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| WEATHER CLIMATE WATER | **World Meteorological Organization**  **COMMISSION FOR WEATHER, CLIMATE, WATER AND RELATED ENVIRONMENTAL SERVICES AND APPLICATIONS**  **Second Session** 17 to 21 October 2022, Geneva | **SERCOM-2/Doc. 5.1(7)** |
| Submitted by: Chair  18.X.2022  **APPROVED** |

*[All Amendments in the document have been made by the Russian Federation]*

**AGENDA ITEM 5: TECHNICAL REGULATIONS AND OTHER TECHNICAL MATTERS**

**AGENDA ITEM 5.1: Recommended amendments to Technical Regulations (WMO-No. 49), including Manuals and Guides**

# Amendments to regulatory material and updates to guidance material on marine meteorological services (including WMO-Nos. 558, 471 and 574)



# GENERAL CONSIDERATIONS

### Introduction

1. This document presents proposed amendments to regulatory material and updates to the guidance material on marine meteorological services in view of the workplan of the Standing Committee on Marine Meteorological and Oceanographic Services (SC-MMO), reflecting emerging needs, the modernization of the Global Maritime Distress and Safety System (GMDSS), amendments to the International Convention for the Safety of Life at Sea (SOLAS) and the new structures established by the WMO governance reform.

2. The publications involved include:

 [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume I, 2018

 [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469#.YxX7A3ZBw2w) (WMO-No. 471), 2018

 [*Sea-ice Information and Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7542) (WMO-No. 574), 2021

3. In connection with this document and with the work of WMO to support the International Maritime Organization (IMO) with respect to maritime safety, WMO has been working in partnership with IMO on the WMO-IMO Symposium on Extreme Maritime Weather. For further information on the latest status of this progress in maritime safety, see [SERCOM-2/INF. 5.1(7)](https://meetings.wmo.int/SERCOM-2/InformationDocuments/Forms/AllItems.aspx).

### Expected action

4. Based on the above, the Commission is invited to adopt [draft Recommendation 5.1(7)/1](#_Draft_Recommendation_5.1(7)/1), [draft Recommendation 5.1(7)/2](#Draft_Rec_5_1_7_2) and [draft Decision 5.1(7)/1](#Draft_Dec_5_1_7_1).

# DRAFT RECOMMENDATIONS

## Draft Recommendation 5.1(7)/1 (SERCOM-2)

### Amendments to the *Manual on* *Marine Meteorological Services* (WMO-No. 558), Volume I

THE COMMISSION FOR WEATHER, CLIMATE, WATER AND RELATED ENVIRONMENTAL SERVICES AND APPLICATIONS,

**Mindful that:**

(1) The International Convention for the Safety of Life at Sea (SOLAS), 1974, 2000 amendments, Chapter V, regulation 5 defines meteorological services and warnings for ships,

(2) The 19 WMO Members who are METAREA Coordinators and are therefore responsible for distributing meteorological maritime safety information through the IMO-WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) play a critical part in the GMDSS,

(3) The modernization of GMDSS introduced multiple recognized mobile satellite services (RMSS) (*IMO resolution MSC.451(99), 2018*) and consequential amendments to the SOLAS Convention,

**Recalling** the responsibility of the Standing Committee on Marine Meteorological and Oceanographic Services (SC-MMO) to ensure that the [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume I contains the latest information,

**Recognizing** the need to revise the [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume I to reflect the modernization of GMDSS and the new structures established by the WMO governance reform,

**Having examined** the proposed amendment to the [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume I, as provided in the [annex](#_Annex_to_draft_4) to the present recommendation,

**Recommends** to the Executive Council the adoption of amendments to the [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume Ithrough the draft resolution provided in the [annex](#_Annex_to_Draft_5) to the present recommendation;

**Invites** the WMO Commission for Observation, Infrastructure and Information Systems (INFCOM) and the relevant bodies, in consultation with the Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM), to review Part VII of the [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Services for Marine Climatology.

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[Annex: 1](#_Annex_to_draft_4)

**Annex to draft Recommendation 5.1(7)/1 (SERCOM-2)**

### Draft Resolution ##/1 (EC-76)

### Amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558)

THE EXECUTIVE COUNCIL,

**Having considered** draft Recommendation 5.1(7)/1 (SERCOM-2) – Amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I,

**Having agreed** draft Recommendation 5.1(7)/1 (SERCOM-2),

**Adopts** the proposed amendments to the [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume I, as provided in the [annex](#_Annex_to_Draft_5) to the present resolution;

**Requests** the Secretary-General to expeditiously arrange for the publication of the amended [*Manual on Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=9784) (WMO-No. 558), Volume I;

**Requests** the Services Commission to periodically review the Manual and update it as necessary.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[Annex: 1](#Annex_res)

### Annex to Draft Resolution ##/1 (EC-76)

**Amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I**

[Proposed amendments are highlighted as tracked changes to WMO-No. 558]

## INTRODUCTION

*[…]*

4. The regulatory material stems from recommendations of the former 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.

*[…]*

## 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 (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 WMO Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM) is responsible for coordinating input to the Manual and Guide. Supported by the WMO Secretariat, SERCOM 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.

~~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 SERCOM ~~Programme Area (PA) Coordination Group~~. The date of implementation should be defined by ~~the~~ SERCOM~~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~~ SERCOM ~~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 five ~~four~~ languages: English, Chinese, French, Russian and Spanish. The WMO Secretariat will notify all Members when a new update becomes available.

*[…]*

## PURPOSE AND ORGANIZATION OF MARINE METEOROLOGICAL SERVICES

*[…]*

3. Marine Meteorological Services shall comprise ~~of~~ the following services and support:

(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) World-W~~w~~ide Navigational Warning Service (WWNWS);

(e) Support services for marine environmental emergency response;

(f) Services for marine climatology;

(g) Training in marine meteorology and the delivery of marine services.

*[…]*

## WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE

*[…]*

7. International standards for the dissemination of internationally coordinated meteorological information, warnings and forecasts ~~forecast and warning services warnings and forecasts~~(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 IMO resolution A.1051(27) as amended by MSC.470(101) ~~Joint IMO/IHO/WMO Manual on Maritime Safety Information~~.

3. The WWMIWS was adopted through IMO ~~R~~resolution A.1051(27) ~~in 2011~~, as amended by MSC.470(101). The content of this resolution includes the following:

(a) Issuing S~~s~~ervice;

(b) Preparation S~~s~~ervice;

(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 I~~i~~ssuing S~~s~~ervice and P~~p~~reparation S~~s~~ervice are defined in the IMO resolution A.1051(27) as amended by MSC.470(101) ~~Joint IMO/IHO/WMO Manual on Maritime Safety Information~~.

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

**Notes:**

1. The AORs given in Appendix I.1 are reviewed by ~~the~~ SERCOM in consultation with the relevant IMO bodies ~~WMO Marine Meteorology and Oceanography Programme (MMOP)~~ to ensure complete area coverage and adequacy of services.

3. The AORs defined in Appendix I.1 represent a minimum requirement for I~~i~~ssuing and P~~p~~reparation S~~s~~ervices. Both I~~i~~ssuing and P~~p~~reparation S~~s~~ervices may extend the area of coverage for the preparation and ~~issue~~ issuance 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.

11. Before drawing up any recommendation on the proposed amendment for submission to the Executive Council, SERCOM ~~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~~ issuance 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.

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

Note: International standards are specified in the IMO manuals of the recognized mobile satellite service (RMSS) providers ~~International SafetyNET Manual~~ and the IMO NAVTEX Manual.

## 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 IMO resolution A.1051(27) as amended by MSC.470(101) ~~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; and

(c) Sea-ice information services.

**1 3 Members shall disseminate meteorological services** via the IMO recognized mobile satellite service (RMSS) providers~~on approved satellite service provider platforms~~ **and NAVTEX in accordance with the IMO GMDSS Master Plan module of the Global Integrated Shipping Information System (GISIS) ~~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**

– **Principle 3: Marine meteorological services for areas not covered by NAVTEX shall be provided by the** IMO RMSS providers~~approved satellite service provider platforms~~ **or HF NBDP for the reception of** ~~Maritime Safety Information~~ maritime safety information **(MSI) in compliance with international standards;**

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

**2.2 Procedures**

**General**

**2.2.2 Clear information identifying the relevant METAREA and I~~i~~ssuing S~~s~~ervice** **shall be included.**

**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~~ IMO manuals of the RMSS providers and the IMO NAVTEX Manual.

**Issue of sea~~-~~ice information**

**2.2.34 Sea-ice and iceberg terminology shall be in accordance with WMO Sea-Ice Nomenclature (WMO-No. 259).***[Russian Federation]*

**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~~ World-Wide Navigational Warning Service (WWNWS). For further information, see Part IV.

**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 and Services ~~in the world~~ (WMO-No. 574).

## APPENDIX I.1 METAREAS AND DESIGNATED NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES FOR THE ISSUANCE ~~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;~~

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

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

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

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

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

**~~Area X~~**~~: The South Indian Ocean and Southern Oceans east of 80°E and south of 30°S, to 95°E, to 12°S, to 127°E and thence to the Timor Sea, South Pacific and Southern Oceans south of 10°S to 141°E, to the Equator, to 170°E, to 29°S, thence south-westward to 45°S at 160°E and then to the meridian at 160°E;~~

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

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

**~~Area XIII~~**~~: Sea areas enclosed north of the line starting 42°30’N 130°E, and thence to 135°E, north-east to 45°N 138°20’E, to 45°N longitude 180°, then to 50°N, then north-west to 53°N 172°E and then following the International Date Line to 67°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°21’S following the coast of Chile to the longitude of Cape Horn at 67°16’W, and 120°W;~~

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

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

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

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

**~~Area XX~~**~~: From the border between Norway and 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.~~

Map

Description automatically generated

**Figure 1. Limits of METAREAS**

The delimitations of these METAREAs is not related to and should not prejudice the delimitations of any boundaries between states.

Note: METAREA VIII (S) Mauritius/Australia deals with the Tropical Cyclone warnings east of 90E in this METAREA.

## 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 R~~resolution A.1051(27), as amended by MSC.470(101) ~~– 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) or equivalent National Authority;

(b) Effective means of communication, such as telephone, email, facsimile and internet, with NMHSs and National Authorities in the METAREA, with other METAREA Coordinators and other data providers; and

(c) Access to broadcast systems for transmission to the navigable waters of the METAREA. As a minimum, this should include those described in paragraph 3.1.1 of MSC.470 (101) as follows NAVTEX and International Enhanced Group Call. Reception should normally be possible at least 300 nautical miles beyond the limit of the METAREA.

Regarding responsibilities, the METAREA Coordinator ~~has to~~ should:

(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)~~ 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 WMO ~~s~~Service ~~d~~Delivery ~~f~~Framework (WMO-No. 1129), including verification, quality management, M~~m~~arine F~~f~~orecaster C~~c~~ompetency 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, IMO GMDSS Master Plan, ITU List IV – List of Coast Stations and Special Service Stations or other relevant nautical publications of national Administrations; ~~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 relevant meetings of SERCOM~~, Worldwide Met-Ocean Information and Warning Service Committee meetings~~., and also a~~A~~ttend and participate in relevant IMO, IHO and WMO meetings as appropriate and required;

(i) Monitor the broadcasts which they originate, to ensure that the information has been correctly broadcast; and

(j) Take into account the need for contingency planning.

The METAREA Coordinator has also to ensure that within its ~~his/her~~ METAREA, NMHSs and National Authorities that act as I~~i~~ssuing S~~s~~ervices 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) Ensure meteorological information is drafted in accordance with the Joint IMO/IHO/ WMO Manual on Maritime Safety Information; and

(d)~~(c)~~ Monitor the ~~SafetyNET~~ MSI transmission of the bulletins that are broadcast by the I~~i~~ssuing S~~s~~ervices within the respective ~~its~~ METAREA.

The METAREA Coordinator has to further ensure that within ~~his/her~~ its METAREA, NMHSs and National Authorities that act as P~~p~~reparation S~~s~~ervices have the capability to:

(a) Be informed of 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~~ promulgation directly to adjacent METAREA Coordinators and/or others as appropriate, using the quickest possible means;

(d) Ensure that information concerning all meteorological warning subject areas listed in the (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 (WMO-No. 471);and

(f) Maintain records of source data relating to ~~meteorological information and warning messages within their area of responsibility.~~ METAREA warnings and forecasts in accordance with the requirements of the national Administration of the METAREA Coordinator.

## 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 I~~i~~ssuing S~~s~~ervice or P~~p~~reparation S~~s~~ervice for broadcasts on ~~SafetyNET~~ the International Enhanced Group Call (EGC) service (Figure 2). The decision process is designed to minimize the impact on the existing service structure. ~~Worldwide Met-Ocean Infor- mation and Warning Service~~ WWMIWS providers have the status of Regional Specialized Meteorological Centres (RSMCs) conducting Marine Meteorological Services as part of the WMO Global Data-processing and Forecast System (GDPFS) framework.

**PRINCIPLES**

1. The ~~Worldwide Met-Ocean Information and Warning Service~~ WWMIWS supports one I~~i~~ssuing S~~s~~ervice per METAREA, and only exceptionally, considers additional I~~i~~ssuing S~~s~~ervices, under the following conditions:

(a) Avoiding duplication of forecasts for the same area;

(b) Maintaining efficiency of forecast production by the incumbent issuing service;

(c) Following the ~~regulations outlined~~ guidelines promulgated in the IMO manuals of the RMSS providers ~~International SafetyNET Manual~~.

2. The ~~Worldwide Met-Ocean Information and Warning Service~~ WWMIWS supports minimal P~~p~~reparation S~~s~~ervices per METAREA to ensure an efficient production of items to be disseminated on ~~SafetyNET~~ International EGC service.

**METHOD**

**Decision 1**: If the application is from a National Meteorological and Hydrological Service (NMHS) or N~~n~~ational A~~a~~uthority, 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 I~~i~~ssuing S~~s~~ervice 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~~ IMO EGC Coordinating Panel.

**Decision 4**: If an I~~i~~ssuing S~~s~~ervice exists for the METAREA, consider whether the ~~Inmarsat~~ region is ~~already~~ sufficiently covered to ensure adequate provision of MSI.

**Decision 4a**: If the Inmarsat region is not already sufficiently covered, the submission is accepted. If it is sufficiently covered, a P~~p~~reparation S~~s~~ervice is recommended.

If the P~~p~~reparation S~~s~~ervice 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 I~~i~~ssuing S~~s~~ervice (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 I~~i~~ssuing S~~s~~ervice.

**Agreements required**:

(a) The Member should reach an agreement with the existing I~~i~~ssuing S~~s~~ervice on forecast area change;

(b) The Member should reach an agreement with the I~~i~~ssuing S~~s~~ervice 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~~ IMO EGC Coordinating Panel;

(c) WMO should add new boundaries in Weather Reporting (WMO-No. 9), Volume D – Information for Shipping;

(d) WMO and the Member should follow the procedures laid out in the IMO manuals of the RMSS providers ~~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 P~~p~~reparation S~~s~~ervice should be recommended.

No

Yes

Is the ~~Inmarsat region~~ Ocean Satellite Region covered?



Application from NMHS or N~~n~~ational A~~a~~uthority?

No

Recommend P~~p~~reparation S~~s~~ervice role

(option to activate the ancillary decision process)

Reject the application

Application received by WMO

Accept the application for I~~i~~ssuing S~~s~~ervice role

Actions:

1. Nominate a METAREA Coordinator

2. Complete a WMO self-assessment

3. Notify the IMO EGC Coordinating ~~SaftyNET~~ Panel

Reject the application

Does an I~~i~~ssuing S~~s~~ervice exist for the area?

Is service 24/7?

Are operational contingency plans in place?

Yes

Yes

Yes

No

No

**Figure 2. Application decision tree for International EGC Service ~~SafetyNET~~ role**



Preparation S~~s~~ervice role accepted?

No

Yes

Preparation S~~s~~ervice role recommended

Accept application for I~~i~~ssuing S~~s~~ervice role

Actions:

1. A coded ~~Inmarsat~~ EGC area (rectangular or circular) should be determined to cover the area

2. Request a transmission time slot from the IMO EGC Coordinating ~~SafetyNET~~ Panel; follow procedures in the IMO manuals of the RMSS providers ~~SafetyNET Manual~~

3. New boundaries should be included in *Weather Reporting*

(WMO-No. 9), Volume D

4. Nominate a METAREA Coordinator

5. Complete a WMO self-assessment

Recommend P~~p~~reparation S~~s~~ervice role

No

Can an area be excluded from the existing forecast coverage of the I~~i~~ssuing S~~s~~ervice?

**Figure 3. Ancillary decision tree for International EGC Service ~~SafetyNET~~ role**

**GOVERNANCE**

Members should submit their application to the ~~chairperson of the WWMIWS Committee~~ WMO Secretariat, using the following email addresses: dpfsmail@wmo.int and mmo@wmo.int. Assessment and final decision procedures are identified in section 1.2.6 of the Manual on the GDPFS ~~follow those for the designation of GDPFS centres~~.

**Responsibilities**

(a) SERCOM President~~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~~ propose an amendment to the Manual on the GDPFS, including RSMC-Marine Meteorological Services (RSMC-MMS) designation to SERCOM and INFCOM;

(b) WMO Executive Council/Congress: To make the final decision on recommendation for I~~i~~ssuing S~~s~~ervice or P~~p~~reparation S~~s~~ervice;

(c) ~~SafetyNET~~ IMO EGC Coordinating Panel: To deliver ~~a SafetyNET issuing service certificate~~ an EGC Authorization 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 or National Authority structure.

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

*[…]*

## PART II. SERVICES FOR COASTAL, OFFSHORE AND LOCAL AREAS

*[…]*

## PART III. MARINE METEOROLOGICAL SUPPORT FOR MARITIME SEARCH AND RESCUE

*[…]*

## PART IV. SUPPORT TO THE WORLDWIDE NAVIGATIONAL WARNING SERVICE

**1. GENERAL**

**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 ~~R~~resolutions A.705(17), as amended by MSC.468(101), – Promulgation of Maritime Safety Information, and A.706(17), as amended by MSC.469(101), – World-W~~w~~ide Navigational Warning Service.

## PART V. SERVICES IN SUPPORT OF MARINE ENVIRONMENTAL EMERGENCY RESPONSE

*[…]*

## PART VI. TRAINING IN THE FIELD OF MARINE METEOROLOGY

*[…]*

## PART VII. SERVICES FOR MARINE CLIMATOLOGY

*[…]*

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.

*[…]*

2.3.1 **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 the appropriate WMO and IOC technical bodies ~~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](#_bookmark34) to this part of the Manual, 4.6.

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.

***2.6 Data rescue***

Members shall support data rescue activities where feasible and shall follow international best practices (see [Guidelines on Best Practices for Climate Data Rescu](http://library.wmo.int/opac/doc_num.php?explnum_id=3318)e (WMO–No . 1182)) such as those recommended by the WMO Commission for Observation, Infrastructure and Information Systems (INFCOM)~~) Climatology(CCl) 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](https://www.oldweather.org/index.html)).

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

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 appropriate WMO and IOC technical bodies, 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.

1.5 Each centre shall submit to the appropriate WMO and IOC technical bodies ~~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.

***2. DATA ACQUISITION CENTRES***

Notes:

2. The governance structure for defining the functions and designation procedure of each centre is proposed by ~~JCOMM~~ WMO INFCOM and IOC IODE and endorsed by the WMO Congress or Executive Council and by the IOC/UNESCO Assembly or Executive Council.

***3. GLOBAL DATA ASSEMBLY CENTRES***

Notes:

2. The governance structure for defining the functions and designation procedure of each centre is proposed by ~~JCOMM~~ the appropriate WMO and IOC technical bodies and endorsed by the WMO Congress or Executive Council and by the IOC/UNESCO Assembly or Executive Council.

***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:

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

***4.2 Capabilities and corresponding functions***

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

Capabilities

A recognized authority designated by ~~JCOMM~~ WMO INFCOM and IOC IODE 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***

(j) Each centre shall report, on an annual basis, to ~~the JCOMM Management Committee~~ appropriate WMO and IOC technical bodies 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.

***4.4 Establishment, governance and withdrawal***

Note: The governance structure for defining the functions and designation procedure of each centre is proposed by ~~JCOMM~~ WMO INFCOM and IOC IODE and endorsed by the WMO Congress or Executive Council and by the IOC/UNESCO Assembly or Executive Council. The approach recommended by ~~JCOMM~~ the appropriate WMO and IOC technical bodies 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.

***4.6 Accreditation and evaluation***

4.6.2.1 An independent committee consisting of at least three members appointed by ~~JCOMM Data Management Coordination Group~~ the appropriate WMO and IOC technical bodies shall conduct the accreditation of a candidate CMOC.

4.6.2.2 The Committee shall:

(f) Submit the report to the ~~JCOMM Data Management Coordination Group~~ WMO INFCOM and IOC IODE and to the authors of the statement of compliance and commitment;

(g) ~~u~~Upon request, provide copies of the proposed statement of compliance and commitment and evaluation report to any ~~JCOMM~~ WMO INFCOM or IOC 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~~ appropriate WMO and IOC technical bodies.

***4.6.2.4 Membership of the Committee:***

(a) IOC IODE Representative;

(b) ~~JCOMM~~ WMO INFCOM Representative ~~(WMO side)~~;

(c) Other representative(s) as needed.

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~~ appropriate WMO and IOC technical bodies 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:

4.6.5.1 An independent committee consisting of at least three members appointed by the ~~JCOMM Data Management Coordination Group~~ appropriate WMO and IOC technical bodies shall conduct the review of an existing CMOC.

4.6.5.2 The Committee shall:

(e) Submit the report to the ~~JCOMM Data Management Coordination Group~~ appropriate WMO and IOC technical bodies 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~~ WMO INFCOM or IOC IODE member.

4.6.5.4 The Chairperson of the Committee shall report the results of the evaluation to the ~~JCOMM Data Management Coordination Group~~ appropriate WMO and IOC technical bodies.

***4.6.5.5 Membership of the Committee:***

(a) IOC IODE Representative;

(b) ~~JCOMM~~ WMO INFCOM 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 ~~JCOMM Data Management Coordination Group~~ appropriate WMO and IOC technical bodies. 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.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Draft Recommendation 5.1(7)/2 (SERCOM-2)

### Updates to the *Guide to Marine Meteorological Services* (WMO-No. 471)

THE COMMISSION FOR WEATHER, CLIMATE, WATER AND RELATED ENVIRONMENTAL SERVICES AND APPLICATIONS,

**Mindful that:**

(1) The International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, Chapter V, regulation 5 defines meteorological services and warnings for ships,~~;~~

(2) The 19 WMO Members who are METAREA Coordinators and are therefore responsible for distributing meteorological maritime safety information through the IMO-WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) play a critical part in the GMDSS,

(3) The modernization of GMDSS introduced multiple recognized mobile satellite services (RMSS) (*IMO resolution MSC.451(99), 2018*) and consequential amendments to the SOLAS Convention,

**Recalling** the responsibility of the Standing Committee on Marine Meteorological and Oceanographic Services (SC-MMO) to ensure that the [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469)(WMO-No. 471) contains the latest information,

**Recognizing** the need to revise the [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469) (WMO-No. 471) to reflect the modernization of GMDSS and the new structures established by the WMO governance reform,

**Having examined** the proposed updates to the [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469) (WMO–No. 471), as provided in the annex to the present recommendation,

**Recommends** to the Executive Council the adoption of updates to the [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469) (WMO–No. 471) through the draft resolution provided in the annex to the present recommendation;

**Invites** the Commission for Observation, Infrastructure and Information Systems (INFCOM) and the relevant bodies, in consultation with SERCOM to review the chapter regarding Services for Marine Climatology.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[Annex: 1](#_Annex_to_draft_1)

## Annex to draft Recommendation 5.1(7)/2 (SERCOM-2)

### Draft Resolution ##/2 (EC-76)

### Updates to the *Guide to Marine Meteorological Services* (WMO-No. 471)

THE EXECUTIVE COUNCIL,

**Having considered** draft Recommendation 5.1(7)/2 (SERCOM-2) – Updates to the [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469) (WMO-No. 471),

**Having agreed** draft Recommendation 5.1(7)/2 (SERCOM-2),

**Adopts** the proposed updates to the [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469) (WMO-No. 471), as provided in the [annex](#_Annex_to_Draft_6) to the present resolution;

**Requests** the Secretary-General to expeditiously arrange for the publication of the updated [*Guide to Marine Meteorological Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7469) (WMO-No. 471);

**Requests** the Services Commission to periodically review the manual and update it as necessary.

### Annex to Draft Resolution ##/2 (EC-76)

### Updates to the *Guide to Marine Meteorological Services* (WMO-No. 471)

[Proposed updates are highlighted as tracked changes to WMO–No. 471]

## 1. INTRODUCTION

Weather information has always been vital for the safety and efficient operation of marine industries, particularly transport and fishing. ~~Early in the twentieth century, wireless telegraphy allowed regular communication between ship and shore, and weather broadcasts to shipping began.~~ The first International Convention for the Safety of Life at Sea (SOLAS Convention) called for all shipping lanes and fishing grounds to be covered with weather information broadcast by radio; governments agreed to share responsibilities for these broadcasts. The International Maritime Organization (IMO)/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) provides uniform coverage of ~~forecasts and~~ warnings and forecasts to ships traversing the oceans. The IMO Polar Code provides additional guidance on the provision of suitable marine meteorological and sea-ice services to support safe shipping in polar waters.

The availability of marine ~~forecasts and~~ warnings and forecasts to mariners in coastal waters is vitally important to the ability of National Meteorological and Hydrological Services (NMHSs) to meet the ~~principles~~ obligations of the SOLAS Convention.

## 2. MARINE METEOROLOGICAL SERVICES

**2.1 GENERAL**

A marine meteorological programme embraces a wide range of activities. In the preparation of analyses, synopses, ~~forecasts and~~ warnings and forecasts, knowledge is required of the present state of the atmosphere and the ocean surface, as well as the climate of the region. In addition, other types of forecasts that refer to special elements and phenomena, such as waves, storm surges, sea ice and ice accretion may be based on relevant observational data.

**2.2.5 Education and communication with users**

The SOLAS Convention together with the IMO resolution A.893 (21) Guidelines for Voyage Planning describes ~~(Chapter V Regulation 34 – Safe navigation and avoidance of dangerous situations, and within Annex A.24 – Voyage planning)~~ how vessels should prepare for their trip and route. The annex specifically outlines for small vessels the importance of:

**2.5.1 Wind**

Information about wind is generally considered to be the most important element to a mariner. Mariners are concerned with changes in wind speed and direction ~~throughout the day they are travelling through or operating within~~ through which they are travelling or within which they are operating.

**2.5.2 Waves**

Information about total wave heights (the combination of swell waves and wind waves) and the individual wave components is of importance to a wide range of users. Consideration should be given to providing information about multiple swells of significant size as this is useful for vessels and coastal activities.

Wind waves have significant effects on the headway vessels can make, how fast fish can be found and caught, how productive loading and unloading operations are, and on the transfer of fishing catches to factory ships and other operations. ~~For example, the safety regulations on vessels of the former Soviet fishing fleet stipulated that when wind speeds reached 30 knots (equivalent to 15 metres per second) or when wave heights were over 4 metres, SRT-type vessels (medium fishing trawlers) should cease to make way or should stay in port.~~

Wind waves, especially high waves with short periods (a choppy sea), and to a lesser extent long swell, can be a danger to small craft. In shallow water areas (such as lakes or island reefs), the wind-wave behaviour and short wavelength are particularly dangerous due to reduced stability for the short-length, flat-bottomed vessels that commonly operate in these areas. Near the coast, where these boats generally operate, wind waves also depend on the coastal morphology ~~irregularity of the coastline~~, the water depth, and surface currents or tidal streams. Combinations of strong currents, high waves and high winds may create hazardous conditions for rigs and vessels.

The direction of wave patterns is also of concern to large vessels for fuel consumption management and ship handling. Some large vessels will find ship handling difficult when the swell direction aligns with their direction of travel and the swell height is over four metres. Wave breaking is also a major cause of damage at sea. High waves with very deep valleys may be called "freak” or “rogue” waves and ~~because they~~ are dangerous to shipping in terms of direct risks to vessel structural integrity due to enhanced loading on the vessel structure. They are generally caused when waves move against a sea current.

**2.5.5 Visibility**

Fog and mist are the most common causes of reduced visibility, but snow, thick haze, smoke and heavy rain can also constitute a hazard as well as impact on radar performance. The visibility limit requiring a warning should be determined in consultation with users.

**2.5.7 Thunderstorms and squalls**

The lightning associated with thunderstorms can be dangerous, since the masts and derricks tower above the water surface. Both heavy rainfall rates and lightning can cause disruption of radio transmissions. Lightning poses a serious hazard to aircraft operations, and may create problems at a drill rig if gas is being burned off at the time. Lightning would also be a serious hazard to exposed personnel ~~in the water~~.

**2.5.8 Air temperature**

Extreme temperatures, either hot or cold, can reduce the efficiency and accident-avoidance capability in workers exposed to the elements, due to incipient hypothermia or, at the other extreme, heat stroke. Heating, cooling and ventilating the working and living space is important, not only for the well-being of personnel, but also for the ~~operation of electronic control facilities~~ operation of ship systems. Air temperature is also a contributing factor to wind chill and spray icing.

**2.5.10 Ocean currents**

Information on ocean currents is used in navigation, fishing operations, and search and rescue operations. The currents also have an impact on the movement of powered and sailing vessels. Fuel consumption management is an important cost factor for marine transportation companies, and details of ocean and tidal currents are ~~a~~ key variables. Knowledge of currents is also particularly vital in modelling the movement of possible oil spills and other contaminants.

**2.5.12 Storm-induced water-level changes and seiching**

The most common and most dangerous storm-induced water-level change is the storm surge generated by a tropical cyclone. Storm surges can also be generated by intense extratropical depressions, particularly when the sea is being funnelled along ~~driven along a narrowing gulf~~. Lives are more often lost in the flooding of low-lying coastal areas from storm surges than from the destructive winds of the cyclone itself. The low atmospheric pressure itself will cause a rise in water levels.

**2.5.15 Freezing spray**

Vessel size is also an important factor in icing rates as the average liquid water content of wave-generated spray decreases exponentially with elevation. Most of the spray is confined in a 5–10 metre range above sea level, which means smaller vessels are exposed to considerably more spray than large ships or drilling platforms.

**2.5.16 Sea ice**

(d) Ice movement~~.~~

WMO No. 574 provides more information.

**2.5.17 Icebergs**

Information is required on the position of icebergs at specified times and their estimated size, speed and direction of movement. ~~During the ice season the south-eastern, southern and south- western limits of regions of icebergs in the vicinity of the Grand Banks of Newfoundland are monitored for the purpose of informing passing ships of the extent of this dangerous region. The guidelines for this~~ Guidelines for international northern hemisphere ice patrol services are laid down in the SOLAS Convention. WMO No. 574 Sea-Ice Information and Services provides more information.

**2.5.18 Tropical cyclones**

The position of the centre of a cyclone (or of an extratropical depression) is usually given in latitude and longitude in high seas warnings designed for large ships at sea; however, for coastal waters, position should be given by distance and bearing from well-known coastal locations. This is because fishers and other users of coastal waters’ forecasts are not so familiar with latitude and longitude. It is important to educate the community and mariners to not simply focus on the centre ~~position~~ of the tropical cyclone, and to be aware that the damaging effects could cover a few hundred kilometres/miles.

**2.5.19 Tsunamis**

~~Tsunamis are generated by underwater seismic activity. They can cause enormous destruction and loss of life. The warning of a significant tsunami should result in the rapid evacuation of all low-lying areas in its path.~~ Tsunamis are generated by underwater seismic activity, volcanic eruptions, landslides, or other large events such as meteorite impacts. They can cause enormous risk to marine craft and the lives of marine users, particularly in port facilities or near the coast, and to coastal facilities. The threat/forecasting of a significant tsunami should result in urgent warnings to port facilities, shipping and coastal craft to take precautionary actions.

**2.5.21 Wind chill**

Wind chill above certain thresholds is a very important consideration for human comfort. Hypothermia and frostbite may result from wind chill in a very short time, impairing work efficiency and increasing the likelihood of accidents. The heavy clothing necessary to withstand the cold also contributes to the possibility of accidents. High values of wind chill will also reduce human survival time in the water.

**2.6 REQUIREMENTS FOR SPECIFIC USERS AND APPLICATIONS**

**2.6.1 SOLAS vessels**

The SOLAS Convention defines SOLAS vessels as those being of weight equal to or greater than 300 gross tonnes and ~~all~~ passenger vessels ~~above 12~~ navigating international waters. SOLAS vessels generally undertake journeys of days and weeks in duration.

International Convention for the Safety of Life at Sea vessels require information relating to four main activities:

(a) Travel on the high seas;

(b) Travel through shipping lanes, pilotage areas;

(c) Entering and exiting a port~~s~~,

(d) At berth, loading and unloading activities.

In all cases, the expected time of arrival at the destination is important and will be affected by weather conditions. Late arrival carries economic penalties for the shipping company. Some ports can only be reached at high tide, and missing a tide means a wait of 12 hours for the next available time window ~~of time~~. Several hours may be required to prepare a ship at sea for extreme conditions. Outlooks of potential ~~possible~~ storm genesis and/or developments should be provided as far in advance as possible ~~for a period two to seven days in advance that are updated regularly are welcomed~~. They enable the ship's captain to take any precautionary measures considered necessary, including altering course to avoid the worst of the weather, and to make appropriate assessments of the expected time of arrival.

The determination of a shipping route across the ocean in order to maximize efficiency and safety should take~~s~~ into account marine climatological data, load-line rules, ocean currents and medium-range forecasts of wind and wave conditions. One way of reducing costs is the application of meteorology to navigation; this has been applied by ship captains for a very long time. Broadly speaking there are two applications: climatology and specific forecasts at the time of the voyage.

Weather routing services are provided in accordance with SOLAS Convention Chapter V Regulation 34 and IMO ~~R~~resolution A.893(21) – Guidelines for voyage planning; and IMO MSC.1/Circ.~~ular~~ 1063 – Participation of ships in weather routing services – Minimum standards for provision of weather rout~~e~~ing services, outlines the minimum characteristics for a service. The SOLAS Convention Chapter V Regulation 5 – Meteorological services and warnings, states that marine meteorological services shall be issued by the NMHS, and this would imply that WMO and its Members should oversee weather routing services and standards as well.

Routing may have a significant impact on the operational costs of a ship. ~~The effect of routing on the operational costs of a ship is mainly reflected in fuel and lubricating oil costs. A possible saving of 12 per cent in fuel has been calculated.~~

**2.6.2 Non-SOLAS vessels**

Offshore yachting activities are vulnerable to intense weather patterns. Yachts may be in transit for a number of days at a time. Wind and wave information is highly important to the navigation and capability of the vessel. Severe ~~W~~weather such as thunderstorms can threaten the ~~is important for~~ safety of crew and vessel ~~protection of radio equipment~~. These vessels may not be able to avoid an intense weather pattern and a broken mast or rudder may delay and/or prevent ~~will require~~ a rescue operation from being activated. Offshore yacht skippers access weather information on marine radio or satellite Internet.

2.6.4 **Recreational boating**

**2.6.4.1 *General***

Kayaking and canoeing on enclosed waters and offshore ~~has~~ have become ~~a~~ popular recreational activities~~y~~. These vessels require information about wind waves, winds, gusts and thunderstorms.

2.6.4.3 **Thunderstorms and squalls**

Small craft are especially vulnerable to sudden changes in the weather associated with thunderstorms and violent cold fronts. The rapid ~~development~~ intensification and movement of these phenomena make them an extreme hazard. Particularly vulnerable are the very small boats on enclosed waters such as bays and harbours.

2.6.5 **~~Dynamically supported craft~~ High-Speed Craft (HSC)**

~~Dynamically supported craft~~ High-Speed Craft (HSC) such as hydrofoil vessels and hovercraft that are operating in coastal and offshore waters are particularly sensitive to changes in wave conditions. Wind also affects operations. The operating limits for wind and waves will vary with the type and size of craft. Because of their higher speed, information on higher ranges of visibility is required.

~~Fast craft~~ HSC such as hydrofoils, hovercraft and catamarans are more sensitive to wind and waves than ordinary craft of the same size. According to the IMO Code for Safety of High-Speed Craft (HSC Code)~~Dynamically Supported Craft~~, the worst intended environmental conditions should be the key threshold for operation of the craft.

2.6.7 **Coastal community activities**

**2.6.7.1 General**

A ~~C~~considerable amount of engineering activity takes place in ~~the~~ coastal zones. Many coastlines must be protected from erosion and flooding, and this often involves major construction work. The protective sea walls and breakwaters must be designed to withstand extreme wave events with relatively long return periods, so information about these extreme conditions ~~are~~ is important for mitigation actions.

2.6.7.3 **Storm surges**

Storm surges and resulting flooding of low-lying areas have caused considerable damage and loss of life in coastal communities. When combined with large waves, there may be large impacts on coastal infrastructure and erosion of foreshore areas. Sufficient advance notice is required for coastal defence measures and possible evacuation of the population to be ~~effected~~ affected.

2.7 **INTERNATIONAL COORDINATING ARRANGEMENTS**

2.7.4 Coordination of marine meteorological broadcasts

It is important that the times of broadcast of forecasts be published and known to ships, and that only one broadcast is made to a given area at a time. WMO coordinates the times of broadcast by satellite to various ocean areas. Broadcasts on Global Maritime Distress and Safety System ([GMDSS](http://weather.gmdss.org/gmdss.html)) communication platforms (~~SafetyNET~~ RMSS, NAVTEX, HF NBDP) and marine radio (HF and VHF) should be in accordance with a definitive timetable maintained in Weather Reporting (WMO-No. 9), Volume D – Information for Shipping.

2.8 **WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE**

**2.8.1 General**

The Worldwide Met-Ocean Information and Warning Service provides maritime safety information (MSI) to mariners in the form of marine ~~forecast and warning products~~ warnings and forecasts. The Worldwide Met-O~~o~~cean Information and Warning Service is coordinated across the oceans through 21 defined areas, called METAREAs. Ships receive the MSI products via marine communication systems such as RMSS ~~SafetyNet~~ and NAVTEX, which form part of GMDSS. The IMO ~~Assembly R~~resolution A.1051(27) – IMO/WMO Worldwide Met-O~~o~~cean Information and Warning Service G~~g~~uidance D~~d~~ocument,as amended by MSC.470(101), outlines the functions of WWMIWS.

The MSI products are issued by NMHSs or National Authorities appointed as WWMIWS I~~i~~ssuing S~~s~~ervices. METAREA coordinators are assigned to coordinate provision of the marine services for each area.

**2.8.2 Areas of responsibility**

The establishment of areas of responsibility is coordinated by the ~~Joint WMO/Intergovernmental Oceanographic Commission (IOC) Technical Commission for Oceanography and Marine Meteorology (JCOMM)~~ WMO Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM), in consultation with relevant IMO bodies, regional associations and approved by the Executive Council.

An I~~i~~ssuing S~~s~~ervice may arrange to receive from other NMHSs or National Authorities ~~forecasts and~~ warnings and forecasts for part of its area of responsibility for incorporation in the complete forecast for the whole area. These contributing services are known as P~~p~~reparation S~~s~~ervices.

The I~~i~~ssuing S~~s~~ervice is responsible for composing the complete broadcast bulletins on the basis of input from the relevant P~~p~~reparation S~~s~~ervices and for monitoring the broadcasts of information to its designated area of responsibility. Where appropriate information, data or advice from a preparation service for a given METAREA is not available, it is the responsibility of the I~~i~~ssuing S~~s~~ervice for that area to ensure that complete broadcast coverage for the area is maintained. An I~~i~~ssuing S~~s~~ervice may agree with a P~~p~~reparation S~~s~~ervice on an appropriate format for the attribution of the forecast and warning information provided by the P~~p~~reparation S~~s~~ervices.

Like NAVAREA, METAREA means a geographical sea area established for the purpose of coordinating the broadcast of maritime meteorological information. The METAREAs are almost identical to the NAVAREAs used by the International Hydrographical Organization (IHO) for the broadcast of navigational warnings except for several areas.

An I~~i~~ssuing S~~s~~ervice may extend the area of coverage of weather and sea bulletins beyond its METAREA, if it so wishes, to meet national requirements. In this case, the area of coverage has to be specified in the text of each broadcast so that ships are quite clear as to the area covered by the bulletin. Similarly, a P~~p~~reparation S~~s~~ervice may extend its area of coverage to meet national requirements, provided the area of coverage is clearly specified in the information supplied to the I~~i~~ssuing S~~s~~ervice.

Whenever an I~~i~~ssuing S~~s~~ervice is no longer able to provide the services for its area of responsibility, the relevant Member should inform the Secretary-General at least six months in advance. Whenever a P~~p~~reparation S~~s~~ervice is no longer able to provide ~~forecasts and/or~~ warnings and/or forecasts for part of a METAREA, it should inform the relevant I~~i~~ssuing S~~s~~ervice, which should try to make alternative arrangements. The Secretary-General should also be informed of changes in the P~~p~~reparation S~~s~~ervice.

Any amendments to the area of responsibility, or proposal for the introduction of a change in an NMHS's responsibility for an area, has to have the approval of the Executive Council based on a recommendation by ~~JCOMM~~ SERCOM, in consultation with the relevant IMO bodies. Before drawing up any such recommendation, the Commission will obtain comments from the NMHSs directly concerned with the proposed amendment as well as comments of the president(s) of the regional association(s) concerned.

Because of the congruence of the METAREAs with the NAVAREAs of IHO it can be hoped that it will not become necessary to amend them.

**2.8.3 About the Global Maritime Distress and Safety System**

The Global Maritime Distress and Safety System has been agreed internationally within IMO by amendment to the SOLAS Convention. For the purposes of the GMDSS communication equipment carriage requirements, the oceans and seas of the world have been divided into four “sea areas” (MSC.496(105)), as follows:

– Sea area A1 ~~– Sea~~ means an area within the radio-telephone coverage of at least one very high frequency (VHF) ~~VHF~~ coast station in which continuous digital selective calling (DSC)1 alerting is available, as may be defined by a Contracting Government2;

– Sea area A2 ~~– Sea~~ means an area, excluding sea area A1, within the radio-telephone coverage of at least one medium frequency (MF) ~~MF~~ coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government2;

– Sea area A3 ~~– Sea~~ means an area, excluding sea areas A1 and A2, within the coverage of a recognized mobile ~~approved~~ satellite service supported by the ship earth station carried on board ~~providers~~ in which continuous alerting is available;

– Sea area A4 ~~– Sea~~ means an area outside of sea areas A1, A2 and A3~~, which generally comprise the polar waters~~.

2 Refer to Provision of radio services for the Global Maritime Distress and Safety System (GMDSS) (resolution MSC.509(105))

Ships are required to carry the appropriate equipment for the sea area(s) in which they will be travelling. Most of the high seas areas of the world are in sea area A3.

Under GMDSS, high seas, weather and sea bulletins are broadcast by satellite using the ~~approved satellite service~~ recognized mobile satellite service providers with the EGC System. The EGC System allows a bulletin to be broadcast to all ships with the relevant receiving equipment in:

The reader should refer to the IMO ~~International SafetyNet Manual~~ manuals of the RMSS providers for further details.

2.8.5 **Other radio communications**

As described in the GMDSS Manual, ~~(http://www.imo.org/en/Publications/Documents/ Newsletters%20and%20Mailers/Mailers/IH970E.pdf)~~ Members should be aware of the radio call protocols for meteorological safety information broadcast on marine radio (HF and VHF).

## 3. SERVICES FOR THE HIGH SEAS

*[…]*

*3.1* ***INTRODUCTION***

The SOLAS Convention requires meteorological services to be disseminated to vessels on ~~SafetyNET~~ the International EGC service and NAVTEX in accordance with the GMDSS Master Plan ~~(see the IMO GMDSS Manual)~~. Members should disseminate meteorological services by marine radio frequencies (for example, MF, HF or VHF) or HF NBDP telegraphy for areas where such a service is provided for ships engaged exclusively on voyages in those areas.

*3.2* ***SERVICE DESCRIPTIONS***

Marine meteorological services for the high seas form part of WWMIWS and include provision of:

(a) Meteorological warnings;

(b) Marine forecasts; and

(c) Sea-ice information services.

Refer to the Manual on Marine Meteorological Services (WMO-No. 558), Volume I, Part I for details on procedures and format requirements. Additionally, refer to Sea-Ice Information and Services (WMO-No. 574) for further supporting material on sea ice and icebergs.

Some I~~i~~ssuing S~~s~~ervices divide their METAREA into subdivisions and issue a complete bulletin of parts 1, 2 and 3 for each subdivision. This may well be the case where P~~p~~reparation S~~s~~ervices are contributing to the bulletin, as their contributions for particular areas can be incorporated into the complete bulletin with the minimum of delay.

Some I~~i~~ssuing S~~s~~ervices may elect to issue a separate bulletin containing sea-ice information and forecasts. This may be useful to reduce the length of a bulletin and also to provide flexibility for dissemination.

Warnings must be issued immediately when the need becomes apparent, without waiting for the next ~~routine~~ scheduled forecast. Thus, warnings may be issued separately from a routine forecast.

## 4. SERVICES FOR COASTAL, OFFSHORE AND LOCAL AREAS

*[…]*

4.2.2 Content of bulletins

Although coastal bulletins may be issued primarily for national interests, they are also used by international shipping, and for this reason in the Manual on Marine Meteorological Services, Volume I, Part II, 3, the contents of coastal weather and sea bulletins are specified. Coastal bulletins do not have to be divided into parts 1, 2 and 3, but they should still follow the order of presentation of information: warnings, synoptic situation, forecasts. There should, as far as possible, be consistency between the warnings and forecasts ~~forecasts and warnings~~ for the coastal waters and the relevant high seas area. Naturally the forecast for coastal waters gives more detail for the smaller area than the high seas forecast.

It is important to determine, by consultation with representatives of user communities, the thresholds of meteorological and sea wave parameters to be used as criteria for the ~~issue~~ issuance of warnings (beyond those agreed for storms and gales) or be mentioned in the forecast, for example wind speed, strength of gusts, wave height, swell period and direction, visibility and squalls.

## 5. MARINE METEOROLOGICAL SUPPORT FOR MARITIME SEARCH AND RESCUE

*[…]*

5.1 **GENERAL**

Under GMDSS, Joint Rescue Coordination Centres (JRCCs) are responsible for coordinating search and rescue of ships in distress in each NAVAREA. The success of a search and rescue operation depends to a large extent on the meteorological information available to the JRCC. Survivors may be aboard ~~an~~ a small open boat that will drift with the wind, waves, tides and currents, and search areas may be extensive if the position of the survival craft is not known with any degree of accuracy. It may be extremely difficult to see a small craft in conditions of poor visibility or choppy waves. Water temperatures provide guidance to JRCCs on potential survival times of persons in the water.

## 6. SERVICES IN SUPPORT OF THE WORLD~~-~~WIDE NAVIGATIONAL WARNING SYSTEM

*[…]*

6.1 **GENERAL**

Maritime safety information is promulgated in accordance with the requirements of IMO r~~R~~esolution A.705(17) – Recommendation on the promulgation of maritime safety information, as amended by MSC.468(101). Navigational warnings are issued under the auspices of the IHO/IMO World-W~~w~~ide Navigational Warning Service in accordance with the requirements of IMO resolution A.706(17) –World-W~~w~~ide Navigational Warning Service, as amended by MSC.469(101).

Navigational warnings are issued in response to SOLAS Chapter V Regulation 4 –Navigational warnings, and carry information which may have a direct bearing on the safety of life at sea. Some of the subjects of concern for navigational warnings rely on sources from NMHSs or the National Authority.

Appropriate coordination and information-sharing agreements should be established with NAVAREA coordinators to facilitate an effective warning service.

## 7. SERVICES IN SUPPORT OF MARINE ENVIRONMENTAL EMERGENCY RESPONSE

*[…]*

## 8. TRAINING IN THE FIELD OF MARINE METEOROLOGY

*[…]*

## 9. SERVICES FOR MARINE CLIMATOLOGY

*[…]*

9.1.4 **Other marine climatology activities**

The IOC International Oceanographic Data and Information Exchange (IODE) has established a network of Global Data Assembly Centres (GDACs), which are also contributing to MCDS. A centre can act as a ~~JCOMM~~ WMO-IOC GDAC, an IODE GDAC, or both, while avoiding overlaps and providing assurance the work is comple~~i~~mentary to the functions of both groups.

9.2.1.2 High-resolution and high-accuracy data

9.2.1.2.2 The marine climate community also requires traceable observations of known uncertainty and, as much as possible, of high quality. Minimizing uncertainties relies on managing observing systems from instrument selection through the delivery of data. This starts by selecting sensors that meet or exceed standards, properly siting and exposing the instruments, and providing routine maintenance and calibration as set out in WMO (~~2008~~ 2018). Maintaining and reporting metadata (for example, sensor calibration, sensor type/make/model, data conversion algorithms, sensor locations) along with the data supports evaluation of uncertainty in the observations, including bias estimation. Information on metadata can be found in section 9.2.3.

9.2.2 **General guidance on the application of quality control and monitoring**

**Real-time monitoring and quality control**

A set of QC tools has been developed by Mété~~e~~o-France to monitor European Meteorological Services Network (EUMETNET) E–Surfmar observation networks.1 The QC checks are mainly based on comparisons with model outputs and can be applied to any marine observing platform that reports on GTS. Reports are generated monthly on network data availability, timeliness and overall quality as compared to previous months and designated targets.

1 ~~http://www.meteo.shom.fr/qctools/.~~ <http://esurfmar.meteo.fr/qctools/>

9.2.3 **Metadata: Observational and discovery**

Historically, the metadata have not been reported, or reportable, alongside the observations on GTS ~~n~~or in DM due to format limitations. This began to change in 2003 with the inclusion of VOSClim fleet metadata within the DM reporting formats. This will improve additionally with the development of BUFR marine templates. Thus, as required, Members (and other contributors) should regularly contribute and update observational metadata for all platforms that they operate to the appropriate international repository. For those programmes ~~coordinated under JCOMM~~, such as ~~under~~ the Ship Observations Team and the Data Buoy Cooperation Panel, the repositories are, or will be, managed by the WMO-IOC Joint Centre for Oceanography and Marine Meteorology in situ Observations Programmes Support (OceanOPS, formerly named JCOMMOPS)~~JCOMM In Situ Observations Programmes Support Centre (JCOMMOPS)~~. In turn, these repositories are linked to the WMO Observing Systems Capability Analysis and Review Tool database. For other programmes, such as Argo and OceanSITES, GDACs typically manage the observational metadata. Metadata at the discovery and processing levels are also of critical importance but typically stewarded at a higher level in MCDS. Thus, Members and other contributors should actively cooperate with Data Acquisition Centres (DACs), GDACs and CMOCS in the generation and management of these higher-level forms of metadata.

9.2.4 **Data (and metadata) rescue**

National and international activities to recover data and metadata from historical ship logbooks and other international marine meteorological and oceanographic data types (for example, early buoy networks) remain critical to enhance climate databases, and should be promoted and further enhanced internationally. The WMO Commission for Observation, Infrastructure and Information Systems (INFCOM)~~Climatology Expert Team on Data Rescue~~ oversees I-DARE (see 9.2.1.1.2), and in the oceanographic data domain the IOC/IODE Global Oceanographic Data Archaeology and Rescue Programme rescues oceanographic data. Additionally, the Atmospheric Circulation Reconstructions over the Earth initiative coordinates global data rescue efforts.

9.3 MARINE CLIMATE DATA SYSTEM

9.3.1 Marine Climate Data System description

9.3.1.1 The ~~JCOMM~~ MCDS provides a routine and standardized collection of RT and DM climatological data and metadata. It includes both marine meteorological and oceanographic data made available through a network of CMOCs, promoting the sharing, collection, recording, mirroring and exchange of data and metadata for all types of end users.

9.3.1.2 Marine Climate Data System DACs receive data directly from ~~JCOMM~~ WMO and IOC coordinated observing platforms within the scope of the DAC, data being in agreed formats and provided in DM and RT, by:

9.3.1.4 All data (original and quality controlled) and metadata received from GDACs are forwarded to the suitable CMOC. CMOCs act as specialized centres, applying HQCSs and bias correction as required, making datasets and products available to the MCDS user interface and advising Members/Member States when appropriate (see CMOC terms of reference for further information (Recommendation 2 (JCOMM-4), Annex 2)). Data and metadata are stored in line with defined ~~JCOMM~~ WMO and IOC standards to ensure data integrity and universal interoperability.

9.3.3 **Data buoys**

9.3.3.2 The DDB and MDB DACs are responsible for collecting data from the respective buoy type that they operate or have links to, applying QC and forwarding the quality-checked data to the DDB and MDB GDACs on a yearly basis. They should also provide feedback on any data quality issues to the ~~JCOMMOPS~~ OceanOPS technical coordinator of buoy operations.

9.3.3.3 The DDB and MDB GDACs are responsible for the integration of all DAC data received from their respective platform types. There are two DDB GDACs that ensure QC, notifying data quality issues to the ~~JCOMMOPS~~ OceanOPS technical coordinator of buoy operations. Operating in pairs, the DDB GDACs compare data holdings frequently to identify missing data streams, so that eventually they may both acquire identical data on a routine basis. All data (original and quality controlled) and associated metadata with flags should be forwarded to the appropriate CMOC. Discovery metadata is made available via WIS and/or IODE ODP where possible.

9.3.7 **Application procedure and evaluation process for establishing a centre within the Marine Climate Data System**

9.3.7.2 The application procedure for establishing an MCDS centre (DAC, GDAC or CMOC) is as follows:

(c) The IOC or WMO Secretariat will then request the appropriate ~~JCOMM co-president to take~~ action through the relevant ~~JCOMM~~ WMO and IOC technical bodies to evaluate and verify compliance with requirements of the proposed centre.

(d) The designated ~~JCOMM~~ WMO and IOC technical bodies~~y~~ will evaluate the request and advise in writing whether the MCDS Centre application should be endorsed. The designated body may wish to delegate this work to individuals and/or groups acting on its behalf (for example, one of the component teams, depending on the nature of the proposed centre), but any advice and proposal to ~~JCOMM~~ the WMO and IOC should still be assessed by and come through the designated bodies.

~~JCOMM~~ WMO and IOC will also conduct reviews of performance and capabilities at the required intervals.

(e) If endorsed by the designated bodies~~y~~, and depending on timing, the bodies~~y~~ will make a recommendation to ~~the JCOMM Management Committee~~ WMO and IOC, and invite them to provide further advice to the relevant technical bodies. ~~to JCOMM.~~

(f) If not endorsed by the designated body, ~~or the Management Committee,~~ ~~the~~ ~~JCOMM co-president~~ WMO and IOC should advise the candidate about areas in which the candidate centre can be improved to meet requirements. Candidates can reapply at a later date once changes have been made to meet these criteria.

(g) If endorsed by the ~~Management Committee~~ appropriate WMO and IOC technical bodies, a recommendation to include the candidate MCDS Centre in the list of such centres in the Manual on Marine Meteorological Services (WMO-No. 558), Volume I (for CMOCs) or the present Guide (for DACs and GDACs) is passed to the next ~~JCOMM~~ WMO INFCOM, and IOC IODE sessions, or, depending on timing, directly to the WMO Congress or Executive Council and the IOC Executive Council or Assembly following ~~JCOMM~~ the appropriate WMO and IOC technical bodies consultation in writing.

(h) If recommended by ~~JCOMM~~ WMO INFCOM and IOC IODE, a resolution for the proposed change in the Manual on Marine Meteorological Services or the present Guide will be proposed to the WMO Congress or Executive Council and a corresponding decision proposed to the IOC Executive Council or Assembly for including the candidate in the list of MCDS Centres.

## APPENDIX 1. MARINE CLIMATE DATA SYSTEM CENTRES (SCOPE, DESIGNATION AND EVALUATION)

1. **INTRODUCTION**

|  |  |  |  |
| --- | --- | --- | --- |
|  | DAC | GDAC | CMOC |
| Functions and tasks | Each centre should report on an annual basis to the ~~JCOMM Management Committee through DMCG~~ appropriate WMO and IOC technical bodies on its status and the activities carried out;  ~~JCOMM~~ the appropriate WMO and IOC technical bodies in turn should keep the Executive Councils of WMO and IOC informed  on the status and activities of the DAC network as a whole, and proposed changes, as required | Each centre should report on an annual basis to the ~~JCOMM Management Committee through DMCG~~ appropriate WMO and IOC technical bodies on its status and the activities carried out;  ~~JCOMM~~ the appropriate WMO and IOC technical bodies in turn should keep the Executive Councils of WMO and IOC informed on status and activities of the GDAC network as a whole, and proposed changes, as required | Each centre should report, on an annual basis, to the ~~JCOMM Management Committee through DMCG~~ appropriate WMO and IOC technical bodies on the services offered to Members/Member States and the activities carried out; the appropriate WMO and IOC technical bodies in turn should keep the World Meteorological Congress and IOC Assembly informed on the status and activities of the CMOC network as a whole, and propose changes, as required |

2.3 Evaluation criteria

|  |  |  |
| --- | --- | --- |
|  | Criteria | How do you meet the requirement? |
| 9 | Centre should report, on an annual basis, to the ~~JCOMM Management Committee through DMCG~~ appropriate WMO and IOC technical bodies on its status and the activities carried out. ~~JCOMM~~ The appropriate WMO and IOC technical bodies in turn should keep the Executive Councils of WMO and IOC informed on status and activities of the DAC network as a whole, and proposed changes, as required |  |

3. GLOBAL DATA ASSEMBLY CENTRES

3.1 Terms of reference

3.1.3 To meet MCDS requirements GDACs must have the following:

Capabilities:

(c) The ~~JCOMM DMCG~~ appropriate WMO and IOC technical bodies must assess each centre at least once every five years to verify it meets the necessary capabilities and performance indicators as agreed by the Commission;

(j) Each centre should report on an annual basis to the ~~JCOMM Management Committee through DMCG~~ appropriate WMO and IOC technical bodies on its status and activities carried out. ~~JCOMM~~ The appropriate WMO and IOC technical bodies in turn should keep the Executive Councils of WMO and IOC informed on status and activities of the GDAC network as a whole, and proposed changes, as required.

3.3 Evaluation criteria

|  |  |  |
| --- | --- | --- |
|  | Criteria | How do you meet the requirement? |
| 14 | Centre should report on an annual basis, to the ~~JCOMM Management Committee through DMCG~~ appropriate WMO and IOC technical bodies on its status and the activities carried out. ~~JCOMM~~ The appropriate WMO and IOC technical bodies in turn should keep the Executive Councils of WMO and IOC informed on status and activities of the DAC network as a whole, and proposed changes, as required |  |

## Draft Decision 5.1(7)/1 (SERCOM-2)

## Updates to *Sea-ice Information and Services* (WMO-No. 574)

**The Commission for Weather, Climate, Water and Related Environmental Services and Applications decides:**

(1) To adopt the updates to [*Sea-ice Information and Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7542) (WMO-No. 574), as provided in the [annex](#_Annex_to_draft_3) to the present decision,

(2) To authorize the Secretariat, in consultation with the president of SERCOM, to make editorial changes to [*Sea-ice Information and Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7542) (WMO-No. 574).

See the [annex](#_Annex_to_draft_3) to the present decision.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Decision justification:

(1) [Resolution 4 (EC-72)](https://library.wmo.int/doc_num.php?explnum_id=10504#page=17) – Strengthening marine services,

(2) [Resolution 11 (SERCOM-1)](https://library.wmo.int/doc_num.php?explnum_id=10767#page=94) – Sea-ice Information Services in the World (WMO-No. 574) transferring format,

(3) The revised publication of [*Sea-ice Information and Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7542) (WMO-No. 574), in 2021,

(4) The Standing Committee on Marine Meteorological and Oceanographic Services (SC-MMO) is to ensure that [*Sea-ice Information and Services*](https://library.wmo.int/index.php?lvl=notice_display&id=7542) (WMO-No. 574) contains the latest information. There is a need to make minor updates to this publication since it was last revised in 2021.

## Annex to draft Decision 5.1(7)/1 (SERCOM-2)

## Updates to *Sea-ice Information and Services* (WMO-No. 574)

[Proposed updates are highlighted as tracked changes to WMO–No. 574]

### Introduction

This publication is intended to provide general information on sea ice and ~~ice~~ iceberg observing methods and systems, as well as information on the sea-ice services available worldwide to mariners and other users, supplementing [*Weather Reporting Volume D – Information for Shipping*](https://community.wmo.int/activity-areas/Marine/Pubs/WMO-No9-Vol-D-Information-for-Shipping) (WMO-No. 9).

Further progress in sea-ice information systems, the need for comprehensive information on sea-ice services, and planning for the 2007–2008 International Polar Year predetermined the decision of the SGSI successor, the Joint WMO/Intergovernmental Oceanographic Commission (IOC) Technical Commission for Oceanography and Marine Meteorology (JCOMM) Expert Team on Sea Ice (ETSI), in 2004, to update this publication on a regular basis. The third edition was published in 2006 and was available in the WMO online library. Preliminary revisions to the 2006 edition were used during the WMO Year of Polar Prediction (YOPP) project (2017–2019). During the Eighteenth World Meteorological Congress in 2019, JCOMM was disbanded. ~~At the time of publication of this latest revision, the~~ The responsibilities of the former JCOMM ETSI were ~~in the process of being~~ incorporated into the new technical commission structures. Revisions to this document are the responsibility of the WMO Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM).

The revised 2021 edition of the document was approved in 2021, during SERCOM-1. This included updates to the technical details, and an agreement to transfer the organizational details of national/regional ice services to an online platform, which could be updated regularly by Members. This latest revision approved by SERCOM-2 in 2022 finetunes some technical details.

### 1. THE NATURE OF ICE

1.1.3 Old ice

Residual ice is first-year ice that has survived one summer’s melt and is in a new cycle of growth. Historically, its thickness averages 30–180 cm depending on its location. After 1 October ~~January~~ in the northern hemisphere and after 1 April ~~July~~ in the southern hemisphere, this sea ice is referred to as second-year ice.

### 2. ICE OBSERVING METHODS

~~Some of these satellites contain instruments that produce visible and infrared images with resolutions of 250 m to 1 km (National Oceanic and Atmospheric Administration (NOAA) Advanced Very-High-Resolution Radiometer (AVHRR), SUOMI National Polar-orbiting Partnership (NPP), Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS), Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS), Sentinel-3 Sea and Land Surface Temperature Radiometer (SLSTR) and Ocean and Land Colour Instrument (OLCI)), while others contain instrumentation which generates passive microwave and scatterometer data at coarser resolutions of 6–70 km (Advanced Microwave Scanning Radiometer 2 (AMSR2), NOAA Advanced Microwave Sounding Unit (AMSU), DMSP Special Sensor Microwave Imager/Sounder (SSMIS), Advanced Scatterometer (ASCAT)). Visible and infrared data do not have cloud-penetrating capability, while microwave data are practically cloud independent. Active microwave SAR data (obtained via RADARSAT-2, Sentinel-1, TerraSAR-X, Constellation of Small Satellites for Mediterranean basin Observation (COSMO-SkyMed), and Advanced Land Observing Satellite 2 (ALOS-2)) are characterized by improved ground resolution (approximately 10–100 m) but lesser coverage due to narrow swaths and greater revisit time between exact repeat orbits. Ice services are also starting to use data from radar altimetry satellites such as Cryosat and Sentinel-3 and high-resolution (20 m or better) optical imagery from Sentinel-2.~~

At the time of this update, June 2022, a number of national and international Earth Observation programmes, and commercial operators were providing satellite data relevant to sea ice and iceberg monitoring. The provision of information is expected to increase significantly over the next decade. The types of satellite sensors that are used by ice services can be divided into 4, described here with their advantages and limitations:

1. The primary sensor for tactical monitoring of sea ice and icebergs by the ice services is **synthetic aperture radar (SAR).** This is an active microwave imaging instrument providing all-weather cloud-penetrating capability that is characterized by improved ground resolution (up to approximately 1 m, but typically 40-100 m) with the trade-off being reducing coverage swaths, from up to 400 km down to a few kilometres, as resolution is increased. Due to power constraints these satellites are unable to provide synoptic hemispheric coverage but can cover wide areas when deployed in constellations. Examples of this type of satellite capable of providing good coverage are: Copernicus Sentinel-1, RADARSAT Constellation Mission, SAOCOM-1, and RADARSAT-2. In addition, a number of commercial operators provide acquisitions with greater flexibility in timing and repeats, these include TerraSAR-X and TanDEM-X, Constellation of Small Satellites for Mediterranean basin Observation (COSMO-SkyMed), ICEYE, and Capella. In addition there are other satellites with a research focus, including Advanced Land Observing Satellite 2 (ALOS-2), Gaofen-3 and L-SAR.

2. Synoptic and climatological monitoring is provided by **passive microwave and scatterometer** data at coarser resolutions, at best 3.125 km. While these provide full daily hemispheric coverage under all weather conditions, the limitations are the much lower resolutions and poor sea ice detection capability at the ice edge, around coastlines, and during the summer melt period. This type of satellite includes the Advanced Microwave Scanning Radiometer 2 (AMSR2), National Oceanic and Atmospheric Administration (NOAA) and EUMETSAT Advanced Microwave Sounding Unit (AMSU), Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave Imager/Sounder (SSMIS), Advanced Scatterometer (ASCAT), and FengYun Microwave Radiation Imager (MWRI).

3. Under cloud-free conditions, satellites containing **optical imaging instruments** that produce visible and infrared images with resolutions of 250 m to 1 km (National Oceanic and Atmospheric Administration (NOAA), 10 m to 1 km are an important supplement to the active and passive microwave imagers. Daylight conditions provide the highest resolution visible imaging, while at night resolution is limited to 1 km from infrared. Infrared imaging provides important information on freezing and melting conditions, while visible can be used to determine the state of the sea ice surface. Optical sensors include the NOAA and EUMETSAT Advanced Very-High-Resolution Radiometer (AVHRR), SUOMI National Polar-orbiting Partnership (NPP),NASA Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS), Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS), Sentinel-3NASA/NOAA Suomi National Polar-orbiting Partnership (NPP) Visible Infrared Imaging Radiometer Suite (VIIRS), and Copernicus Sentinel-3 Ocean and Land Colour Instrument (OLCI) and Sea and Land Surface Temperature Radiometer (SLSTR) and Ocean and Land Colour Instrument (OLCI)), while others contain instrumentation which generates passive microwave and scatterometer data at coarser resolutions of 6–70 km (Advanced Microwave Scanning Radiometer 2 (AMSR2), NOAA Advanced Microwave), and Copernicus Sentinel-2 Multispectral Instrument (MSI).

4. The final type of satellite data that is starting to be used by ice services is **satellite altimetry**. This can either be from radar, where the height of the snow-ice interface above sea level is measured under dry-snow and all-weather conditions, or laser, measuring the height of snow-air interface when cloud-free. These types of satellite provide measurements along a single or multiple parallel orbital transects. Examples of radar altimeter include the CryoSat-2 SAR Interferometric Radar Altimeter (SIRAL), and Copernicus Sentinel-3 SENTINEL-3 Ku/C Radar Altimeter (SRAL). There is only one laser altimeter currently in operation, the NASA ICESat-2 Advanced Topographic Laser Altimeter System (ATLAS).

### 3. INTEGRATED OBSERVATIONAL SYSTEMS

Operators now have various sea-ice reporting regimes. Synoptic ship observation reports provide limited ice information. However, groups in both the Arctic and Antarctic have developed software programs to encourage the collection of shipborne observations from research and voluntary participants. For example, in the Arctic, the Ice Watch Programme (https://icewatch.met.no) has developed the Arctic Shipborne Sea Ice Standardization Tool (ASSIST), ~~sponsored by the WMO World Climate Research Programme (WCRP), provides a software program~~ designed to capture sea-ice conditions and processes. In addition, there is the IceWatchApp for mobile phones that allows citizen scientists to submit photographic records of sea-ice conditions. In the Antarctic, the Antarctic Sea Ice Processes and Climate (ASPeCt, http://aspect.antarctica.gov.au/) ~~expert group,~~ an Expert Group sponsored by the Scientific Committee on Antarctic Research (SCAR/WCRP), seeks to collect the same data and provides the IceBox sea-ice data acquisition and analysis system.

### 4. ICE INFORMATION SERVICES

*[…]*

### 5. INTERNATIONAL COOPERATION

~~On a larger scale, until it was disbanded at the Eighteenth World Meteorological Congress~~

~~in 2019, JCOMM ETSI~~~~2~~ ~~was instrumental in developing internationally accepted terminology,~~

~~formats to exchange operational and archived data on sea ice, and other guidance material.~~

~~JCOMM ETSI actively collaborated with other international sea-ice groups such as the~~

~~International Ice Charting Working Group (IICWG) and the Baltic Sea Ice Meeting (BSIM).~~

The international sea-ice terminology, including an illustrated glossary and a system of sea-ice

symbols, was developed and first published in 1971 in English, French, Russian and Spanish

(see Sea Ice Nomenclature (WMO-No. 259)) and since that time has been regularly updated

and amended.

In the 1980s and 1990s, several formats were developed to archive the exchange of sea-ice information: SIGRID, designed by WMO in 1989 and SIGRID-2, designed by WMO in 1994. In addition, in cooperation with the International Ice Charting Working Group (IICWG) ~~IICWG~~, two JCOMM Technical Report Series documents, [*SIGRID-3:*](https://library.wmo.int/index.php?lvl=notice_display&id=11295)[*A Vector Archive Format for Sea Ice Charts*](https://library.wmo.int/index.php?lvl=notice_display&id=11295)(WMO/TD-No. 1214) and the [*Ice Chart Colour Code*](https://library.wmo.int/index.php?lvl=notice_display&id=11296)[*Standard*](https://library.wmo.int/index.php?lvl=notice_display&id=11296)(WMO/TD-No. 1215), were prepared and issued in 2004.

On a larger scale, until it was disbanded at the Eighteenth World Meteorological Congress in 2019, JCOMM ETSI2 was instrumental in developing internationally accepted terminology, formats to exchange operational and archived data on sea ice, and other guidance material. JCOMM ETSI actively collaborated with other international sea-ice groups such as the International Ice Charting Working Group (IICWG) and the Baltic Sea Ice Meeting (BSIM).

2 ~~At the time of publication of this document, the responsibilities of the former ETSI were being incorporated into the new WMO Technical Commission structures.~~ Since 2020, WMO SERCOM.

In December 2014, following the recommendations and decisions of JCOMM ETSI and IICWG, Norway (Norwegian Meteorological Institute (NMI)), the Russian Federation (AARI) and the United States (USNIC) initiated ~~a pilot project on~~ integrated sea-ice analysis for Antarctic waters. Joint activities include weekly hemispheric sea-ice charting and southern hemispheric tabular iceberg analysis by USNIC, hemispheric sea-ice charting every other week and weekly hemispheric tabular iceberg analysis by AARI, and weekly regional Antarctic peninsula sea-ice charting by NMI. More recently Argentina and Chile have set up production of regional sea-ice information updated on a regular basis for the support of shipping.

WMO SERCOM continues to cooperate with the IICWG, the IMO, the IHO, and the Arctic Council’s Arctic Shipping Best Practices Information Forum, and national agencies, to ensure the most relevant ice information is available for public use.

### 6. NATIONAL AND REGIONAL SEA-ICE SERVICES

*[…]*

### LIST OF ACRONYMS

|  |  |
| --- | --- |
| ATLAS | Advanced Topographic Laser Altimeter System |
| MSI | Multispectral Instrument |
| MWRI | Microwave Radiation Imager |
| SERCOM | Commission for Weather, Climate, Water and Related Environmental Services and Applications |
| SIRAL | SAR Interferometric Radar Altimeter |
| SRAL | SENTINEL-3 Ku/C Radar Altimeter |
| VIIRS | Visible Infrared Imaging Radiometer Suite |

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