Provision of improved marine weather information in graphical formats: practices for sea ice (SIGRID-3/“Ice Objects Catalogue”/S-411)

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Procedures for sea ice standards management

- Within the WMO JCOMM ETSI is responsible for operational sea ice standards including the WMO Sea Ice Nomenclature
- JCOMM ETMSS is responsible for GMDSS standards and is developing Marine Objects Catalogue
  - in part of sea ice input is provided by ETSI
- By agreement with IHO TSMAD, JCOMM ETSI is the formal body responsible for the Ice Objects Catalogue with WMO Secretariat as co-manager of the catalogue
- International Ice Charting Working Group (IICWG)
  - Technical advisory body to ETSI
  - <u>Meets annually</u>

Top level harmonizing sea ice standard

- "WMO Sea Ice Nomenclature" (WMO No.259, latest revision Mar 2014)
  - Volumes 1 "Terminology" (terms and definitions)
  - Volumes 2 “Illustrated glossary"
  - Volume 3 "International system of sea ice symbols" (coding tables and symbols for ice charts)
  - From 2007 WMO No.259 is formally managed in electronic form
  - Close to 200 terms and definitions in 13 sections supporting sea ice observations at a point”, “ice analysis (ice charting)” and sea ice climatology [in part of operations]

Sea ice information transport standards

- Ice charting standards for ice services:
  - "SIGRID-3: a vector archive format for sea ice charts" (WMO/TD-No. 1214, revision 3 May 2014) is the main transport format for ice charts at a level of ice services.
    - geometry based on shapefile format
    - thematic content and coding compliant with WMO No.259
    - supports all types of sea ice objects: polygones (areas), lines and points
  - “Ice chart colour standard” (WMO/TD-No. 1215, revision 1 May 2014) is a presentation standard for ice chart
- Standards for ice (sea, fresh-water) display on ECDIS:
  - Ice Object Catalogue (version 5.2, May 2014) is a standard sea ice content for ENC.
  - Ice Information Product Specification Edition 1.1.0, June 2014 Special Publication JCOMM S-411
- WMO GRiB and NetCDF are used to support sea ice input/export for numerical models

Relation between SIGRID-3, Ice Objects Catalogue and S-411

SIGRID-3 / Color standard	Ice Objects Catalogue	S-411
• Contains all ice parameters needed in ice chart • Vector-based “shape files” (polygons, lines, points) • Color standard provides rules for ice chart display • Not compatible with ECDIS (S-411)	• Basic building block of S-411 • Describes ice objects and attributes equivalent to codes of SIGRID-3 • Defines *what* ice information can be used in S-411	• Defines how ice information is displayed on an ECDIS • Ice information exchange standard of the S-100 family • Basic structure the same as S-57 • Includes a Portrayal Standard which defines the appearance of an ice object

JCOMM
Expert Team on Sea Ice

Electronic Chart Systems
Ice Objects Catalogue
Version 5.2

May 1, 2014

Approved by the JCOMM Expert Team on Sea Ice at its 5th Meeting

Prepared by:
John Falkingham, ENC Ice Objects Task Group Leader

Secretariat of the World Meteorological Organization – Geneva – Switzerland

2014

Ice object summary: (pl=3, ln=9, pt=16)

Ice Object Class	Acronym	Code
Polygon		
Sea Ice	SEAICE	30 300
Lake Ice	LACICE	30 301
Iceberg Area	BRGARE	30 302
Polyline		
Ice Edge	ICELNE	30 320
Iceberg Limit	BRGLNE	30 321
Limit of Open Water	OPNLNE	30 322
Limit of All Known Ice	LKILNE	30 323
Line of Ice Ridge	I_RIDG	30 324
Line of Ice Lead	I_LEAD	30 325
Line of Ice Fracture	I_FRAL	30 326
Line of Ice Crack	I_CRAC	30 327
Jammed Brash Barrier	JMDBRR	30 362
Point		
Ice Compacting	ICECOM	30 350
Ice Lead	ICELEA	30 351
Iceberg	ICEBRG	30 352
Floeberg	FLOBRG	30 353
Ice Thickness	ICETHK	30 354
Ice Shear	ICESHR	30 355
Ice Divergence	ICEDIV	30 356
Ice Ridge/Hummock	ICERDG	30 357
Ice Keel/Bummock	ICEKEL	30 358
Ice Drift	ICEDFT	30 359
Ice Fracture	ICEFRA	30 360
Ice Rafting	ICERFT	30 361
Stage of Melt	STGMLT	30 363
Snow Cover	SNWCVR	30 364
Strips and Patches	STRPTC	30 365
Grounded Hummock	I_GRHM	30 366

Ice object example:

Ice Object Class:	Sea Ice
Acronym:	SEAICE
Code:	30300
subset 'Attribute_A':	ICEACT; ICEAPC; ICESOD; ICEFLZ; ICESPC; ICELVL; ICECRT; ICEPRS; ICEFTY; ICEDSP; ICEDDR; ICERCN; ICERFQ; ICERMH; ICERXH; ICERDV; ICEKCN, ICEKFQ, ICEKMD, ICEKXD, ICEFCN; ICETCK; ICEMAX; ICEMIN; ICETTY; ICEMLT; ICESCN; ICESCT; ICEDOS; ICELST; ICELFQ; ICELOR; ICELWD; IA_SFA; IA_SFB; IA_SFC; IA_FFA; IA_FFB; IA_FFC; IA_SNG; IA_MLT; IA_PLG; IA_HLG; IA_DUG; ICEBRS
subset 'Attribute_B':	NOBJNM; OBJNAM; INFORM; NINFOM; SCAMIN; SCAMAX; TXTDSC; NTXTDS; PICREP; ICESYM; ICNSYM
subset 'Attribute_C':	RECDAT; RECIND; SORDAT; SORIND;
Geometric Primitive:	Area
Definition:	Sea Ice is an area at sea that is covered, in whole or in part, with ice.
References:	"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States. "Ice in ECDIS Workshop," June 3-4, 2000, St. John's, Canada. "WMO Sea-Ice Nomenclature and International System of Sea-Ice Symbols", WMO Publication No. 259, Suppl. No. 5, 1989 "SIGRID-3: A Vector Archive Format for Sea Ice Charts", JCOMM Technical Report No. 23, 2004
Distinction:	LACICE
Remarks:	
Change from Version 5.0:	Attributes ICEBRS, ICESYM, ICNSYM, ICECRT, ICEPRS added; Attributes OBJNAM and NOBJNM moved to subset B

Ice feature attributes summary (57):

Ice Feature Attribute	Acronym	Code
Total Concentration	ICEACT	30 300
Partial Concentration	ICEAPC	30 301
Ice Stage of Development	ICESOD	30 302
Lake Ice Stage of Development	ICELSO	30 303
Floe Sizes	ICEFLZ	30 304
Melt Stage	ICEMLT	30 305
Concentration of Strips and Patches	ICESPC	30 306
Number of Icebergs in Area	ICEBNM	30 307
Level Ice	ICELVL	30 308
Compacting Rate	ICECRT	30 309
Ice Fracture Type	ICEFTY	30 310
Ice Lead Status	ICELST	30 311
Frequency of Leads or Fractures	ICELFQ	30 312
Orientation of Leads or Fractures	ICELOR	30 313
Width of Ice Feature (such as Lead, Fracture, Crack or Brash Barrier)	ICELWD	30 314
Ice Location Information	ICELOC	30 315
Iceberg Size	ICEBSZ	30 316
Ice Drift Direction	ICEDDR	30 317
Ice Drift Speed	ICEDSP	30 318
Ice Average Thickness	ICETCK	30 319
Maximum Ice Thickness	ICEMAX	30 320
Minimum Ice Thickness	ICEMIN	30 321
Ice Thickness Type	ICETTY	30 322
Snow Depth	ICESCT	30 323

Ice Feature Attribute	Acronym	Code
Snow Cover Concentration	ICESCN	30 324
Direction Of Sastrugi	ICEDOS	30 325
Ice Ridge Concentration	ICERCN	30 326
Ice Ridge Classification	ICERDV	30 327
Ice Ridge Mean Height	ICERMH	30 328
Ice Ridge Frequency	ICERFQ	30 329
Ice Ridge Maximum Height	ICERXH	30 330
Ice Keel Concentration	ICEKCN	30 331
Ice Keel Frequency	ICEKFQ	30 332
Ice Keel Mean Depth	ICEKMD	30 333
Ice Keel Maximum Depth	ICEKXD	30 334
Ice Rafting Concentration	ICEFCN	30 335
Ice Stage of Development and Floe Size for the 1st p.c.	IA_SFA	30 336
Ice Stage of Development and Floe Size for the 2nd p.c.	IA_SFB	30 337
Ice Stage of Development and Floe Size for the 3rd p.c.	IA_SFC	30 338
Ice Breccia for the 1st partial concentration	IA_FFA	30 339
Ice Breccia for the 2nd partial concentration	IA_FFB	30 340
Ice Breccia for the 3rd partial concentration	IA_FFC	30 341
Snow concentration	IA_SNG	30 344
Stage of melting	IA_MLT	30 345
Contamination	IA_PLG	30 346
Hillocks concentration	IA_HLG	30 347
Fractures concentration	IA_DUG	30 349
Icebergs concentration	IA_BCN	30 353
Prevailing iceberg form	IA_BFM	30 354
Max. height of the above-water part (iceberg / grounded hummock)	IA_BUH	30 355
Number of ice objects	IA_OBN	30 358
Ice Location (relative to a line)	IA_LOC	30 359
Max. width of ice lead (or fracture or crack)	IA_DXW	30 360
Min. width of ice lead (or fracture or crack)	IA_DMW	30 361
Brash Ice	ICEBRS	30 362
Ice Pressure	ICEPRS	30 363
The international coloring	ICESYM	30 390

Ice attribute example:

Ice Attribute:	Concentration of Strips and Patches
Acronym:	ICESPC
Attribute Type:	Enumerated
Code:	30306
Expected Input:	
ID	Meaning
11	Strips and Patches (concentrations 1/10)
12	Strips and Patches (concentrations 2/10)
13	Strips and Patches (concentrations 3/10)
14	Strips and Patches (concentrations 4/10)
15	Strips and Patches (concentrations 5/10)
16	Strips and Patches (concentrations 6/10)
17	Strips and Patches (concentrations 7/10)
18	Strips and Patches (concentrations 8/10)
19	Strips and Patches (concentrations 9/10)
91	Strips and Patches (concentrations 9+/10)
20	Strips and Patches (concentrations 10/10)
99	Undetermined/Unknown
Definition:	A strip is a long narrow area of floating ice, about 1 kilometre or less in width, usually composed of small fragments detached from the main mass of ice, and run together under the influence of wind, swell or current. If the area of ice becomes more rounded in shape, it is referred to as a patch. ICESPC indicates the concentration in tenths within the area of Strips and Patches.
References:	"SIGRID-3: A Vector Archive Format for Sea Ice Charts", JCOMM Technical Report No. 23, 2004 "WMO Sea-Ice Nomenclature and International System of Sea-Ice Symbols", WMO Publication No. 259, Suppl. No. 5, 1989
Remarks:	The concentration of Strips and Patches are provided exclusive of Floe Size values. When a Strips and Patches value is supplied, Floe Size values are null.
Changes from Version 5.0:	Code 91 added to allow 9+/10 to be expressed

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

JCOMM

Ice Information Product Specification

Edition 1.1.0, June 2014

Special Publication JCOMM S-411

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Content

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Basics for S-411

- ✓ Development was led by the BSH as a part of JCOMM/ETSI, latest revision 1.1.0 (June 2014)
- ✓ Adopted as version 1.0 by JCOMM ETSI-5, March 2014
- ✓ Latest version 1.1.0 (June 2014)

- ✓ The Ice Information product specification is based on the IHO S-100 framework specification, Geography Markup Language (GML) , Encoding Standard and the ISO 19100 series of standards.
- ✓ It is a vector product specification that is primarily intended for encoding the extent and nature of Sea Ice for navigational purpose.

Application schema

- ✓ The application schema of ice information product contains 28 feature types with their attributes, enumerations etc.
- ✓ It is based on the ice objects catalogue (Version 5.1) and can also be found in the ICE domain of the IHO Registry.
- ✓ The full schema as XML Schema File included in Annex B – Data Product format (encoding).

Geometry

Ice Information datasets use S-100 Level 3a geometry which supports 0-, 1-, and 2-dimensional objects (points, line strings, and polygons).

Portrayal/symbols

12.2.1.1 IceNavigationalDisplayMode (Traffic Light Principle, depends on Ice Class)

Object Class	Acronym						
Sea Ice	seaice						? ? ? ? ?
Lake Ice	lacice						? ? ? ? ?
Iceberg Area	icebrg						

12.2.1.2 IceScientificIceactDisplayMode

iceact	description	rgb	color
1	Ice Free	000 100 255	
2	Open Water (< 1/10 ice)	150 200 255	
3	Bergy Water	150 200 255	
10	1/10 ice	140 255 160	
12	1/10 to 2/10 ice	140 255 160	
13	1/10 to 3/10 ice	140 255 160	
20	2/10 ice	140 255 160	
23	2/10 to 3/10 ice	140 255 160	
24	2/10 to 4/10 ice	140 255 160	
30	3/10 ice	140 255 160	
34	3/10 to 4/10 ice	140 255 160	
35	3/10 to 5/10 ice	255 255 000	
40	4/10 ice	255 255 000	
45	4/10 to 5/10 ice	255 255 000	
46	4/10 to 6/10 ice	255 255 000	
50	5/10 ice	255 255 000	
56	5/10 to 6/10 ice	255 255 000	
57	5/10 to 7/10 ice	255 255 000	
60	6/10 ice	255 255 000	
67	6/10 to 7/10 ice	255 255 000	
68	6/10 to 8/10 ice	255 125 007	
70	7/10 ice	255 125 007	
78	7/10 to 8/10 ice	255 125 007	
79	7/10 to 9/10 ice	255 125 007	
80	8/10 ice	255 125 007	
81	8/10 to 10/10 ice	255 000 000	
89	8/10 to 9/10 ice	255 125 007	
90	9/10 ice	255 000 000	
91	9/10 to 10/10 or 9+/10 ice	255 000 000	
92	10/10 ice	145 000 000	
99	Undetermined/Unknown	SymbolFill	

12.2.1.3 IceScientificIcesodDisplayMode

icesod	desc	rgb	color
1	Ice Free	150 200 255	
70	Brash Ice	150 200 255	
80	No stage of development	150 200 255	
81	New Ice (<10 cm)	240 210 250	
82	Nilas Ice Rind (<10 cm)	255 100 255	
83	Young Ice (10 to <30 cm)	170 040 240	
84	Grey Ice (10 to <15 cm)	135 060 215	
85	Grey – White Ice (15 to <30 cm)	220 080 235	
86	First Year Ice (30 to 200 cm)	255 255 000	
87	Thin First Year Ice (30 to <70 cm)	155 210 000	
88	Thin First Year Ice Stage 1 (30 to <50 cm)	215 250 130	
89	Thin First Year Ice Stage 2 (50 to <70 cm)	175 250 000	
91	Medium First Year Ice (70 to 120 cm)	000 200 020	
93	Thick First Year Ice (>120 cm)	000 120 000	
94	Residual Ice	000 120 000	
95	Old Ice	180 100 050	
96	Second Year Ice	255 120 010	
97	Multi-Year Ice	200 000 000	
98	Glacier Ice (Icebergs)	SymbolFill	
99	Undetermined/Unknown	SymbolFill	

12.2.2 Line Features

Object Class	Acronym	
Ice Edge	icelne	
Iceberg Limit	brglne	
Limit of Open Water	opnlne	
Limit of All Known Ice	lkilne	
Line of Ice Ridge	i_ridg	
Line of Ice Lead	i_lead	
Line of Ice Fracture	i_fral	
Line of Ice Crack	i_crac	

12.2.3 Point Features

Feature Class	Acronym	Symbol
Ice Compacting	icecom	
Ice Lead	icelea	
Floeberg	flobrg	
Ice Shear	iceshr	
Ice Divergence	icediv	
Ice Ridge / Hummock	icerdg	
Ice Keel / Bummock	icekel	
Ice Fracture	icefra	
Ice Rafting	icerft	
Jammed Brash Barrier	jmdbrr	
Stage of Melt	stgmlt	
Snow Cover	snwcvr	
Strips and Patches	strptc	
Grounded Hummock	i_grhm	
Iceberg	icebrg	
	icebrg 01 (Growler)	
	icebrg 02 (Bergy Bit)	
	icebrg 03 (Small Iceberg)	
	icebrg 04 (Medium Iceberg)	
	icebrg 05 (Large Iceberg)	
	icebrg 06 (Very large Iceberg)	
	icebrg 07 (Ice Island Fragment)	
	icebrg 08 (Ice Island)	
	icebrg 09 (Radar Target)	
	icebrg 99 (Unknown)	
Ice Drift	icedft	
	icedft 01 (No Ice Motion)	
	icedft 02 (NE)	
	icedft 03 (E)	
	icedft 04 (SE)	
	icedft 05 (S)	
	icedft 06 (SW)	
	icedft 07 (W)	
	icedft 08 (NW)	
	icedft 09 (N)	
	icedft 10 (Variable)	

Under implementation…..