ICE CHART COLOUR CODE STANDARD

WMO/TD-No. 1215

2004

JCOMM Technical Report No. 24

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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N O T E

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1. Preface

While the WMO international standard for ice charts only dealt with black and white charts, in keeping with the paper facsimile technology of the time, colour has long been used to help differentiate the various ice conditions on a paper chart. In the last decade, progress in computer processing and communication, as well as increased demands of users prompted the necessity to develop a new WMO International Ice Colour Code Standard for ice charts.

In the Russian Federation, one of the first colour coding standards for en-route and operational ice charts was included into the “Manual on Air Reconnaissance conduct” published in 1953. However, practices of routine colour enhancement of paper ice charts in support of navigation through the Northern Sea Route may be traced back to the 1930s. Subsequent editions of the stated manual included recommendations for colour coding which were very close to the original summer (blue-green-brown scheme) and winter (purple-green-brown scheme) for navigation in the Arctic Seas. The last edition published in 1981 served as one of the starting points for developing new WMO International Ice Colour Code.

Similar to the practices in the Eurasian Arctic, ice service specialists in the Canadian Ice Service coloured paper charts manually as an aid to briefing icebreaker captains. There was no standard for these colour schemes but they were generally based on some version of green-yellow-red for light-medium-heavy ice conditions. As colour technology became more commonplace, the Canadian Ice Service adopted an internal standard based on the Ice Services Specialist practices and began producing colour charts routinely. Correspondingly, Canadian practice provided another of the bases for the present standard.

The same long practice of colour coding on a national level is characteristic of the Baltic Sea ice services, e.g. ice charts have been optionally coloured by German experts from the 1st part of the XX century which served as another prototype for a colour standard for seas with seasonal ice cover. Additionally, a specific case of colour coding has been examined by Danish ice experts for Greenland waters, to contribute to an international colour standard.

The first steps in colour code standardization were undertaken by the former CMM Group on Sea Ice as early as the 1950s. After a long break, the next phase was initiated by the International Ice Charting Working Group (IICWG), an ad-hoc group closely related to the JCOMM Expert Team on Sea Ice. The IICWG-II Meeting (October 2000) started with initial ideas and principles. IICWG-III (November 2001) drafted the basis for agreement on the standard with refinements based on comments from Ice Services who tested the proposal during the first half of 2002.

During 2003, IICWG and ETSI experts proceeded with editing and testing the standard, which in its final version includes two separate colour codes with options for use on ice charts:

1) one based on total concentration (CT) intended for use when the stage of development is relatively uniform but concentration is highly variable (e.g. arctic summer navigation);
2) one based on stage of development (SoD) intended for use when the concentration is relatively uniform (high) but the stage of development is variable (e.g. arctic winter navigation).

The CT and SoD Colour Code Standards are given below as tables 1 and 2 respectfully. For the convenience of users, definitions of basic symbols in WMO oval form are repeated in Table 3.

Section 2 provides notes for utilizing the Colour Code Standard.

Application of the Standard is exemplified in the sample ice charts from national ice services included in Annex I.

2. Ice Chart Colour Code - Notes

1) Two separate colour codes are mutually exclusive - only one or the other should be used on a single chart.
2) A legend depicting the colour code used should be included on every chart.
3) The optional colour indicating 9+-10 tenths of nilas or grey ice should only be used to indicate level ice, mainly on leads; it should not be used for ice broken into brash or ice cakes or for concentrations less than 9+ tenths.
4) Undefined ice is used when it is known that ice is in an area but its characteristics are not known - this is different from “No Information” which indicates that nothing at all is known about the area.
5) No specific colour is assigned to areas of “No Information”; such areas should be clearly indicated on ice charts - text annotation may be used where appropriate; an assigned colour within the code should not be used to indicate “No Information”.
6) Colour codes do not preclude use of black and white hatching patterns or egg codes; egg codes and/or black and white hatching may be used along with colours.
7) If properly documented, other symbols may be used in addition to the standard colours to depict special ice conditions under national practice.

The present document is an integral part and extension of the WMO Sea Ice Nomenclature, Supplement No. 4 (WMO - No. 259) currently in force.

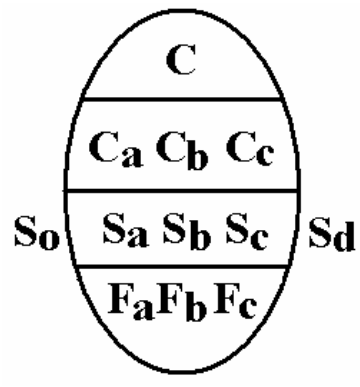
Table 1. Total Concentration Colour Code Standard

Colour		RGB colour model	Total concentration (definition from WMO Nomenclature)	Number from WMO Nomenclature
alternative	prime			
		000-100-255	Ice free	4.2.8
		150-200-255	Less than one tenth (open water)	4.2.6
		140-255-160	1/10 - 3/10 (very open ice)	4.2.5
		255-255-000	4/10 - 6/10 (open ice)	4.2.4
		255-125-007	7/10 - 8/10 (close ice)	4.2.3
		255-000-000	9/10 - 10/10 (very close ice)	4.2.2
		150-150-150	Fast ice	1.1.1
		210-210-210	Ice shelf	10.3
	? ? ?	255-255-255	Undefined ice	-
Optional		255-175-255	7/10-10/10 new ice	2.1
		255-100-255	9/10-10/10 nilas, grey ice (mainly on leads)	2.2, 2.4
Areas of No Information are annotated accordingly				

Table 2. Stage of Development Colour Code Standard

Colour		RGB colour model	Stage of development (SoD)	Number from WMO Sea Ice Nomenclature
alternative	prime			
		000-100-255	Ice free	4.2.8
		150-200-255	<1/10 ice of unspecified SoD (open water)	4.2.6
		240-210-250	New ice	2.1
		255-175-255	Dark nilas	2.2.1
		255-100-255	Light nilas	2.2.2
		170-040-240	Young ice	2.4
		135-060-215	Grey ice	2.4.1
		220-080-235	Grey-white ice	2.4.2
		255-255-000	First-year ice (FY)	2.5
		155-210-000	FY thin ice (white ice)	2.5.1
		215-250-130	FY thin ice (white ice) first stage	2.5.1.1
		175-250-000	FY thin ice (white ice) second stage	2.5.1.2
		000-200-020	FY medium ice	2.5.2
		000-120-000	FY thick ice	2.5.3
		180-100-050	Old ice	2.6
		255-120-010	Second-year ice	2.6.1
		200-000-000	Multi-year ice	2.6.2
		150-150-150	Fast ice of unspecified SoD	2.6
		210-210-210	Ice shelf	10.3
	? ? ?	255-255-255	Ice of undefined SoD	-
	▲ ▲ ▲	255-255-255	Drifting ice of land origin (icebergs)	10.4.2
Areas of No Information are annotated accordingly				

Table 3. Definitions of Basic Symbols in Oval Form (according to WMO Sea Ice Nomenclature, Suppl. No 4, WMO-No.259)



Concentration (C)
C – Total concentration of ice in the area, reported in tenths (see symbols in table 3.1).
Note: Ranges of concentration may be reported.
C_a C_b C_c – Partial concentrations of thickest (C_a), second thickest (C_b) and third thickest (C_c) ice, in tenths.
Note: Less than 1/10 is not reported. 10/10 of one stage of development is reported by C, S_a and F_a or C S_a F_p F_s

Stage of development (S)
S_a S_b S_c – Stage of development of thickest (S_a), second thickest (S_b) and third thickest S_c) ice, of which the concentrations are reported by C_a, C_b, C_c respectively (see symbols in table 3.2).
Notes:
(1) If more than one class of stage of development remains after selection of S_a and S_b, S_c should indicate the class having the greatest concentration of the remaining classes (see also Note (2))
(2) Reporting of S_a, S_b and S_c should generally be restricted to a maximum of three significant classes. In exceptional cases, further classes can be reported as follows:
S_o – stage of development of ice thicker than Sa but having a concentration of less than 1/10;
S_d – stage of development of any other remaining class.
(3) No concentration are reported for S_o and S_d.

Form of ice (F)

(a) First variant
F_a F_b F_c – Form of ice (floe size) corresponding to S_a, S_b and S_c respectively (see symbols in table 3.3).
Notes: (1) Absence of information on any one of these forms of ice should be reported with an "x" at the corresponding position.
(2) When icebergs are present in sufficient numbers to have concentration figure, this situation can be reported with F_a = 9, the appropriate symbol for S_a and the corresponding partial concentration C_a.
(3) In situation when only two stages of development are present, a dash (-) should be added in place of F_c to separate these situations from those when F_p and F_s are being reported.

(b) Second variant
F_p F_s – Predominant (F_p) and secondary (F_s) floe size, reported independently from S_a, S_b and S_c respectively (see symbols in table 3.3).
Note: If only the predominant floe size (form of ice) is reported, only the symbol for F_p shall be reported.

Table 3.1
Total concentration of ice (C)

Concentration	*Symbol*
Ice free	
Less than one tenth	0
1/10	1
2/10	2
3/10	3
4/10	4
5/10	5
6/10	6
7/10	7
8/10	8
9/10	9
More than 9/10 less than 10/10	9+
10/10	10
Undetermined or unknown	x

Table 3.2
Stage of development and thickness (S_a S_b S_c S_o S_d)

Number from WMO Sea Ice Nomenclature	*Element*	*Thickness*	*Symbol*
	No stage of development	-	0
2.1	New ice	-	1
2.2	Nilas; ice rind	< 10 cm	2
2.4	Young ice	10-30 cm	3
2.4.1	Gray ice	10-15 cm	4
2.4.2	Gray-white ice	15-30 cm	5
2.5	First-year ice	30-200 cm	6
2.5.1	Thin first-year ice	30-70 cm	7
2.5.1.1	Thin first-year ice, first stage	30-50 cm	8
2.5.1.2	Thin first-year ice, second stage	50-70 cm	9
2.5.2	Medium first-year ice	70-120 cm	1•
2.5.3	Thick first-year ice	> 120 cm	4•
2.6	Old ice		7•
2.6.1	Second-year ice		8•
2.6.2	Multi-year ice		9•
10.4	Ice of land origin		▲•
	Undetermined or unknown		x

Table 3.3
Form of ice (F_a F_b F_c F_p F_s)

Element	*Floe size*	*Symbol*
Pancake ice	-	0
Small ice cake; brash ice	< 2 m	1
Ice cake	2-20 m	2
Small floe	20-100 m	3
Medium floe	100-500 m	4
Big floe	500 m-2 km	5
Vast floe	2-10 km	6
Giant floe	> 10 km	7
Fast ice	-	8
Icebergs, growlers or floebergs	-	9
Undetermined or unknown	-	x

Annex I

Sample ice charts from national ice services

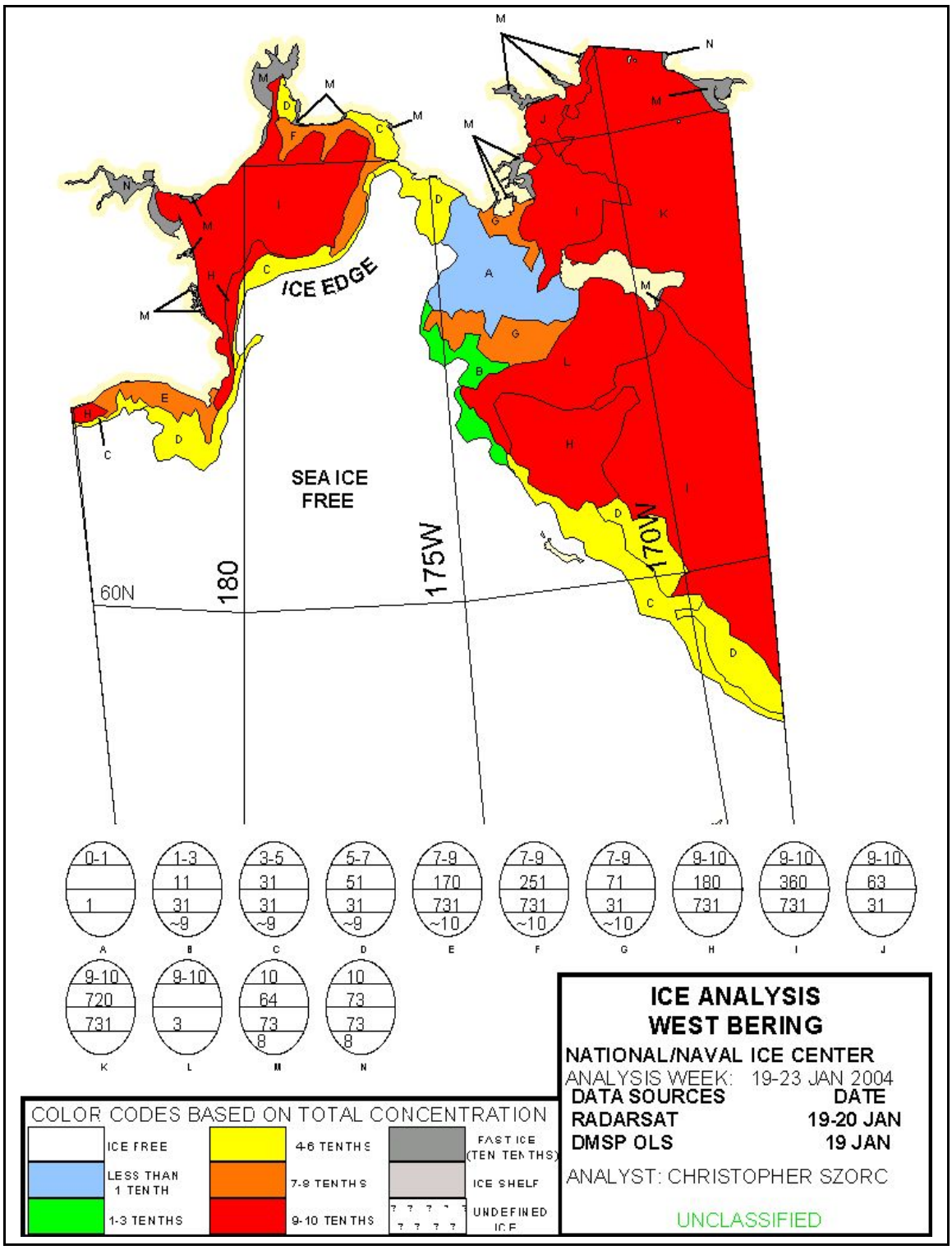


Fig. 1. Bering Sea western part ice chart for 19-23 January 2003 produced by USA National Ice Center. Ice chart is based on Total concentration Colour Standard.

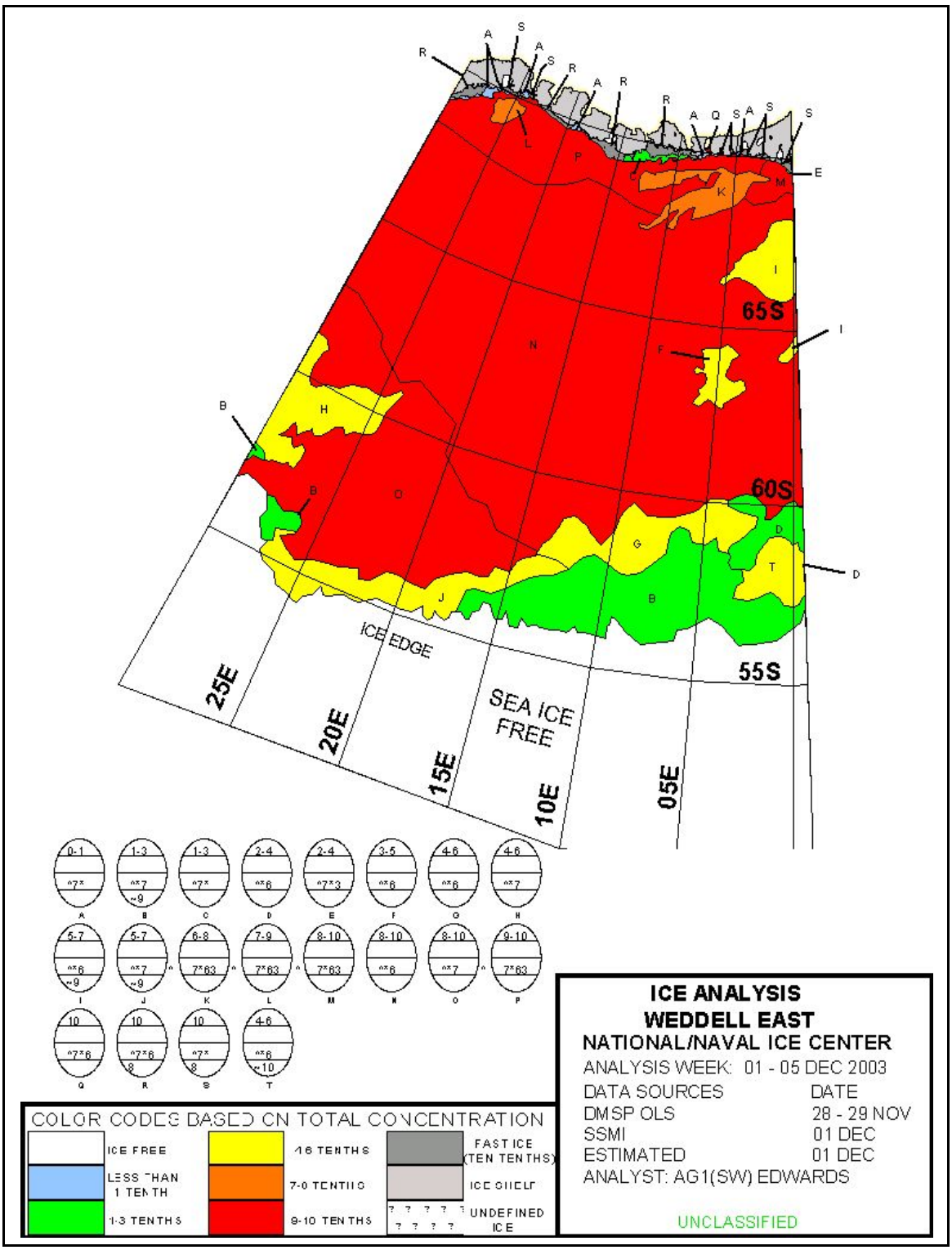


Fig. 2. Weddell Sea eastern part ice chart for 01-05 December 2003 produced by USA National Ice Center. Ice chart is based on Total concentration Colour Standard.

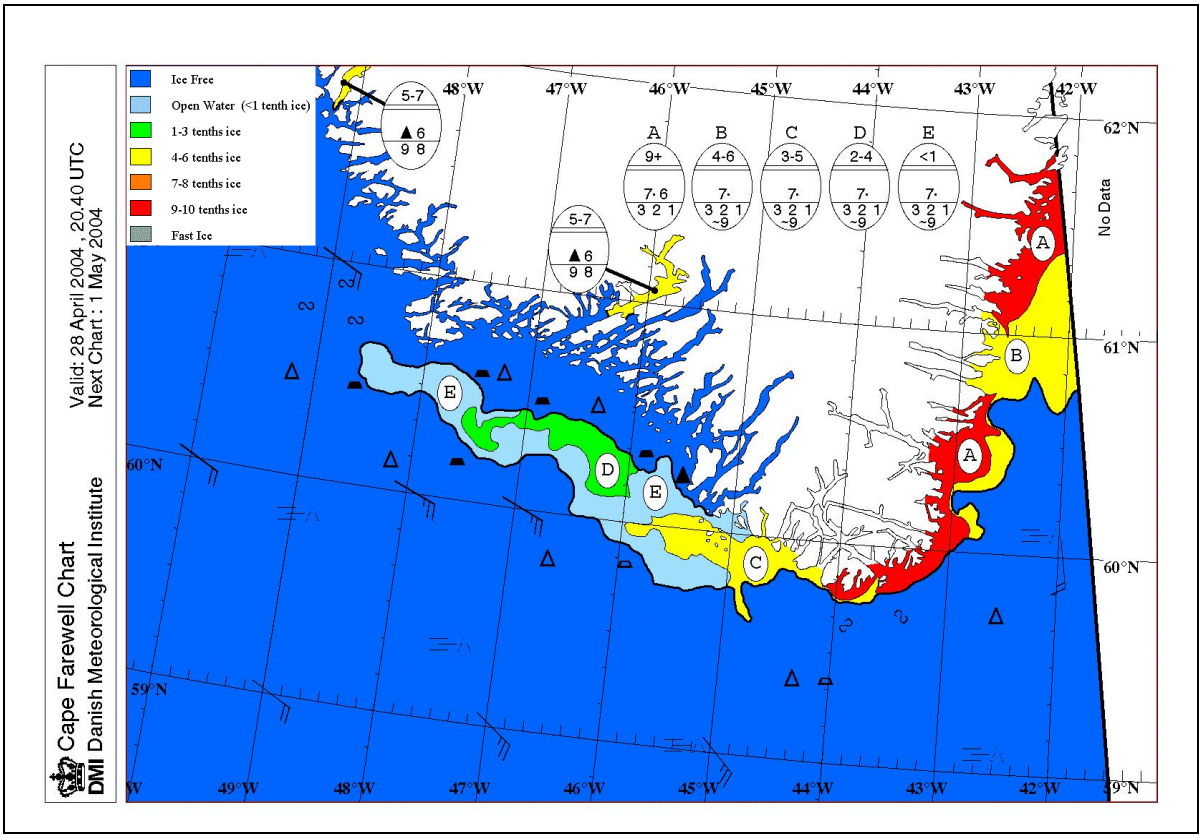


Fig. 3. Cape Farewell ice chart for 28 April 2004 produced by Danish Meteorological Institute. Ice chart is based on Total concentration Colour Standard.

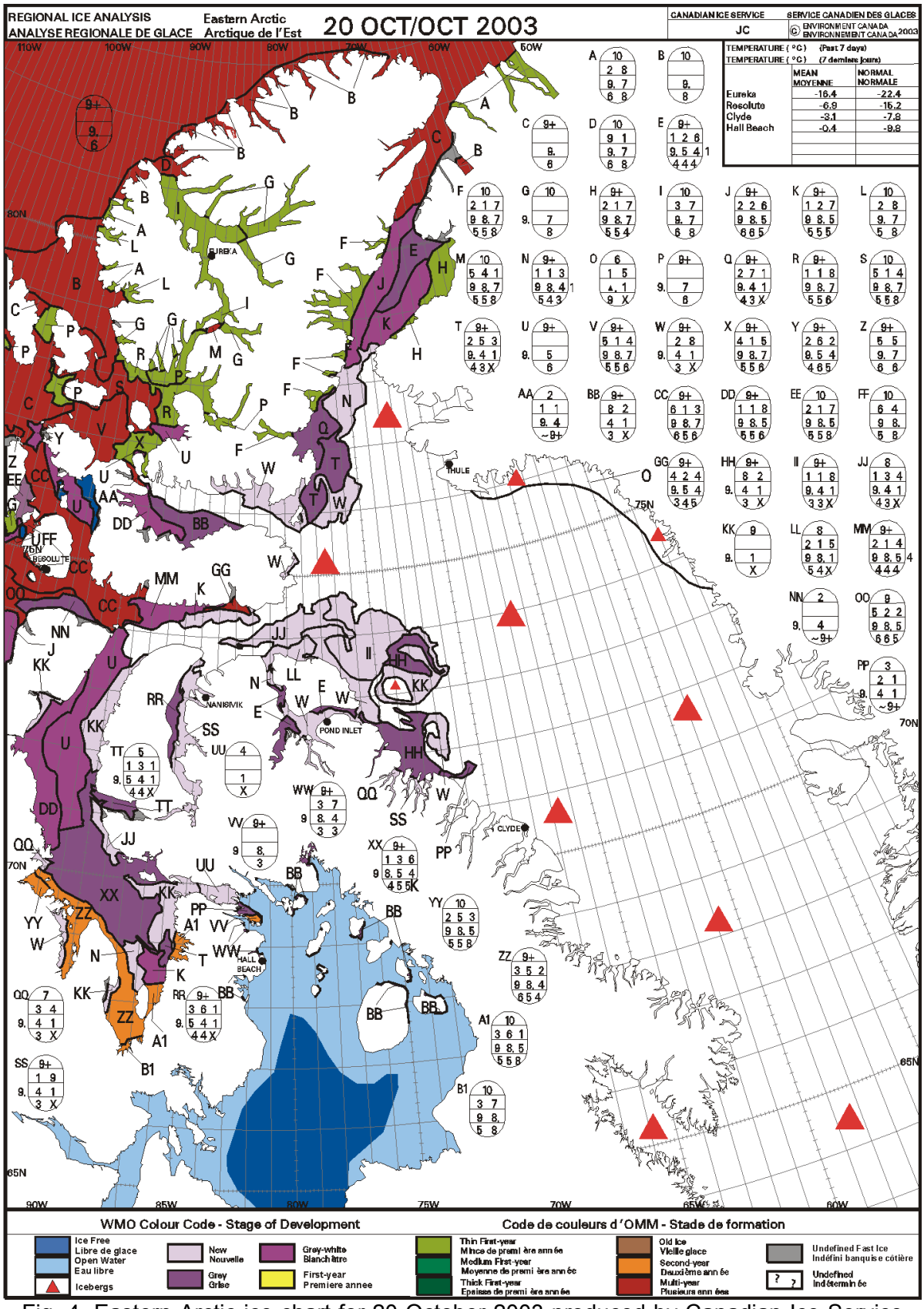


Fig. 4. Eastern Arctic ice chart for 20 October 2003 produced by Canadian Ice Service. Ice chart is based on Stage of Development Colour Standard.

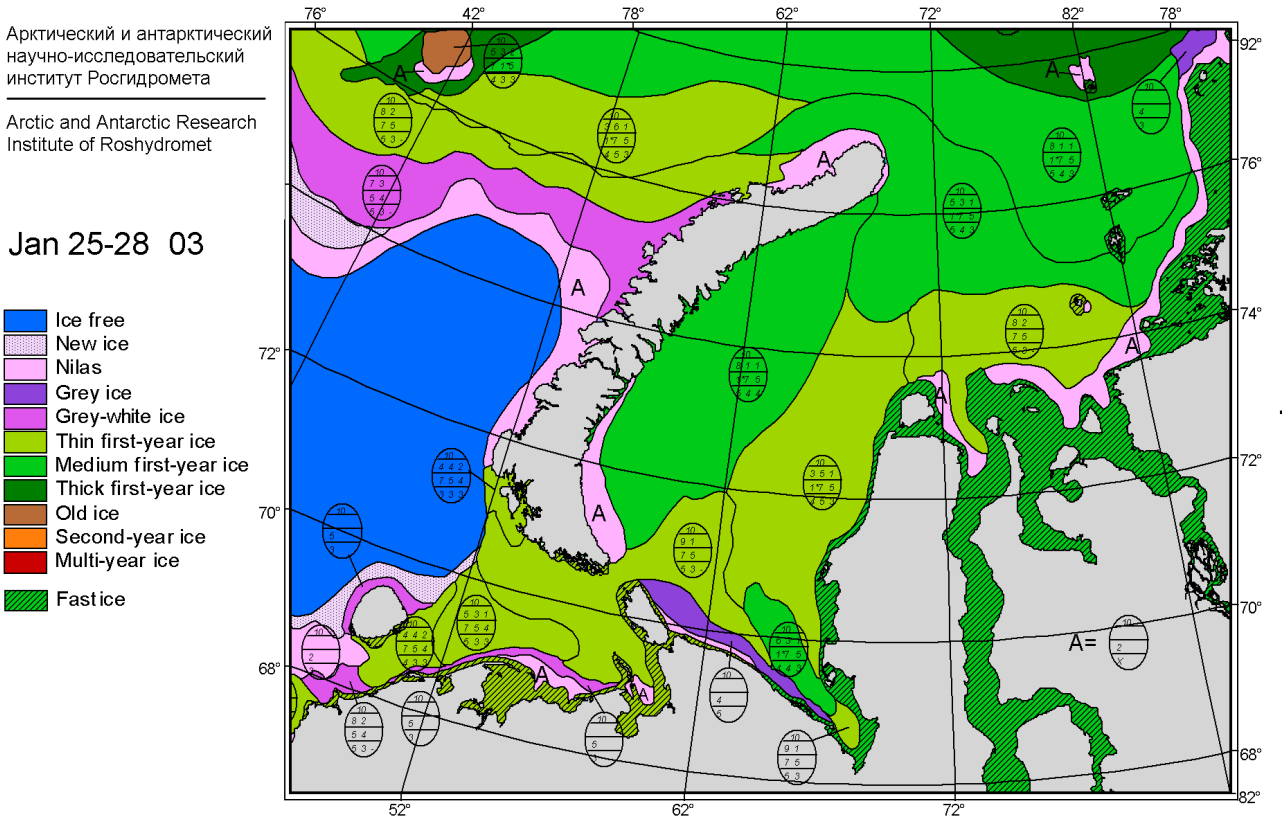


Fig. 5. Barents Sea ice conditions chart for 25-28 January 2003 produced by Arctic and Antarctic Research Institute, Russian Federation. Ice chart is based on Stage of Development Colour Standard with optional hatching of fast ice.