ASPeCt Sea-Ice Cards

Manual for shipboard observations of sea ice.

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AAS4506 (May 2024) based on ASPeCt V1_2015/16 (P. Heil AAS5032)
https://data.aad.gov.au/metadata/AAS_4506_AAD_SeaIce_Cards

Antartic Sea-Ice Processes and Climate

Icebreaking vessels are unique platforms for gathering data regarding Antarctic sea-ice thickness, distribution, and other characteristics. These data enhance our understanding of processes, validate satellite-derived products, and provide input for numerical models.

Established in 1996, Antarctic Sea Ice Processes and Climate (ASPeCt) is an expert group operating under the Scientific Committee of Antarctic Research (SCAR) Physical Sciences program and dedicated to multi-disciplinary research within the Antarctic sea ice zone.

ASPeCt sea-ice cards are an authoritative document for observing Antarctic sea ice, adhering to global observing protocols outlined by the World Meteorological Organization (WMO). The cards describe the standard procedure for conducting underway observations. They specify the variables to be observed, offer visual guidance on sea-ice types, and provide the ASPeCt data codes for recording observations.

Australian Government
Department of Climate Change, Energy, the Environment and Water
Australian Antarctic Division

AUSTRALIAN ANTARCTIC PROGRAM

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Best practices for ASPeCt observations

Establish a professional relationship with voyage management and bridge crew.

Study these cards to ensure that you observe the specific measure. Check with the ASPeCt coordinator if unsure.

Find a place with a **full-spherical** view around the ship. Observe the sea ice. Total sea-ice concentration includes all sea-ice types. Beyond this, each sea-ice type is described separately.

Observations are recorded **on the hour**. If time-poor, then omit night / poor visibility. If time-rich (ie many volunteers), then make simultaneous observations. Each person's observations are valued. Beginners are welcome.

ASPeCt protocol is to observe **sea ice within a 1 km radius** of the ship. To estimate 1 km, a ship's officer may refer you to the RADAR display on the bridge. Orientate unique features by referring to distance information on the display. Icebergs and ice roughness reflect the RADAR signal and appear bright on the display.

Acknowledgments These cards include standards of Worby and Allison (1999) 'A Technique for Making Ship-Based Observations of Antarctic Sea Ice Thickness and Characteristics: Part 1 Observational Technique and Results.' (Antarctic CRC Research Report No. 14, ISBN: 1 875796 09 6, ISSN: 1320-730X).

Further description and definitions from Sea-ice Information and Services. World Meteorological Organization (WMO), 2021 (2021 edition; WMO-No. 574), and WMO Sea Ice Nomenclature (2014 edition; WMO No. 259, volume 1 – Terminology and Codes.)

Thank you to F. Olivier, I. Allison, V. Lytle, A. Rada, and P. Heil for the photographs; and to F. Lake for the sea-ice concentration graphics.

Thank you to all ASPeCt observers, and the ship's officers and crew supporting ASPeCt observations of sea ice.

ASPeCt protocol

Sea-ice and snow symbols & codes.

ICE TYPE ty

10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

OPEN WATER ow

0 No openings
1 Small cracks
2 Very narrow breaks, 500 m
3 Narrow breaks 50-200 m
4 Wide breaks 200-500 m
5 Very wide breaks, >500 m
6 Lead/coastal lead
7 Polynya/coastal polynya
8 Water broken by small scattered floes
9 Open sea

CONCENTRATION

TOTAL C, PARTIAL Ca Cb Cc
In tenths

FLOE SIZE f

100 Pancakes
200 New sheet ice
300 Brash/broken ice
400 Cake ice, 2000 m
500 Small floes, 20-100 m
600 Medium floes, 100-500 m
700 Large floes, 500-2000 m
800 Vast floes, >2000 m

SNOW TYPE s

0 No snow observation
1 No snow, no ice or brash
2 Cold new snow, <1 day old
3 Cold, old snow
4 Cold wind-packed snow
5 New melting snow (wet new snow)
6 Old melting snow
7 Glaze
8 Melt slush
9 Melt puddles
10 Saturated snow (waves)
11 Sastrugi

THICKNESS

ICE Z, SNOW SZ
In centimetres

TOPOGRAPHY t

100 Level ice
200 Rafted pancakes
300 Cemented pancakes
400 Finger rafting

5xy New, unconsolidated ridges (no snow)
6xy New ridges filled with snow
7xy Consolidated ridges (no weathering)
8xy Older, weathered ridges

x values: areal coverage
0 0-10%
1 10-20%
2 20-30%
3 30-40%
4 40-50%
5 50-60%
6 60-70%
7 70-80%
8 80-90%
9 90-100%

y values: average sail height
1 0.5 m
2 1.0 m
3 1.5 m
4 2.0 m
5 3.0 m
6 4.0 m
7 5.0 m

Instructions for observing each variable are outlined in these cards.

ASPeCt protocol

Weather & visibility symbols & codes.

Weather

Choose one code that best describes the weather at the ship when you conducted the sea-ice observation.

Visibility

Choose a code that best describes the visibility (how far you can see from the ship's bridge).

VISIBILITY v

90 <50 m
91 50–200 m
92 200–500 m
93 500–1000 m
94 1–2 km
95 2–4 km
96 4–10 km
97 >10 km
-1 Not available

WEATHER ww

Cloud Development During Past Hour
00 Cloud development not observed or not observable
01 Clouds dissolving or becoming less developed
02 State of sky on the whole unchanged
03 Clouds forming or developing

Fog/Precipitation During Past Hour But Not At Time Of Obs
20 Drizzle not freezing or snow grains
21 Rain not freezing or snow grains
22 Snow not freezing or snow grains
23 Rain and snow, or ice pellets
24 Drizzle or rain, freezing
25 Showers of rain
26 Showers or snow or of rain and snow
27 Showers of hail or of hail and rain
28 Fog in the past hour, not at present

Blowing or Drifting Snow
36 Drifting snow, below eye level, slight/moderate
37 Drifting snow, below eye level, heavy
38 Blowing snow, above eye level, slight/moderate
39 Blowing snow, above eye level, heavy

Fog/ Mist, visibility <1000 m
41 Fog in patches
42 Fog thinning in last hour, sky discernible
43 Fog thinning in last hour, sky not discernible
44 Fog unchanged in last hour, sky discernible
45 Fog unchanged in last hour, sky not discernible
46 Fog beginning/thickening in last hour, sky discernible
47 Fog beginning/thickening in last hour, sky not discernible
48 Fog depositing rime, sky discernible
49 Fog depositing rime, sky not discernible

Precipitation As Drizzle
50 Slight drizzle, intermittent
51 Slight drizzle, continuous
52 Moderate drizzle, intermittent
53 Moderate drizzle, continuous
54 Dense drizzle, intermittent
55 Dense drizzle, continuous
56 Freezing drizzle, slight
57 Freezing drizzle, moderate or dense
58 Drizzle and rain, slight
59 Drizzle and rain, moderate or dense

Precipitation As Rain, Not Showers
60 Slight rain, intermittent
61 Slight rain, continuous
62 Moderate rain, intermittent
63 Moderate rain, continuous
64 Heavy rain, intermittent
65 Heavy rain, continuous
66 Freezing rain, slight
67 Freezing rain, moderate or heavy
68 Rain or drizzle and snow, slight
69 Rain or drizzle and snow, moderate/heavy

Frozen Precipitation, Not Showers
70 Slight fall of snow flakes, intermittent
71 Slight fall of snow flakes, continuous
72 Moderate fall of snow flakes, intermittent
73 Moderate fall of snow flakes, continuous
74 Heavy fall of snow flakes, intermittent
75 Heavy fall of snow flakes, continuous
76 Ice prisms, with/without fog
77 Snow grains, with/without fog
78 Isolated starlike snow crystals
79 Ice pellets

Precipitation As Showers
80 Slight rain showers
81 Moderate or heavy rain showers
82 Violent rain showers
83 Slight showers of rain and snow
84 Moderate/heavy showers of rain and snow
85 Slight snow showers
86 Moderate or heavy snow showers
87 Slight showers of soft or small hail
88 Moderate/heavy showers of soft/small hail
89 Slight showers of hail
90 Moderate or heavy showers of hail

WMO code 4677 (updated 1997)

Total concentration (c)

Proportion (sea-surface area) covered by ice.

Use these diagrams to **scale** your observations.
Record concentration in tenths.
Include all sea-ice types.
Estimate within one-kilometer radius of ship.

Distance of observations

Oblique view (ship-based) makes **separate floes seem to merge**. This results in over-estimation of both concentration and floe size.

Even in good light, observations beyond 3 km are subjective.

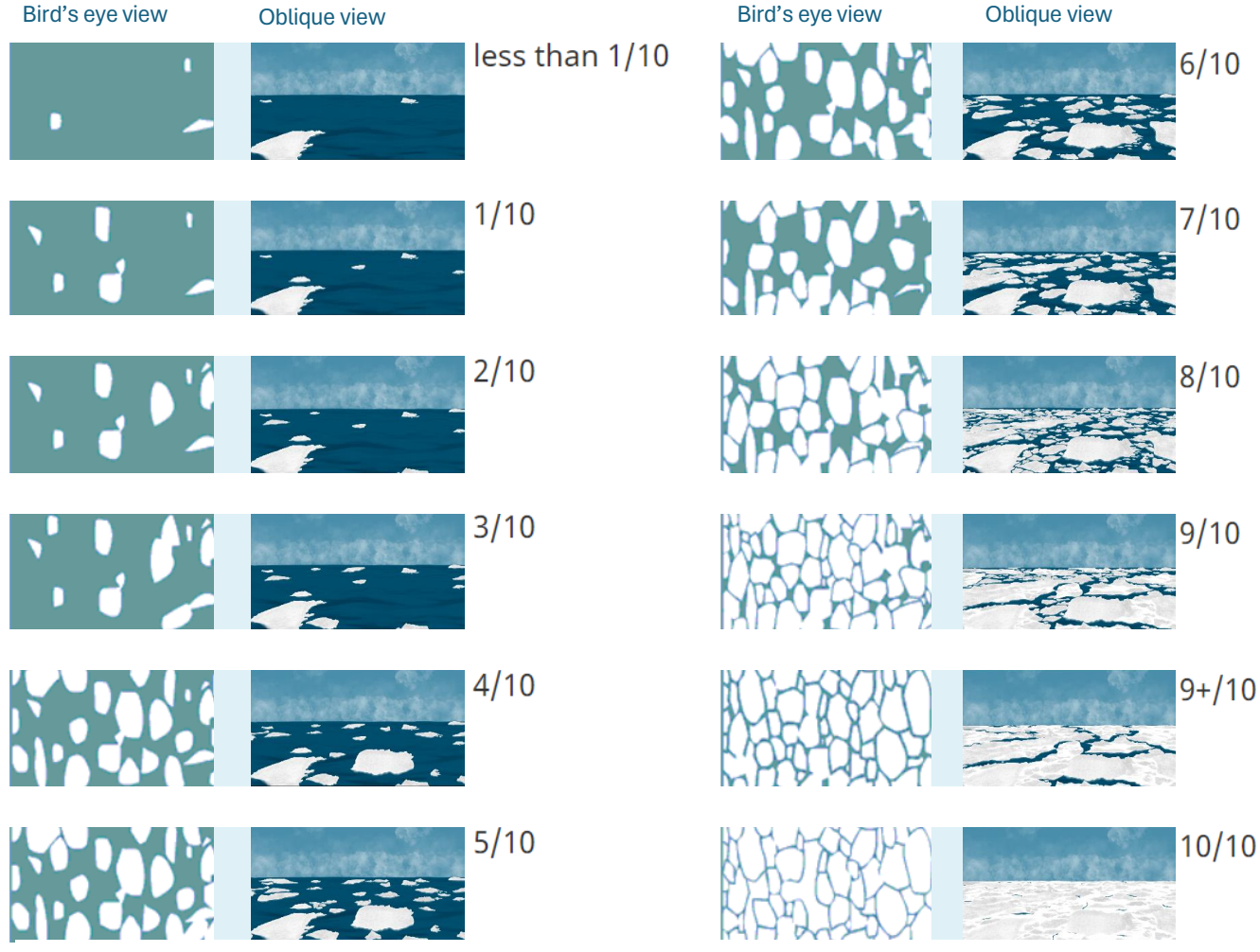
We recommend limiting observations to **one-kilometer radius of the ship**.

Concentrated sea ice

Where there are only small cracks, record concentration (c) as 10 and open water (ow) as 1.

In regions of complete sea-ice cover (100%) record open water (ow) as 0 (no openings).

See page 17 for open water.



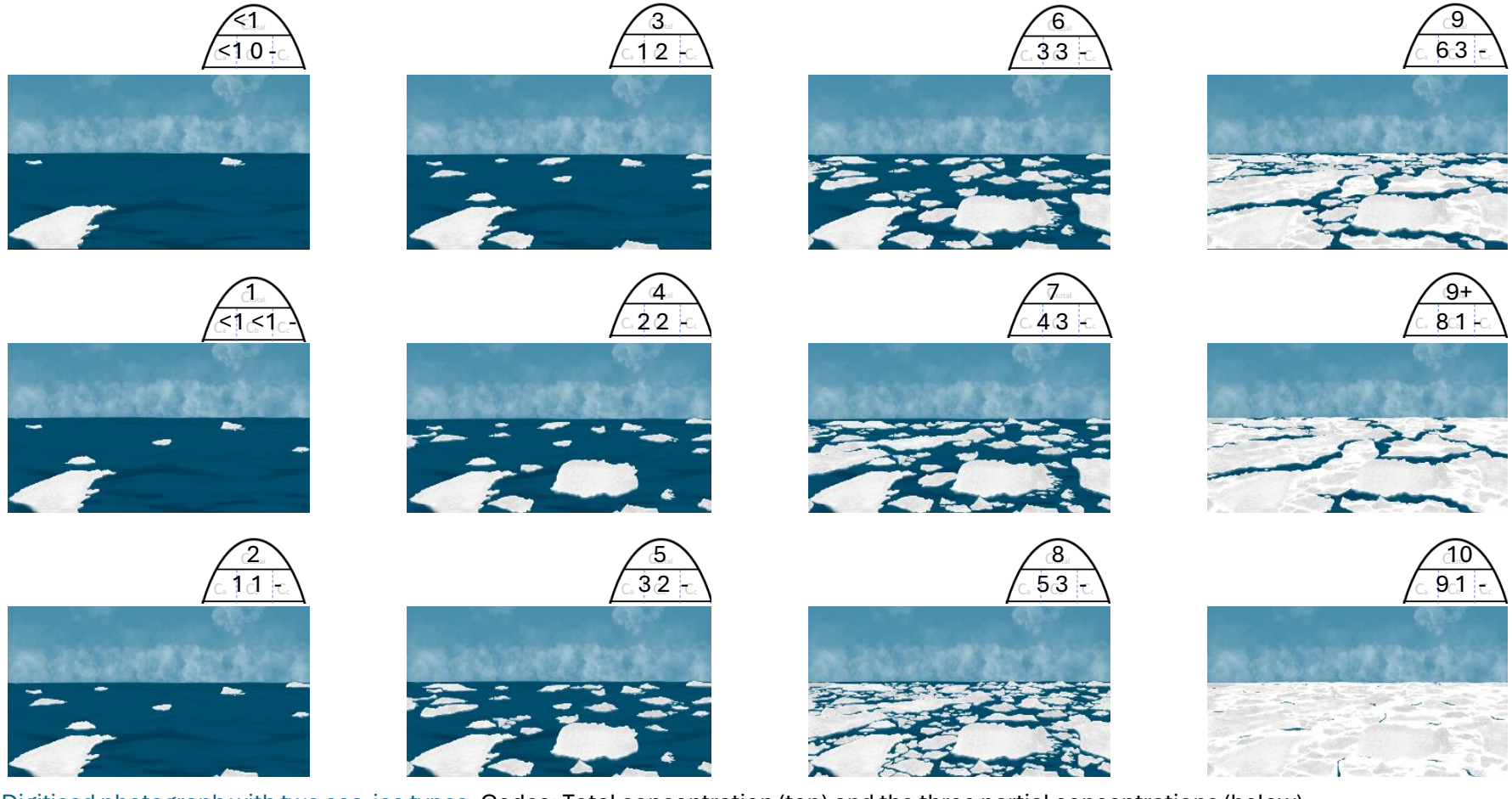
Partial concentrations

(C_a, C_b, C_c)

Proportion cover of each sea-ice type.

Identify up to three dominant sea-ice types:
Thickest (C_a), 2nd thickest (C_b), and 3rd thickest (C_c).
Record proportion cover from 0 to 10 i.e., in tenths.

Partial concentrations sum to total concentration.
Group sea-ice types if necessary for representation.



Digitised photograph with two sea-ice types. Codes: Total concentration (top) and the three partial concentrations (below).

Ice type (ty): Stage of development

Ice type is the primary sea-ice classification.

ICE TYPE ty

10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

New ice (frazil, grease ice and shuga) congeals to nilas or pancakes, which thickens by growth or rafting to young grey and grey-white ice, which thickens by growth or ridging to first year ice (thin, medium and thick).

The following five cards describe each sea-ice type.

Use these cards and other training materials to learn the name, appearance and code for every sea-ice type.

For each observation:

- Estimate total concentration (proportion cover) of sea ice.
- Identify the different sea-ice types within 1 km radius of ship.
- Record sea-ice types in order of sea-ice thickness.
- Estimate partial concentration of up to three sea-ice types.
- Estimate remaining variables for each sea-ice type.

Ice Type	Ice Thickness
New ice	Less than 5 cm
Nilas or pancakes	Less than 10 cm
Young ice	Less than 30 cm
First year ice	30 – 180 cm
Multiyear ice	Greater than 180 cm

Ice type (ty): New ice

Crystals loosely congealed.

Less than 5 cm thick.

ICE TYPE ty

10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

Top: Frazil crystals between brash ice and fast ice: Water surface appears 'oily'.

Middle: Shuga (clumps of sea ice crystals and snow) over open water. Note water vapour.

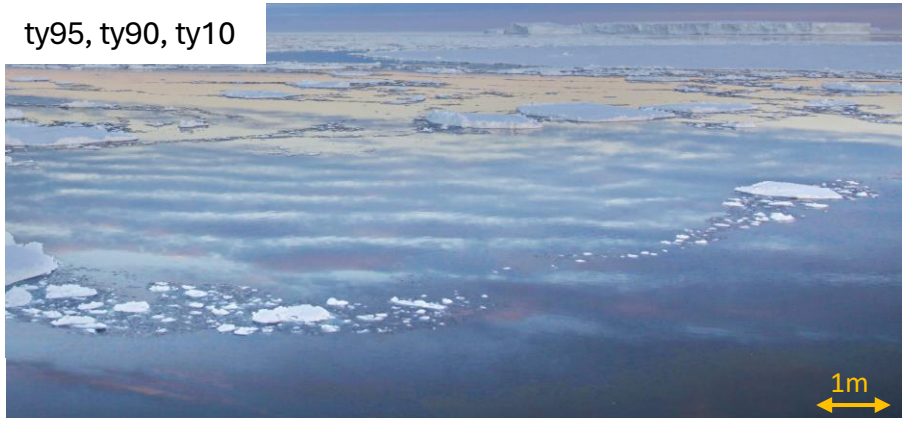
Bottom: Grease ice (between pancakes). Water surface appears smooth and matt.

Frazil (**crystals**) Spicules or plates of sea ice in the top few centimetres of the ocean may form in large quantities and give the sea an oily appearance (top photo).

Shuga (**clumps**) Accumulation of spongy white lumps, a few centimetres across; formed from grease ice or slush (snow and frazil). Interacts with winds and waves. May line up in wind direction forming characteristic bands (middle photo).

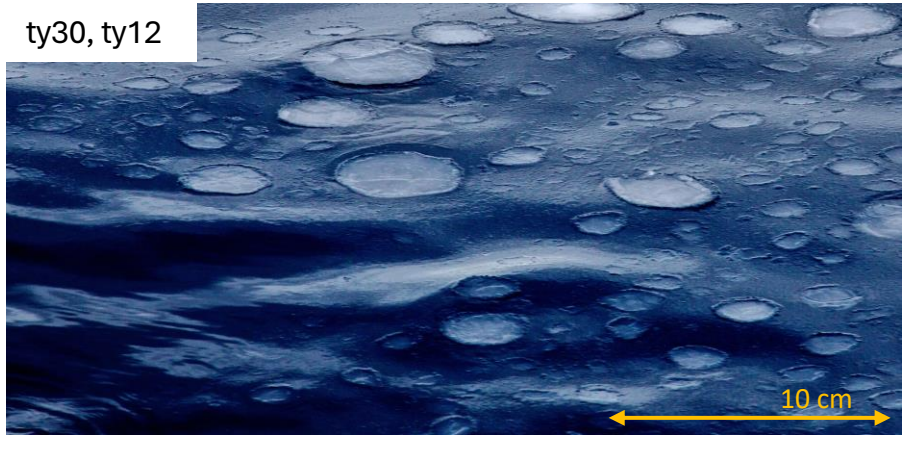
Grease ice (**sheet**) A later stage of frazil when crystals coagulate to form a soupy layer on the sea surface, smoothing the waves; matt appearance (bottom photo).

ty95, ty90, ty10



ty11

ty30, ty12



Ice type (ty): Nilas and pancake

Between 5 and 10 cm thick.

ICE TYPE ty

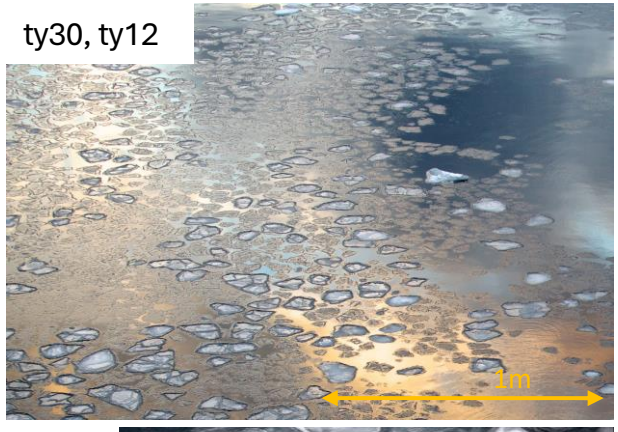
10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

Right: Pancake ice in various states of fusion, in between grease ice (top), open water (middle) and nilas (bottom).

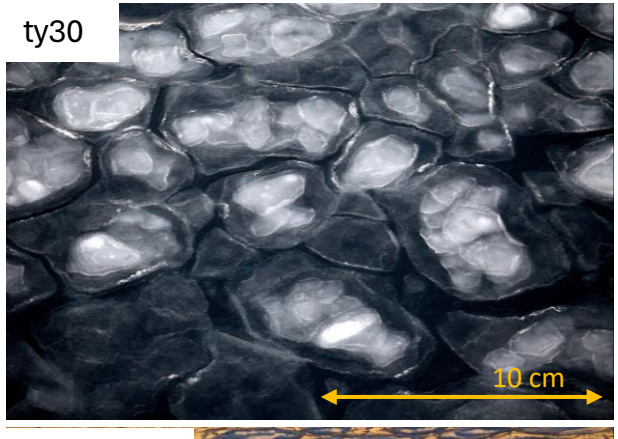
Below: Nilas rafts by one sheet sliding over the top of another in an open-water lead between older sea ice.

ty60, ty20

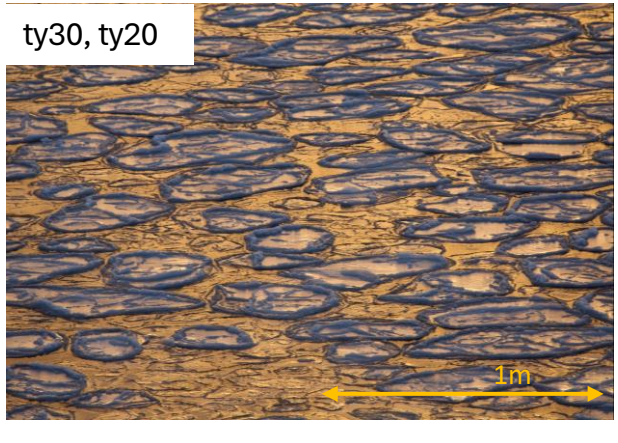
ty30, ty12



ty30



ty30, ty20



Nilas (sheet) Thin, elastic icy crust on ocean surface. Bends on swell. Nilas forms from growth of grease ice in quiescent weather. **Rafts rather than ridges**; interlocking fingers thicken exponentially.

Pancakes (floes) Circular or elongated discs of sea ice. Forms in turbulent conditions (e.g., wind) when frazil and grease ice clump, collide, and congeal into floes with raised rims.

Ice type (ty): Young Ice

Between 10 and 30 cm thick.
Classified by colour.

ICE TYPE ty

10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

Young ice may form sheets or cakes. Cakes are older and thicker than pancakes, often tightly packed, and usually flat.

Top: Young grey ice formed by the rafting of sheets of nilas ice.

Middle: Young grey-white ice formed by rafting and cementing of pancakes.

Bottom: Young grey-white ice cakes formed from pancakes, covered with thick snow.

Young grey ice (10–15 cm) Less elastic than nilas. **Breaks on swell**. **Rafts under pressure.** May form by growth or from rafting of nilas or pancakes thus thickening exponentially.

Young grey-white ice (15-30 cm) **More likely to ridge than raft**.

Do not include ridges when approximating thickness.

ty50, ty40

ty50

ty50

Ice type (ty): First year

Thin: 30 to 70 cm thick.

Medium: 70 to 120 cm thick.

Thick: 120 to 180 cm thick.

ICE TYPE ty

10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

Estimates of sea-ice thickness exclude ridges and snow.

Top: Thin first year ice floes with snow over relatively smooth surface.

Middle: Medium first year ice floes with snow drifts and a few, incipient (newly formed) ridges.

Bottom: Thick first year ice floes with a snow over fully developed ridges.

Categorised by thickness of level ice.

Thickness is estimated from overturning ice (page 12).

First-year ice types may also be **identified by topography (ridging)**. **Thin** first-year sea ice has a **smooth surface**, **medium** first-year sea ice often shows **incipient ridges** and **thick** first-year sea ice holds **fully-developed ridges**.

Thin ty60

Medium ty70

Thick ty80

Ice type (ty): Multiyear, brash & fast ice

ICE TYPE ty

10 Frazil
11 Shuga
12 Grease
20 Nilas
30 Pancakes
40 Young grey ice, 0.1-0.15 m
50 Young grey-white ice, 0.15-0.3 m
60 First year, 0.3-0.7 m
70 First year, 0.7-1.2 m
80 First year, >1.2 m
85 Multiyear floes
90 Brash
95 Fast ice

Multiyear floes are residual ice.
The brash is broken ice.
Fast ice is the coastal sheet of (continuous) sea ice.

Top: Brash between (and on top of) first year floes.

Middle: Rafts of brash ice and a partially melted first year floe. Typical of late summer.

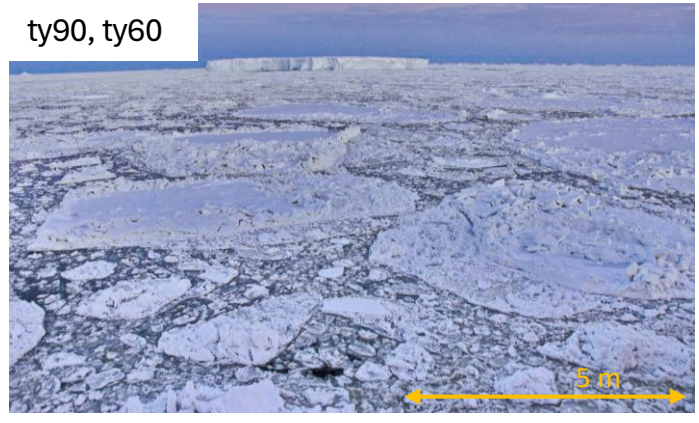
Bottom: Fast ice attached to the Antarctic plateau and enveloping a large piece of multi-year ice.

Multiyear floes (85) **Survived** at least one summer. Ridges smoother, having rounded in the melt. Old sea ice appears whiter because of brine drainage and loss of air pockets. Rare in the Antarctic.

Brash (90) **Fragments** of sea ice not more than 2 m across; wreckage of other sea-ice types. Brash is common in summer, between colliding floes or in regions where pressure ridges have collapsed.

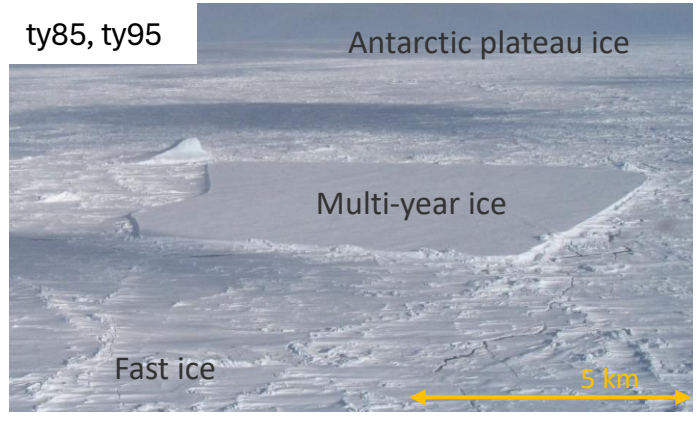
Fast ice (95) 'Land fast' sea ice **attached to land** or plateau ice, or between shoals of grounded icebergs. Vertical fluctuations may be evident due to tidal oscillation. Fast ice may form *in situ* by seawater freezing, or by incorporation of pack ice.

ty90, ty60



ty90, ty70

ty85, ty95



Ice thickness (z)

Estimated from overturning sea ice.

Snow thickness (sz)

Differentiated from sea ice by colour.

Height above sea level is **freeboard.**
Depth below sea level is **draft.**
Draft + freeboard = sea-ice thickness

The hydrostatic ratio (proportion below sea level) is about 0.9, **i.e., 90% sea ice below sea level!**

THICKNESS

ICE z, SNOW sz
In centimetres

Top: Overturned sea ice as viewed from ship, used to estimate thickness by reference to a 55 cm diameter buoy.

Middle: Overturned sea ice as viewed from a ship, used to estimate thickness by reference to a calibrated stick where each interval on the stick is 10 cm at the waterline.

Bottom: Overturned sea ice as viewed from the ship, clearly showing sea ice formed by rafting of sheets, and snow layer.

Measure overturning ice by reference to stick/buoy, calibrated to sea surface.

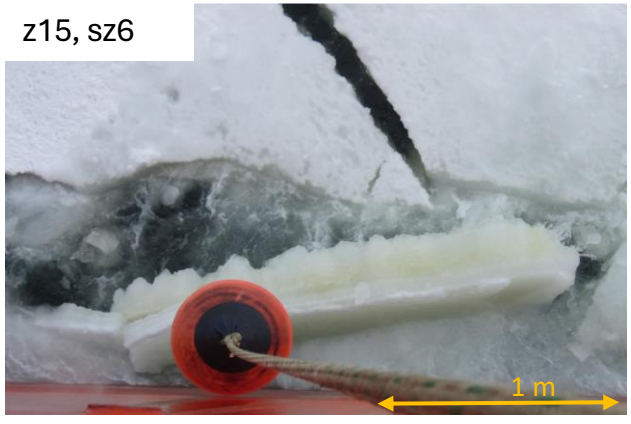
Estimate the thickness of level sea ice, including rafted sea ice, but not ridged sea ice. Ridge height and area recorded as topography (page 14).

Thin sea ice does not overturn: Leave Z blank.

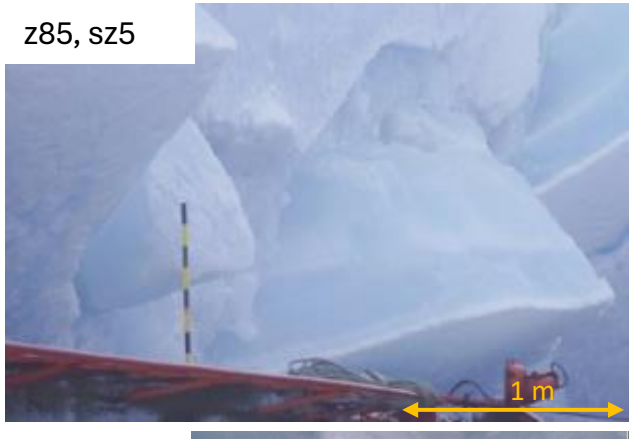
Prepare by **observing sea-ice thickness off hour.** Then record **on the hour.**

Estimate the thickness of **level sea ice**. Include rafted sea ice but not ridges.

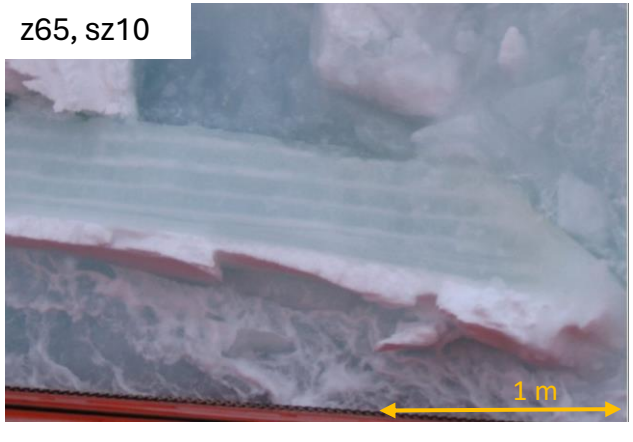
z15, sz6



z85, sz5



z65, sz10



Floe size (f): Form of ice

Progressively larger categories for diameter of ice floes.

FLOE SIZE f

100 Pancakes
200 New sheet ice
300 Brash/broken ice
400 Cake ice less than 20 m
500 Small floes, 20-100 m
600 Medium floes, 100-500 m
700 Large floes, 500-2000 m
800 Vast floes, >2000 m

Classified in **logarithmic-scale**
i.e., increasingly large category sizes.

Cracks/leads delineate floe boundaries: Ridges do not.
Floes frozen together? Record total diameter.
Refer to the ship's length and RADAR as guides.

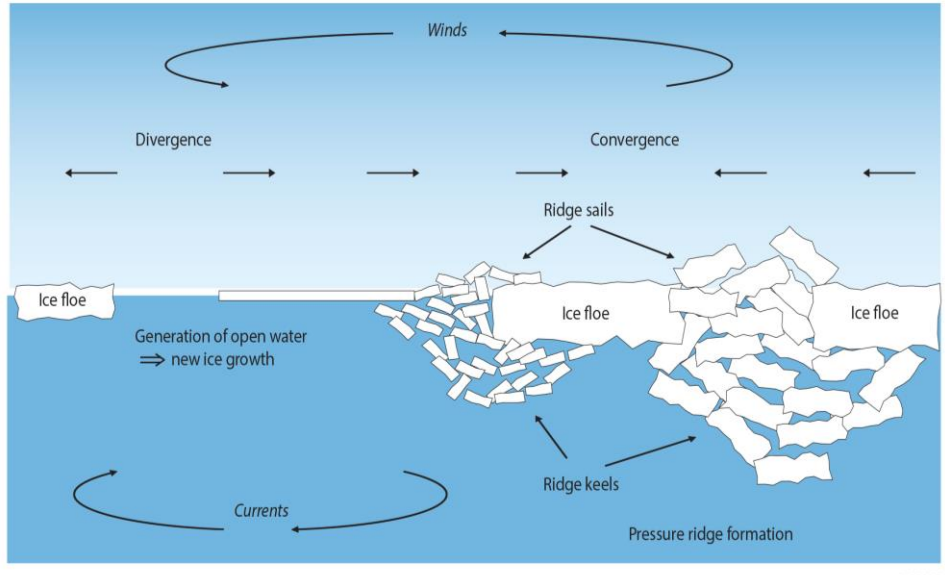
Pancake Circular pieces of ice 0.3-3 metres diameter, generally up to 10 cm thick, with rims due to pieces striking against one another. May form on slight swell from grease ice or shuga, a result of breaking nilas or, under severe swell or waves, from grey ice.

Cake Relatively flat pieces of sea ice 3- 20 metres diameter, 10 to 30 cm thick.

Floe Relatively flat pieces of sea ice 20 metres or more diameter, categorized by horizontal extent.

Brash Fragments not more than 2 metres across, Wreckage of other forms of ice. Brash is common between colliding floes or in regions where pressure ridges have collapsed. Decaying sea ice.

Below: Ice-floe dynamics caused by wind, waves and ocean currents. Divergence causes the sea ice to separate exposing open water which freezes to form a sheet of thin ice. Convergence causes both thin and thick sea ice to break and form ridges (above water) and keels (below).



©AMAP

Topography (t)

Area, height, consolidation & weathering of ridges.

Topography + thickness of level ice approximates **total sea-ice mass.**

TOPOGRAPHY t

100 Level ice
200 Rafted pancakes
300 Cemented pancakes
400 Finger rafting
5xy New, unconsolidated ridges
6xy New ridges filled with snow
7xy Consolidated ridges
8xy Older, weathered ridges
x values: coverage (%)
y values: ridge height (m)

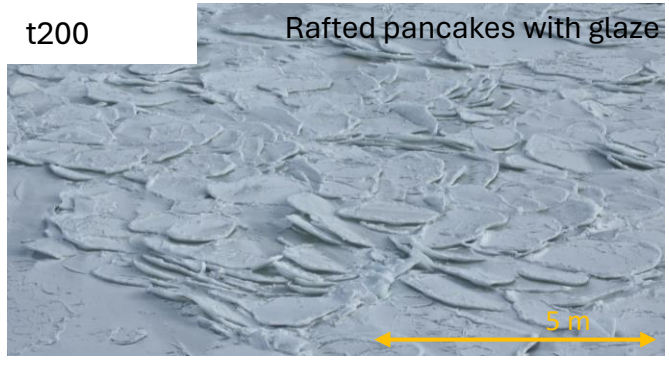
Rafting Pressure by currents or winds force sea ice to slide over each other: The main dynamic mechanism whereby floes reach 0.6m thick.

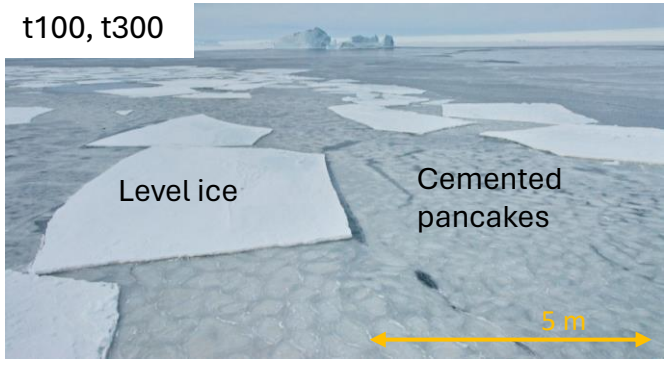
Ridge Broken sea ice, forced up (and down) by pressure. Submerged ice is termed a keel.

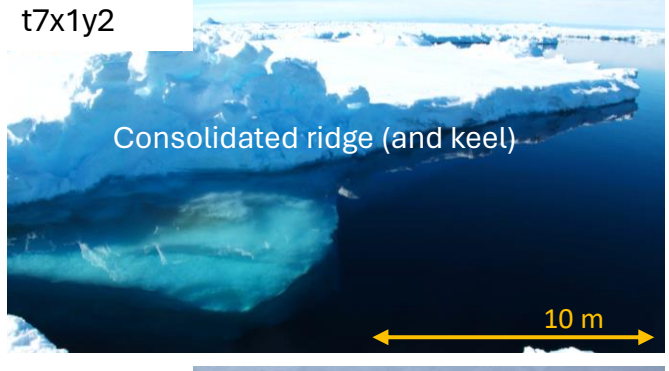
New Ridge Sharp peaks, slope generally greater than 40°.

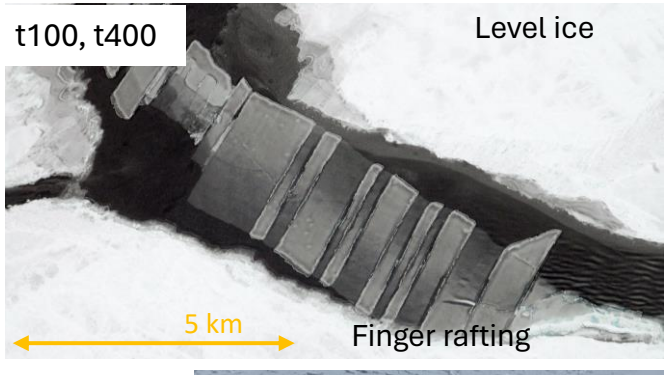
Consolidated Ridge Frozen.

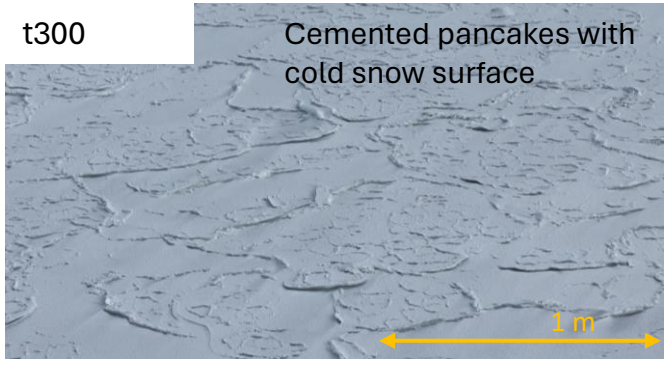
Weathered Ridge Peaks slightly rounded, slope usually 30°-40°. Fragments not discernible.











Snow type (s)

Description of sea-ice **surface.**

SNOW TYPE s

0 No snow observation
1 No snow, no ice or brash
2 Cold new snow, <1 day old
3 Cold, old snow
4 Cold wind-packed snow
5 New melting snow (wet)
6 Old melting snow
7 Glaze
8 Melt slush
9 Melt puddles
10 Saturated snow (waves)
11 Sastrugi

Relevant to measures from satellite images. If fresh snow falls on old snow, **describe fresh snow.**

Top: Wet new snow on grey ice.

Middle: Cold wind-packed snow on first-year sea ice.

Bottom: Cold wind-packed snow on first-year sea ice, and new melting snow on both nilas and grey ice.

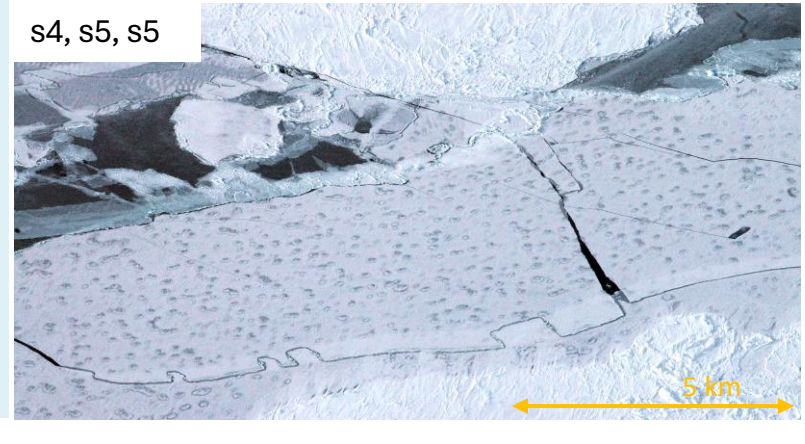
Sastrugi Sharp, irregular ridges in a snow surface formed by wind erosion and deposition.

Puddle/pond Accumulation of water on sea ice due to melting snow, wave over-wash, upward percolation, or (in the more advanced stages of melt) the melting of sea ice.

Glaze Coating of ice, often blue in appearance, generally clear and smooth but usually containing air pockets. Glaze forms by freezing a thin layer of super-cooled rain or fog.

Melt slush Snow which is saturated and mixed with water.

Melt pond Water pooling on sea ice. More common in Arctic.



Open water (ow)

Size of cracks and leads:

NOT concentration of open water.

OPEN WATER ow

0 No openings
1 Small cracks
2 Very narrow break, <50 m
3 Narrow breaks 50-200 m
4 Wide breaks 200-500 m
5 Very wide breaks, >500 m
6 Lead/coastal lead
7 Polynya/coastal polynya
8 Water broken by small floes
9 Open sea

If multiple types of open water, then code the widest and include others in comments.

Top: Narrow break of open water between pancake and nilas. Grease ice forming in the break.

Middle: Coastal polynya adjacent to Antarctic Plateau. Offshore, grey ice and grey-white ice with narrow breaks.

Bottom: Cracks, breaks and a lead of open water in young ice.

Crack Fracture in fast ice, consolidated ice, or a single floe followed by separation ranging from a few cm to 1 m.

Break Rupture through very close pack ice, compact sea ice, consolidated sea ice, fast ice, or even within a single floe resulting from deformation processes.

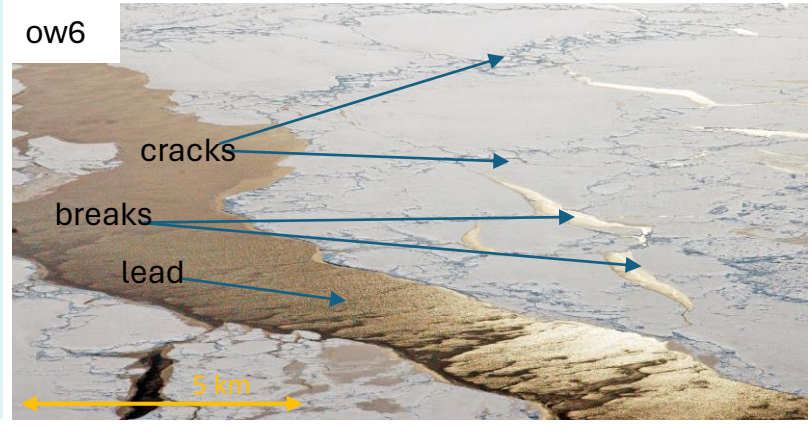
Lead Area of open water (or new sea ice) between ice floes. Generally applied to linear features. Typically, a few meters to over a kilometer in width.

Polynya Non-linear-shaped opening enclosed by sea ice. May contain brash ice and/or be covered with new ice, nilas or young ice.

ow3

ow7

ow6



ASPeCt software

Ice observation software (IceBox).

Type your observation into ICEBOX on a laptop on the bridge to **check and correct** your data.

	Position				Sea Ice Observations														Meteorological Observations						
Hr	Latitude		Longitude		Conc.	Ice							B Ice	Melt Ponds					Twater	Tair	Wind Speed	Wind Dir.	Cloud	Visib	Weather
[Z]	dd°mm.sss'[S]		dd°mm.sss'[E/W]		[tenths]	c	ty	z [cm]	f	t	s	sz [cm]	smb	c [%]	mz [cm]	l1 [m]	l2 [m]	O/W	[°C]	[°C]	[m/s]	[°]	[_/8]		
12	62°06.000'	S	128°57.000'	E	9	7	30	10	100	200	1	0						2	-1.84	-9.5	10		1	97	2
						2	12	5	0	000	1	0													

Above: Screenshot of ICEBOX software.

Below: ASPeCt data sheets with an example observation coded in blue.

Code weather, visibility & cloud. Other meteorological observations will be available from the bridge.

	POSITION			SEA ICE OBSERVATIONS																				
					PRIMARY							SECONDARY							TERTIARY							
hr (Z)	Lat (°S) dd mm	Long (°E/W) ddd mm	Conc (tenths)	c	ty	z	f	t	s	sz	c	ty	z	f	t	s	sz	c	ty	z	f	t	s	sz	O/W	hr (Z)
01	66°27'S	75°04'E	9	4	60	30	600	611	3	10	3	20	10	500	100	1	0	2	12	2	200	100	1	0	1	01

	METEOROLOGICAL OBSERVATIONS						PHOTO	VIDEO	COMMENTS		OBSERVER	
hr (Z)	Twater (C)	Tair (C)	Wind (sp/d)	Cloud (oktas)	Visib (v)	Weath (ww)	film/ frame	Tape no./ Reading	Text	Ref no.	Name	hr (Z)
01	-1.8	-16.4	16/040	6	95	85	3/28	1/1:27:36	just completed ice station C	1	I.C. Maurice	01

BROWN ICE smb

- 0 White ice
- 1 < 3 mg chla m^2
- 2 ~ 4.5mg chla m^2
- 3 ~ 10 mg chla m^2
- 4 ~ 30 mg chla m^2
- 9 Unable to determine

Other Data

ASPeCt also records primary production (**brown ice**), which is coded according to colour of overturned sea ice.

Melt-pond observations are mainly relevant in high summer. Percentage of sea-ice surface melting, depth of ponds, and maximum diameter of biggest and smallest melt-ponds.

MELT POND

- C (%) Coverage
- Mz (cm) Depth
- L1 (m) Length widest
- L2 (m) Length narrowest

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Subject: Sea-ice obs.

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