

WORLD METEOROLOGICAL ORGANIZATION

**INTERGOVERNMENTAL OCEANOGRAPHIC
COMMISSION (OF UNESCO)**

JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY
(JCOMM)
EXPERT TEAM ON MARITIME SAFETY SERVICES

ETMSS-III/Doc. 6.2
(03.IX.2010)

THIRD SESSION

ITEM 6.2

ST PETERSBURG, RUSSIAN FEDERATION
4 TO 8 OCTOBER 2010

Original: ENGLISH

CATALOGUE OF MARINE & OCEANOGRAPHIC PARAMETERS

(Submitted by the Secretariat)

Summary and Purpose of Document

This document provides a short background information on MSI in graphical/numerical form and introduce the draft Catalogue of Met-ocean Feature Object Classes and Attributes

ACTION PROPOSED

The participants of the session are invited to:

- (a) Note and comment on the information provided as appropriate;
- (b) Review and enrich the draft Catalogue of Met-ocean Feature Object Classes and Attributes.

BACKGROUND

Since 1999, JCOMM has requested ETMSS to work on the implementation of graphical/numerical MSI broadcast within the GMDSS. Despite some limited studies and discussions, the Team has failed to consider this main issue. In the same context, the WMO EC-LX (June 2008) emphasized the continuing importance to mariners in receiving graphical products via radio transmissions and requested JCOMM to continue researching methods for transmitting graphical products to marine users. On the other hand, the WMO Executive Council, at its sixty-first session (Geneva, June 2009), encouraged WMO Members to investigate low-cost options for on-demand approaches that are compatible with Electronic Navigation Charts (ENC).

The Marine Information Objects (MIO) consist of supplementary information to be used with an ENC. Supplementary means additional, non-mandatory information not already covered by existing IMO, IHO, and IEC (International Electrotechnical Commission) standards or specifications. Examples of MIOs include ice coverage, tide/water level, current flow, and meteorological, oceanographic, and marine habitats. Depending on the navigation situation or task-at-hand, the provision and use of the MIOs (e.g., ice coverage, weather conditions, etc.) can be crucial in terms of improving both the safety and efficiency of maritime navigation, as well as ensuring the protection of the marine environment. In order to facilitate the development and implementation of MIOs, the IHO and IEC agreed to establish a Harmonization Group on Marine Information Objects (HGMIO) in May 2002, which developed specific standards.

The increase of ENC systems on SOLAS vessels as regulatory material and the emergence of the e-navigation concept within IMO (see agenda items 2.2 & 6.1) have reinforced the priority given to this requirement and the need to find appropriate resources to develop a suitable service.

Both the ETMSS and ETSI have been working on this issue. ETSI has already developed the Sea Ice Objects Catalogue in accordance with the S-57 and S-100 IHO chart data exchange standards.

For other Met-ocean parameters, the ETMSS (Chair and Vice-chair) and the WMO Secretariat have initiated the development of a catalogue on Met-ocean Object Classes and Attributes. JCOMM-III requested ETMSS to continue to develop this catalogue to define standards for ENC and e-Navigation, in collaboration with ETSI and guidance from IMO and IHO (SFSPA **Project #22 (with ETSI)** – see agenda item 2).

Attachment: Progress Activity Report

CONTENTS

Progress/Activity Report	1
Annex I – Terms of Reference	8
Annex II – Proposed Met-Ocean Feature Object Classes and Attributes.....	9
Annex III – Met-Ocean Object Classes	14
Annex IV – Met-Ocean Attributes.....	48
Annex V – References.....	85
Annex VI – Acronyms and other Abbreviations	87

PROGRESS/ACTIVITY REPORT

1. Background

1.1 Mariners strongly benefit from displaying information on electronic charts. The Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) recognized at the first session (2001, Akureyri, Iceland) that meteorological analysis and forecast charts are regarded by the users as essential adjuncts to forecasts and warnings in text format and of vital importance to the safety of life at sea. In 2007 the Expert Team on Maritime Safety Services (ETMSS) noted at the second session in Angra dos Reis, Brazil, the usefulness of the information in graphical form. It received the highest positive response of any field reported (94% yes) in the 4-yearly Manual on Marine Meteorological Services (MMMS) survey conducted in 2004. ETMSS-II stated with reference to the 2001 amendments to the International Convention for the Safety of Life at Sea (SOLAS), Chapter V, that weather information in graphical form should be made available for shipping.

The WMO Executive Council (EC) LX in 2008

requested JCOMM to continue researching methods for transmitting graphical products to marine users, and requested the Secretary-General to promote resource mobilization to further develop these activities and partnerships through national and international support. (in paragraph 4.2.25)

In the following year EC-LXI

noted the successful development, in accordance with IHO standards, of product specification for sea ice information in Electronic Navigation Chart Systems (ENC). It encouraged Members to make maximum use of these essential tools and requested JCOMM, in consultation with IMO, to develop similar standards for other met-ocean variables. It requested the WMO Secretary-General to promote resource mobilization to develop these activities and partnerships through national and international support. (in paragraph 4.2.31)

1.2 There have been several approaches to push forward the development of product specifications for meteorological and oceanographic parameters consistent with the existing IHO standards by JCOMM, especially the ETMSS, which appointed a Rapporteur on Weather Information in graphical form in Electronic Chart Display and Information System (ECDIS). But, as concluded at ETMSS-II, the primary reason for the failure in achieving this project, in addition to its complexity and scope, is simply the lack of human resource.

1.3 The development of graphical products for mariners should be consistent with the International Maritime Organization (IMO) concept of e-navigation, discussed at the 54th session of the Sub-committee on Safety of Navigation (NAV) in 2008. It is defined that e-navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment. One of the core objectives to meet the user needs is to facilitate safe and secure navigation of vessels having regard to hydrographic, meteorological and navigational information and risks.

1.4 There are various possibilities to deliver and display the information. Alternatives to the dissemination via radiofacsimile broadcast are the use of satellite channels and delivering data via e-mail or FTP mail. Automatic Identification System (AIS) binary massaging may become a key feature of e-navigation. Also different graphical approaches exist. Some of them are forecaster-generated grids, vector charts or warning polygons. In this report the focus is directed to the development of met-ocean information in ECDIS.

1.5 ECDIS is a computerized navigation system which has advanced functions such as route planning and automatic alarms. It is also possible to include time variable navigational objects representing the dynamic variability of the elements surrounding the ships. These objects are known under the term Marine Information Objects or Marine Information Overlays (MIOs). These consist of supplementary information that are not ENC objects or specified navigational elements or parameters. Supplementary means additional, non-mandatory information not already covered by existing IMO, International Hydrographic Organization (IHO), and International Electrotechnical Commission (IEC) standards or specifications. The existing navigational information for ECDIS is based on the *IHO Transfer Standard for Digital Hydrographic Data (S-57)* and *IHO Specifications for Chart Content and Display Aspects of ECDIS (S-52)*, where the Objects and the associated Attributes as well as the colours and symbols are defined. MIOs should conform to these standards.

1.6 The concept ECDIS is based on assuming that real world entities can be categorized into a finite number of types. These entity types are termed feature object classes. An instance of a feature object class, referred to as a feature object, can be more precisely described by assigning to it a number of attributes and then specifying values for those attributes. A particular real world entity is encoded by specifying the appropriate feature object class, attributes and attribute values.

1.7 Although the *IHO Hydrographic Geospatial Standard for Marine Data and Information (S-100)*, developed to overcome limitations of S-57, will be active as of 2010, S-57 will remain for the foreseeable future and therefore define the standard for the development of MIOs. Nevertheless as S-100 provides the facility to transfer and display time-varying and gridded information it will be in future more than an alternative for the dissemination of met-ocean Maritime Safety Information (MSI).

1.8 The dissemination at sea is limited due to restrictions of the bandwidth of radio and satellite channels for transmission of MSI. The IMO Sub-committee on Radiocommunications and Search and Rescue (COMSAR) and the NAV Sub-committee figure out the requests for future systems which should be able to disseminate graphical products. In addition to the limited bandwidth of systems, the potential cost implication for MSI providers (including met-ocean Issuing Services) that would be involved in the dissemination at sea of such additional graphical/numerical information, will require to define highly compressed format(s) and perhaps to consider pull systems for non-essential data. The latter would imply that transmission costs, if any, had to be paid by users.

2 Terms of Reference for an Internship

2.1 As emphasized in 1.1 the work in developing standards for Met-ocean information in ENCs is strongly recommended. The Terms of Reference (ToR) for the internship are therefore concentrated on ECDIS – see Annex I.

2.2 The purpose of the internship is as a first step to prepare an inventory of the existing IMO and IHO standards for ECDIS and associated documentation. The second step shall develop a catalogue on met-ocean feature object classes and attributes required for transmitting met-ocean graphical products to mariners, consistent with the standards mentioned above. A progress/activity report is included.

2.3 NOTE: The work on Sea Ice Objects and Attributes is already done and therefore not included in this ToR. Detailed information on this work is available in the *Ice Objects Catalogue – Version 4.0*.

3. REVIEW OF EXISTING DOCUMENTATION WITHIN WMO RELEVANT TO THE WORK

3.1 WMO Publications

3.1.1 It follows a list, including very short descriptions of content, of the consulted publications sorted by subject.

3.1.1.1 Marine Meteorology

- WMO-No. 8 (2008) (Guide to Meteorological Instruments and Methods of Observation) – Guidance on the most effective practices for carrying out meteorological observations and measurements. Part II, Chapter 4 (Marine Observations) contains a list of elements, which should be observed on ships.
- WMO-No. 9, Volume D (2008) (Weather Reporting – Information for Shipping) – Includes marine meteorological and other related geophysical information necessary for safe and economic conduct of shipping operations, as well as for fishing and other marine activities.
- WMO-No. 182 (1992) (International Meteorological Vocabulary) – Defines the terms used in meteorology.
- WMO-No. 306 (1995) (Manual on Codes) – Inventory of Code Forms and Binary Codes made up of Symbolic Letters (or groups of letters) representing meteorological and other related geophysical parameters. The specifications and if necessary code figures in Code Tables are given.
- WMO-No. 471 (2001) (Guide to Marine Meteorological Services) – Gives overview of the Marine Meteorological Services, lists terminology used for them and explains the different services.
- WMO-No. 485 (1992) (Manual on the Global Data-processing and Forecasting System) – Contains standard and recommended practices and procedures, explains the organization and functions of the Global Data-processing and Forecasting System and the data-processing and forecasting aspects.
- WMO-No. 488 (2007) (Guide to the Global Observing System) – Deals with the organization and implementation of the Global Observing System.
- WMO-No. 544 (2003) (Manual on the Global Observing System) – Specifies what is to be observed where and when in order to meet the relevant observational requirements.
- WMO-No. 558 (1990) (Manual on Marine Meteorological Services) – Contains standard and recommended practices to be applied by members providing Marine Meteorological Services.
- WMO-No. 702 (1998) (Guide to Wave Analysis) – Guidance material on wave forecasting methodology suitable for use by National Meteorological Services.
- WMO/TD-No. 850 (1998) (Handbook of Offshore Forecasting Services) – Assistance to offshore forecast users including some terminology and a couple of examples of forecasts in different manners.

3.1.1.2 Aeronautic

- WMO-No. 49, Volume II (2007) (Technical Regulations Basis Documents No. 2 – Meteorological Service for International Air Navigation) – Gives the core standards and recommended practices used for meteorological services for international air navigation, e.g. SIGMET and AIRMET information.

3.1.2 Most of the publications turned out to be useful for the purpose of developing a list of met-ocean objects. These were WMO-No. 182 for definitions, WMO-No. 306 as a guideline for the coding, WMO-No. 8 as a reference for the observed elements on ships, WMO-No. 471 listing parameters required by Rescue Coordination Centres (RCCs), WMO-No. 558 and WMO-No. 485 which include already used symbology, WMO-No.49 giving the meteorological parameters disseminated in aeronautics and WMO-No.850 for some terminology.

3.2 WMO Working Documents

3.2.1 Expert Team on Maritime Safety Services (ETMSS)

- Lisbon, Portugal (2002, First Session), Weather Information in Graphical Form for GMDSS – Terms of Reference for the Rapporteur – Contains a proposal for the appointment of a Rapporteur on weather information in graphical form and the appropriate Terms of Reference.
- Lisbon, Portugal (2002, First Session), Weather Information in Graphical Form for GMDSS – Report from the Services Programme Area Coordinator on Progress of Project with Inmarsat – Contains a progress report on the project by Inmarsat Ltd., in conjunction with the Australian Bureau of Meteorology, to develop a facility for transmitting SafetyNET graphical products via Inmarsat C.
- Angra dos Reis, Brazil (2007, Second Session), Weather Information in Graphical Form for GMDSS – Contains proposal for the JCOMM project related to the provision of Maritime Safety Information (MSI) in graphical format for SOLAS and non-SOLAS vessels via the Inmarsat SafetyNET
- Geneva, Switzerland (2009, Task Team on Maritime Safety Information, submitted by Dr Vasily Smolyanitsky), Met-ocean Information in Graphical/Numerical Form and E-Navigation Charts – Provides information on the Expert Team on Sea Ice (ETSI) ENC Ice Objects Task Group (TG-ENCIO) activities since 2004 regarding development of documentation for sea ice products presentation within ENC.
- Geneva, Switzerland (2009, Task Team on Maritime Safety Information, submitted by International Hydrographic Bureau (IHB)), Met-ocean Information in Graphical/Numerical Form and E-Navigation Charts – Provides information on the changes to the IHO Committee Structure and the joint IHO IEC Harmonization Group on Marine Information Overlays (HGMIO).
- Geneva, Switzerland (2009, Task Team on Maritime Safety Information), Final Report, JCOMM Meeting Report No. 64.

3.2.2 Harmonization Group on Marine Information Objects/Overlays (HGMIO)

- HGMIO2/6e, Monaco (2002), Oceanographic Object Attribution – Technical White Paper – Contains an overview of the progress done so far and a proposed list of oceanographic object classes and attributes.
- HGMIO2/10, Monaco (2002), Proposed Object Classes and Attributes for Weather – Contains a catalogue of the object classes and attributes.
- HGMIO4-4B, Durham, New Hampshire, USA (2007), Marine Information Objects (MIO) – Gives overview of the state of the art of ECDIS and a MIO development procedure.

- HGMIO4-7B, Durham, New Hampshire, USA (2007), General Content Specification for Marine Information Overlays (MIOs) – Contains the General Content Specification for MIOs.
- HGMIO (Lee Alexander, Michel Huet; 2007), Relationship of Marine Information Overlays (MIOs) to Current/Future IHO Standards, Version 4 – Deals mainly with the current S-57 standard and the future S-100 standard.

3.2.3 Expert Team on Sea Ice (ETSI)

- Geneva, Switzerland (2007, Third Session), Ice Objects Catalogue – Catalogue of the new defined Object Classes and Attributes for sea ice information in ECDIS.

4. REVIEW OF RELEVANT PUBLICATIONS BY ORGANIZATIONS/AGENCIES EXCEPT WMO

4.1 It follows a list of the ECDIS-related publications by organisations/agencies except WMO sorted by organisation/agency.

4.1.1 International Electrotechnical Commission (IEC)

- IEC 61174 (2008) (Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results)
- IEC 62288 (2008) (Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results)

4.1.2 International Hydrographic Organization (IHO)

- S-32 Appendix 1 (2007) (Hydrographic Dictionary – Glossary of ECDIS Related terms) – Provides a list of all ECDIS-related terms in use, with specific definitions.
- S-52 (2008) (Specifications for Chart Content and Display Aspects of ECDIS) – Provides specifications and guidance regarding the issuing of ENC's, their display in an ECDIS and their updating.
- S-57 (2000) (IHO Transfer Standard for Digital Hydrographic Data) – Describes the data standard to be used for exchange of digital hydrographic data, and for the distribution of digital hydrographic products to manufacturers, mariners, and other data users.

4.1.3 International Maritime Organization (IMO)

- Resolution A.817(19) (1995) (Performance Standards for Electronic Chart Display and Information Systems (ECDIS)) – Determines performance standards for ECDIS.
- Resolution MSC.64(67) (1996) (Adoption of New and Amended Performance Standards) – Amendment to A.817(19)
- Resolution MSC.86(70) (1998) (Adoption of New and Amended Performance Standards for Navigational Equipment) - Amendment to A.817(19)

- Resolution MSC.191(79) (2004) (Performance Standards for the Presentation of Navigation-related Information on Shipborne Navigational Displays) – Additional standard, determines e.g. radar presentation
- Resolution MSC.232(82) (2006) (Adoption of the Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)) - Amendment to A.817(19)
- NAV 54/25 Annex 12 (2007) (Draft Strategy for the Development and Implementation of E-navigation) – Explains the IMO concept of E-navigation, e.g. lists user needs and basic requirements, gives reasons and anticipated benefits for e-navigation.
- NAV 55/INF.9 (2009) (Development of an E-navigation Strategy Implementation Plan – Results of a Worldwide E-navigation User Needs Survey) – Describes the detailed e-navigation user needs including environmental information.
- NAV 55/8/2 (2009) (ITU Matters, Including Radiocommunication; ITU-R Study Group Matters – World Radiocommunication Conference 2011 – Future Spectrum Requirement with Respect to E-navigation) – Gives overview of current limitations and suggestions of future requirements.

4.1.4 Intergovernmental Oceanographic Commission (IOC)

- IOC Manuals and Guides No. 4 (1975) (Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices) – Guides through the different oceanographic and marine meteorological parameters by explaining them and the measurement methods.
- IOC Technical Series No. 37 (1991) (Tsunami Glossary) – Lists as many as possible of the terms found in the tsunami literature and provide their specific definitions.

4.2 IHO S-57 has been used because of the catalogues of the already existing Feature Object Classes and Attributes. The IOC documentations have been helpful for the symbology (Manuals and Guides No. 4) and terminology (Technical Series No. 37).

5. DEVELOPMENT OF A CATALOGUE ON MET-OCEAN OBJECTS AND ATTRIBUTES

5.1 The first task has been to get an overview of ECDIS-related documentations within WMO – see item 3 – and by other organisations/agencies – see item 4. After consultation of these publications a better view on ECDIS, the related standards and the already existing Objects and Attributes has been present. As a basis the *Proposed Object Classes and Attributes for Weather*, the development of the *Ice Objects Catalogue – Version 4.0* and some former work done on oceanographic objects and attributes has been helpful. To clarify the needs of the mariners on met-ocean information important for the safety at sea the lecture of the documentation has been also very useful.

5.2 Comparing and combining all the information has lead to a first list of proposed Met-ocean Feature Object Classes and associated Attributes attached in Annex II. A duplication of already existing Objects and Attributes has been avoided. Furthermore the names of the Objects and Attributes are as far as possible consistent with the terminology defined in the *International Meteorological Vocabulary*. The proposed Objects and Attributes are divided into categories, meaning sorted by the necessity for safety and security of navigation. The “additional parameters” are listed for completeness and can be considered for efficiency of navigation.

5.3 In a next step catalogues of the proposed met-ocean Object Classes and Attributes, respectively, have been developed (Annexes III and IV). They are consistent with the existing *IHO Object Catalogue* (S-57, Appendix A) and the *Ice Objects Catalogue – Version 4.0*. For every

Object Class references of WMO publications which contain the meteorological parameter the Object deals with are given. Additionally the Objects are defined using official WMO terminology where available. The Object Classes have also each an acronym as well as a list of the subset Attributes which are used with the particular Object, containing already defined and new proposed Attributes.

5.4 These new Attributes refer also to WMO publications dealing with marine meteorological services or the global data-processing and forecasting system. As for the Objects, the terminology used for the names of the Attributes themselves, and/or the expected input has been defined where possible, but there also occurred some gaps of defined terminology in WMO publications.

6. DISCUSSION AND CONCLUSION

6.1 There remains a lot of work to do until the new met-ocean Object Classes and Attributes can be implemented into the IHO standard. The now provided Catalogues have to be discussed by members of expert teams of WMO and IHO dealing with safety at sea, navigational aspects or marine meteorology. Further the symbology has to be defined and references made. As a last step companies have to develop systems which allow to display the new met-ocean information on the ECDIS.

6.2 A special task has to be done by WMO. Several problems occurred because of missing definitions in the WMO publications. Therefore the need of a Marine Glossary within WMO turned out.

6.3 The work done in this internship should contribute to the development of the possibility to display met-ocean information in the ECDIS environment. Aim of this issue is to improve the safety of navigation at sea.

6.4 I very much like to acknowledge Alice Soares for supervising my internship. She took the time to give me advise and discuss subjects with me, even when she was very busy. Thanks also to Henri Savina who contributed to my work by giving several helpful comments on the issue.

TERMS OF REFERENCE

***Internship at the Marine Meteorology and Ocean Affairs Division
2 June to 31 August 2009***

1. Prepare an inventory of the existing IMO and IHO standards for Electronic Chart Display and Information System (ECDIS) and associated documentation.
 2. Develop a catalogue on Met-ocean Objects and Attributes required for transmitting Met-ocean graphical products to mariners, consistent with IMO/IHO Performance Standards for ECDIS.
 3. Prepare a progress/activity report.
-

PROPOSED MET-OCEAN FEATURE OBJECT CLASSES AND ATTRIBUTES

Category*	Proposed Parameters WMO July 2009	Proposed Objects (Attributes) WMO July 2009	WMO-No. 471, 1992 WMO-No. 558, 1990 Guide to / Manual on Marine Meteorological Services	HGMIO2/10 Nov 1999/Aug 2003 Jana Schulze Objects (Attributes) HGMIO2-6e [II] Jun 2002 IHB / Maxim an Norden	WMO-No. 49, 2008 Technical Regulations Volume II (SIG/AIRMET)	Status of the JCOMM Observation Requirements 2007
1 - HIGH	Wind	Surface Wind Force [1] (Category of Surface Wind Force) Surface Wind Direction [1] (Value of Surface Wind Direction + Change in Surface Wind Direction) Gust (Category of Surface Wind Force)	Surface Winds	Wind (Wind Velocity + Weather Forecast + Wind Gust + Gust Velocity)	Surface Wind Speed Strong Surface Winds and Gusts Squall	Surface Winds (A,B,C,D,M,S) Surface and Upper Air Winds (D) Sea Surface Winds: Direction (G) Wind Speed: Profiles (G) Sea Surface Winds: Speed, Coastal; Speed (G)
	Sea State	Wave [1] (Significant Wave Height + Length + Period + Direction) Swell [1] (Significant Wave Height + Length + Period + Direction) Wind Sea [1] (Significant Wave Height + Length + Period + Direction) Storm Surge (Value of Storm Surge) Tsunami (Significant Wave Height + Length + Period + Direction)	Sea and Swell Surf and Breakers Storm Surge	Sea Swell (Weather Forecast + Wave Height + Wave Length) Wind Wave (Weather Forecast + Wave Height + Wave Length) Breaking Waves [II] Swell [II] Storm Surge [II]	Tsunami	Sea State (A,B,C,D,M,S) Ocean Waves: Direction; Period; Significant Wave Height; 1D Freq Spectral Data; 2D Freq, Direction Spectral Data (G) Significant Wave Height (W) Dominant Wave Direction (W) Wave Period (W) 1D Frequency Spectral Wave Energy Density (W) 2D Frequency Direction Spectral Wave Energy Density (W)
	Tropical Cyclone	Tropical Cyclone (Category of Tropical Cyclone)		Tropical Cyclones (Category of Tropical Cyclones + Geographic Position of Tropical Cyclone + Weather Forecast + Speed of a Tropical Cyclone)	Tropical Cyclone	

	Visibility	Surface Visibility [1] (Category of Surface Visibility)	Surface Visibility		Surface Visibility	Visibility (A,D,S)
Category*	Proposed Parameters WMO July 2009	Proposed Objects (Attributes) WMO July 2009	WMO-No. 471, 1992 WMO-No. 558, 1990 Guide to / Manual on Marine Meteorological Services	HGMIO2/10 Nov 1999/Aug 2003 Jana Schulze Objects (Attributes) HGMIO2-6e [II] Jun 2002 IHB / Maxim an Norden	WMO-No. 49, 2008 Technical Regulations Volume II (SIG/AIRMET)	Status of the JCOMM Observation Requirements 2007
1 – HIGH	Significant Weather	Significant Weather (Category of Significant Weather)	Precipitation and cloud cover; including height of cloud base	Area of Precipitation (Weather Forecast) Significant Weather (Category of Significant Weather)	Thunderstorms Hail Snow Freezing Precipitation	Lightning (A,S) Precipitation (B,M,S)
	Fronts	Front (Category of Front)		Fronts (Category of Front + Weather Forecast)		
	Atmospheric Pressure	Centre of Low Pressure (Value of Atmospheric Pressure + Atmospheric Pressure Accuracy) Centre of High Pressure (Value of Atmospheric Pressure + Atmospheric Pressure Accuracy) Atmospheric Pressure Contour (Value of Atmospheric Pressure Contour + Atmospheric Pressure Accuracy)	Atmospheric Pressure	High Pressure (Category of + Value of High Pressure + Weather Forecast) Low Pressure (Category of + Value of Low Pressure + Weather Forecast) Pressure Area (Pressure Value 1 + Value 2 + Weather Forecast) Isopleths (Category of Isopleths + Pressure Value of an Isopleth + Weather Forecast)		Atmospheric Pressure: Surface (G)
	Icing	Icing (Icing Intensity)	Ice Accretion		Icing	Ice Accretion (D,M,S)
	Expected Progress	Expected Movement (Direction of + Speed of Expected Movement) Expected Change in Intensity (Category of Expected Change in Intensity)		Motion [of an Weather Object] (Speed [of a Weather Object])	Movement or Expected Movement Expected Changes in Intensity	

	Surface Current	Sea-surface Current (Direction of + Speed of Surface Current)	Surface Currents	Major Currents [II] Coastal Currents [II] Wind Driven Currents [II] Rip Currents [II] Upwelling [II] Fronts and Eddies [II] Flow Rates [II]		Surface and Near-surface Currents (A) 3D Ocean Currents (B) Ocean Currents: Direction, Profiles; Direction, Surface; Direction, Surface, Offshore; Speed, Profiles; Speed, Surface; Speed Surface, Offshore (G) Surface and Sub-surface Currents (M,S) Surface / Tidal Currents (C)
Category*	Proposed Parameters WMO July 2009	Proposed Objects (Attributes) WMO July 2009	WMO-No. 471, 1992 WMO-No. 558, 1990 Guide to / Manual on Marine Meteorological Services	HGMIO2/10 Nov 1999/Aug 2003 Jana Schulze Objects (Attributes) HGMIO2-6e [II] Jun 2002 IHB / Maxim an Norden	WMO-No. 49, 2008 Technical Regulations Volume II (SIG/AIRMET)	Status of the JCOMM Observation Requirements 2007
2 – MEDIUM	Air Temperature	Maximum Air Temperature (Value of Temperature + Temperature Accuracy) Minimum Air Temperature (Value of Temperature + Temperature Accuracy) Air Temperature Contour (Value of Air Temperature Contour + Temperature Accuracy)	Air Temperature	Isopleths (Category of Isopleths + Air Temperature Value of an Isopleth + Weather Forecast)		Surface Air Temperature (D,M,S) Air Temperature: Profiles (G) Air Temperature (B,M,S)
	Sea-surface Temperature	Maximum Sea-surface Temperature (Value of Temperature + Temperature Accuracy) Minimum Sea-surface Temperature (Value of Temperature + Temperature Accuracy) Sea-surface Temperature Contour (Value of Temperature Contour + Temperature Accuracy)	Sea-surface Temperature	Temperature [II]		Sea Surface Temperature (D,M,S) Sea Surface Temps (G) Sea Temperature (B)

3 – LOW	Pressure Tendency	Maximum Pressure Increase / Minimum Pressure Decrease (Value of Pressure Tendency + Pressure Accuracy) Maximum Pressure Decrease / Minimum Pressure Increase (Value of Pressure Tendency + Pressure Accuracy) Pressure Tendency Contour (Value of Pressure Tendency Contour + Pressure Accuracy)				
	Clouds	Cloud [1] (Height of Cloud Base + Total Cloud Cover)	Precipitation and cloud cover; including height of cloud base		Cloud	Cloud Cover (D,S) Cloud Top Temperature (G) Imagery: Cloud (G)
Category*	Proposed Parameters WMO July 2009	Proposed Objects (Attributes) WMO July 2009	WMO-No. 471, 1992 WMO-No. 558, 1990 Guide to / Manual on Marine Meteorological Services	HGMIO2/10 Nov 1999/Aug 2003 Jana Schulze Objects (Attributes) HGMIO2-6e [II] Jun 2002 IHB / Maxim an Norden	WMO-No. 49, 2008 Technical Regulations Volume II (SIG/AIRMET)	Status of the JCOMM Observation Requirements 2007
3 - LOW	Dew-point Temperature	Maximum Dew-point Temperature (Value of Temperature + Temperature Accuracy) Minimum Dew-point Temperature (Value of Temperature + Temperature Accuracy) Dew-point Temperature Contour (Value of Dew-point Temperature Contour + Temperature Accuracy)	Humidity			Water Vapor: Profiles (G)
			Water Discoloration	Salinity [II]	Turbulence	Bathymetrie / Shoreline (A,B,C,D,M,S)
				Pressure [II]	Mountain Wave	Bathymetrie (G)
				Solar Radiation [II]	Duststorm	Ocean Color (G)
			Sound Velocity [II]		Sandstorm	Ocean Temperature: Profiles; Profiles, Coastal (G)
				Acoustic Propagation [II]	Volcanic Ash	Ozone: Profiles (G)

			Light Reflection [II]	Radioactive Cloud	Ozone: Total Column (G)
			Ocean Colour [II]	Mountain Obscuration	Incoming Longwave Radiation: Surface (G)
			Bioluminescence [II]	Hoar Frost or Rime	Radiances: Microwave (G)
			Flooding [II]	Rising Sand or Dust	Radiances: Raw Data, Instrument Specific (G)
			Roughness [II]	Frost	Radiances: Visible (G)
			Impact Burial [II]		Salinity: Profiles, Subsurface; Surface (G)
			Bottom Sediment [II]		Sea Surface Height (G)
			Marine Vegetation [II]		Ocean Temperature and Density (M,S)
			Erosion [II]		Ocean Density (B)
			Dredging [II]		
			Damming [II]		
			Pollution [II]		
			Trafficability [II]		
			Estuaries [II]		

*The proposed Objects and Attributes are divided into categories, meaning sorted by the necessity for safety and security of navigation. The “additional parameters” are listed for completeness and can be considered for efficiency of navigation.

[1] In accordance to observed elements listed in WMO-No. 8, Part II

(A) Met-ocean Data Requirements: Vessel Safety and Support

(B) Met-ocean Data Requirements: Pollution at Sea

(C) Met-ocean Data Requirements: Support for MPEROAs

(D) Met-ocean Data Requirements: SAR Operations

(G) General Observation Requirements for Met-ocean Forecast Systems

(M) Marine Accident Emergency Response

NOTE: The work on Sea Ice Objects and Attributes is already done and therefore not included. Detailed information on this work is available in the *Ice Objects Catalogue – Version 4.0*.

Annex III**MET-OCEAN OBJECT CLASSES**

Met-Ocean Object Class	Acronyms
Surface Wind Speed	SUWISP
Surface Wind Direction	SUWIDI
Gust	GUSGUS
Wave	WAVWAV
Swell	SWELLS
Wind Sea	WINSEA
Storm Surge	STOSUR
Tsunami	TSUNAM
Tropical Cyclone	TROCYC
Surface Visibility	SURVIS
Significant Weather	SIGWET
Front	FRONTS
Centre of Depression	CENDEP
Centre of Anticyclone	CENANT
Isobar	ISOBAR
Icing	ICINGS
Expected Movement	EXPMOV
Expected Change in Intensity	EXPINT
Sea-surface Current	SESUCU
Minimum Air Temperature	MINTEM
Maximum Air Temperature	MAXTEM
Isotherm	ISOTHE
Minimum Sea-surface Temperature	MINSST
Maximum Sea-surface Temperature	MAXSST
Sea-surface Temperature Contour	SSTCON
Pressure Tendency	PRETEN
Maximum Pressure Decrease/Minimum Pressure Increase	MAXPDE
Maximum Pressure Increase/Minimum Pressure Decrease	MAXPIN
Pressure Tendency Contour	PRTCON
Cloud	CLOUDS
Minimum Dew-point Temperature	MINDPT
Maximum Dew-point Temperature	MAXDPT
Dew-point Temperature Contour	DPTCON

Met-Ocean Object Class:	Surface Wind Speed
--------------------------------	---------------------------

Acronym: **SUWISP**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **BEAFOR**; **VAWISP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Wind blowing near the Earth's surface. It is measured, by convention, at a height of 10 m above ground in an area where the distance between the anemometer and any obstruction is at least 10 times the height of the obstruction. (WMO-No. 182, S3850 → surface wind)

Number on a progressive scale (Beaufort scale) corresponding to the effects produced by winds within a particular range of speeds. (WMO-No. 182, W1040 (1) → wind force)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

WMO/TD-No. 850

Remarks: Use either **BEAFOR** or **VAWISP**.

Distinction:

Met-Ocean Object Class:	Surface Wind Direction
--------------------------------	-------------------------------

Acronym: **SUWIDI**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **COMDIR**; **CHAWDI**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Wind blowing near the Earth's surface. It is measured, by convention, at a height of 10 m above ground in an area where the distance between the anemometer and any obstruction is at least 10 times the height of the obstruction. (WMO-No. 182, S3850 → surface wind)

Direction from which the wind blows. (WMO-No.182, W0990 → wind direction)

References: WMO-No 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins and 2.2.3

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

WMO/TD-No. 850

Remarks:

Distinction:

MET-Ocean Object Class:	Gust
--------------------------------	-------------

Acronym: **GUSGUS**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATWFO**; **COMDIR**

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Sudden, brief increase of the wind speed over its mean value. (WMO-No. 182, G0920)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Wave
--

Acronym: **WAVWAV**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **SIWAHE; CATSEH; WAVLEN; SIWAPE; SIWADI;**

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Very generally, any pattern with some roughly identifiable periodicity in time and/or space. (IOC-No. 37, p.129 (1))

More specifically, a disturbance propagated by virtue of periodic motions (oscillations) of the particles of the medium. At any point in the medium, the displacement is a function of location within the medium. (IOC-No. 37, p.129 (2))

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Swell

Acronym: **SWELLS**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATSWH; SIWAHE; WAVLEN; SIWAPE; SIWADI;**

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Any system of water waves which has left its generating area. (WMO-No. 182, S3900)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Wind Sea
--

Acronym: **WINSEA**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATSEH**; **SIWAHE**; **SIWALE**; **SIWAPE**; **SIWADI**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Wave raised by the wind blowing in the immediate neighbourhood of an observation site at the time of observation. (WMO-No. 182, W1130)

References:

Remarks:

Distinction:

Met-Ocean Object Class: Storm Surge

Acronym: **STOSUR**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; T_MTOB; T_HWLW; **HEISUR**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: The difference between the actual water level under influence of a meteorological disturbance (storm tide) and the level which would have been attained in absence of the meteorological disturbance (i.e. astronomical tide). (WMO-No. 182, S2960)

References: WMO-No. 471, 2.3, Meteorological Services in Support of Maritime Search and Rescue

Remarks:

Distinction:

Met-Ocean Object Class: Tsunami

Acronym: **TSUNAM**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **SIWAHE; WAVLEN; SIWAPE; SIWADI;**

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: A series of travelling waves of extremely long length and period, generated by disturbances associated with earthquakes occurring below or near the ocean floor. (Also called seismic sea wave and, popularly, tidal wave.) An ocean wave produced by a submarine earthquake, landslide or volcanic eruption. (IOC-No. 37, p.120)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Tropical Cyclone
--------------------------------	-------------------------

Acronym: **TROCYC**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATCYC**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Generic term for a non-frontal synoptic scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation. (WMO-No. 182, T1510)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Surface Visibility
--

Acronym: **SURVIS**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATVIS**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Greatest Distance at which a black object of suitable dimensions can be seen and recognized against the horizon sky during daylight or could be seen and recognized during the night if the general illumination were raised to the normal daylight level. (WMO-No. 182, V0390)

References: WMO-No. 471, 2.3, Meteorological Services in Support of Maritime Search and Rescue

Remarks:

Distinction:

Met-Ocean Object Class:	Significant Weather
--------------------------------	----------------------------

Acronym: **SIGWET**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATSWE**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Area

Definition: Term in marine meteorology concerning the occurrence or expected occurrence of specified en-route weather phenomena which may effect the safety of ship in navigation (WMO-No. 182, S1080, changed from aeronautical to marine purposes)

References: WMO-No. 306, Code Table 4683

Remarks:

Distinction:

Met-Ocean Object Class: Front

Acronym: **FRONTS**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATFRO**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Line

Definition: The interface or transition zone between air masses of different densities (temperature, humidity). (WMO-No. 182, F1290 (1))

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Centre of Depression
--

Acronym: **CENDEP**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **VALATP**

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Region of the atmosphere in which the pressures are lower than those of the surrounding region at the same level. (WMO-No. 182, D0230

Point of the lowest pressure in the Low Pressure Area.

References: WMO-No. 558, Appendix I.4

Remarks:

Distinction:

Met-Ocean Object Class:	Centre of Anticyclone
--------------------------------	------------------------------

Acronym: **CEHIPR**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **VALATP**

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Region of the atmosphere where the pressures are high relative to those in the surrounding region at the same level. (WMO-No. 182, A2090)

Point of the highest Pressure in the Area of High Pressure.

References: WMO-No. 558, Appendix I.4

Remarks:

Distinction:

Met-Ocean Object Class: Isobar
--

Acronym: **ISOBAR**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **VALPCO**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Line

Definition: Line joining points of equal pressure on a surface (level surface, vertical cross section, etc.). (WMO-No. 182, I1200)

References: WMO-No. 558, Appendix I.4

Remarks:

Distinction:

Met-Ocean Object Class: Icing

Acronym: **ICINGS**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; ***IC/INT***;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: Any deposit or coating of ice on an object caused by the impact of liquid hydrometers, usually supercooled. (WMO-No. 182, I0200)

References: WMO-No. 49

WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Expected Movement
--------------------------------	--------------------------

Acronym: **EXPMOV**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **DIEXMO**; **SPEXMO**; **SUNITS**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition:

References: WMO-No. 49, Table A6-1. Template for SIGMET and AIRMET messages and special air-reports (uplink)

Remarks:

Distinction:

Met-Ocean Object Class:	Expected Change in Intensity
--------------------------------	-------------------------------------

Acronym: **EXPINT**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **CATINT**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition:

References: WMO-No. 49, Table A6-1. Template for SIGMET and AIRMET messages and special air-reports (uplink)

Remarks:

Distinction:

Met-Ocean Object Class:	Sea-surface Current
--------------------------------	----------------------------

Acronym: **SESUCU**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **DISUCU**; **SPSUCU**; **VUNITS**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: A current that does not extend more than a few (2-3) metres below the surface. (IHO Hydrographic Dictionary (web*), HR-1090 → surface current)

*http://www.iho.shom.fr/Dhydro/Html/site_edition/consultation.html, 08/04/2009.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Minimum Air Temperature
--------------------------------	--------------------------------

Acronym: **MINTEM**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTMP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: The temperature indicated by a thermometer exposed to the air in a place sheltered from direct solar radiation. (WMO-No. 182, A1390)

The lowest value of air temperature in the treated area.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Maximum Air Temperature
--------------------------------	--------------------------------

Acronym: **MAXTEM**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTMP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: The temperature indicated by a thermometer exposed to the air in a place sheltered from direct solar radiation. (WMO-No. 182, A1390)

The highest value of air temperature in the treated area.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Isotherm
--------------------------------	-----------------

Acronym: **ISOTHE**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTCO**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Line

Definition: Line joining points of equal air temperature. (WMO-No. 182, I1490

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Minimum Sea-surface Temperature
--------------------------------	--

Acronym: **MINSST**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTMP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Temperature of the surface layer of a body of water. (WMO-No. 182, S3830)

The lowest value of sea-surface temperature in the treated area.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Maximum Sea-surface Temperature
--------------------------------	--

Acronym: **MAXSST**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTMP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Temperature of the surface layer of a body of water. (WMO-No. 182, S3830)

The highest value of sea-surface temperature in the treated area.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Sea-surface Temperature Contour

Acronym: **SSTCON**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTCO**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Line

Definition: Line joining points of equal sea-surface temperature.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class: Pressure Tendency

Acronym: **PRETEN**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **AMPRCH**; **CHPRCH**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Character and amount of a station pressure change over three hours
(over 24 hours in tropical regions). (WMO-No. 182, P1690)

References:

Remarks:

Distinction:

Met-Ocean Object Class:	Maximum Pressure Decrease/Minimum Pressure Increase
--------------------------------	--

Acronym: **MAXPDE**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **AMPRCH**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Point of the maximum pressure decrease or minimum pressure increase in absence of pressure decrease in the treated area.

References:

Remarks:

Distinction:

Met-Ocean Object Class:	Maximum Pressure Increase/Minimum Pressure Decrease
--------------------------------	--

Acronym: **MAXPIN**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **AMPRCH**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Point of the maximum pressure increase or minimum pressure decrease in absence of pressure increase in the treated area.

References:

Remarks:

Distinction:

Met-Ocean Object Class: Isallobars
--

Acronym: **ISALLO**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **ATPACC**; **VALISA**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Line

Definition: Line joining points of equal pressure change during a specific time interval. (WMO-No. 182, I1050)

References:

Remarks:

Distinction:

Met-Ocean Object Class: Cloud

Acronym: **CLOUDS**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **HCLOBA**; **TCLOCO**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive:

Definition: A hydrometeor consisting of minute particles of liquid water or ice, or of both, suspended in the free air and usually not touching the ground. It may also include larger particles of liquid water or ice and non-aqueous liquid or solid particles such as those present in fumes, smoke and dust. (WMO-No. 182, C1450)

References: WMO-No. 471., 2.3, Meteorological Services in Support of Maritime Search and Rescue

Remarks:

Distinction:

Met-Ocean Object Class:	Minimum Dew-point Temperature
--------------------------------	--------------------------------------

Acronym: **MINDPT**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTMP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Temperature to which a volume of air must be cooled at constant pressure and constant moisture in order to reach saturation; any further cooling causes condensation. (WMO-No. 182, D0420)

The lowest value of dew-point temperature in the treated area.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Maximum Dew-point Temperature
--------------------------------	--------------------------------------

Acronym: **MAXDPT**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; **TMPACC**; **VALTMP**;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Point

Definition: Temperature to which a volume of air must be cooled at constant pressure and constant moisture in order to reach saturation; any further cooling causes condensation. (WMO-No. 182, D0420)

The highest value of dew-point temperature in the treated area.

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

Met-Ocean Object Class:	Dew-point Temperature Contour
--------------------------------	--------------------------------------

Acronym: **DPTCON**

Code:

subset 'Attribute_A': NOBJNM; OBJNAM; ***TMPACC***; ***VALTCO***;

subset 'Attribute_B': INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP;

subset 'Attribute_C': RECDAT; RECIND; SORDAT; SORIND;

Geometric Primitive: Line

Definition: Line joining points of equal dew-point. (WMO-No. 182, I1320)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

Remarks:

Distinction:

MET-OCEAN ATTRIBUTES

Met-Ocean Attribute	Acronym
Beaufort Force	BEAFOR
Value of Surface Wind Speed	VAWISP
Compass Points of Surface Wind Direction	COMDIR
Change in Surface Wind Direction	CHAWDI
Significant Wave Height	SIWAHE
Category of Significant Sea Wave Height	CATSEH
Category of Significant Swell Wave Height	CATSWH
Wave Length	WAVLEN
Significant Wave Period	SIWAPE
Significant Wave Direction	SIWADI
Height of Storm Surge	HEISUR
Category of Tropical Cyclone	CATCYC
Category of Surface Visibility	CATVIS
Category of Significant Weather	CATSWE
Category of Front	CATFRO
Atmospheric Pressure Accuracy	ATPACC
Value of Atmospheric Pressure	VALATP
Value of Atmospheric Pressure Contour	VALPCO
Icing Intensity	ICIINT
Direction of Expected Movement	DIEXMO
Speed of Expected Movement	SPEXMO
Category of Expected Change in Intensity	CATINT
Direction of Surface Current	DISUCU
Speed of Surface Current	SPSUCU
Temperature Accuracy	TMPACC
Value of Temperature	VALTMP
Value of Temperature Contour	VALTCO
Amount of Pressure Change	AMPRCH
Characteristic of Pressure Change	CHPRCH
Value of Isallobar	VALISA
Height of Cloud Base	HCLOBA
Total Cloud Cover	TCLOCO
Velocity Units	VUNITS

Met-Ocean Attribute:	Beaufort Force
-----------------------------	-----------------------

Acronym: **BEAFOR**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01:	calm
	02:	light air
	03:	light breeze
	04:	gentle breeze
	05:	moderate breeze
	06:	fresh breeze
	07:	strong breeze
	08:	near gale
	09:	gale
	10:	strong gale
	11:	storm
	12:	violent storm
	13:	hurricane

Definition:	calm:	Absence of air motion or wind with a speed of less than 1 knot (Beaufort scale wind force 0). (WMO-No. 182, C0030)
	light air:	Wind with a speed between 1 and 3 knots (Beaufort scale wind force 1). (WMO-No. 182, L0500)
	light breeze:	Wind with a speed between 4 and 6 knots (Beaufort scale wind force 2). (WMO-No. 182, L0510)
	gentle breeze:	Wind with a speed between 7 and 10 knots (Beaufort scale wind force 3). (WMO-No. 182, G0200)
	moderate breeze:	Wind with a speed between 11 and 16 knots (Beaufort scale wind force 4). (WMO-No. 182, M1680)
	fresh breeze:	Wind with a speed between 17 and 21 knots (Beaufort scale wind force 5). (WMO-No. 182, F1200)
	strong breeze:	Wind with a speed between 22 and 27 knots (Beaufort scale wind force 6). (WMO-No. 182, S3120)
	near gale:	Wind with a speed between 28 and 33 knots (Beaufort scale wind force 7). (WMO-No. 182, N0150)

gale:	Wind with a speed between 34 and 40 knots (Beaufort scale wind force 8). (WMO-No. 182, G0010)
strong gale:	Wind with a speed between 41 and 47 knots (Beaufort scale wind force 9). (WMO-No. 182, S3130)
storm:	Wind with a speed between 48 and 55 knots (Beaufort scale wind force 10). (WMO-No. 182, S2950 (2))
violent storm:	Wind with a speed between 56 and 63 knots (Beaufort scale wind force 11). (WMO-No. 182, V0340)
hurricane:	Name given to a warm core tropical cyclone with maximum surface wind of 118 km h^{-1} (64 knots, 74 mph) or greater (hurricane force wind) in the North Atlantic, the Caribbean and the Gulf of Mexico, and in the Eastern North Pacific Ocean. (WMO-No. 182, H0860 (1))

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

WMO/TD-No. 850

Remarks:

Met-Ocean Attribute:	Value of Surface Wind Speed
-----------------------------	------------------------------------

Acronym: **VAWISP**

Code:

Attribute Type: F

Definition: ---

Minimum Value: 0

Indication: Unit: defined in the VUNITS attribute of the M_UNIT meta object class, e.g. meter per second (m/s)

Resolution: 1 m/s or 1 knot

Format: xx

Example: 13 for a surface wind speed of 2.5 m/s to 3.4 m/s.

References: WMO-No. 471, §2.2.3

Remarks: WMO-No. 558, Part I, §3.2.2

Remarks:

Met-Ocean Attribute:	Compass point of Surface Wind Direction
-----------------------------	--

Acronym: **COMDIR**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	North (N)
	02	North-North-East (NNE)
	03	North-East (NE)
	04	East-North-East (ENE)
	05	East (E)
	06	East-South-East (ESE)
	07	South-East (SE)
	08	South-South-East (SSE)
	09	South (S)
	10	South-South-West (SSW)
	11	South-West (SW)
	12	West-South-West (WSW)
	13	West (W)
	14	West-North-West (WNW)
	15	North-West (NW)
	16	North-North-West (NNW)

Definition:	North	349-011 degrees (true north)
	North-North-East	012-033 degrees (true north)
	North-East	034-056 degrees (true north)
	East-North-East	057-078 degrees (true north)
	East	079-101 degrees (true north)
	East-South-East	102-123 degrees (true north)
	South-East	124-146 degrees (true north)
	South-South-East	147-168 degrees (true north)
	South	169-191 degrees (true north)
	South-South-West	192-213 degrees (true north)
	South-West	214-236 degrees (true north)
	West-South-West	237-258 degrees (true north)
	West	259-281 degrees (true north)

West-North-West	282-303 degrees (true north)
North-West	304-326 degrees (true north)
North-North-West	327-348

References:

WMO/TD-No. 577

WMO-No. 471, 2.2.3

Remarks:

Met-Ocean Attribute:**Change in Surface Wind Direction**Acronym: **CHAWDI**

Code:

Attribute Type: **E**

Expected Input: 01: wind shift
 02: veering wind
 03: backing wind

Definition: wind shift: Sudden change of wind direction. (WMO-No. 182, W1160)

veering wind: Clockwise change of wind direction, in either hemisphere. (WMO-No. 182, V0130)

backing wind: Counter-clockwise change of wind direction, in either hemisphere. (WMO-No. 182, B0060)

References: WMO-No. 471, Annex 2.B, Multilingual List of Terms used in Weather and Sea Bulletins

WMO-No. 558, Appendix I.2, Multilingual List of Terms used in Weather and Sea Bulletins

WMO/TD-No. 850

Remarks:

Met-Ocean Attribute:	Significant Wave Height
-----------------------------	--------------------------------

Acronym: **SIWAHE**

Code:

Attribute Type: F

Definition: The average height of the 1/3 highest waves. (WMO-No. 702, p.9)

Minimum Value: 0

Indication: Unit: metre (m)

Resolution: 1 m

Format: xx

Example: 3 for a significant wave height of 2.5 m to 3.4 m.

References: WMO-No. 471, 1.2.1.1

WMO-No. 558, Appendix I.4

Remarks:

Met-Ocean Attribute:**Category of Significant Sea Wave Height**Acronym: **CATSEH**

Code:

Attribute Type: **E**

Expected Input:	ID	Meaning
	01	Calm (glassy)
	02	Calm (rippled)
	03	Smooth (wavelets)
	04	Slight
	05	Moderate
	06	Rough
	07	Very rough
	08	High
	09	Very high
	10	Phenomenal

Definition: The average height of the 1/3 highest sea waves. (according to WMO-No. 702, p.9)

Calm (glassy)	0 m
Calm (rippled)	0-0.1 m
Smooth (wavelets)	0.1-0.5 m
Slight	0.5-1.25 m
Moderate	1.25-2.5 m
Rough	2.5-4 m
Very rough	4-6 m
High	6-9 m
Very high	9-14m
Phenomenal	over 14 m

References: WMO-No. 8, Part II, §4.2.12.5

Remarks:

Met-Ocean Attribute:	Significant Swell Wave Height
-----------------------------	--------------------------------------

Acronym: **CATSWH**

Code:

Attribute Type: E

Expected Input: ID Meaning

01 Low

02 Moderate

03 Heavy

Definition: The average height of the 1/3 highest swell waves. (according to WMO-No. 702, p.9)

Low 0-2 m

Moderate 2-4 m

Heavy over 4 m

References: WMO-No. 8, Part II, §4.2.12.5

Remarks:

Met-Ocean Attribute:	Wave Length
-----------------------------	--------------------

Acronym: **WAVLEN**

Code:

Attribute Type: F

Definition: The horizontal distance, in metres, between two successive crests.
(WMO-No. 702, 1.2.1)

Minimum Value: 0

Indication: Unit: metre (m)

Resolution: 1 m

Format: xx

Example: 3 for a wave length of 2.5 m to 3.4 m.

References:

Remarks:

Met-Ocean Attribute:**Significant Wave Period**

Acronym: **SIWAPE**

Code:

Attribute Type: F

Definition: The average period of the 1/3 highest waves. (WMO-No. 702, p.9)

Minimum Value: 0

Indication: Unit: second (s)

Resolution: 1 s

Format: xx

Example: 3 for a significant wave period of 2.5 s to 3.4 s.

References: WMO-No. 471, 1.2.1.1

Remarks:

Met-Ocean Attribute:	Significant Wave Direction
-----------------------------	-----------------------------------

Acronym: **SIWADI**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	North (N)
	02	North-east (NE)
	03	East (E)
	04	South-east (SE)
	05	South (S)
	06	South-west (SW)
	07	West (W)
	08	North-west (NW)

Definition:

North	337-022 degrees (true north) WMO/TD-No. 850, p.26
North-east	023-067 degrees (true north) WMO/TD-No. 850, p.26
East	068-112 degrees (true north) WMO/TD-No. 850, p.26
South-east	113-157 degrees (true north) WMO/TD-No. 850, p.26
South	158-202 degrees (true north) WMO/TD-No. 850, p.26
South-west	203-247 degrees (true north) WMO/TD-No. 850, p.26
West	248-292 degrees (true north) WMO/TD-No. 850, p.26
North-west	293-337 degrees (true north) WMO/TD-No. 850, p.26

References:

WMO-No. 471, 1.2.1.1

WMO-No. 558, Appendix I.4

WMO/TD-No. 850

Remarks:

Met-Ocean Attribute:**Height of Storm Surge**

Acronym: **HEISUR**

Code:

Attribute Type: **F**

Definition: ---

Minimum Value: **0**

Indication: Unit: metre (m)

Resolution: 0.5 m

Format: **xx.x**

Example: 1.5 for a storm surge height of 1.25 m to 1.74 m.

References: WMO-No. 471, §2.3.2

Remarks: WMO-No. 558, Part I, §3.2.2

Remarks:

Met-Ocean Attribute:**Category of Tropical Cyclone**

Acronym: **CATCYC**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	Maximum winds 34-63 knots
	02	Maximum winds of 64 knots or more

Definition: Specifies the intensity of the tropical cyclone.

References: WMO-No. 558, Appendix I.4, Symbols and Depictions Used on Radio-facsimile Charts for Marine Purposes

Remarks:

Met-Ocean Attribute:	Category of Surface Visibility
-----------------------------	---------------------------------------

Acronym: **CATVIS**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	Very poor (less than 0.5 nautical miles)
	02	poor (0.5 to 2 nautical miles)
	03	moderate (2 to 5 nautical miles)
	04	good (greater than 5 nautical miles)

Definition:	Very poor	Less than 0.5 nautical miles IHO/IMO/WMO S-53, 2009, 8.5.4
	poor	0.5 to 2 nautical miles IHO/IMO/WMO S-53, 2009, 8.5.4
	moderate	2 to 5 nautical miles IHO/IMO/WMO S-53, 2009, 8.5.4
	Good	Greater than 5 nautical miles IHO/IMO/WMO S-53, 2009, 8.5.4

References: IHO/IMO/WMO S-53, 8.5.4.

Remarks:

Met-Ocean Attribute:	Category of Significant Weather
-----------------------------	--

Acronym: **CATSWE**

Code:

Attribute Type: L

Expected Input:	ID	Meaning
	00	Area of heavy swell
	11	Area of strong winds (6 and 7 Beaufort)
	22	Area of medium cloud
	55	Area of gales (8 Beaufort or more)
	66	Area of continuous precipitation
	77	Area of squally weather
	88	Area of heavy showers
	99	Area of thunderstorms

Definition:	Area of heavy swell	Area where the significant swell wave height is above 4 m.
	Area of strong winds (6 and 7 Beaufort)	
	Area of poor visibility	Area where the visibility is less than 2 nm
	Area of gales (8 Beaufort or more)	
	Area of continuous precipitation	
	Area of squally weather	Atmospheric phenomenon characterized by an abrupt and large increase of wind speed with the duration of the order of minutes which diminishes rather suddenly. It is often accompanied by showers or thunderstorms.
	Area of heavy showers	Area of showers with a precipitation rate of 10 mm/h or more. (WMO-No.8, Part 1, Chapter 14)
	Area of thunderstorms	Sudden electrical discharges manifested by a flash of light (lightning) and a sharp or rumbling sound (thunder). Thunderstorms are associated with convective clouds (Cumulonimbus) and are,

more often, accompanied by precipitation in the form of rainshowers or hail, or occasionally snow, snow pellets, or ice pellets. (WMO-No. 182, T0940)

References:

WMO/TD-No. 850

WMO-No. 306, Code Table 4683

Remarks:

Met-Ocean Attribute:	Category of Front
-----------------------------	--------------------------

Acronym: **CATFRO**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	cold front at the surface
	02	warm front at the surface
	03	occluded front at the surface
	04	quasi-stationary front at the surface
	05	convergence line
	06	intertropical convergence zone

Definition:	Cold front	Any non-occluded front which moves in such a way that cold air replaces relatively warmer air. (WMO-No. 182, C2210)
	Warm front	Any non-occluded front which moves in such a way that warm air replaces cold air. (WMO-No. 182, W0100)
	Occluded front	A composite of two fronts, formed as a cold front overtakes a warm front or quasi-stationary front. (WMO-No. 182, O0070)
	Quasi-stationary front	A front which is stationary or nearly so (conventionally, moving with a speed less than five knots). (WMO-No. 182, S2760)
	Convergence line	Line along which the horizontal convergence is a maximum. (WMO-No. 182, C3060)
	Intertropical convergence zone	Narrow zone where the trade winds of the two hemispheres meet. (WMO-No. 182, I0800)

References: WMO-No. 558, Appendix I.4

Remarks:

Met-Ocean Attribute:**Atmospheric Pressure Accuracy****Acronym:** ATPACC**Code:****Attribute Type:** F

Definition: Pressure (force per unit area) exerted by the atmosphere on any surface by virtue of its weight; it is equivalent to the weight of a vertical column of air extending above a surface of unit area to the outer limit of the atmosphere. (WMO-No. 182, A2930)

The extent to which the results of the readings of an instrument approach the true value of the calculated or measured quantities, supposing all possible corrections are applied. (WMO-No. 182, A0270)

Minimum Value: 0**Indication:** Unit: hectopascal (hPa)

Resolution: 0.1 hPa

Format: x.x**Example:** 0.2 for an atmospheric pressure accuracy of 0.2 hPa.**References:****Remarks:**

Met-Ocean Attribute:**Value of Atmospheric Pressure**

Acronym: **VALATP**

Code:

Attribute Type: F

Definition: ---

Minimum Value: 0

Indication: Unit: hectopascal (hPa)

Resolution: 1 hPa

Format: xxxx

Example: 998 for an atmospheric pressure of 998 hPa.

References: WMO-No. 485, Appendix II-4

Remarks:

Met-Ocean Attribute:	Value of Atmospheric Pressure Contour
-----------------------------	--

Acronym: **VALPCO**

Code:

Attribute Type: **F**

Definition: ---

Minimum Value: **0**

Indication: Unit: hectopascal (hPa)

Resolution: 1 hPa

Format: xxxx

Example: 998 for an atmospheric pressure of 998 hPa.

References: WMO-No. 485, Appendix II-4

Remarks:

Met-Ocean Attribute:	Icing Intensity
-----------------------------	------------------------

Acronym: **ICIINT**

Code:

Attribute Type: **E**

Expected Input:	ID	Meaning
	01	light
	02	moderate
	03	severe
	04	very severe

Definition: Rate at which ice accretion occurs, expressed in units of depth per unit time. (WMO-No. 182, I0220)

Light	1-3 cm/24 hr
Moderate	4-6 cm/24 hr
Severe	7-14 cm/24 hr
Very severe	>14 cm/24 hr

References: WMO/TD-No. 850

Remarks:

Met-Ocean Attribute:	Direction of Expected Movement
-----------------------------	---------------------------------------

Acronym: **DIEXMO**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	North (N)
	02	North-east (NE)
	03	East (E)
	04	South-east (SE)
	05	South (S)
	06	South-west (SW)
	07	West (W)
	08	North-west (NW)

Definition:	North	337-022 degrees (true north) WMO/TD-No. 850, p.26
	North-east	023-067 degrees (true north) WMO/TD-No. 850, p.26
	East	068-112 degrees (true north) WMO/TD-No. 850, p.26
	South-east	113-157 degrees (true north) WMO/TD-No. 850, p.26
	South	158-202 degrees (true north) WMO/TD-No. 850, p.26
	South-west	203-247 degrees (true north) WMO/TD-No. 850, p.26
	West	248-292 degrees (true north) WMO/TD-No. 850, p.26
	North-west	293-337 degrees (true north) WMO/TD-No. 850, p.26

References: WMO-No. 558, Appendix I.4

Remarks:

Met-Ocean Attribute:	Speed of Expected Movement
-----------------------------	-----------------------------------

Acronym: **SPEXMO**

Code:

Attribute Type: F

Definition: ---

Minimum Value: 0

Indication: Unit: defined in the VUNITS attribute of the M_UNIT meta object class,
e.g. meter per second (m/s)

Resolution: 1 m/s or 1 knot

Format: xx

Example: 3 for a speed of 2.5 m/s to 3.4 m/s.

References:

Remarks:

Met-Ocean Attribute:**Category of Expected Change in Intensity**

Acronym: **CATINT**

Code:

Attribute Type: **E**

Expected Input:	ID	Meaning
	00	Much weakening
	01	Weakening
	02	No change
	03	Intensification
	04	Strong intensification
	05	Not observed previously
	06	Undetermined

Definition: Specifies the expected change in intensity in the upcoming 24 hours.

References: WMO-No. 306, Code Table 0252

Remarks:

Met-Ocean Attribute:	Direction of Surface Current
-----------------------------	-------------------------------------

Acronym: **DISUCU**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	North (N)
	02	North-east (NE)
	03	East (E)
	04	South-east (SE)
	05	South (S)
	06	South-west (SW)
	07	West (W)
	08	North-west (NW)

Definition: Direction to which the surface current flows.

North	337-022 degrees (true north) WMO/TD-No. 850, p.26
North-east	023-067 degrees (true north) WMO/TD-No. 850, p.26
East	068-112 degrees (true north) WMO/TD-No. 850, p.26
South-east	113-157 degrees (true north) WMO/TD-No. 850, p.26
South	158-202 degrees (true north) WMO/TD-No. 850, p.26
South-west	203-247 degrees (true north) WMO/TD-No. 850, p.26
West	248-292 degrees (true north) WMO/TD-No. 850, p.26
North-west	293-337 degrees (true north) WMO/TD-No. 850, p.26

References: WMO-No. 471, §2.3.2

WMO-No. 558, Part I, §3.2.2

Remarks:

Met-Ocean Attribute:	Speed of Surface Current
-----------------------------	---------------------------------

Acronym: **SPSUCU**

Code:

Attribute Type: **F**

Definition: ---

Minimum Value: **0**

Indication: Unit: defined in the VUNITS attribute of the M_UNIT meta object class,
e.g. meter per second (m/s)

Resolution: 1 m/s or 1 knot

Format: **xx**

Example: **3** for a speed of 2.5 m/s to 3.4 m/s.

References: **WMO-No. 471, §2.3.2**

WMO-No. 558, Part I, §3.2.2

Remarks:

Met-Ocean Attribute:	Temperature Accuracy
-----------------------------	-----------------------------

Acronym: **TMPACC**

Code:

Attribute Type: **F**

Definition: A physical quantity characterizing the mean random motion of molecules in a physical body. (WMO-No. 182, T0150)

The extent to which the results of the readings of an instrument approach the true value of the calculated or measured quantities, supposing all possible corrections are applied. (WMO-No. 182, A0270 → accuracy)

Minimum Value: **0**

Indication: Unit: degrees Celsius (°C)

Resolution: 0.1 °C

Format: **x.x**

Example: **0.2** for a temperature accuracy of 0.2 °C.

References:

Remarks:

Met-Ocean Attribute:	Value of Temperature
-----------------------------	-----------------------------

Acronym: **VALTMP**

Code:

Attribute Type: **F**

Definition: ---

Minimum Value: ---

Indication: Unit: degrees Celsius (°C)

Resolution: 0.1 °C

Format: **sxx.x**

s: sign, negative values only.

Example: 12.2 for a temperature of 12.2 °C.

References: WMO-No. 485, Appendix II-4

Remarks:

Met-Ocean Attribute:**Value of Temperature Contour**

Acronym: **VALTCO**

Code:

Attribute Type: F

Definition: ---

Minimum Value: ---

Indication: Unit: degrees Celsius (°C)

Resolution: 1 °C

Format: sxx.x
s: sign, negative values only.

Example: 12 for a temperature of 12 °C.

References:

Remarks:

Met-Ocean Attribute:	Amount of Pressure Change
-----------------------------	----------------------------------

Acronym: **AMPRCH**

Code:

Attribute Type: F

Definition: ---

Minimum Value: 0

Indication: Unit: hectopascal (hPa)

Resolution: 0.1 hPa

Format: xx.x

Example: 1.7 for an atmospheric pressure of 1.7 hPa.

References: WMO-No. 485, Appendix II-4

Remarks:

Met-Ocean Attribute:	Characteristic of Pressure Change
-----------------------------	--

Acronym: **CHPRCH**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	00	Increasing, then decreasing; atmospheric the same as or higher than three hours ago
	01	Increasing, then steady; or increasing, then increasing more slowly; atmospheric pressure now higher than three hours ago
	02	Increasing (steadily or unsteadily); atmospheric pressure now higher than three hours ago
	03	Decreasing or steady, then increasing; or increasing, then increasing more rapidly; atmospheric pressure now higher than three hours ago
	04	Steady; atmospheric pressure the same as three hours ago
	05	Decreasing, then increasing; atmospheric pressure the same as or lower than three hours ago
	06	Decreasing, then steady; or decreasing, then decreasing more slowly; atmospheric pressure now lower than three hours ago
	07	Decreasing (steadily or unsteadily); atmospheric pressure now lower than three hours ago
	08	Steady or increasing, then decreasing; or decreasing, then decreasing more rapidly; atmospheric pressure now lower than three hours ago

Definition: Characteristic of pressure tendency during the three hours preceding the time of observation. (WMO-No. 485, App. II-4)

References: WMO-No. 485, Appendix II-4

Remarks:

Met-Ocean Attribute:	Value of Isallobar
----------------------	--------------------

Acronym: **VALISA**

Code:

Attribute Type: F

Definition: ---

Minimum Value: 0

Indication: Unit: hectopascal (hPa)

Resolution: 1 hPa

Format: sxx
s: sign, negative values only

Example: 1 for an atmospheric pressure change of 1 hPa.

References: WMO-No. 485, Appendix II-4

Remarks:

Met-Ocean Attribute:	Height of Cloud Base
-----------------------------	-----------------------------

Acronym: **HCLOBA**

Code:

Attribute Type: **E**

Expected Input:	ID	Meaning
	00:	0 to 50 m
	01:	50 to 100 m
	02:	100 to 200 m
	03:	200 to 300 m
	04:	300 to 600 m
	05:	600 to 1000 m
	06:	1000 to 1500 m
	07:	1500 to 2000 m
	08:	2000 to 2500 m
	09:	2500 m or more, or no clouds
	99:	Height of base of cloud not known or base of clouds at a level lower and tops at a level higher than that of the station

Note: A height exactly equal to one of the values at the ends of the ranges shall be coded in the higher range, e.g. a height of 600 m shall be reported by code figure 5.

Definition: Height above the Earth's surface of the base of the lower cloud layer whose amount exceeds a specific value. (WMO-No. 182, C0280 (1))

References: WMO-No. 306, Code table 1600

Remarks:

Met-Ocean Attribute:	Total Cloud Cover
-----------------------------	--------------------------

Acronym: **TCLOCO**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	00:	0
	01:	1 okta ro 1/10 or less, but not zero
	02:	2 oktas or 2/10-3/10
	03:	3 oktas or 4/10
	04:	4 oktas or 5/10
	05:	5 oktas or 6/10
	06:	6 oktas or 7/10-8/10
	07:	7 oktas or 9/10 or more, but not 8 oktas or 10/10
	08:	8 oktas or 10/10
	09:	9 sky obscured, or cloud amount cannot be estimated
	99:	No measurements made

Definition: Fraction of the celestial dome hidden by all the visible clouds. (WMO-No. 182, T1110)

References: WMO-No. 485, Appendix II-4
WMO-No. 306, Code Table 2700

Remarks:

Met-Ocean Attribute:	Velocity Units
-----------------------------	-----------------------

Acronym: **VUNITS**

Code:

Attribute Type: E

Expected Input:	ID	Meaning
	01	Meter per second
	02	Knot

Definition:	Meter per second	Velocities are specified in meter per second (SI units of velocity).
-------------	------------------	--

	Knot	Velocities are specified in knot.
--	------	-----------------------------------

References:

Remarks:

REFERENCES

- IEC, 2008, Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results, IEC 61174
- IEC, 2008, Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results, IEC 62288
- IHO, 2000, IHO Transfer Standard for Digital Hydrographic Data, IHO S-57.
- IHO, 2007, Hydrographic Dictionary Appendix 1 – Glossary of ECDIS Related Terms, IHO S-32.
- IHO, 2008, IHO Specifications for Chart Content and Display Aspects of ECDIS Appendix 2 – Colour and Symbol Specifications for ECDIS, IHO S-52.
- IMO, 1995, Performance Standards for Electronic Chart Display and Information Systems (ECDIS), Resolution A.817(19)
- IMO, 1996, Adoption of New and Amended Performance Standards, Resolution MSC.64(67)
- IMO, 1998, Adoption of New and Amended Performance Standards for Navigational Equipment, Resolution MSC.86(70)
- IMO, 2004, Performance Standards for the Presentation of Navigation-related Information on Shipborne Navigational Displays, Resolution MSC.191(79)
- IMO, 2006, Adoption of the Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS), Resolution MSC.232(82)
- IMO, 2007, Draft Strategy for the Development and Implementation of E-navigation, NAV 54/25 Annex 12. (working document)
- IMO, 2009, Development of an E-navigation Strategy Implementation Plan – Results of a Worldwide E-navigation User Needs Survey, NAV 55/INF.9 (working document)
- IMO, 2009, ITU Matters, Including Radiocommunication; ITU-R Study Group Matters – World Radiocommunication Conference 2011 – Future Spectrum Requirement with Respect to E-navigation, NAV 55/8/2 (working document)
- IMO/IEC, 2002, Oceanographic Object Attribution – Technical White Paper, HGMIO2/6e, Monaco (working document)
- IMO/IEC, 2002, Proposed Object Classes and Attributes for Weather, HGMIO2/10, Monaco (working document)
- IMO/IEC, 2007, Marine Information Objects (MIO), HGMIO4-4B, Durham, New Hampshire, USA (working document)
- IMO/IEC, 2007, General Content Specification for Marine Information Overlays (MIOs), HGMIO4-7B, Durham, New Hampshire, USA (working document)
- IMO/IEC, 2007, Relationship of Marine Information Overlays (MIOs) to Current/Future IHO Standards, Version 4, HGMIO (Lee Alexander, Michel Huet) (working document)
- IOC, 1975, Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices, IOC Manuals and Guides No. 4.

- IOC, 1991, Tsunami Glossary, IOC Technical Series No. 37.
- WMO, 1990, Manual on Marine Meteorological Services, WMO-No. 558.
- WMO, 1992, Manual on the Global Data-processing and Forecasting System, WMO-No. 485.
- WMO, 1992, International Meteorological Vocabulary, WMO-No. 182
- WMO, 1995, Manual on Codes Volume I.1 Part A – Alphanumeric Codes, WMO-No. 306.
- WMO, 1998, Guide to Wave Analysis, WMO-No. 702.
- WMO, 1998, Handbook of Offshore Forecasting Services, WMO/TD-No. 850.
- WMO, 2001, Guide to Marine Meteorological Services, WMO-No. 471.
- WMO, 2002, Weather Information in Graphical Form for GMDSS – Terms of Reference for the Rapporteur, ETMSS First Session, Lisbon, Portugal (working document)
- WMO, 2002, Weather Information in Graphical Form for GMDSS – Report from the Services Programme Area Coordinator on Progress of Project with Inmarsat, ETMSS First Session, Lisbon, Portugal (working document)
- WMO, 2003, Manual on the Global Observing System Volume I – Global Aspects, WMO-No. 544.
- WMO, 2006, Tropical Cyclone Operational Plan for the South-West Indian Ocean, WMO/TD-No. 577.
- WMO, 2007, Guide to the Global Observing System, WMO-No. 488.
- WMO, 2007, Technical Regulations Basis Documents No. 2 – Meteorological Service for International Air Navigation, WMO-No. 49.
- WMO, 2007, Weather Information in Graphical Form for GMDSS, ETMSS Second Session, Angra dos Reis, Brazil (working document)
- WMO, 2007, Ice Objects Catalogue – Version 4, ETSI Third Session, Geneva, Switzerland (working document)
- WMO, 2008, Guide to Meteorological Instruments and Methods of Observation Part II – Observing System Chapter 4 – Marine Observations, WMO-No. 8.
- WMO, 2008, Weather Reporting Volume D – Information for Shipping, WMO-No. 9.
- WMO, 2009, Met-ocean Information in Graphical/Numerical Form and E-Navigation Charts, JCOMM/ETMSS TTMSI First Session, submitted by Dr Vasily Smolyanitsky, Geneva, Switzerland (working document)
- WMO, 2009, Met-ocean Information in Graphical/Numerical Form and E-Navigation Charts, JCOMM/ETMSS TTMSI First Session, submitted by IHB, Geneva, Switzerland (working document)
- WMO, 2009, Final Report, JCOMM Meeting Report No. 64, JCOMM/ETMSS TTMSI First Session, Geneva, Switzerland (working document)
-

ACRONYMS AND OTHER ABBREVIATIONS

AIS	Automatic Identification System
EC	Executive Council (WMO)
ENC	Electronic Navigational Chart
ETMSS	Expert Team on Maritime Safety Services (JCOMM)
ETSI	Expert Team on Sea Ice (JCOMM)
GMDSS	Global Maritime Distress and Safety System
HGMIO	Harmonization Group on Marine Information Objects/Overlays (IHO/IEC)
IEC	International Electrotechnical Commission
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
MIO	Marine Information Overlays
MMMS	Manual on Marine Meteorological Services
MSC	Maritime Safety Committee (IMO)
MSI	Maritime Safety Information
NAV	Sub-committee on Safety of Navigation (IMO)
RCC	Rescue Coordination Centre
SOLAS	International Convention for the Safety of Life at Sea
TG-ENCIO	Task Group on Electronic Navigational Chart Ice Objects (JCOMM/ETSI)
ToR	Terms of Reference
TTMSI	Task Team on Maritime Safety Information (JCOMM/ETMSS)
UNESCO	United Nations Educational, Scientific and Cultural Organization
WMO	World Meteorological Organization
