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Caitlin Magnusson
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ICE

All information below comes from The Canadian Ice Service
http://ice-glaces.ec.gc.ca/

Types of Sea Ice

New Ice: Recently formed ice composed of ice crystals that are only weakly frozen together (if at all).
Nilas: A thin elastic crust of ice (up to 10 cm in thickness), easily bending on waves.
Young Ice: Ice in the transition stage between nilas and first-year ice, 10-30 cm in thickness.
First-year Ice: Sea ice with not more than one winter's growth, developing from young ice, with a thickness of 30 cm or greater.
Old Ice: Sea ice that has survived at least one summer's melt. It tends to be smoother than first year ice.
Pancake Ice: Circular pieces of ice 30 cm to 3 m in diameter, up to 10 cm in thickness. It may rapidly form over wide areas of water.

Brash Ice: Accumulation of floating ice made up of fragments not more than 2 m across, the wreckage of other forms of ice.

I**ce Cake:** Any flat piece of ice less than 20 m across.

Floe: Any relatively flat piece of ice 20 m or more across.
Floeberg: A massive piece of ice composed of pieces frozen together and separated from any ice surroundings. They may typically protrude up to 5 m

Fast Ice: Ice which forms and remains fast along the coast. It may be attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs. It can extend a few meters or several hundred kilometers from the coast. If higher than 2 m above sea-level, it is called an ice shelf.

Anchor Ice: Submerged ice attached or anchored to the bottom, of any type of formation.
Grounded Ice: Floating ice which is aground in shoal water.

Fresh Water Ice vs. Salt Water Ice: Sea ice is much less dense than fresh-water ice. Fresh water freezes at a steady state of 0 degrees C. Salt water freezes at temperatures below freezing, and the freezing point becomes lower as salinity increases. In addition to the lowering of the freezing temperature, salt in ice is responsible for other melting phenomena. Since fresh water ice melts at 0°C, a large block of pure ice will remain solid at any temperature below zero. However, there is always a bit of liquid brine trapped in the salt ice, making **brine cells**. As the temperature falls, more and more pure ice is formed leaving a

smaller volume of brine at a higher salinity. Conversely, when the temperature increases, the brine melts some of the pure ice around it, and the brine volume increases but with a lower salinity.

Insulation: Snow cover acts as a blanket. The effectiveness of snow as an insulator, or blanket, depends mainly on how compact it is. The table below gives the heat insulating abilities of various types of snow compared to the thickness of ice that would have the same insulating effect. Even a few centimeters of snow on top of ice will drastically slow down the rate of ice growth.

5 cm of various snow types:	Equivalent to an ice thickness of:
Newly fallen soft snow	264 - 381 centimeters
Slightly settled snow	175 - 193 centimeters
Normal snow	61 - 97 centimeters
Old snow	41 - 61 centimeters
Hard packed snow	24 - 31 centimeters
Extremely cold, wind swept snow	19 - 24 centimeters

Ice Expansion: As the temperature of sea ice falls below its freezing point, the ice expands rapidly at first, and continues to expand but at a decreasing rate until a certain temperature is reached, and then it contracts slightly. The greater the salinity of the ice, the greater the expansion with cooling.

Sunlight: The incoming solar radiation is partially absorbed by the surface it strikes and partially reflected. The percentage that is reflected varies with the type of surface; this is called the **albedo**. The remainder of the incoming solar radiation is absorbed, causing a rise in the temperature of the surface.

Albedo Values

Surface	Albedo value
Sea water	0.05-0.10
Arable land	0.10-0.25
Snow-free sea ice	0.30-0.40
Melting snow	0.40-0.50
Fresh snow	0.80-0.90

Sea water absorbs almost all of the solar radiation that hits it, while ice with a fresh snow cover absorbs only a little bit.

Ice Strength Ice strength is related to temperature. Ice that is near 0ºC is weak and isn't able to support the same weight as colder ice - regardless of thickness. If the snow is beginning to melt, then the ice is losing its strength.

SAFE LOAD	OPERATION	FRESH ICE	SEA ICE
One person	at rest	8 cm	13 cm
0.4 ton	moving slowly	10 cm	18 cm
2 ton vehicle	moving slowly	25 cm *	40 cm *
10 ton tracked vehicle	moving slowly	43 cm	66 cm
13 ton aircraft	parked	61 cm	102 cm
* estimated numbers, not provided in original table			

Iceberg is a giant piece of ice protruding 5 m or more above sea-level, which has broken away from a glacier and which can be afloat or aground. About 90% of all icebergs in Canadian water come from the glaciers of Western Greenland. Most icebergs are white because they are ice formed from snow, and have reflective bubbles. Blue ice is formed from re-frozen glacier melt. So many of the icebergs come from Western Greenland because Greenland is physically shaped like a bowl. The actual rock island is below sea level, and there is a huge dome of ice sitting on top of it. Essentially, icebergs flop off like ice-cream falling off the edge of the cone. Icebergs float because the density of ice (about 900 kg per cubic meter) is lower than that of seawater (about 1025 kg per cubic meter). Most of the melting of an iceberg happens on its submerged side because of the high density and thermal conductivity of sea water.