, for the benefit of the port personnel and ships' officers as well as the public.

2.2.6.2 Normally the display should be in the form of weather charts accompanied by a statement in plain language of the synoptic weather situation and forecast for the next 24 hours. Where possible, further outlook beyond 24 hours should also be included.

2.2.6.3 The display of information should, if possible, include important climatological particulars of the port location, which should be of interest to marine users in planning their operations.

2.2.7 Sea-ice bulletins

2.2.7.1 Sea-ice bulletins should be issued for main ports and harbour areas concerned, including the fairways, during the ice season.

2.2.7.2 Sea-ice bulletins, when issued for main ports and harbour areas, shall be coordinated with those issued for coastal and offshore areas, in order to ensure complete areal coverage.

2.2.7.3 Details regarding the content and issue of sea-ice bulletins should be established in consultation with local port and harbour authorities and sea-ice operational services.

2.2.7.4 **Sea-ice terminology, codes and symbols used in sea-ice bulletins shall not be in conflict with WMO Sea-ice Nomenclature (WMO-No. 259).**

2.2.8 **Collection of observational data**

Observations of suitable parameters should be organized at appropriate sites in the port or harbour area in order to obtain the data necessary for the provision of detailed forecast and climatological services as well as information on actual weather and sea conditions.

3. **SPECIALIZED SERVICES**

3.1 **Principles**

The principles for the provision of specialized marine meteorological services for main ports and harbour areas are as follows:

Principle 1

Specialized marine meteorological services are provided in support of specified marine activities carried out in main ports and harbour areas, at the request of the operating agencies or authorities concerned and in consultation with them.

Principle 2

Criteria for information to be included in specialized marine meteorological services are established in consultation with the appropriate operating agencies or authorities concerned, also taking into account any criteria established by national practices and international conventions.

3.2 **Procedures**

3.2.1 **Issue of special bulletins**

3.2.1.1 Special port weather and sea bulletins should be issued for specific marine operations in the port and harbour area, as arranged with the operating agencies or authorities concerned.

3.2.1.2 Special port weather and sea bulletins, when established, should conform as far as possible to the procedures specified under 2.2.2 above.

Note: Advice regarding special port weather and sea bulletins is given in Chapter 5 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

3.2.1.3 At the request of appropriate authorities, special information pertaining to the extent and movement of oil spills that may affect waterborne activities in harbours should be prepared and supplied to the authority concerned.

PART IV

TRAINING IN THE FIELD OF MARINE METEOROLOGY

1. GENERAL

The training programme in the field of marine meteorology shall be addressed to:

- (a) Meteorological personnel engaged in observational, forecasting and climatological duties for marine purposes;
- (b) Port meteorological officers (PMOs);
- (c) Seafarers whilst at sea and in navigation schools;
- (d) Marine observers on board ships.

2. TRAINING OF MARINE METEOROLOGICAL PERSONNEL

2.1 Principles

The principles for the training of meteorological personnel in marine meteorology are as follows:

Principle 1

The training of meteorological personnel constitutes an essential factor in the provision of meteorological services in support of marine activities.

Principle 2

International cooperation in the field of education and training in marine meteorology is achieved through assistance in the form of short- and long-term fellowships, on-the-job training, assignment of experts to countries to help in the training of personnel, training courses and instruction manuals, regional training seminars and by publication of suitable compendia of lecture notes and other guidance material specially intended for marine purposes.

2.2 Procedures

2.2.1 The programme of training in marine meteorology shall apply to all the classes of meteorological personnel (Classes I, II, III and IV) engaged in marine meteorological activities and shall be carried out, if necessary, by special training centres equipped for the purpose.

Note: Guidance on classification of meteorological personnel and curricula for their training is contained in *Guidelines for the*

Education and Training of Personnel in Meteorology and Operational Hydrology (WMO-No. 258).

2.2.2 Members should ensure that centres equipped for the training of marine meteorological personnel are staffed by qualified and experienced specialists.

2.2.3 Members should make arrangements enabling meteorological personnel engaged in training and in the provision of services in marine meteorology to familiarize themselves with the marine environment.

Note: Specific arrangements include the organization of sea voyages and visits for the purpose of familiarization to those countries where well-established marine meteorological services are provided.

2.2.4 Members should, in addition to standard textbooks and their own lecture notes, take into account the internationally accepted syllabuses for marine meteorological training personnel and the special compendia of lecture notes issued by WMO intended for different classes of meteorological personnel.

2.2.5 Members should pay full attention to the use of films and audio-visual aids for marine meteorological training purposes.

2.2.6 Members should endeavour to introduce marine meteorology and related physical oceanography as one of the subjects to be taught in the regular courses on meteorology given by universities in their country.

3. METEOROLOGICAL TRAINING OF PORT METEOROLOGICAL OFFICERS

3.1 Principles

The principles for the meteorological training of PMOs are as follows:

Principle 1

The objective of the meteorological training of a PMO is to keep up to date his knowledge of the principles and organization of meteorological

forecasting for the marine environment, the use of marine meteorological instruments and methods of observing on board ship, the use of codes and meteorological logbooks, as well as the procedures for recording and transmitting observations.

Principle 2

The training programme of a PMO includes arrangements for keeping the PMO continuously informed of the latest issues of relevant publications, magazines and other material available nationally and internationally for meteorological observing tasks.

3.2 Procedures

3.2.1 Regular courses for the training of PMOs in their duties should be provided nationally.

Notes:

1. Visits to one or more ports with well-established PMO services may be considered as part of the training course.
2. The duties of PMOs are described in Chapter 1 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

3.2.2 Information regarding the main objectives and organization of international scientific cooperative investigations and experiments that include the use of voluntary observing ships should be part of the updated training of PMOs.

4. METEOROLOGICAL TRAINING OF SEAFARERS

4.1 Principles

The principles for the meteorological training of seafarers are as follows:

Principle 1

The training of non-professional seafarers, such as those on pleasure boats, in the language and terminology used in warnings and bulletins contributes considerably to the safety of their navigation.

Principle 2

Assistance in the training of seafarers in meteorological observations and transmission of meteorological reports, and in the use and correct

interpretation of marine meteorological information, is an integral part of meteorological services to enhance the safety and efficiency of ship operations.

4.2 Procedures

4.2.1 Members should give every assistance to navigation schools to ensure that courses in basic marine meteorology meet the relevant requirements of the IMO International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (see note following). This is to ensure that seafarers are competent to make meteorological observations and to transmit them, as well as to understand the warnings, synopses and forecasts provided for their use.

Note: Applicable requirements from the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, administered by IMO, are reproduced in Chapter 7 of the *Guide to Marine Meteorological Services* (WMO-No. 471).

4.2.2 Members should arrange for the provision of suitable guidance material to shipmasters and navigation schools, in the light of standard textbooks and special publications issued by WMO, on the use and interpretation of weather charts.

4.2.3 Members should encourage the inclusion of a reasonable level of practical meteorological knowledge and its application to navigation in statutory syllabuses for examinations of ships' officers, having due regard to established international standards and recommendations with respect to the training and certification of seafarers.

5. METEOROLOGICAL BRIEFING OF MARINE OBSERVERS

5.1 Principle

The principle for the meteorological briefing of marine observers is as follows:

The making, recording and transmitting by radio of routine marine meteorological observations are voluntary additions to the official duties of merchant ships' officers and continuous briefing on these meteorological tasks is an important area of responsibility of NMSs.

5.2 **Procedures**

Members should arrange, through PMOs as appropriate, that marine observers on board ships are adequately briefed in the making of accurate

observations, in their recording in meteorological logbooks and, in addition, in the transmission of the information in accordance with the standing procedures contained in the *Manual on the Global Telecommunication System* (WMO-No. 386).

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