



**NOAA Teacher at Sea
Christine Hedge
Onboard USCGC *Healy*
August 7 – September 16, 2009**

NOAA Teacher at Sea: Christine Hedge

Ship: U.S. Coast Guard Cutter *Healy*

Mission: U.S.-Canada 2009 Arctic Seafloor Continental Shelf Survey

Geographical Location: Beaufort Sea, north of the Arctic Circle

Date: August 16, 2009

Weather Data from the Bridge

80^o 6.28'N 140^o 33.69'W

Temp: 32.4^oF

Conditions: low visibility

Science and Technology Log

**FRAZIL, NILAS, GREASE ICE,
PANCAKE ICE, BRASH, AND
SHUGA**

These are just a few of the sea ice vocabulary words I have been learning. Ice observers and ice analysts are important people to have around while operating a ship in the Arctic. Depending on the situation and the ship, observations can be made by looking at the ice from the ship, from satellite imagery, from the air in a helicopter, or from actually walking out onto the ice and measuring the thickness. On the *Healy*, we are using ship-based and satellite imagery observations.

HOW THICK IS IT?

The ice we are plowing through today is about 0.7 – 1.2 meters thick.

In general, flat first-year ice is between 0.3 – 2.0 m thick, although it can get much thicker with ridging.

Flat second-year ice can be up to 2.5 m thick. Multi-year ice is at least 3 m thick but can be more than 15 m thick.



Blue sea ice with red reflected from the *Healy*

WHY IS SOME OF THE ICE BLUE?

Seawater is about 3.5% salt, but first-year ice has an average salinity of only about 0.5%. As the sea ice grows it rejects most of the salt in the seawater from which it forms. The ice with less salt reflects more light and air bubbles form as the ice ages. This causes more light to scatter, producing a deeper blue color over time.

HOW IS ICE CLASSIFIED?

Experienced ice observers look at 3 basic parameters:

1) Concentration – how tightly the ice is packed

This is reported in tenths. Less than 1/10th ice is basically open water. The higher the number, the more tightly packed the sea ice. At 10/10^{ths} the ice is considered “compact”.

2) Form – the horizontal shape and dimension of the pieces of ice

These have specialized names and ranges of size. For example, a brash is about the size of a bicycle. Pancake ice is circular pieces of ice, with raised edges that look like giant lily pads or pancakes.

3) Stage of Development – direct observation of the age and structural characteristics

The three major classifications are first-year ice, second-year ice, and multi-year ice. Structural characteristics can include things like thickness, color, ponds or melt water on top, ridges or hummocks.



Sea ice with ponding

WHY DOES ICE CHANGE AND GROW?

Classifying ice by stage of development is really interesting. What sets the different classifications apart (first-year, second-year, multi-year) is the growth and aging of the sea ice. Ice grows in the fall and winter during the freezing cycle. Ice decays during the spring and summer during the thawing cycle. The amount of thawing that happens in the summer determines how much first-year ice survives to become second-year ice and how much second-year ice survives to become multi-year ice.

HOW IS CLIMATE CHANGE IMPACTING SEA ICE?

Drastic changes in the condition and amount of Arctic sea ice have been observed over the past few decades. The least ice extent ever was observed in 2007. This can mean more dangerous conditions for ships to sail in a region where variable and hazardous ice conditions still exist year round.

Personal Log

Different movies play every day in the lounge spaces of the ship. When the crew and scientists have time off they can kick back and relax with their friends. On Saturday night, there are two



special social events for morale boosters. There is bingo, and a movie on the big screen projected in the helicopter hanger. Everyone dresses in their warmest gear, camp chairs are set up, and popcorn, candy, and soda are provided. It is a kind of Arctic Drive-in experience. Last night, we watched *Star Trek*. Of course, when the movie was over we walked out into bright daylight even though it was 10pm.

Bundling up for the Saturday night movie