S-412

Weather Warnings Data Classification and Encoding Guide

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IHO

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Document History

Changes to the Product Specification S-412 are coordinated by the SERCOM, formely JCOMM.

Table 1

Version Number	Date	Approved By	Purpose
1.2.0	January 2026	WMO	Initial document creation by IIC Technologies. Version number in line with the PS.

1 Overview

1.1 Preface

The “Data Classification and Encoding Guide” has been developed to provide consistent, standardized instructions for encoding S-412 data.

The purpose of the Data Classification and Encoding Guide is to facilitate S-412 encoding to meet WMO SERCOM standards for the proper display of Marine Weather Warning information in an ECDIS. The document describes how to encode marine weather information considered relevant to be displayed on an ECDIS.

The content of a Marine Weather Warning product is at the discretion of the producing authority, provided that the conventions described within this document are followed. A “producing authority” is a Hydrographic Office (HO) or an organization authorized by a government, HO or other relevant government institution to produce Marine Weather Warning product.

1.2 S-412 Annex A — Data Classification and Encoding Guide — Metadata

NOTE This information uniquely identifies this Annex to the Product Specification and provides information about its creation and maintenance.

Title	The World Meteorological Organization Marine Weather Warning Product Specification, Annex A – Data Classification and Encoding Guide
Version	1.2.0
Date	January 2026
Language	English
Classification	Unclassified
Contact	World Meteorological Organization 7 bis, avenue de la Paix P.O. Box 2300 CH-1211 Geneva 2, Switzerland Telephone: +41 (0) 22 730 84 03 Email: publications@wmo.int
URL	www.wmo.int
Identifier	S-412 Annex A
Maintenance	Changes to S-412 Annex A; Data Classification and Encoding Guide are coordinated by the SERCOM, formely JCOMM and must be made available via the IHO web site.

1.3 Terms, definitions and abbreviations

1.3.1 Terms and definition

See S-412 Product Specification main document, clause 1.4.

1.3.2 Abbreviated terms

For a list of abbreviations, see S-412 Product Specification main document, Clause 1.6.1.

1.4 Use of language

Within this document: • “Must” indicates a mandatory requirement.
• “Should” indicates an optional requirement, that is the recommended process to be followed, but is not mandatory.
• “May” means “allowed to” or “could possibly” and is not mandatory.

1.5 Maintenance

Changes to the Data Classification and Encoding Guide must occur in accordance with the S-412 Marine Weather Warning Product Specification clause 1.9.

2 General

2.1 Introduction

This S-412 Data Classification and Encoding Guide (DCEG) contains rules and guidance for converting data describing the real world into data products that conform to the S-412 specification.

The S-412 specification contains an application schema (UML model) describing the conceptual domain model in terms of classes and a Feature Catalogue that specifies the data model, i.e., specifies the data model types corresponding to the various classes in the application schema.

To simplify the DCEG text, the various data model types will be provided without the suffixes “class”, “type” or “instance”; e.g. the term “feature” should be understood as “feature class” or “feature type” or “feature instance” as best fits the immediate context in which it is used (and where there might be confusion, it is written out in full as feature class/type/instance). The model defines real world entities as a combination of descriptive and spatial characteristics (S-412 Product Specification — section 4).

This clause of the DCEG contains general information needed to understand the encoding rules and describes fundamental common rules and constraints. It also describes datasets and metadata. The data model object types used within S-412 and their encoding rules and guidelines are defined in detail in subsequent clauses of this document.

Within this document the features and attributes appear in bold text or italic text, to distinguish them from surrounding words.

2.2 Multiple Datasets

In order to facilitate the efficient processing and exchange of S-412 data, S-412 data files will be split by the time and date in which the file data is valid.

Guidance to be enhanced by WMO.

2.3 Descriptive characteristics

2.3.1 Feature

A feature contains descriptive attributes that characterize real world entities.

The word ‘feature’ as used in the ISO 191xx series and in S-100 based product specifications has two distinct but related senses – ‘feature type’ and ‘feature instance’. A feature instance is a single occurrence of the feature and is represented as an object in a dataset.

The location of a feature instance on the Earth’s surface is indicated by a relationship to one or more spatial primitive instances.

S-412 makes use of the Geographic (Geo) feature type which carries the descriptive characteristics of a real-world entity and of the Information type feature which carries information associated to on or more geo feature.

2.3.2 Geographic feature class

Geographic (Geo) feature types carry the descriptive characteristics of a real world entity which is provided by a spatial primitive instance.

2.3.3 Meta feature class

S-412 does not make use of meta features.

2.3.4 Charted background feature

The data product is primarily distributed to be visualized as an overlay of an S-101 ENC on an ECDIS or other GIS applications. Consequently, all necessary descriptive and spatial characteristics to provide a charted background should be provided by the underlying application.

2.4 Spatial characteristics

2.4.1 Spatial primitives

The allowable geometric primitive for each feature type is defined in the Feature Catalogue. The only allowable geometric primitive in an S-412 data product is surface.

Each spatial value must be referenced by at least one feature instance.

2.4.2 Time

S-412 datasets can represent real-world phenomena in the present or future. Because of the unique nature of atmospheric and oceanographic concepts and their geographical changes in time, a variety of time attributes are included in S-412 to ensure instances of features are attributed correctly through time. Features or information types outside of the temporal range of a dataset shall not be included in a dataset. Time shall always be provided in Coordinated Universal Time (UTC).

The dateTimeRange is a complex attribute consisting of simple attributes, dateTimeStart and dateTimeEnd, to allow certain features to define a specific temporal range. The dateTimeRange attribute is mandatory for each feature. This attribute provides data producers the flexibility to manage the temporal resolution of their datasets at the feature level and to concatenate data files in a manner which best suits their workflow and customer's needs. In order for features to be portrayed, the user's system must clearly indicate the dateTimeRange of a feature or a group of features if the values are the same. Instances of this attribute may be used for data validation and to ensure temporal quality.

Three other simple dateTime attributes (issuedDateTime, nextUpdateDateTime, and cancellationDate) are mandatory for each WeatherWarning and inherited into the sub-feature types. The issuedDateTime attribute provides a timestamp for when the WeatherWarning has been issued. The nextUpdateDateTime attribute provides the time information for the next expected WeatherWarning to be issued. The cancellationDate {is used to mark when a WeatherWarning is set to expire, or be cancelled}.

3 Geo Features

3.1 Convergent Boundary

3.2 IceAccretionWarning

Table 3-1

IHO Definition : A product issued by a national authority when ice accumulation rates pose a hazard to vessels.
S-412 Geo Feature: IceAccretionWarning
Primitives: surface

Table 3-2

S-412Attribute	Acronym	Allowable Encoding Value	Type	Multiplicity
iceAccretionRate	()		EN	1,1
sourceOfIcing	()		EN	0,1

3.3 RestrictedVisibilityWarning

Table 3-3

IHO Definition : A product issued by a national authority when horizontal visibility is degraded to less than 0.5 nautical miles by fog, smoke, dust, haze, heavy precipitation, or any other phenomena.
S-412 Geo Feature: RestrictedVisibilityWarning
Primitives: surface

Table 3-4

S-412Attribute	Acronym	Allowable Encoding Value	Type	Multiplicity

3.4 SignificantWaveHeightWarning

Table 3-5

IHO Definition : A product issued by a national authority when sea state conditions pose a hazard or are life-threatening.
S-412 Geo Feature: SignificantWaveHeightWarning
Primitives: surface

Table 3-6

S-412Attribute	Acronym	Allowable Encoding Value	Type	Multiplicity
significantWaveHeightWarningThreshold	()		EN	1,1

3.5 ThunderstormWarning

Table 3-7

IHO Definition : A product issued by a national authority when an area of thunderstorms or squalls poses a hazard. Conditions could include strong winds, locally higher waves, potentially heavy precipitation, hail, and dangerous lightning strikes.
S-412 Geo Feature: ThunderstormWarning
Primitives: surface

Table 3-8

S-412Attribute	Acronym	Allowable Encoding Value	Type	Multiplicity

4 Attributes and Enumerates Descriptions

include::attributes/all.adoc