

Manual on Marine Meteorological Services

Volume I – Global Aspects

Annex VI to the WMO Technical Regulations

2012 edition

Updated in 2018

WEATHER CLIMATE WATER



WORLD
METEOROLOGICAL
ORGANIZATION

WMO-No. 558

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EDITORIAL NOTE

The following typographical practice has been followed: Standard practices and procedures have been printed in **bold**. Recommended practices and procedures have been printed in regular font. Notes have been printed in smaller type.

METEOTERM, the WMO terminology database, may be consulted at <http://public.wmo.int/en/resources/meteoterm>.

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INTRODUCTION

Purpose and scope of the *Manual on Marine Meteorological Services*

1. The *Manual on Marine Meteorological Services* (WMO-No. 558) is issued in accordance with a decision of the Eighth World Meteorological Congress.
2. This Manual is designed:
 - (a) To specify obligations of Members in the implementation of Marine Meteorological Services (MMS);
 - (b) To facilitate cooperation in respect of the international coordination of MMS, in particular the delivery of the International Maritime Organization (IMO)/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS);
 - (c) To facilitate cooperation between the World Weather Watch (WWW) and MMS;
 - (d) To ensure adequate uniformity and standardization in the practices and procedures followed to achieve (a), (b) and (c) above.
3. The Manual consists of Volumes I and II, dealing with global and regional aspects, respectively. Volume I is composed of seven parts, which contain the regulatory material dealing essentially with international obligations of Members to provide MMS for the high seas, offshore, coastal and local waters. Additional obligations, if any, for national marine activities should be met in accordance with local practices and procedures.
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), from resolutions of regional associations and from decisions taken by Congress and the Executive Council.
5. Volume I of the Manual – Global Aspects – forms part of the *Technical Regulations* (WMO-No. 49) and is referred to as Annex VI to the *Technical Regulations*. It should be read in conjunction with the three volumes and the set of annexes which together comprise the *Technical Regulations*.
6. Volume II of the Manual – Regional Aspects – does not form part of the *Technical Regulations*.
7. Members will implement and operate their respective MMS in accordance with decisions of Congress, the Executive Council, the technical commissions and regional associations. Where those decisions are technical and regulatory in nature, they will, in due course, be documented in the *Technical Regulations*.
8. The *Manual on Marine Meteorological Services* (WMO-No. 558) is supported by the *Guide to Marine Meteorological Services* (WMO-No. 471).

Appendices

9. Appendices are used where a set of provisions on a single topic might, due to their detailed nature and length, otherwise interrupt the flow of the relevant section of this Manual. Also, appendices are used to facilitate the ongoing review and update process by identifying sub-sections which fall under the specific responsibility of a particular group.

GENERAL PROVISIONS

1. The *Technical Regulations* (WMO-No. 49) of the World Meteorological Organization are presented in three volumes:

Volume I – General meteorological standards and recommended practices

Volume II – Meteorological service for international air navigation

Volume III – Hydrology

Purpose of the Technical Regulations

2. The Technical Regulations are determined by the World Meteorological Congress in accordance with Article 8 (d) of the Convention.

3. These Regulations are designed:

- (a) To facilitate cooperation in meteorology and hydrology among Members;
- (b) To meet, in the most effective manner, specific needs in the various fields of application of meteorology and operational hydrology in the international sphere;
- (c) To ensure adequate uniformity and standardization in the practices and procedures employed in achieving (a) and (b) above.

Types of Regulations

4. The Technical Regulations comprise *standard* practices and procedures and *recommended* practices and procedures.

5. The definitions of these two types of Regulations are as follows:

The *standard* practices and procedures:

- (a) Shall be the practices and procedures that Members are required 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 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 Arabic, Chinese, French, Russian and Spanish texts.

The *recommended* practices and procedures:

- (a) Shall be the practices and procedures with which Members are urged to comply;
- (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 otherwise provided by decision of Congress) and by suitable equivalent terms in the Arabic, Chinese, French, Russian and Spanish texts.

6. 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 Regulation 128 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 Technical Regulations, except those for which they have lodged a 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 the effective date of the change.

7. Members are urged to comply with *recommended* practices and procedures, but it is not necessary to notify the Secretary-General of non-observance except with regard to practices and procedures contained in Volume II.

8. In order to clarify the status of the various Regulations, 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.

Status of annexes and appendices

9. The following annexes to the *Technical Regulations* (Volumes I to III), also called Manuals, are published separately and contain regulatory material having the status of *standard* and/or *recommended* practices and procedures:

- I *International Cloud Atlas* (WMO-No. 407) – Manual on the Observation of Clouds and Other Meteors, sections 1, 2.1.1, 2.1.4, 2.1.5, 2.2.2, 1 to 4 in 2.3.1 to 2.3.10 (for example, 2.3.1.1, 2.3.1.2, etc.), 2.8.2, 2.8.3, 2.8.5, 3.1 and the definitions (in grey-shaded boxes) of 3.2;
- II *Manual on Codes* (WMO-No. 306), Volume I;
- III *Manual on the Global Telecommunication System* (WMO-No. 386);
- IV *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485);
- V *Manual on the Global Observing System* (WMO-No. 544), Volume I;
- VI *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I;
- VII *Manual on the WMO Information System* (WMO-No. 1060);
- VIII *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160).

These annexes (Manuals) are established by decision of Congress and are intended to facilitate the application of Technical Regulations to specific fields. Annexes may contain both *standard* and *recommended* practices and procedures.

10. Texts called appendices, appearing in the *Technical Regulations* or in an annex to the *Technical Regulations*, have the same status as the Regulations to which they refer.

Status of notes and attachments

11. Certain notes (preceded by the indication “Note”) are included in the *Technical Regulations* for explanatory purposes; they may, for instance, refer to relevant WMO Guides and publications. These notes do not have the status of Technical Regulations.

12. The *Technical Regulations* may also include attachments, which usually contain detailed guidelines related to *standard* and *recommended* practices and procedures. Attachments, however, do not have regulatory status.

Updating of the *Technical Regulations* and their annexes (Manuals)

13. The *Technical Regulations* are updated, as necessary, in the light of developments in meteorology and hydrology and related techniques, and in the application of meteorology and operational hydrology. Certain principles previously agreed upon by Congress and applied in the selection of material for inclusion in the Technical Regulations are reproduced below. These principles provide guidance for constituent bodies, in particular technical commissions, when dealing with matters pertaining to the Technical Regulations:

- (a) Technical commissions should not recommend that a Regulation be a standard practice unless it is supported by a strong majority;

- (b) Technical Regulations should contain appropriate instructions to Members regarding implementation of the provision in question;
- (c) No major changes should be made to the Technical Regulations without consulting the appropriate technical commissions;
- (d) Any amendments to the Technical Regulations submitted by Members or by constituent bodies should be communicated to all Members at least three months before they are submitted to Congress.

14. Amendments to the *Technical Regulations* – as a rule – are approved by Congress.

15. If a recommendation for an amendment is made by a session of the appropriate technical commission and if the new regulation needs to be implemented before the next session of Congress, the Executive Council may, on behalf of the Organization, approve the amendment in accordance with Article 14 (c) of the Convention. Amendments to annexes to the *Technical Regulations* proposed by the appropriate technical commissions are normally approved by the Executive Council.

16. If a recommendation for an amendment is made by the appropriate technical commission and the implementation of the new regulation is urgent, the President of the Organization may, on behalf of the Executive Council, take action as provided by Regulation 9 (5) of the General Regulations.

Note: A simple (fast-track) procedure may be used for amendments to technical specifications in Annexes II (*Manual on Codes* (WMO-No. 306)), III (*Manual on the Global Telecommunication System* (WMO-No. 386)), IV (*Manual on the Global Data-processing and Forecasting System* (WMO-No. 485)), V (*Manual on the Global Observing System* (WMO-No. 544)), VII (*Manual on the WMO Information System* (WMO-No. 1060)) and VIII (*Manual on the WMO Integrated Global Observing System* (WMO-No. 1160)). Application of the simple (fast-track) procedure is defined in those Annexes.

17. After each session of Congress (every four years), a new edition of the *Technical Regulations*, including the amendments approved by Congress, is issued. With regard to the amendments between sessions of Congress, Volumes I and III of the *Technical Regulations* are updated, as necessary, upon approval of changes thereto by the Executive Council. The *Technical Regulations* updated as a result of an approved amendment by the Executive Council are considered a new update of the current edition. The material in Volume II is prepared by the World Meteorological Organization and the International Civil Aviation Organization working in close cooperation, in accordance with the Working Arrangements agreed by these Organizations. In order to ensure consistency between Volume II and Annex 3 to the Convention on International Civil Aviation – *Meteorological Service for International Air Navigation*, the issuance of amendments to Volume II is synchronized with the respective amendments to Annex 3 by the International Civil Aviation Organization.

Note: Editions are identified by the year of the respective session of Congress whereas updates are identified by the year of approval by the Executive Council, for example "Updated in 2012".

WMO Guides

18. In addition to the *Technical Regulations*, appropriate Guides are published by the Organization. They describe practices, procedures and specifications which Members are invited to follow or implement in establishing and conducting their arrangements for compliance with the Technical Regulations, and in otherwise developing meteorological and hydrological services in their respective countries. The Guides are updated, as necessary, in the light of scientific and

technological developments in hydrometeorology, climatology and their applications. The technical commissions are responsible for the selection of material to be included in the Guides. These Guides and their subsequent amendments shall be considered by the Executive Council.

PROCEDURES FOR AMENDING THE MANUAL AND GUIDE ON MARINE METEOROLOGICAL SERVICES

GENERAL VALIDATION AND IMPLEMENTATION PROCEDURES

1. Amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558) 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.
 2. The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology has a Committee for the IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) and several Expert Teams (ETs). The WWMIWS Committee, supported by the WMO Secretariat, shall validate any changes (unless consequent to an amendment to the WMO Technical Regulations) and develop draft recommendations to respond to these changes, as appropriate.
 3. The WWMIWS Committee is responsible for coordinating input to the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services*. Responsibility for specific content is divided as follows:
 - (a) The WWMIWS Committee is responsible for all aspects of Marine Meteorological Services (MMS), except those listed under (b) to (e) below;
 - (b) The Expert Team on Marine Climatology (ETMC) is responsible for providing advice and content on marine climatology;
 - (c) The Expert Team on Sea Ice (ETSI) is responsible for providing advice and content on sea ice;
 - (d) The Expert Team on Disaster Risk Reduction (ETDRR) is responsible for providing advice and content on sea state and coastal hazards;
 - (e) The Expert Team on Operational Ocean Forecast Systems (ETOOFS) is responsible for providing advice and content on ocean services.
 4. Any draft must be endorsed by the Programme Area (PA) Coordination Group. The date of implementation should be defined by the WWMIWS Committee, in coordination with the Expert Teams, so as to give WMO Members sufficient time to implement the amendments after the date of notification. The WWMIWS Committee should provide justification if a time span of less than three months is proposed.
 5. The procedures for approval of amendments are outlined in the *Technical Regulations* (WMO-No. 49), Volume I, General Provisions, paragraphs 15 and 16. For ease of reference, the General Provisions are reproduced after the introduction to this Manual.
 6. Once amendments to the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services* are adopted, an updated version of the Manual or Guide shall be issued in four languages: English, French, Russian and Spanish. The WMO Secretariat will notify all Members when a new update becomes available.
-

PURPOSE AND ORGANIZATION OF MARINE METEOROLOGICAL SERVICES

1. The purpose of Marine Meteorological Services (MMS) shall be to make available to marine users at sea or on the coast the required marine meteorological and related geophysical information, to the extent technically possible.
2. Marine Meteorological Services shall be organized to provide, to the extent possible, maritime users with the meteorological and related oceanographic information (warnings, forecasts, charts, expert advice and climatological data) required for safe navigation and high efficiency of operations, using adequate modes of dissemination. The services shall perform functions with regard to guidance and training in a coherent manner.
3. Marine Meteorological Services shall comprise the following:
 - (a) Services for the high seas, in particular to support the WWMIWS;
 - (b) Services for coastal, offshore and local waters;
 - (c) Support services for search and rescue;
 - (d) Support services for the IMO/International Hydrographic Organization (IHO) Worldwide Navigational Warning Service (WWNWS);
 - (e) Support services for marine environmental emergency response;
 - (f) Services for marine climatology;
 - (g) Training in marine meteorology.

PRINCIPLES OF MARINE METEOROLOGICAL SERVICES

Principle 1

4. Marine Meteorological Services shall be provided to satisfy the requirements for information on marine environmental conditions and phenomena, established by international conventions and national practices in relation to marine operations.

Principle 2

5. Marine Meteorological Services shall be designed for the safety of marine operations and to promote, wherever possible, the efficiency and economy of marine activities.

Principle 3

6. Marine Meteorological Services shall include guidance on the use and interpretation of meteorological and related oceanographic information.

WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE

7. International standards for the dissemination of internationally coordinated meteorological information, forecast and warnings services (which do not apply to purely national services) shall be used.

Notes:

1. The WWMIWS provides these international standards.
2. The WWMIWS and WWNWS are defined in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*.
3. The WWMIWS was adopted through IMO Resolution A.1051(27) in 2011. The content of this resolution includes the following:
 - (a) Issuing service;
 - (b) Preparation service;
 - (c) METAREA Coordinator's role and responsibilities;
 - (d) Requirements for dissemination;
 - (e) Requirements for service provision in the high seas.
4. The roles and responsibilities of an issuing service and preparation service are defined in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*.
5. The roles and responsibilities of a METAREA Coordinator are laid out in [Appendix I.2](#).

Areas of responsibility

8. Areas of responsibility (AORs) and the services responsible for the preparation and issue of warnings, and weather and sea bulletins through the WWMIWS shall be as given in [Appendix I.1](#) (Figure 1).

Notes:

1. The AORs given in [Appendix I.1](#) are reviewed by the WMO Marine Meteorology and Oceanography Programme (MMOP) to ensure complete area coverage and adequacy of services.
2. A broadcast area may be subdivided in the text of the Enhanced Group Call (EGC) message into sub-areas to meet the requirements of the National Meteorological and Hydrological Service (NMHS) concerned.
3. The AORs defined in Appendix I.1 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 AORs, if they so wish, to meet national requirements. In this case, the area of coverage should be specified in the text of each broadcast.

9. When forecast areas of adjacent METAREAs overlap, the respective issuing Members should:

- (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.

19. Any proposal for a change in the responsibilities of Members for an area shall have the approval of the WMO Executive Council and shall follow the procedures outlined in [Appendix I.3](#).

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

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

Coordination of broadcast schedules

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

14. Dissemination of information shall be in accordance with international standards.

Note: International standards are specified in the IMO *International SafetyNET Manual* and *NAVTEX Manual*.

15. A schedule of transmission start times for these bulletins shall be compiled for all METAREAs and Land Earth Stations (LEs) that serve the areas. The schedule shall take into consideration, inter alia, the existing WMO synoptic times for observations, data analysis and forecast production.

16. As these broadcast schedules for WMMIWS have to be coordinated, under the aegis of WMO, with other organizations, Members should not independently change or request WMO to arrange frequent alterations to these coordinated and published schedules.

Coordination of observational networks and data management

17. The coordination of observational networks and management of observational data shall be achieved using the following frameworks:

- (a) The Global Observing System;
- (b) The Voluntary Observing Scheme;
- (c) The Ship of Opportunity Programme.

18. Observation standards for voluntary observing ships and the marine observation network are specified in the *Manual on the Global Observing System* (WMO No. 544), Volume I – Global Aspects.

19. Port Meteorological Officer services are specified in the *Manual on the Global Observing System* (WMO No. 544), Volume I – Global Aspects.

PART I. SERVICES FOR THE HIGH SEAS

1. GENERAL

1.1 Marine meteorological services (MMS) for the high seas shall form part of the IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) disseminated to Safety of Life at Sea (SOLAS) ships through the Global Maritime Distress and Safety System (GMDSS).

Note: The services for the high seas are primarily designed to cover Sea Areas A3 and A4 under the GMDSS (see the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*).

1.2 Marine meteorological services for the high seas shall include provision of:

- (a) Meteorological warnings;**
- (b) Marine forecasts;**
- (c) Sea-ice information services.**

1.3 Members shall disseminate meteorological services on approved satellite service provider platforms and NAVTEX in accordance with the GMDSS Master Plan. Members should disseminate meteorological services on marine radio frequencies (e.g. MF, HF, VHF), or by High-frequency Narrow-band Direct Printing (HF NBDP) telegraphy for areas where such a service is provided for ships engaged exclusively in voyages in those areas.

2. PROVISION OF MARINE METEOROLOGICAL SERVICES FOR THE HIGH SEAS

2.1 Principles

The principles for the preparation and issuing of marine meteorological services for the high seas shall be as follows:

- **Principle 1: For the purpose of preparing and issuing meteorological warnings, marine forecasts and sea-ice information services, the oceans and seas shall be divided into areas for which Members assume responsibility;**
- **Principle 2: The Areas of Responsibility (AORs) together shall provide complete coverage of oceans and seas by marine meteorological services;**
- **Principle 3: Marine meteorological services for areas not covered by NAVTEX shall be provided by the approved satellite service provider platforms or HF NBDP for the reception of Maritime Safety Information (MSI) in compliance with international standards;**

Note: The accepted international standard is the International Convention for the Safety of Life at Sea (SOLAS), Chapter IV – Radiocommunications.

- **Principle 4: The preparation and issue of marine meteorological services to the assigned AORs shall be coordinated in accordance with the procedures described under [Purpose and organization of Marine Meteorological Services](#);**
- **Principle 5: The efficiency and effectiveness of the provision of marine meteorological services shall be monitored by obtaining opinions and reports from marine users;**

- **Principle 6: Meteorological Maritime Safety Information broadcasts shall be monitored to ensure the accuracy and integrity of the broadcast.**

2.2 Procedures

General

2.2.1 All marine meteorological services that are used for broadcast on marine radio should include the radio call term “SECURITE” at the beginning of the product.

2.2.2 Clear information identifying the relevant METAREA and issuing service shall be included.

Note: For example: “Marine weather bulletin for METAREA II issued by Météo-France”.

2.2.3 Members shall ensure that broadcast of meteorological products conforms to international specifications.

Note: These international specifications are in the International Maritime Organization (IMO) *International SafetyNET Manual* and *NAVTEX Manual*, available from the JCOMM Services website.

2.2.4 All marine meteorological services shall be in plain language or shall use the accepted abbreviations listed in [Appendix I.4](#).

2.2.5 Marine meteorological services for broadcast on NAVTEX shall be prepared using the accepted abbreviations listed in [Appendix I.4](#), whilst recalling the requirement that warnings shall remain in plain English.

2.2.6 Marine meteorological services intended for the WWMIWS shall be broadcast in English.

Note: Additionally, if a Member wishes to issue warnings and forecasts to meet national obligations under the SOLAS Convention, broadcasts may be made in other languages. These broadcasts will be part of a national service.

2.2.7 The terminology used in marine meteorological services should be in accordance with the multilingual list of terms contained in the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 2.

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

2.2.9 Wind speed shall be given in knots or metres per second. The words “knots” or “metres per second” shall be referenced in the text of the message.

2.2.10 Wind force shall be given in Beaufort notation.

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

2.2.11 Wave heights of sea, swell or total wave height shall be given in metres, feet or Douglas Scale notation. If metres or feet are used, the unit shall be referenced in the text of the message.

Note: The definition used for wave height values is the significant wave height contained in the *Guide to Wave Analysis and Forecasting* (WMO-No. 702).

Preparation and issue of marine forecasts for the high seas

2.2.12 Marine forecasts for the high seas shall include the following items in the given order:

Part I: Warnings;

Part II: Synopsis of major features;

Part III: Forecasts.

Members should provide sea-ice services as part of the high seas forecast or as a stand-alone bulletin.

2.2.13 Members shall determine criteria for amending and updating forecasts.

2.2.14 These criteria should focus on standard warning thresholds as a priority, and should consider national requirements where applicable.

2.2.15 Marine forecasts shall be prepared and issued at least twice daily at scheduled times.

2.2.16 The valid period of the forecast shall be at least 24 hours.

2.2.17 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 universal time coordinated (UTC) of the beginning and end of the period.

Part I: Warnings

2.2.18 Part I shall have a reference to current warnings issued for the area. This reference shall be in the form of an identifier for a uniquely numbered or named warning, or shall include the relevant contents of the warning.

Note: Refer to 2.2.35–2.2.48 below for further requirements on preparation and issue of warning content.

2.2.19 When the identifier option is used, additional information on time of issue and coordinate area should be provided.

2.2.20 Should there be no warnings in effect, that fact shall be explicitly stated in Part I.

Note: For example: Warnings: Nil.

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

Part II: Synopses

2.2.22 The synopses given in Part II of weather and sea bulletins shall contain the following items in the given order:

(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.

2.2.23 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. The location of significant fronts and troughs should be included whenever this helps to clarify the weather situation.

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

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

Part III: Forecasts

2.2.26 The forecasts given in Part III of weather and sea bulletins shall contain the following items in the given order:

- (a) The valid period of forecast;
- (b) The name or designation of the 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 and swell conditions);
 - (iii) Visibility, when the forecast is less than 6 nautical miles (10 kilometres).

2.2.27 The forecasts should include expected significant changes during the forecast period and significant hydrometeors such as freezing precipitation, snowfall or rainfall.

2.2.28 An outlook section should be included to highlight expected weather systems with wind speeds of gale force and above. The outlook should specify the period of time beyond the forecast validity period that it covers.

2.2.29 Visibility shall be indicated in descriptive terms, nautical miles or kilometres.

2.2.30 The following descriptive terms should be used:

Very poor: Less than 0.5 nautical miles;

Poor: 0.5 to less than 2 nautical miles;

Moderate: 2 to 5 nautical miles;

Good*: Greater than 5 nautical miles (*not mandatory).

Note: This Manual is the authoritative source for descriptive terms concerning visibility.

Issue of sea-ice information

2.2.31 Members shall provide the limit of sea ice and icebergs, where ice conditions pose a hazard to navigation.

2.2.32 Members should include information about sea-ice concentration and stage of development. Other information may be included if available (for example, ice pressure, floe size).

2.2.33 Descriptions of the limit of all known ice or icebergs shall be given using latitude and longitude coordinates. The location of the ice or the icebergs shall be given relative to the limit.

2.2.34 Sea-ice and iceberg terminology shall be in accordance with standards.

Note: The standards are specified in *WMO Sea-ice Nomenclature* (WMO-No. 259).

Preparation and issue of warning content

2.2.35 Members shall provide warning content suitable for inclusion in Part I of the high seas forecast product, or for issuing as a stand-alone product for broadcast irrespective of the high seas forecast scheduled times.

2.2.36 Warnings shall be provided for the following phenomena:

- (a) Wind of gale force (Beaufort force 8) and above;
- (b) Ice accretion.

2.2.37 Warnings should be provided for the following phenomena:

- (a) Unusual and hazardous sea-ice conditions;
- (b) Dangerous sea states.

2.2.38 Warnings shall contain the following items in the given order:

- (a) Type and severity of warning;
- (b) Date and time of issue in UTC;
- (c) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;
- (d) Extent of affected area;
- (e) Description of the hazardous phenomenon characteristics.

2.2.39 Warnings shall be as brief, clear and complete as possible.

2.2.40 Warnings shall be issued at least 18 hours prior to the onset of expected hazardous conditions for synoptic scale systems, and shall be broadcast immediately.

2.2.41 Warnings shall be updated whenever necessary and broadcast immediately.

2.2.42 Warnings shall remain in force until amended or cancelled.

Procedures for wind warnings issued as a separate product

2.2.43 Warnings shall be issued for gale force (Beaufort force 8) and above.

2.2.44 The severity of wind warnings shall use the following categories:

- (a) Gale force (Beaufort force 8 or 9);
- (b) Storm force (Beaufort force 10 or 11);

(c) **Hurricane force (Beaufort force 12 or over).**

2.2.45 Warnings of gale force winds and above should include the following additional content:

- (a) Type of disturbance (for example, low, hurricane, front) with a statement of central pressure in hectopascals;
- (b) Name of the tropical cyclone, when relevant;
- (c) Direction and speed of movement of disturbances;
- (d) Wind speed or force, and direction in the affected areas;
- (e) Sea and swell conditions in the affected area;
- (f) Other appropriate information such as indications of future positions of disturbances.

Procedures for ice-accretion warnings

2.2.46 **Members shall issue warnings for potentially hazardous ice accretion.**

2.2.47 Members should include the rate of ice deposition on the superstructure of the vessel in warnings of ice accretion.

Procedures for sea-ice related warnings

2.2.48 Members should issue warnings for strong ice pressure and other hazardous sea-ice conditions.

Note: Warnings containing iceberg information may be issued through the NAVAREA Worldwide Navigational Warning Service (WWNWS). For further information, see Part IV.

2.3 Provision of graphical forecast information

General

2.3.1 **Members who provide e-navigation transmissions shall have the capability of providing marine users with comprehensive marine environmental information for display on ship navigation systems. Additionally, they shall enable mariners to overlay forecast and hazard data over charts, route plans and other S-10x data sets in the ships' Electronic Chart Display and Information Systems (ECDIS).**

2.3.2 **Members who provide radio facsimile transmissions shall have the capability of providing marine users with comprehensive marine environmental information, both in pictorial form and text form.**

Procedures for radio facsimile

2.3.3 Members should publish and make available to marine users a transmission schedule indicating times of transmission, radio frequencies and areas covered.

2.3.4 **Members shall notify the WMO Secretariat of changes to the schedule.**

Note: The Secretariat will include them in *Weather Reporting* (WMO-No. 9), Volume D – Information for Shipping and *Sea-ice Information Services in the World* (WMO-No. 574).

2.3.5 Members should use the following projections, 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°;
- (d) Polar projection with recommended prime meridians 0°, 45°E/W, 90°E/W and 180°.

2.3.6 Members should include the name of the projection, the scale at the standard parallels and the scales for other latitudes on every chart.

2.3.7 Members should consider aspects of line width, spacing, text and symbol choice to ensure clear reproduction of charts for facsimile transmission.

2.3.8 Members should include a legend on each chart for facsimile transmission that includes the following information:

- (a) Name of issuing meteorological forecast centre in plain language;
- (b) Title of the metocean parameter presented;
- (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) Unit of parameter presented on map;
- (e) Special symbols or isopleths.

2.3.9 Members should prepare charts using symbols from the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485).

2.3.10 While individual Members may use other symbols for specialized depictions, these should not conflict with those given in the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485).

2.3.11 Members should produce sea-ice information charts using symbols, or in vector or gridded format.

Note: Formats for sea-ice information are described in *Sea-ice Nomenclature* (WMO-No. 259), Volume III – *International System of Sea-ice Symbols*, and in *SIGRID-3: A Vector Archive Format for Sea-ice Charts* (WMO/TD-No. 1214).

Procedures for e-navigation displays

2.3.12 **The information provided shall be in a compatible format.**

Note: Information must be compatible with the WMO/IHO S-411 and S-412 formats, as defined by the WMO/IHO Met-Ocean Feature Catalogue, or WMO Ice Objects Feature Catalogue, held by IHO.

APPENDIX I.1. METAREAS AND DESIGNATED NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES FOR THE ISSUE OF METEOROLOGICAL MARITIME SAFETY INFORMATION FOR THE WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE

COORDINATES FOR THE WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE 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 Hudson Bay and approaches, and from the east coast boundary of Suriname to 7°N out to 35°W;

Area V: Atlantic waters bounded by the coast of Brazil, the parallels 7°N and 35° 50'S, the meridian of 20°W and bounded by the Brazilian legal waters with French Guiana and Uruguay;

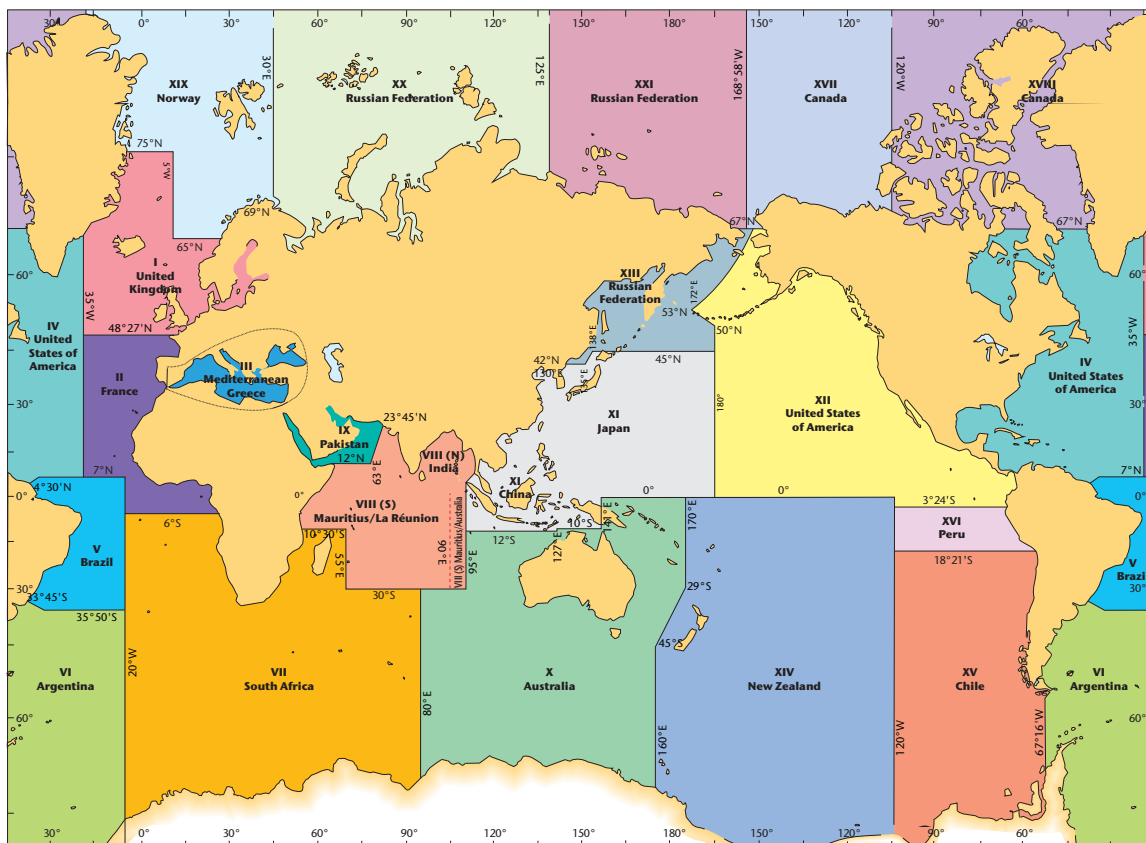


Figure 1. Limits of METAREAS

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

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

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

Area VIII (S): The east African coast from the Equator southward to $10^{\circ}30'S$, thence to $55^{\circ}E$, to $30^{\circ}S$, to $95^{\circ}E$, 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 $80^{\circ}E$ and south of $30^{\circ}S$, to $95^{\circ}E$, to $12^{\circ}S$, to $127^{\circ}E$ and thence to the Timor Sea, South Pacific and Southern Oceans south of $10^{\circ}S$ to $141^{\circ}E$, to the Equator, to $170^{\circ}E$, to $29^{\circ}S$, thence south-westward to $45^{\circ}S$ at $160^{\circ}E$ and then to the meridian at $160^{\circ}E$;

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 $42^{\circ}30'N$ $130^{\circ}E$, and thence to $135^{\circ}E$, north-east to $45^{\circ}N$ $138^{\circ}20'E$, to $45^{\circ}N$ longitude 180° ;

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

Area XIII: Sea areas enclosed north of the line starting $42^{\circ}30'N$ $130^{\circ}E$, and thence to $135^{\circ}E$, north-east to $45^{\circ}N$ $138^{\circ}20'E$, to $45^{\circ}N$ longitude 180° , then to $50^{\circ}N$, then north-west to $53^{\circ}N$ $172^{\circ}E$ and then following the International Date Line to $67^{\circ}N$, and then west to the Russian Federation coastline;

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 $18^{\circ}21'S$ following the coast of Chile to the longitude of Cape Horn at $67^{\circ}16'W$, and $120^{\circ}W$;

Area XVI: The South Pacific Ocean between $18^{\circ}21'S$ and $3^{\circ}24'S$ bounded by the coast of Peru and $120^{\circ}W$;

Area XVII: The Arctic Ocean bounded by $67^{\circ}N$ and $168^{\circ}58'W$ to $90^{\circ}N$ $168^{\circ}58'W$, $90^{\circ}N$ $120^{\circ}W$, southward to the Canadian coastline along the $120^{\circ}W$ meridian;

Area XVIII: The Arctic Ocean bounded by a position on the Canadian coastline at the $120^{\circ}W$ meridian to $90^{\circ}N$ $120^{\circ}W$, $90^{\circ}N$ and $35^{\circ}W$, $67^{\circ}N$ $35^{\circ}W$;

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

Area XX: From the border between Norway and the Russian Federation (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, southward 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 northward along the 125°E meridian to 90°N then to 168°58'W, southward along the 168°58'W meridian to the 67°N parallel, westward along the 67°N parallel to a position on the Russian Federation coastline.

APPENDIX I.2. TERMS OF REFERENCE OF A METAREA COORDINATOR

The following description of the role and responsibilities of a METAREA Coordinator is contained in IMO Assembly Resolution A.1051(27) – IMO/WMO Worldwide Met-Ocean Information and Warning Service - Guidance Document.

Regarding resources, the METAREA Coordinator should have:

- (a) The expertise and information sources of National Meteorological and Hydrological Services (NMHSs);
- (b) Effective means of communication, such as telephone, email, facsimile and internet, with NMHSs in the METAREA, with other METAREA Coordinators and other data providers.

Regarding responsibilities, the METAREA Coordinator has to:

- (a) Act as the central point of contact on matters relating to meteorological information and warnings within the METAREA;
- (b) Promote and oversee the use of established international standards and practices in the dissemination of meteorological information and warnings throughout the METAREA;
- (c) Coordinate preliminary discussions between neighbouring Members seeking to establish and operate NAVTEX services, prior to formal application;
- (d) Coordinate the dissemination of meteorological bulletins on the WMO Information System (WIS) and ensure the correct display of SafetyNET and Maritime Safety information (MSI) messages on the WWMIWS website hosted by Météo-France;
- (e) Liaise with entities that have responsibility for maritime safety, marine communications, port authorities and other relevant maritime responsibilities, on the effective use of meteorological information and warning services;
- (f) Act as a coordination point for implementation of WMO strategic initiatives under the service delivery framework, including verification, quality management, marine forecaster competency framework and resilience activities;
- (g) Be responsible for maintaining details of marine weather services and marine communications relevant for international service documentation such as *Weather Reporting* (WMO-No 9), Volume D – *Information for Shipping*, the United Kingdom Hydrographic Office (UKHO) Admiralty List of Radio Signals and the IMO Global Maritime Distress and Safety System (GMDSS) Master Plan;
- (h) Contribute to the development of international standards and practices through attendance and participation in the Worldwide Met-Ocean Information and Warning Service Committee meetings. Attend and participate in relevant IMO, IHO and WMO meetings as appropriate and required.

The METAREA Coordinator has also to ensure that within his/her METAREA NMHSs that act as issuing services have the capability to:

- (a) Select meteorological information and warnings for broadcast in accordance with the guidance given in the *Manual on Marine Meteorological Services* (WMO-No. 558);
- (b) Provide insights and monitor changes in customer requirements for updates to the *Guide to Marine Meteorological Services* (WMO-No. 471);
- (c) Monitor the SafetyNET transmission of the bulletins that are broadcast by the issuing service within its METAREA.

The METAREA Coordinator has to further ensure that within his/her METAREA NMHSs that act as preparation services have the capability to:

- (a) Be informed or gather information on all meteorological events that could significantly affect the safety of navigation within their area of responsibility;
 - (b) Assess all meteorological information immediately upon receipt in the light of expert knowledge for relevance to navigation within their area of responsibility;
 - (c) Forward marine meteorological information that may require wider dissemination directly to adjacent METAREA Coordinators and others as appropriate, using the quickest possible means;
 - (d) Ensure that information concerning all meteorological warning subject areas listed in the *Manual on Marine Meteorological Services* (WMO-No. 558) that may require a METAREA warning within their own area of responsibility is forwarded immediately to the appropriate NMHSs and METAREA Coordinators affected by the meteorological event;
 - (e) Provide insights and monitor changes in customer requirements for updates to the *Guide to Marine Meteorological Services* (WMO-No. 471);
 - (f) Maintain records of source data relating to meteorological information and warning messages within their area of responsibility.
-

APPENDIX I.3. DESIGNATION OF ISSUING OR PREPARATION SERVICE OF THE WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE

This appendix describes the decision process in assessing an application by a Member for inclusion in the Worldwide Met-Ocean Information and Warning Service (WWMIWS) as an issuing service or preparation service for broadcasts on SafetyNET (Figure 2). The decision process is designed to minimize the impact on the existing service structure. Worldwide Met-Ocean Information and Warning Service providers have the status of Regional Specialized Meteorological Centres (RSMCs) as part of the WMO Global Data-processing and Forecast System (GDPFS) framework.

PRINCIPLES

1. The Worldwide Met-Ocean Information and Warning Service supports one issuing service per METAREA, and only exceptionally, considers additional issuing services, under the following conditions:
 - (a) Avoiding duplication of forecasts for the same area;
 - (b) Maintaining efficiency of forecast production by incumbent issuing service;
 - (c) Following the regulations outlined in the IMO *International SafetyNET Manual*.
2. The Worldwide Met-Ocean Information and Warning Service supports minimal preparation services per METAREA to ensure efficient production of items to be disseminated on SafetyNET.

METHOD

Decision 1: If the application is from a National Meteorological and Hydrological Service (NMHS) or national authority, then OK to proceed. If not, reject.

Decision 2: If the answer under Decision 1 is "Yes", check that the Member's operations satisfy the following conditions:

- (a) The service is provided 24/7;
- (b) The Member has an operational contingency plan for bulletin production and dissemination. If not, reject.

Decision 3: If no issuing service exists for the METAREA (or if replacement is required), the application is accepted (and dissemination costs must be borne by the applying Member).

Actions:

- (a) The Member should nominate a METAREA Coordinator;
- (b) The Member should complete a WMO self-assessment;
- (c) WMO should notify the SafetyNET Panel.

Decision 4: If an issuing service exists for the METAREA, consider whether the Inmarsat region is already covered.

Decision 4a: If the Inmarsat region is not already covered, the submission is accepted. If it is covered, a preparation service is recommended.

If the preparation service option is not desired by the NMHS, consider the following ancillary decision process (Figure 3):

If the proposed area for the high seas forecast can be excluded from existing forecast coverage produced by the issuing service (i.e. the southern sector of the area, rather than a small area within the broader area, so that a forecaster does not have to consider disparate geographic areas), then OK to proceed to Decision 3 to consider application as an issuing service.

Agreements required:

- (a) The Member should reach an agreement with the existing issuing service on forecast area change;
- (b) The Member should reach an agreement with the issuing service on dissemination cost liability.

Actions:

- (a) The Member should identify a coded Enhanced Group Call (EGC) area (rectangular or circular) to cover the proposed area;
- (b) WMO should request a transmission time slot from the SafetyNET Panel;
- (c) WMO should add new boundaries in *Weather Reporting* (WMO-No. 9), Volume D – Information for Shipping;

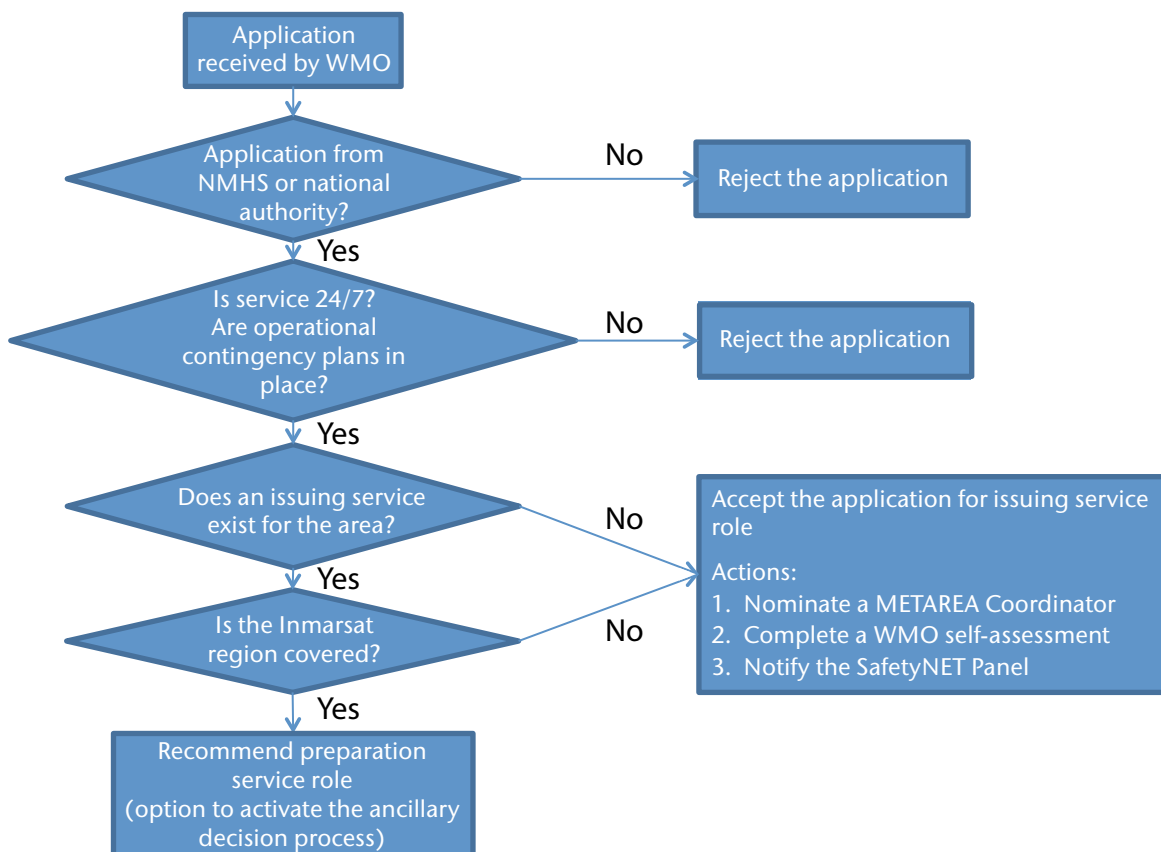


Figure 2. Application decision tree for SafetyNET role

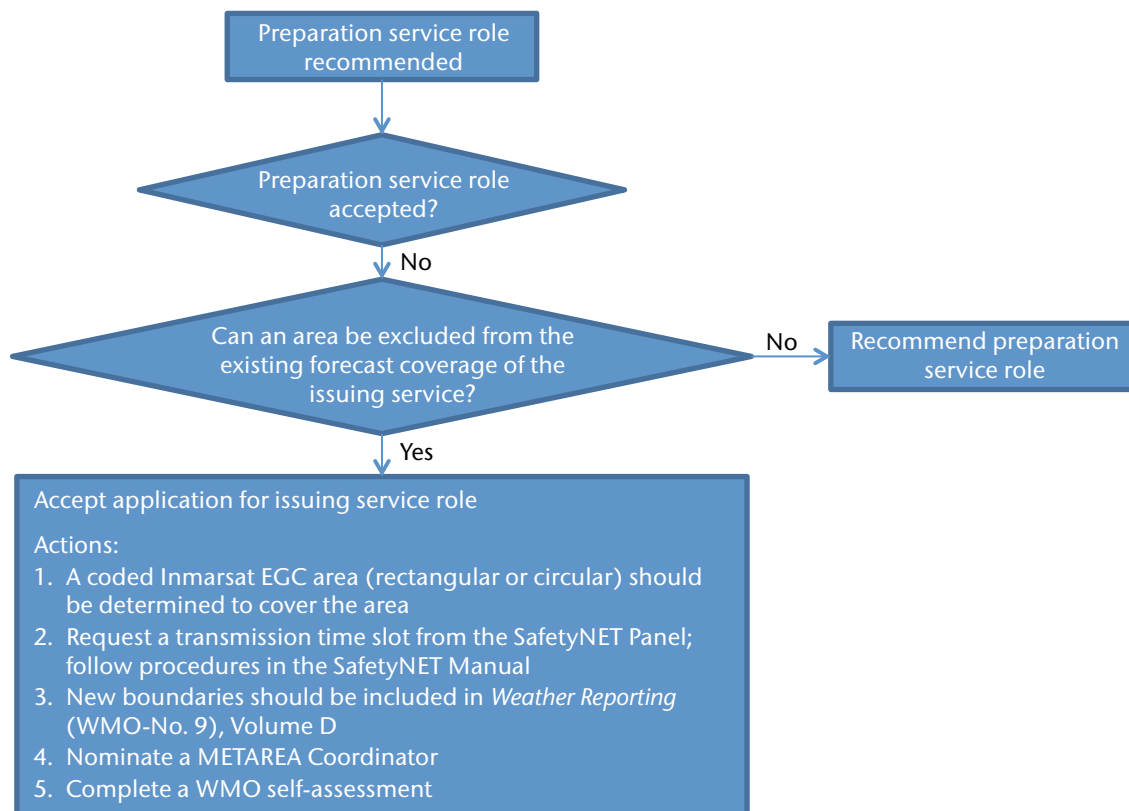


Figure 3. Ancillary decision tree for SafetyNET role

- (d) WMO and the Member should follow the procedures laid out in the IMO *International SafetyNET Manual*;
- (e) The Member should develop backup arrangements;
- (f) The Member should nominate a METAREA Coordinator;
- (g) The Member should complete a WMO self-assessment.

If the area cannot be excluded, a preparation service should be recommended.

GOVERNANCE

Members should submit their application to the chairperson of the WWMIWS Committee, using the following email address: mmo@wmo.int. Assessment and final decision procedures follow those for the designation of GDPFS centres.

Responsibilities

- (a) Chairperson of the WWMIWS Committee: To assess the information provided in the application against the decision flowchart, and provide a recommendation to the WMO Executive Council/Congress;
- (b) WMO Executive Council/Congress: To make the final decision on recommendation for issuing service or preparation service;

- (c) SafetyNET Panel: To deliver a SafetyNET issuing service certificate upon recommendation from WMO.

Application process

Applications will be reviewed and assessed by the chairperson of the WWMIWS Committee. The review process will generally take a few weeks, and regular communication on progress will be provided to the Member.

Decisions will be communicated in writing to the applicant. The response will contain details of the assessment and recommendations for implementation within the WWMIWS or within the NMHS structure.

APPENDIX I.4. COMMON ABBREVIATIONS FOR THE INTERNATIONAL NAVTEX SERVICE

<i>General descriptive terms</i>	<i>Abbreviations</i>
24-hour	24-HR
Backing	BACK
Becoming	BECMG
Blizzard	BZ
Building	BLDN
Coastal	CSTL
Cold front	C-FRONT or CFNT
Decreasing	DECR
Deepening	DPN
East or easterly	E
Expected	EXP
Feet	FT
Filling	FLN
Fog	FG
Following	FLW
Forecast	FCST
Freezing spray	FRZ-SPR
Frequent/frequency	FRQ
From	FM
Further outlooks or tending	TEND
Hail	HL
Heavy	HVY
Hectopascal	HPA
Hurricane	HURR
Improving/improve	IMPR
Increasing	INCR
Intensifying/intensify	INTSF
Isolated	ISOL
Kilometres per hour	KMH
Knots	KT
Latitude/longitude	LAT/LONG
Light	LGT
Locally	LOC
Mean sea level	MSL
Meteo	MET

<i>General descriptive terms</i>	<i>Abbreviations</i>
Metres	M
Metres per second	M/S
Millibar	MB
Moderate	MOD
Moving/move	MOV or MVG
Nautical miles	NM
Navigation/navigational	NAV
Near	NR
Next	NXT
No change	NC
No significant change	NOSIG
North or northerly	N
North-east or north-easterly	NE
North-west or north-westerly	NW
Occasionally (at times)	OCNL
Occlusion front	O-FRONT or OFNT
Outside the ice edge	OUT-EDGE
Over open water	OVR-OW
Quasi-stationary	QSTNR
Quickly	QCKY
Rain	RN
Rapidly	RPDY
Risk	RSK
Scattered	SCT
Severe	SEV or SVR
Showers	SHWRS or SH
Slight	SLGT or SLT
Slowly	SLWY
South or southerly	S
South-east or south-easterly	SE
South-west or south-westerly	SW
Stationary	STNR
Storm	STRM
Strong	STRG
Temporarily/temporary	TEMPO
Thunderstorm	TSTM
Tropical Storm	TROP-STRM
Used for @ in email addresses	AT

<i>General descriptive terms</i>	<i>Abbreviations</i>
Valid	VLD
Variable	VRB
Veering	VEER
Visibility	VIS
Warm Front	W-FRONT or WFNT
Warning	WARN
Weakening	WKN
West or westerly	W

Notes:

1. Use of the above abbreviations in the meteorological content of the International NAVTEX Service broadcasts could reduce the length of bulletins by 6–8% and transmission time by more than 20%.
2. Whenever possible, the terms “expected” and “latitude/longitude” are omitted in the messages.
3. Recall that warnings shall remain in plain English.

NAVTEX ABBREVIATIONS FOR ICE FEATURES

General rules

1. Abbreviations concerning ice type shall have two parts: the first part shall indicate the ice concentration and the second part the ice thickness or stage of development.

Concentration

2. The concentration abbreviations shall be given either in tenths or in amount of ice. The two-symbol abbreviations in Table 1 shall be used for all concentrations.

Table 1. Ice concentration

<i>Abbreviation</i>	<i>Description</i>
1T	1 tenth
2T	2 tenths
3T	3 tenths
4T	4 tenths
5T	5 tenths
6T	6 tenths
7T	7 tenths
8T	8 tenths
9T	9 tenths
+T; 9+	9+ tenths
XT	10 tenths (X is roman 10)
BW	bergy water
OW	open water (less than 1/10)

<i>Abbreviation</i>	<i>Description</i>
VO	very open ice
OP	open ice
CL	close ice
VC	very close ice
CO	compact or consolidated ice
FI	fast ice

Ice thickness and stages of ice development

3. The ice thickness should be given as a range in centimetres or as a stage of development. When given as a range, a single thickness should have at least two digits (e.g. 05–10 cm, 30–50 cm).

4. **All stages of sea-ice development shall be characterized by a two-symbol abbreviation (Table 2), but for lake ice, three-symbol abbreviations shall be used.**

Note: It is also possible to use the abbreviation GT (greater than) and LT (less than) as in GT80 cm.

5. Members should use “??” as the two-symbol abbreviation if thickness is not known (or not applicable as in bergy water).

6. **The abbreviated sea-ice type, using stages of development, shall consist of four symbols. For lake ice, most ice types shall consist of five symbols.**

Notes:

- For example: 5TGR (5 tenths grey ice), +TNI (9+ tenths new ice), FIGW (grey-white fast ice).
- Clearly more symbols are needed if a thickness range is given (e.g. CL10–20 cm).

Table 2. Stages of ice development

<i>Abbreviation</i>	<i>Description</i>
NI	new ice
NL	nilas
DN	dark nilas
LN	light nilas
GR	grey ice
GW	grey-white ice
YG	young ice
FY	first year ice
F1; W1	thin first year stage 1 (Baltic white ice stage 1)
F2; W2	thin first year stage 2 (Baltic white ice stage 2)
FM	medium first year
FT	thick first year
OI	old ice
MY	multi-year ice

<i>Abbreviation</i>	<i>Description</i>
THN	thin ice (main use for lake ice)
MED	medium ice (main use for lake ice)
THK	thick ice (main use for lake ice)
VTK	very thick ice (main use for lake ice)
??	undetermined

Ice-surface topography

6. As required, the ice type abbreviation should be followed by an abbreviation giving the topography of the ice (Table 3). The topography should be separated by a colon (":").

Note: There can be none, one or several of these abbreviations. For example XTGW:HRDG:ROTN (10 tenths grey-white ice which is heavily ridged and rotten).

Egg code

7. As required, an Egg code should be used.

8. In this case, the ice definition shall start with the total concentration (in tenths, using just the first character of the ice concentration abbreviation in Table 1) followed by EGG. The partial ice type shall then follow separated by a hyphen ("-").

Note: For example: 9EGG-5TGW:RDG-4TNI (total concentration 9 tenths, with 5 tenths of ridged grey-white ice and 4 tenths new ice).

Table 3. Ice-surface topography

<i>Abbreviation</i>	<i>Description</i>
LVL	level ice
RFT	rafted ice
HRFT	heavily rafted
RDG	ridged ice (hummocked)
HRDG	heavily ridged
ROTN	rotten ice

Other abbreviations to be used in the text are given in Table 4.

Table 4. Miscellaneous abbreviations

<i>Abbreviation</i>	<i>Description</i>
PRESS	ice pressure
LGT	light
FI-LEAD	lead along the fast ice
CSTL-LEAD	coastal lead
GT	greater than
LT	less than

PART II. SERVICES FOR COASTAL, OFFSHORE AND LOCAL AREAS

1. GENERAL

1.1 Marine meteorological service requirements

Note: This part describes the minimum standards for text products.

Marine meteorological services (MMS) for coastal, offshore and local waters should 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) Special transport in coastal areas;
- (e) Fishing;
- (f) Fixed or floating installations at sea;
- (g) Recreational boating.

Notes:

- 1. Provision of services relating to oceanographic and hydrographic information may be the responsibility of more than one national agency or authority.
- 2. The limits of coastal waters may be determined by the Member, in consideration of users' requirements in these waters. However, coastal waters are typically considered to be within the range of Sea Area A1 and within range of very-high-frequency (VHF) digital selective calling (DSC).
- 3. Offshore waters are typically defined as being beyond the coastal waters to a limit determined by the Member, notwithstanding the limitations of archipelagic waters or bounded sea areas (e.g. the Mediterranean, the Baltic).
- 4. Local waters mentioned in this chapter refer to ports, bays and harbours along with other specified near-shore marine operations requiring a specific service.
- 5. Coastal warnings for navigation purposes are defined in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*, and procedures for these products are described in Part IV of the present Manual.

1.2 Dissemination of information

Members should ensure rapid dissemination of information, in particular warnings, by means appropriate for the users, including existing and emerging communication technologies.

1.3 Coordination with neighbouring countries

Members should coordinate services for coastal, offshore and local areas, wherever possible, with those of neighbouring countries.

1.4 Coordination with services for the high seas

Members shall ensure that coastal, offshore and local services do not conflict with those for the high seas, in accordance with the procedures laid out in Part I of this Manual. Members responsible for METAREA coordination shall ensure that services are coordinated nationally and internationally in accordance with the procedures described in Part I of this Manual.

2. PRINCIPLES

The principles for the provision of general services shall be as follows:

- **Principle 1: General marine meteorological services for coastal, offshore and local areas shall be similar to those for the high seas, but modified according to local requirements;**
- **Principle 2: The efficiency and effectiveness of the provision of marine meteorological services shall be monitored by obtaining opinions and reports from marine users;**
- Principle 3: Members should provide marine meteorological services to meet user and broadcast requirements (considering the requirements of the Global Maritime Distress and Safety System (GMDSS) and the SOLAS Convention).

Note: Members can choose to provide the service in one product or in multiple products.

3. PROCEDURES

Marine meteorological services for coastal, offshore and local areas shall include:

- (a) Marine forecasts;
- (b) Synopses;
- (c) Meteorological warnings;
- (d) Sea-ice bulletins, where appropriate.

3.1 Issue of marine meteorological services

3.1.1 Coastal, offshore and local areas for which Members issue marine forecasts shall be clearly defined.

3.1.2 All marine meteorological services that are broadcast on marine radio should include the radio call term "SECURITE" at the beginning of the product.

3.1.3 Clear information identifying the relevant sub-area and issuing service shall be included.

Note: For example: "Marine weather bulletin for Raglan coastal waters issued by the New Zealand MetService".

3.1.4 Information on broadcast schedules and the content and forecast areas of marine meteorological services shall be conveyed to the WMO Secretariat.

Note: The WMO Secretariat will include this information in *Weather Reporting* (WMO-No. 9), Volume D – Information for Shipping.

3.1.5 Members should announce major changes in form and content of marine meteorological services prior to the effective date of the change, and leave enough time for mariners to be notified and official documentation to be updated.

3.1.6 Members shall determine criteria for amending and updating forecasts.

3.1.7 These criteria should focus on standard warning thresholds as a priority, and should consider national requirements where applicable.

3.1.8 Marine forecasts should be issued at least twice per day.

3.1.9 Wind information in plain language forecasts shall be given using the following format guidelines:

- (a) Wind direction shall be given in points of the compass and not in degrees;
- (b) Wind speed should be given in knots or metres per second, otherwise Beaufort notation should be used to describe wind force;

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

3.1.10 The unit of wind speed, wave height and visibility shall be referenced in the text of the message.

3.1.11 Warnings shall always be given in plain language. Synopses and forecasts shall be given in plain language for radio marine broadcast, but abbreviations may be used in messages received in text form on board (e.g. NAVTEX).

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

3.1.13 Members who provide a MAFOR style forecast shall follow the international standard.

Note: The *Manual on Codes* (WMO-No.306) provides the international standard.

3.2 Forecasts

3.2.1 The forecasts should contain the following items in the given order:

- (a) The date and time of issue;
- (b) The valid period of the forecast;
- (c) Name and designation of forecast area(s);
- (d) Warning status;
- (e) Synopses;
- (f) A description of:
 - (i) Wind speed or force and direction;
 - (ii) Visibility, when less than 6 nautical miles (10 kilometres) visibility is forecast;
 - (iii) Phenomena that may restrict visibility;
 - (iv) Ice accretion, where applicable;
 - (v) Waves (sea and swell).

Note: Marine forecasts may, in addition, include meteorological reports from selected coastal stations, ships and other sea stations.

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

3.2.3 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 of the beginning and end of the period.

3.2.4 The minimum valid period should be 24 hours from time of issue.

3.2.5 Visibility should be indicated in nautical miles or kilometres, or given in descriptive terms, as stated in Part I.

3.3 Synopses

3.3.1 Date and time of reference should be added to the synopsis of major features of the surface weather chart.

3.3.2 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. The location of significant fronts and troughs should be included whenever this helps to clarify the weather situation.

3.3.3 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.

3.4 Warnings

3.4.1 Warnings shall be given for the following phenomena:

- (a) Winds of gale force (Beaufort 8) and above;
- (b) Potentially hazardous ice accretion;
- (c) Unusual and hazardous sea-ice conditions.

3.4.2 Warnings should be given for the following phenomena:

- (a) Near gales (Beaufort force 7);
- (b) Severe thunderstorms/squall lines;
- (c) Restricted visibility (one nautical mile or less);
- (d) Storm-induced water-level changes;
- (e) Tsunami;
- (f) Harbour seiches.

Note: Warnings on phenomena may be the responsibility of more than one national agency or authority.

3.4.3 Warnings should include the times when unfavourable weather and sea conditions are expected to begin and end.

3.5 Content of warnings and order of items

3.5.1 Warnings shall contain the following items in the given order:

- (a) Type of warning;

- (b) **Date and time of issue;**
- (c) **Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;**
- (d) **Extent of affected area;**
- (e) **Description of the phenomena;**
- (f) **Type of disturbance (for example, low, hurricane, front) with a statement of central pressure in hectopascals;**
- (g) **Direction and speed of movement of disturbances.**

3.5.2 When warnings are included for more than one pressure disturbance or system, the warnings should be presented in a descending order of threat.

3.5.3 **Warnings shall be as brief, clear and complete as possible.**

3.5.4 **The time of the last location of each tropical cyclone shall be indicated in the warning.**

3.6 **Issue of warnings**

3.6.1 Members should issue warnings at least 18 hours prior to the onset of expected hazardous conditions for synoptic scale systems, and should broadcast them immediately.

3.6.2 **Warnings shall be updated whenever necessary and broadcast immediately.**

3.6.3 **Warnings shall remain in force until amended or cancelled.**

3.7 **Sea-ice information**

3.7.1 **Members shall issue sea-ice information services during the ice season.**

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

3.7.2 Sea-ice information services should include limit of ice, limit of icebergs, sea-ice concentration and stage of development.

3.7.3 Sea-ice terminology, codes and symbols that differ from or are in addition to international standards must be defined within the bulletin.

Note: *WMO Sea-ice Nomenclature* (WMO-No. 259) provides the accepted standard.

PART III. MARINE METEOROLOGICAL SUPPORT FOR MARITIME SEARCH AND RESCUE

1. GENERAL

Members should prepare meteorological services in support of Search and Rescue (SAR) following internationally specified requirements.

Note: Requirements for maritime SAR services are contained in the joint IMO/ICAO *IAMSAR Manual – International Aeronautical and Maritime Search and Rescue Manual*, obtainable from IMO and ICAO.

2. PRINCIPLES

2.1 Members should prepare meteorological services in support of SAR as a high priority for timely response.

2.2 Members should prepare meteorological services in support of SAR operations taking into account the specialized requirements for both aircraft and maritime operations.

Note: For the purpose of marine meteorological support for maritime SAR, a meteorological forecast centre may serve more than one Joint Rescue Coordination Centre (JRCC). Likewise, a JRCC may request information from more than one meteorological forecast centre depending on the nature of the maritime SAR operation.

3. PROCEDURES

3.1 General

3.1.1 **Members shall provide meteorological services for SAR in accordance with the national overall coordination procedures for SAR and taking into account the international recommendations and the requirements in force.**

3.1.2 Members should make procedural arrangements between Joint Rescue Coordination Centres (JRCCs) and meteorological forecast centres for the three phases of SAR operations:

- (a) Request for support;
- (b) Preparation of meteorological products;
- (c) Post-event review.

3.2 Request phase

3.2.1 **Members shall deal with requests from JRCCs as expeditiously as possible and such requests shall be given highest priority when a SAR operation is in progress.**

3.2.2 **On receiving formal notification from a JRCC that a ship, aircraft or survival craft is in distress, Members shall make every effort to meet the requirements of the JRCC.**

3.2.3 Members, working with a JRCC, should establish an agreed method for notification of SAR operations and all subsequent communications between the JRCC and the weather forecast centre. Communication by telephone should be established to confirm requests for support and to clarify requirements.

3.2.4 Members shall expect that special weather forecasts covering periods greater than 24 hours may be required for maritime SAR operations on a continental shelf and large ocean areas.

3.3 Preparation phase

3.3.1 When communicating with JRCCs or when providing weather forecasts, Members should use terminology similar to that used in weather bulletins and warnings to shipping and aviation.

3.3.2 Members shall ensure that meteorological products supplied to JRCCs include the period for which the forecast is valid.

3.3.3 Members should ensure that meteorological products supplied to JRCCs include reference to the search area to avoid confusion in the event of multiple search areas.

3.3.4 Members should ensure that information provided to a JRCC meets its request; it may include the following parameters:

- (a) Surface wind speed and direction;
- (b) Sea state;
- (c) Surface horizontal visibility;
- (d) Sea-surface temperature;
- (e) Tide and current information;
- (f) Sea ice;
- (g) Icebergs;
- (h) Ice accretion;
- (i) Precipitation and cloud cover, including height of cloud base;
- (j) Air temperature;
- (k) Turbulence;
- (l) Lowest QNH pressure (atmospheric pressure adjusted to sea level);
- (m) Icing;
- (n) Freezing level;
- (o) Upper-level wind speed and direction, temperature.

3.3.5 Members should also provide drift prognoses or the prognostic input data (wind and ocean currents) required by drift models during a SAR operation.

3.3.6 Members shall take into consideration the ranges prescribed in the *IAMSAR Manual*, used for planning aerial search paths, when specifying values for surface wind speed and horizontal visibility.

3.3.7 At the request of the JRCC, Members should provide historical values of wind speed and direction, sea-surface temperature and ocean currents to assist with search intelligence and survivability assessments.

Note: Some of the information to be provided may be the responsibility of more than one authority and will require coordination nationally.

3.3.8 Members should provide, in agreement with the JRCC, the required metocean parameters and, if available, the drift prognoses in a gridded or digital form that may be integrated into decision support tools used by the JRCC.

3.4 **Post-event phase**

Members, in collaboration with the JRCC, should conduct a post-event review to identify opportunities for improvements.

3.5 **Communication protocols**

3.5.1 Members should maintain a permanent record of all communications showing the times of origin, transmission and reception of the information provided.

3.5.2 Members should encourage ships taking part in any medium or long-term SAR operation, or in the vicinity of an SAR operation, to make weather observations at main and intermediate standard times. Members should request that the observations consist of surface synoptic observations and that they be transmitted immediately, either in the international ship code form or in plain language. Members should ensure that the information is transmitted either to the appropriate coastal radio station for onward transmission or through a Land Earth Station (LES) directly to a meteorological service.

PART IV. SUPPORT TO THE WORLDWIDE NAVIGATIONAL WARNING SERVICE

1. GENERAL

1.1 The IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) shall have the capability to provide relevant metocean information as input to NAVAREA warnings issued by NAVAREA Coordinators.

1.2 Members shall issue navigational warnings in response to international requirements.

Notes:

1. The specific international requirement is laid out in the SOLAS Convention, Chapter V, Regulation 4.
2. Full details of navigational warnings are described in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*, and all services are managed as set out in IMO Resolutions A.705(17) – Promulgation of Maritime Safety Information, and A.706(17) – Worldwide Navigational Warning Service.

2. ROLES AND RESPONSIBILITIES

2.1 Members should provide metocean information in support of navigational warnings, as required.

Notes:

1. Navigational warnings (18 identified hazard types) are identified in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*.
2. The main hazard types (identified in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*) with which WWMIWS can assist are drifting hazards, the impact of space weather on radionavigation services, and tsunamis and abnormal water levels.

2.2 Members should encourage METAREA Coordinators to work with NAVAREA Coordinators in order to establish and regularly review procedures to supply metocean information to the NAVAREAs.

3. GUIDANCE FOR NAVAREA WARNING TYPE (5) – DRIFTING HAZARDS

Members should, in coordination with the NAVAREA Coordinator, ensure that information can be provided on:

- (a) Icebergs;
- (b) Volcanic activity resulting in heavy ash or floating pumice.

Notes:

1. The information about icebergs will include the coordinate position or area of the icebergs.
2. The information about volcanic activity can be based on information from Volcanic Ash Advisory Centres (VAACs), and will include the coordinate position of the volcano eruption. Additional information about the area of ash plume or floating pumice can be provided if available.

4. **GUIDANCE FOR NAVAREA WARNING TYPE (12) – SIGNIFICANT MALFUNCTION OF RADIO OR SATELLITE COMMUNICATION SERVICES**

4.1 Members should, in coordination with the NAVAREA Coordinator, ensure that information about the impact of space weather can be provided.

4.2 Members should jointly determine the criteria for issuing warnings with the NAVAREA Coordinator.

5. **GUIDANCE FOR NAVAREA WARNING TYPE (16) – TSUNAMIS AND OTHER NATURAL PHENOMENA SUCH AS ABNORMAL CHANGES IN SEA LEVEL**

5.1 Members should, in coordination with the NAVAREA Coordinator, ensure that information about the risk of tsunami and abnormal water levels can be provided.

5.2 Members should jointly determine, with the NAVAREA Coordinator, the criteria for issuing warnings of abnormal changes in sea level.

Notes:

1. The NAVAREA warning of the risk of tsunami serves as an initial advice to mariners and is not updated. The mariner is expected to seek further information from local port masters or take effective action to stay safe.
 2. The information about the risk of tsunami will include a general description of the area affected.
 3. The information about abnormal water levels can include details of the residual water level anomaly and the area affected, which may pose a risk to ships navigating in shallow water or impact port operations at higher water levels.
-

PART V. SERVICES IN SUPPORT OF MARINE ENVIRONMENTAL EMERGENCY RESPONSE

1. GENERAL

The Global Data-processing and Forecasting System (GDPFS) shall be a framework to help develop and enhance the capacity of Members to provide a consistent level of metocean and drift information in the event of a range of marine environmental incidents, including:

- (a) Spills of oil and other noxious substances;
- (b) Discharges of radioactive material in marine and coastal zones;
- (c) Other marine environmental hazards (e.g. harmful algal blooms).

2 PROCEDURES

2.1 Members should provide specialized services at the request of national response agencies.

2.2 In coordination with appropriate national authorities, Members should provide historical and predicted information on:

- (a) Wind speed and direction;
- (b) State of the sea;
- (c) Visibility, both vertical and horizontal;
- (d) Tide height and time;
- (e) Sea currents and other oceanographic information.

2.3 Members should ensure that information about the state of the sea assists authorities in determining the safety of both shore-based and open-water operations.

2.4 Members should ensure that values for surface wind speed take into consideration any thresholds used for determining substance dispersant/mixing rates, and for containment planning.

2.5 Members should provide, in agreement with the national response agency, the required metocean parameters in a gridded or digital form that may be integrated into decision/planning support tools.

2.6 Members should also provide drift prognoses or the prognostic input data (wind and ocean currents) required by drift models during a marine pollution response operation.

PART VI. 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.

2. TRAINING OF MARINE METEOROLOGICAL PERSONNEL

2.1 Principles

The principles for the training of meteorological personnel in marine meteorology shall be 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: Training programmes shall be designed to address competencies specific to the provision of marine meteorological services in order to qualify or certify personnel;**
- Principle 3: International cooperation in the field of education and training in marine meteorology may be achieved through assistance in the form of short- and long-term fellowships; on-the-job training; assignment of experts to countries to help train personnel; training courses and instruction manuals; regional training seminars; and publication of suitable compendia of lecture notes and other guidance material specially intended for marine purposes.

2.2 Procedures

2.2.1 Members shall apply and make available the programme of training in marine meteorology to all classes of meteorological personnel (Classes I, II, III and IV) engaged in marine meteorological activities.

Note: Guidance on classification of meteorological personnel and curricula for their training is contained in *Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology* (WMO-No. 1083).

2.2.2 Members should ensure that the development and delivery of training programmes for marine meteorological personnel are enabled by qualified staff or experienced specialists.

2.2.3 Members should ensure that meteorological personnel engaged in training and in the provision of services in marine meteorology are familiar with marine user requirements.

Note: Specific arrangements could include the organization of sea voyages; visits to local marine radio bases for the purpose of familiarization; accompanying an inspection of weather equipment on a voluntary observing ship; or a visit to countries where well-established marine meteorological services are provided.

2.2.4 Members should ensure that their training material takes into account the internationally accepted training programmes for marine meteorological personnel.

2.2.5 Members should pay full attention to the use of virtual training material for marine meteorological training purposes.

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

2.2.7 Members should ensure that meteorological personnel are assessed against the required competencies.

3. METEOROLOGICAL TRAINING OF PORT METEOROLOGICAL OFFICERS

3.1 Principles

The objective of the meteorological training of a PMO is to keep up to date knowledge of the principles and organization of meteorological forecasting for the marine environment, the use of marine meteorological instruments and methods of observation on board ship, the use of codes and meteorological logbooks, as well as the procedures for recording and transmitting observations.

3.2 Procedures

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 the *Guide to the Global Observing System* (WMO-No. 488), Part III, Annex D.
3. Training requirements for ships' officers are specified in the IMO International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.

4. METEOROLOGICAL TRAINING OF SEAFARERS

4.1 Principles

The training of seafarers in the use and correct interpretation of marine meteorological information, especially Maritime Safety Information (MSI), is integral to the safety of navigation and efficiency of ship operations.

4.2 Procedures

4.2.1 Members that choose to assist navigational schools should ensure that information in basic marine meteorology meets the relevant requirements.

Note: The relevant requirements are defined in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, administered by IMO.

4.2.2 Members should arrange for the provision of suitable education and outreach material on the use and interpretation of marine weather services, in the light of standard textbooks and special publications issued by WMO.

PART VII. SERVICES FOR MARINE CLIMATOLOGY

1. INTRODUCTION

1.1 General purpose and societal applications of marine climatology

Note: Marine climatology today supports transport, maritime industry and fisheries, engineering, energy production, tourism, insurance, coast management, disaster risk reduction planning, and basic and applied sciences with data and information about the atmosphere over the ocean, the marine environment, including sea ice, and the ocean-atmosphere interactions. Growing interest in climate services (e.g. engineering design studies, planning of marine operations, expertise in insurance claims or official investigations regarding marine accidents, cargo ventilation studies and support to energy production) and studies of climate change have increased the demand for marine climatological data. A comprehensive account of the uses of marine climatology can be found in the *Guide to the Applications of Marine Climatology* (WMO-No. 781), and in *Advances in the Applications of Marine Climatology - The Dynamic Part of the WMO Guide to the Applications of Marine Climatology* (JCOMM Technical Report No. 13 rev. 2, WMO/TD-No. 1081).

1.1.1 Members should address the end user requirements for appropriate marine meteorological and oceanographic climatological data, and particularly the requirements for long-term climate monitoring, sub-seasonal to longer predictions, climate services and ocean observation.

1.1.2 **Members shall follow the technical regulations and procedures described in this Part when collecting, processing, archiving, exchanging, and providing to end users marine climatological data, summaries and products.**

1.2 Modernization of the Marine Climatological Summaries Scheme

Note: A modernization of the former Marine Climatological Summaries Scheme (MCSS), established in 1963, was promoted by JCOMM to take into account the actual evolution of marine climatological practices and new sources of data (e.g. data buoys, oceanographic data, satellite data). The historical background and details of such modernization is provided in the *Guide to Marine Meteorological Services* (WMO-No. 471), 9.1.2. The Marine Climate Data System (MCDS) is now replacing the MCSS, which has been declared obsolete by the fifth session of JCOMM (2017).

Members playing a role in MCDS shall follow the technical regulations described in section 2 below.

1.3 Purpose and scope of the Marine Climate Data System

Note: The Marine Climate Data System is meant to formalize and coordinate the activities of existing systems and to address gaps in order to produce a dedicated WMO-Intergovernmental Oceanographic Commission (IOC) operational data system with a view to compiling coherent marine meteorological and oceanographic (metocean) climate datasets of known quality, extending beyond the Essential Climate Variables (ECVs) (information on ECVs can be found in [The Global Observing System for Climate: Implementation Needs \(GCOS-200\)](#)). The data and metadata are collected from multiple sources to be served on a free and unrestricted basis to end users.

1.3.1 **The objective of MCDS shall be to improve the timeliness of metocean climate data and metadata, facilitate the exchange of metocean climate datasets between countries, and thereby increase the amount of metocean observations eventually made available for the relevant end user applications.** Furthermore, integrated data and metadata are made available and contain comprehensive dataset information such as historical details on current and past data codes and formats. The Marine Climate Data System extends to products that satisfy the metocean climate data requirements for climate monitoring, forecasting and services.

Note: The Marine Climate Data System requires state-of-the-art integrated and standardized international systems for the improved data and metadata flow and management of a wide range of metocean climate data. This includes integrating collection, rescue, quality control, formatting, archiving, exchange and access of in-situ and remote sensing sources. The Marine Climate Data System is based on improved quality management and documented processes and procedures, using higher-level quality control, added value data processing, including bias correction, and comparison of the observations with satellite and meteorological and oceanographic model gridded fields. The data management structure is standardized, well-defined and documented (see the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1, and *The Marine Climate Data System*, JCOMM Technical Report No. 85 (in preparation) for existing and new data, and state-of-the-art marine climate and statistical products).

1.4 **Ensuring the flow of metocean data to long-term archives**

Members shall make their essential metocean data (observations and metadata) available through MCDS in order for these data to be processed according to MCDS recommended procedures and reach long-term archives for their use in marine climatology applications.

2. **THE MARINE CLIMATE DATA SYSTEM**

2.1 **Overview of data flows**

2.1.1 The role and responsibilities of Data Acquisition Centres (DACs), Global Data Assembly Centres (GDACs), and Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs) are defined in such a way as to ensure the proper and efficient functioning of MCDS. Metocean data are routinely collected from various sources, data are processed, agreed quality control procedures are applied at various levels, and integrated products are delivered to end users. **Each MCDS centre shall be responsible for the consistency and completeness of the data acquired from the multiple sources or centres at the previous level, prior to providing them to the centre at the next level or to users, as outlined in Figure 4.**

2.2 **Generic roles and responsibilities**

2.2.1 **Data Acquisition Centres**

The Data Acquisition Centres shall receive data from various sources (listed in the note under 2.2.3.6 below) in agreed formats and in real time and/or delayed mode. Agreed quality checks, as defined in the scope of the DACs (see *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1, 2.1.3), shall be applied, duplicate records identified and data forwarded to the appropriate GDAC.

Note: The Terms of Reference for MCDS DACs are laid out in the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1.

2.2.2 **Global Data Assembly Centres**

2.2.2.1 The Global Data Assembly Centres shall acquire all data streams from their DACs, on the basis of terms defined between the centres; they shall identify and remove duplicate observations and combine the data to establish a complete dataset.

2.2.2.2 The Global Data Assembly Centres shall perform agreed additional quality checks and forward the data along with reference metadata and additional quality flags to the CMOC, in agreed formats, ensuring that different versions of single observations are identified and linked.

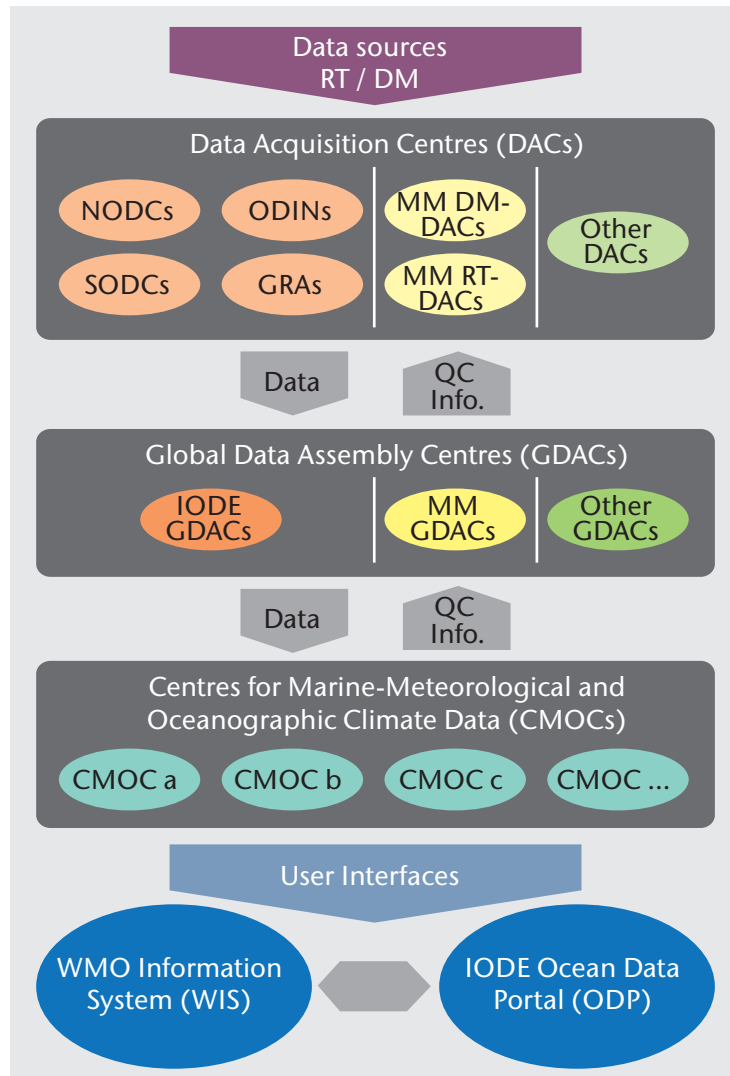
Note: In some cases, a GDAC may also perform the functions of a DAC, such as collection of data from individual platforms.

2.2.2.3 Where the defined scope of active GDACs is similar, the centre shall network with each other, establishing regular comparisons, and take action to ensure overall consistency of the data assembled.

Note: The Terms of Reference for MCDS GDACs are laid out in the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1.

2.2.3 Centres for Marine Meteorological and Oceanographic Climate Data

2.2.3.1 The Centres for Marine Meteorological and Oceanographic Climate Data shall collect data from GDACs and other sources, undertake data rescue, apply documented higher-level quality control and bias corrections as needed, and make integrated datasets and products available to the MCDS User Interface (MCDS-UI).



Key:

- | | |
|---|---|
| DM = Delayed mode data | ODINs = Ocean Data and Information Networks |
| GRAs = GOOS Regional Alliances | QC = Quality Control |
| MM = Marine-Meteorological | RT = Real-time data |
| NODCs = IODE National Oceanographic Data Centre | SODCs = IODE Specialized Ocean Data Centre |

Figure 4. Marine Climate Data System data flows, from source to users

2.2.3.2 The Centres for Marine Meteorological and Oceanographic Climate Data shall network with each other, complement each other, to ensure overall consistency of the data that are served, and shall mirror their datasets when appropriate.

2.2.3.3 Data and metadata shall be stored in line with defined standards to ensure data integrity and universal interoperability.

Note: The Centres for Marine Meteorological and Oceanographic Climate Data provide end users with data and products and expert advice on the use of such data and products. In some cases, a CMOC may also perform the functions of a GDAC.

2.2.3.4 The Centres for Marine Meteorological and Oceanographic Climate Data should also collect data from partner organizations such as the International Oceanographic Data and Information Exchange (IODE) of IOC and its network of National Oceanographic Data Centres (NODCs), Associated Data Units and GDACs, and encourage partner organizations to become members operating under the JCOMM MCDS.

2.2.3.5 The Centres for Marine Meteorological and Oceanographic Climate Data shall investigate the domain of cooperation with Members in their area of responsibility.

2.2.3.6 Centres shall make data and products available through a MCDS-UI. The MCDS-UI shall be interoperable with the WMO Information System (WIS) and/or IODE Ocean Data Portal (ODP).

Notes:

1. Examples of MCDS data sources:
 - (a) Ship-based observations;
 - (b) Profiling floats and gliders;
 - (c) Data buoys;
 - (d) Sea-level observing stations;
 - (e) Wave observations;
 - (f) Polar observations, including iceberg information and ice charting;
 - (g) Surface ocean observations from Earth-orbiting satellites.
2. The capabilities and corresponding functions of CMOCs are provided in the [appendix](#) to this part of the Manual.

2.3 Designation and evaluation process

2.3.1 The governance structure for defining the designation procedure, functions and evaluation process for MCDS centres (i.e. DACs, GDACs, and CMOCs) shall be recommended by JCOMM and adopted by both the WMO and IOC Executive Bodies. The detailed designation and evaluation process for DACs and GDACs is provided in the *Guide to Marine Meteorological Services* (WMO-No. 471), 9, 9.3.7. The detailed designation and evaluation process for CMOCs is provided in the [appendix](#) to this part of the Manual, 4.6.

2.3.2 The host of a candidate DAC, GDAC or CMOC shall produce a statement of compliance with requirements and commitments, list and demonstrate the capabilities of the proposed centre, state the scope of the data and/or products managed by the centre and state the formal commitment to hosting the centre in line with the terms of reference of each specific centre.

2.3.3 The JCOMM MCDS Evaluation Committee shall comprise at least three members, including at least one from IOC (preferably from the IODE) and one from WMO.

2.3.4 The JCOMM MCDS Evaluation Committee shall evaluate the application. A unanimous decision is required for approval.

2.4 Quality management

All DACs shall apply minimum quality control (e.g. minimum quality control standards (MQCS)) for ship data as detailed in the *Guide to Marine Meteorological Services* (WMO-No. 471), 9.2.2, before providing the data to the GDACs. These should provide feedback on the minimum quality control to the DACs and may apply additional higher-level quality control (e.g. higher-level quality control standards (HQCS)) for ship data as detailed in the *Guide to Marine Meteorological Services*. **The Centres for Marine Meteorological and Oceanographic Climate Data shall apply additional higher-level quality control, as defined by the CMOCs, and provide feedback to the GDACs.**

Note:

1. Members participating in the MCDS, operating DACs, GDACs and CMOCs should adhere to the *Technical Regulations* (WMO-No. 49), Volume I, Part VII, when implementing a quality management system (QMS).
2. Members should consult the *Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services* (WMO-No. 1100) or the *IODE Quality Management Framework for National Oceanographic Data Centres, Manuals and Guides 67* (Paris: Unesco, 2013) when setting up a QMS.
3. The International Oceanographic Data and Information Exchange, through Recommendation IODE-XXII.18, has established guidance for NODCs that addresses the implementation of QMSs to ensure that NODCs acting as GDACs provide data and services in compliance with IOC Oceanographic Data Exchange Policy.

2.5 Metadata

2.5.1 Members shall comply with the Technical Regulations defined in the *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160) with regard to the provision of WIGOS metadata so that such metadata are submitted to the MCDS.

2.5.2 Members shall compile and archive lists of their platforms and associated observational metadata in agreed formats. For the Voluntary Observing Ships (VOSs), the metadata shall be as defined in the *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47).

2.5.3 Members shall submit the agreed metadata to the appropriate repository in a timely manner (e.g. quarterly to WMO for the VOS metadata).

2.6 Data rescue

Members shall support data rescue activities where feasible and shall follow international best practices (see *Guidelines on Best Practices for Climate Data Rescue* (WMO–No. 1182)) such as those recommended by the WMO Commission for Climatology (CCI) Expert Team on Data Rescue (ET-DARE), with regard to climate data and database modernization activities. Those areas include cataloguing new sources of data, providing digitization services or coordinating with crowdsourcing groups (see, for example, the [Old Weather project](#)).

2.7 Data storage and access

Notes:

1. Long-term commitments for preservation and accessibility of metocean data are needed to safeguard present and future holdings against loss or degradation.
2. A key element within the MCDS operation is the long-term archive in support of climate services and studies of climate change and variability.

2.7.1 Data, metadata and information relevant to MCDS shall be archived in formal long-term archives, made publicly available, and shall be interoperable with WIS and/or IODE ODP.

2.7.2 As part of MCDS, a CMOC shall make all its data, metadata and products available to the international research community in a way consistent with the relevant WMO and IOC data policies. Where applicable, software should also be shared.

2.7.3 Data and products managed within a CMOC shall be subject to version control using procedures agreed upon within the MCDS.

2.7.4 Data from MCDS Members shall be in agreed and documented archival formats, such as the International Maritime Meteorological Archive (IMMA) format, as defined in their scope, and of known quality.

3. MARINE CLIMATOLOGY PRODUCTS AND SERVICES

3.1 Metocean observations from Members support a wide spectrum of climate products. These can be generally categorized as compiled datasets, gridded analyses or statistical summaries. For definitions and examples, see the *Guide to Marine Meteorological Services* (WMO-No. 471).

Note: Metocean climate products are required to support a range of applications that are outlined in the *Guide to Marine Meteorological Services* (WMO-No. 471), 9, and the *Guide to the Applications of Marine Climatology* (WMO-No. 781).

3.2 Members shall provide data and metadata to the appropriate DACs within the MCDS to support the development of metocean climate products. Development of such products is among the responsibilities of CMOCs as outlined in the CMOC capabilities and corresponding functions (see the appendix to this part of the Manual, 4), but also frequently undertaken by the research community.

3.3 Members should provide expertise in collaboration with relevant CMOCs and the appropriate expert teams within WMO to ensure that the products created are relevant to the Members' user communities.

Note: The access policy for marine climate data products shall comply with existing WMO and IOC resolutions on data exchange policies (respectively Resolution 40 (Cg-XII) and IOC -XXII-6).

4 PROVISION OF METOCEAN INFORMATION AND EXPERT ADVICE

4.1 The provision of metocean and related oceanographic information and expert advice on the use and interpretation of historical data and related products should be arranged in accordance with national practices.

4.2 Metocean data shall be preserved by Members in a form that renders these data easily accessible for use in applications requiring expert advice.

Note: One of the main purposes for which metocean data are preserved is their use in the computation of climatologies and long-term trends to serve the applications listed in section 1.1 of this Part.

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

4.4 The supply of metocean data for special application purposes should be governed by the provisions on exchanges of climatological data contained in the WMO Technical Regulations.

APPENDIX VII.1. MARINE CLIMATE DATA SYSTEM CENTRES: SCOPE, DESIGNATION AND EVALUATION

1. SCOPE AND GOVERNANCE

1.1 Each candidate host of a Marine Climate Data System (MCDS) centre shall submit a statement of compliance and evaluation criteria demonstrating how it will meet the required capabilities and fulfil the functions proposed by the centre and endorsed by JCOMM, the WMO Congress or Executive Council, and by the IOC/UNESCO Assembly or Executive Council.

1.2 A designated JCOMM Marine Climate Data System Evaluation Committee shall then evaluate the request, considering to what extent the candidate centre meets the capabilities, functions and tasks described in the relevant terms of reference.

1.3 Generic capabilities to be assessed for all centres include having the necessary infrastructure to fulfil the approved functions and the ability to apply defined international standards for data management. **Centres for Marine Meteorological and Oceanographic Climate Data shall be interoperable with the WMO Information System (WIS) and/or the International Oceanographic Data and Information Exchange (IODE) Ocean Data Portal (ODP).**

Evaluation results are then provided to the applicant centre by the MCDS Evaluation Committee.

1.4 For each centre, functions should be assessed within the confines of its agreed scope. Functions are described in full for each centre in the appropriate terms of reference.

1.5 Each centre shall submit to the JCOMM Management Committee, through the Data Management Coordination Group (DMCG), an annual report on its status and the activities carried out, as outlined in the scope of its functions. The progress of the MCDS centre will be assessed and recommendations will be provided to the centre.

Note: A comparison of the capabilities, functions and tasks of each centre is included in the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1.

2. DATA ACQUISITION CENTRES

Notes:

1. The Terms of Reference of the DACs and their Evaluation Criteria are provided in the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1.
2. The governance structure for defining the functions and designation procedure of each centre is proposed by JCOMM and endorsed by the WMO Congress or Executive Council and by the IOC/UNESCO Assembly or Executive Council.

2.1 The host of a candidate DAC shall produce a statement of compliance with requirements and commitments, list and demonstrate the capabilities of the proposed centre, state the scope of the data and products managed by the centre and state the formal commitment to host the DAC.

Note: The purpose of DACs is to receive and gather meteorological and oceanographic data (real-time or delayed-mode) and metadata directly from the observation platforms.

2.2 Each DAC shall be responsible for data from a single or multiple platform types.

2.3 Data Acquisition Centres shall collect metadata from the observational platforms within their area of responsibility where feasible, apply agreed minimum quality control, provide feedback to platform operators, identify and manage duplicate records, and forward data and metadata to appropriate GDACs, in agreed formats and defined timescales.

Note: The Guide to Marine Meteorological Services (WMO-No. 471), Appendix 1, includes a list of DACs.

3. GLOBAL DATA ASSEMBLY CENTRES

Notes:

1. The Terms of Reference of GDACs and their Evaluation Criteria are provided in the *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1.
2. The governance structure for defining the functions and designation procedure of each centre is proposed by JCOMM and endorsed by the WMO Congress or Executive Council and by the IOC/UNESCO Assembly or Executive Council.

3.1 The host of a candidate GDAC shall produce a statement of compliance with requirements and commitments, list and demonstrate the capabilities of the proposed centre, state the scope of the data and products managed by the centre and state the formal commitment to host the GDAC.

Note: The purpose of GDACs is to receive and assemble meteorological and oceanographic data and metadata from one or more DACs.

3.2 Each GDAC shall collect data from one or multiple platform types.

3.3 Global Data Assembly Centres shall collect and/or receive metadata directly from DACs and possibly other sources, shall flag or link like-for-like observations that may exist in datasets provided by different DACs, provide feedback to DACs and apply agreed additional quality control before forwarding data and metadata to appropriate CMOCs in agreed formats and defined timescales.

Notes:

1. The *Guide to Marine Meteorological Services* (WMO-No. 471), Appendix 1, includes a list of GDACs.
2. The former MCSS Global Collecting Centres (GCCs) are automatically evolving into MCDS GDACs.

3.4 While mirroring is not a mandatory function for GDACs, it can be done and, when it is, it must be detailed in the scope and work plan of the GDACs as appropriate.

4. CENTRES FOR MARINE METEOROLOGICAL AND OCEANOGRAPHIC CLIMATE DATA

4.1 General

4.1.1 The marine meteorological and oceanographic climate data collected from multiple sources and made available through the MCDS shall be of known quality, and shall be served on a free and unrestricted basis to end users through a global network of less than ten WMO-IOC CMOCs. Data, metadata and information shall be fully interoperable with WIS and IODE ODP, and shall be compatible with other types of climatological data.

Notes:

1. A CMOC covers different and specific JCOMM data domains (e.g. marine meteorology, physical oceanography, historical period(s), geographical coverage, specific procedures applied to the data) and helps enhance international partnerships.

2. The primary objectives of the network of CMOCs are to improve availability, recovery and archiving of contemporary and historical data, metadata and products, and to obtain standardized quality of a high level in a more timely manner. These objectives ensure the long-term stability of the data management system, permit the sharing of responsibility and expertise, help optimize resources and prevent loss from technological failures.

4.1.2 Groups of CMOCs shall operate within a given data domain (e.g. global, regional, atmospheric, surface and sub-surface oceanic) and provide complementary functions. To achieve maximum continuity, reliability and completeness of data, metadata and products, specialized CMOCs are also established for mirroring the processes, data and metadata across the CMOC domain.

4.2 Capabilities and corresponding functions

4.2.1 A CMOC shall have the following capabilities and corresponding functions:

Capabilities

- (a) Each centre shall have, or have access to, the infrastructure, facilities, experience and staff required to fulfil the approved functions;
- (b) Each centre shall have, or have access to, interoperability with the WIS and/or IODE ODP;
- (c) Each centre shall be able to apply defined international data and quality management standards;
- (d) Mirroring CMOCs shall be able to actively and reliably mirror (i.e. maintain mutually consistent) data, metadata and products, as agreed within the CMOC network;

A recognized authority designated by JCOMM will be assessing each centre, at least once every five years, to verify whether it meets the necessary capabilities and performance indicators as agreed by the Commission.

Corresponding functions

- (a) Each centre shall contribute to WMO and IOC applications, for example, by rescuing, collecting, processing, archiving, sharing, distributing and mirroring worldwide marine meteorological and oceanographic data and metadata documented in appropriate WMO and IOC publications;
- (b) Each centre shall provide advice to Members in response to enquiries regarding standards and best practices, for example, for data rescue, collection, processing, archiving and distribution of marine meteorological and oceanographic data, metadata and products;
- (c) Each centre shall make datasets, and corresponding metadata maintained as part of its scope, available and discoverable through WIS and/or IODE ODP;
- (d) All CMOCs shall communicate and liaise closely within the network, particularly on the development of quality processes and procedures, through meetings held on a regular basis;
- (e) Each centre shall apply appropriate data processing and quality control procedures, and generate the required products within its scope;
- (f) Following the procedures documented in the relevant WMO and IOC publications, all centres within the CMOC network shall closely cooperate in the rescue, exchange, processing and archiving of marine meteorological and oceanographic data, metadata and products;

- (g) **Each centre shall undertake its defined core functions and replicate data from other centres that are appropriate to its domain**, so that the set of data and products offered from the CMOC network is mutually consistent when accessed from any individual centre;
- (h) **Specialized CMOCs shall mirror data, metadata, products and processes at defined timescales**; the method of mirroring will be agreed upon among mirroring centres;
- (i) **All kinds of data, metadata and processes managed within a CMOC domain shall be subject to a stringent version control (e.g. Digital Object Identifier (DOI))**;
- (j) **Each centre shall report, on an annual basis, to the JCOMM Management Committee on the services offered to Members and the activities carried out**. The Commission should, in turn, keep the WMO Executive Council and the IOC/UNESCO Assembly informed on the status and activities of the CMOC network as a whole, and propose changes as required.

4.3 **Data and software policy requirements**

A CMOC shall make all data, metadata and products falling within the scope of the CMOC network freely and openly available to the international research community in a way consistent with WMO Resolution 40 (Cg-XII) and IOC Resolution IOC-XXII-6. Where applicable, software should also be made openly and freely available.

4.4 **Establishment, governance and withdrawal**

Note: The governance structure for defining the functions and designation procedure of each centre is proposed by JCOMM and endorsed by the WMO Congress or Executive Council and by the IOC/UNESCO Assembly or Executive Council. The approach recommended by JCOMM for endorsing the establishment of a CMOC and for withdrawing an existing centre is described in the *Guide to Marine Meteorological Services* (WMO-No. 471), 9.3.7.

The host of a candidate CMOC shall produce a statement of compliance with requirements and commitments, list and demonstrate the capabilities of the proposed centre, state the scope of the data and products managed by the centre, and state the formal commitment to host the centre.

4.5 **List of established Centres for Marine Meteorological and Oceanographic Climate Data**

The table below provides the list of established CMOCs with their scope.

<i>CMOC</i>	<i>Scope</i>
National Marine Data and Information Service (NMDIS) of the State Oceanic Administration (SOA), Tianjin, China	Collection of marine meteorological and oceanographic climate data in the Asia-Pacific region, and data rescue Capacity-building in the Asia-Pacific region Mirroring with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS)

4.6 Accreditation and evaluation

4.6.1 ***Accreditation of a new Centre for Marine Meteorological and Oceanographic Climate Data***

4.6.1.1 The agency proposing to host a CMOC shall follow the procedures listed here. It shall prepare a document that clearly addresses all of the obligations and corresponding functions described in Annex 2 to Recommendation 2 (JCOMM-4) and in Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology, Fourth session, *Executive summary of the abridged final report with resolutions and recommendations* (WMO-IOC/JCOMM-4/3, WMO-No. 1093), hereafter referred to as Executive Summary of JCOMM-4. Explicitly, this should include descriptions of the proposed outcomes and outputs (services, products) and how these would contribute to WMO and IOC requirements for managing marine meteorological and oceanographic climatological data. The proposing agency should also describe what their annual report will contain.

4.6.1.2 Further actions will proceed as described in Annex 3 to Recommendation 2 (JCOMM-4) and in the Executive Summary of JCOMM-4 (WMO-IOC/JCOMM-4/3, WMO-No. 1093).

4.6.2 ***Terms of Reference of the CMOC Accreditation Committee***

4.6.2.1 An independent committee consisting of at least three members appointed by the JCOMM Data Management Coordination Group shall conduct the accreditation of a candidate CMOC.

4.6.2.2 The Committee shall:

- (a) Elect a chairperson;
- (b) Review the documentation submitted by the candidate CMOC, paying special attention to the accreditation criteria. The proposal will be judged against each of the criterion and will be scored as described in 4.6.3 below. For accreditation, a candidate needs to satisfy the committee that all criteria are fully met; there must be unanimity among committee members;
- (c) Decide what expressions of support are appropriate for a proposal, and from which groups (criteria 2 and 3). The rationale will be explained in the committee report;
- (d) If required, designate someone to consult or visit the candidate CMOC in order to:
 - (i) Inform the candidate about possible elements that need to be clarified, and seek clarification;
 - (ii) Verify specific functions and capabilities of the candidate CMOC;
 - (iii) Negotiate needed changes to the proposed statement of compliance and commitment;
 - (iv) Submit a report with recommendations to the Committee within the time period specified in Recommendation 2 (JCOMM-4) and its annexes;
- (e) Prepare a written report of its evaluation explaining the results. In particular, if the proposed statement of compliance and commitment does not meet one or more criteria, the Committee shall explain its reasons and may suggest a possible remedy;
- (f) Submit the report to the JCOMM Data Management Coordination Group and to the authors of the statement of compliance and commitment;

- (g) **Upon request, provide copies of the proposed statement of compliance and commitment and evaluation report to any JCOMM or IODE member.**

4.6.2.3 The Chairperson of the Committee shall report the results of the evaluation to the JCOMM Data Management Coordination Group.

4.6.2.4 Membership of the Committee:

- (a) IODE Representative;
- (b) JCOMM Representative (WMO side);
- (c) Other representative(s) as needed.

4.6.3 Accreditation criteria

The obligations, capabilities and functions of a CMOC are extensively described in Annexes 2 and 3 of Recommendation 2 (JCOMM-4) and in the Executive Summary of JCOMM-4 (WMO-IOC/JCOMM-4/3, WMO-No. 1093). The following criteria have been devised to test whether the requirements are met. They are presented in the form of questions for which a simple “yes” or “no” is possible. Generally, if there is uncertainty surrounding a “yes” response, the criterion should be judged as unmet. In cases where a criterion is considered unmet, discussions with the Accreditation Committee on the possibility of proceeding with the establishment of a CMOC while simultaneously addressing the unmet criterion is possible and will be considered on a case-by-case basis.

1. Does the scope of activities (rescue, collection, quality control, calibration and bias correction, processing, archiving, sharing, distribution and mirroring of data, metadata, products and services) unnecessarily overlap with that of an agency operating within the MCDS, an IODE National Oceanographic Data Centre (NODC), the High-Quality Global Data Management System for Climate, an existing International Science Council’s World Data System (ISC-WDS) centre or some other well-established data management activity? If so, is the added value of the overlap activity well explained and does it warrant the establishment of the CMOC?
2. If the scope of activities is regional, is there evidence of support from Members from the region (e.g. expressions of support)?
3. Does the proposal for the CMOC clearly explain how its activities will be coordinated with other relevant, existing systems (e.g. by means of well described procedures, letters of cooperation, expressions of support from major data providers)?
4. Is the proposed CMOC activity well defined, scientifically sound (e.g. supported by a publication record) and does it fill a clearly articulated and real gap in formal WMO or IOC data management activities?
5. Are the variables to be treated as Global Climate Observing System (GCOS) Essential Climate Variables (ECVs)? If they are, is the added value that the proposal brings to the management of these variables sufficient to warrant the overlap and the creation of a CMOC?
6. Are the processes for assessing and assigning quality indicators well documented, and is this documentation easily available?
7. Will the proposed procedures ensure that the quality within the CMOC datasets is internally consistent?
8. Are there any restrictions on access to the data, metadata and information served by the proposed CMOC? If so, do these go against the spirit of free and unrestricted access?

9. Are the infrastructure, experience, financial resources and assigned staff of the proposed CMOC sufficient to meet the planned operations?
10. Interoperability means that the data, metadata and information are widely visible and available through the WIS and/or IODE ODP. Will this interoperability function be met by the proposed CMOC?
11. Does the CMOC proposal clearly describe the data domains of its operations in terms of data type(s), geographic and temporal coverage?
12. Are there any domain-specific procedures to be applied by the proposed CMOC? If so, is their purpose (e.g. enhancing interoperability, ensuring data quality and consistency, improving access, improving coordination) well described, useful, and is documentation of these procedures easily available?
13. Are the proposed procedures, standards and best practices suitable and adequate for data quality and management? Where applicable, are the procedures of the [Ocean Data Standards and Best Practices](#) going to be used? If not, is a new standard or best practice submitted for consideration?
14. Is there a clear description of what the CMOC will undertake to mirror its processes, data and metadata? Is there evidence (for example, a letter of agreement) of a cooperative arrangement with an existing CMOC or another established and ongoing data management system for this mirroring?
15. Is the mirroring process sufficiently robust to be reliable and timely?
16. Are the proposed methods for version control of data sufficient to distinguish identical copies of data from near-identical copies?
17. Are the proposed methods for version control of metadata sufficient to distinguish different versions of metadata?
18. Are the proposed methods for version control of processes sufficient to ensure that data users are certain about the processing steps through which data have passed?

4.6.4 ***Annual reporting and performance indicators***

4.6.4.1 These are intended to demonstrate that the CMOC is meeting its obligations and fulfilling its functions. The CMOC will report in writing to the Chairperson of the JCOMM Data Management Coordination Group annually, no later than 28 February of each year. Any other useful information on the operations of the CMOC in the past year is welcome. Reports should be limited to 20 pages or less and can be drafted using the following template:

- Summary;
- Background;
- Operations: changes in infrastructure, data processing and provision, staff, etc.;
- Annual statistics;
- MCDS relations/interactions;
- Scientific/data processing issues;
- Outlook/recommendations

4.6.4.2 The following information should be included in the report:

- (a) Statistics on the type and volume of data processed in the past year compared with previous years of operation. If reprocessing of data already received in a previous year is included in these statistics, an explanation of the reasons for reprocessing should be given;
- (b) If CMOC operations have been changed to include new kinds of data, metadata and products or to exclude previously handled items, an explanation for the changes should be given;
- (c) Statistics on the type and volume of data, metadata and products actually served in the past year compared to previous years of operation. If there have been changes in serving operations, an explanation should be given. Data and information served through WIS and/or IODE ODP should be clearly described;
- (d) A description of the mirroring functions of the CMOC both for its own data and metadata and in support of another CMOC. Statistics to demonstrate the robustness and timeliness of the mirroring operations should also be provided;
- (e) Information on the coordination activities undertaken with other CMOCs, NODCs, the High-Quality Global Data Management System for Climate, an existing ISC-WDS centre or with another established data management system;
- (f) A description of any changes in infrastructure or staff in the past year;
- (g) If one or more variables are GCOS ECVs, a description of the coordination activities carried out with the data system handling the ECVs should be provided and an explanation of the value added operations provided by the CMOC for these variables should also be given;
- (h) An updated list of documents on quality management, standards or best practices used at the CMOC. The documents produced or updated in the past year should be highlighted and a description of how all documentation is made available should be provided;
- (i) If there have been any noticeable changes in aspects of the data received and processed in the past year (e.g. quality, timeliness, new instrumentation) compared to previous years, a description of the changes should be given and the reason explained. A description of any actions taken as a result of these changes should also be given;
- (j) If there have been any changes in access restrictions to data, metadata, products or services, an explanation should be given;
- (k) Statistics by type of data on the spatial and temporal coverage of the data managed by the CMOC during the past year compared to previous years;
- (l) A description of any changes in the processing of data or information during the past year, with the reason for those changes;
- (m) A description of how the activities of the CMOC reflect common procedures employed by others in the CMOC network;
- (n) An account of any interactions with other individuals or organizations where the CMOC responded with assistance or provided advice to Members regarding standards and best practices (e.g. on data rescue and on collection, processing, archiving and distribution of marine meteorological and oceanographic data, metadata, and products);
- (o) A list of citations or statements from users that show usage of the CMOC operations, products or services.

4.6.5 ***Terms of Reference of the Review Committee for an existing Centre for Marine Meteorological and Oceanographic Climate Data***

4.6.5.1 An independent committee consisting of at least three members appointed by the JCOMM Data Management Coordination Group shall conduct the review of an existing CMOC.

4.6.5.2 The Committee shall:

- (a) Elect a chairperson;
- (b) Consider the annual reports from the CMOC under review. The reports shall be used to evaluate whether the CMOC is continuing to meet all of the criteria used in the original evaluation. If there have been changes in the accreditation criteria, these shall also be used. As necessary, the Committee may seek additional information from the CMOC on its activities. The Review Committee may also wish to read the report of the Accreditation Committee and any previous reviews of the CMOC. All of these documents should be made available by the CMOC;
- (c) If required, designate someone to consult and/or visit the CMOC in order to:
 - (i) Inform the centre about possible elements that need to be clarified, and seek clarification;
 - (ii) Verify specific functions and capabilities of the CMOC;
 - (iii) Negotiate needed changes to the proposed statement of compliance and commitment;
 - (iv) Submit a report with recommendations to the Committee within the time period specified in Recommendation 2 (JCOMM-4) and its annexes.
- (d) Prepare a written report of its evaluation that explains the results. In particular, if the Committee deems that the proposed statement of compliance and commitment does not meet one or more criteria, it shall explain why and may suggest a possible remedy;
- (e) Submit the report to the JCOMM Data Management Coordination Group and to the authors of the statement of compliance and commitment;
- (f) Upon request, provide copies of the proposed statement of compliance and commitment and evaluation report to any JCOMM or IODE member.

4.6.5.3 The Committee may suggest enhancements (e.g. new or improved products) to the operations of the CMOC though the CMOC is not obliged to implement them.

4.6.5.4 The Chairperson of the Committee shall report the results of the evaluation to the JCOMM Data Management Coordination Group.

4.6.5.5 Membership of the Committee:

- (a) IODE Representative;
- (b) JCOMM Representative (WMO side);
- (c) Other representative(s) as needed.

4.6.6 ***The review process for an existing Centre for Marine Meteorological and Oceanographic Climate Data***

4.6.6.1 **General**

4.6.6.1.1 Annex 3 to Recommendation 2 (JCOMM-4) and the Executive Summary of JCOMM-4 (WMO-IOC/JCOMM-4/3, WMO-No. 1093) state that the performance of an existing CMOC will be reviewed once every 5 years by the JCOMM Data Management Coordination Group. It may be necessary for one or more members of the Review Committee to visit the CMOC. In this case, it is expected that the CMOC will finance the visit.

4.6.6.1.3 Further actions will proceed as described in Annex 3 to Recommendation 2 (JCOMM-4) and in the Executive Summary of JCOMM-4 (WMO-IOC/JCOMM-4/3, WMO-No. 1093).

4.6.6.2 **Five-year review criteria**

1. Is the objective of the CMOC or the scope of its activities (rescuing, collecting, processing, archiving, sharing, distributing and mirroring data, metadata and information, products and services) still relevant given any changes that may have taken place in the management of metocean data in the past five years?
2. Is the coordination of the centre's activities with other CMOCs and existing systems functioning at the right level? Has the centre been active in coordination activities and meetings of the CMOC network?
3. Is the infrastructure and assigned staff continuing to support CMOC operations adequately? Have there been any improvements over the past five years to enhance operations?
4. Is there any documented community support from groups outside the CMOC network for the operations of the centre?
5. Have there been any changes in GCOS ECV designations that impact the operations of the CMOC? Does the CMOC continue to demonstrate added value to the management of GCOS ECVs?
6. Do the processes used for quality management continue to be sufficient?
7. Has the CMOC provided written reports of its operation on or before 31 January of each year?
8. Are there any changes to restrictions on access to data, metadata and information, products or services? If so, do these go against the spirit of free and unrestricted access?
9. Interoperability means that data, metadata and information are widely visible and available through WIS and IODE ODP. Is this interoperability function being met? Have other interoperability operations been established?
10. Are the data domains still clearly described in terms of data type, geographic and temporal coverage?
11. Do the data and information management procedures applied (such as those aimed at enhancing interoperability, ensuring data quality and consistency, improving access and coordination) continue to be well described and useful?

12. Does the scope of the CMOC activities overlap with that of NODCs, the High-Quality Global Data Management System for Climate, an existing ISC-WDS centre or another well-established data management activity? If so, is the added value of the overlap well described and does it warrant the continuing operations of the CMOC?
 13. Are the procedures, standards and best practices followed by the centre still suitable and adequate for defining data quality and management? If the standards or best practices chosen at the time of accreditation or of the last review were not part of the [JCOMM Catalogue of Standards and Practices](#), has a proposal been made to the Catalogue to incorporate the new procedures?
 14. Does the mirroring arrangement with another CMOC, or another established and ongoing data management system, continue to function in an appropriate, robust and timely manner?
 15. Is the documentation on accreditation and annual review easily available?
 16. Are the quality processes and procedures of the existing CMOC in agreement with the rest of the CMOC network?
 17. Are the methods for version control of data, metadata, products and processes sufficient for a user to adequately distinguish between versions?
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