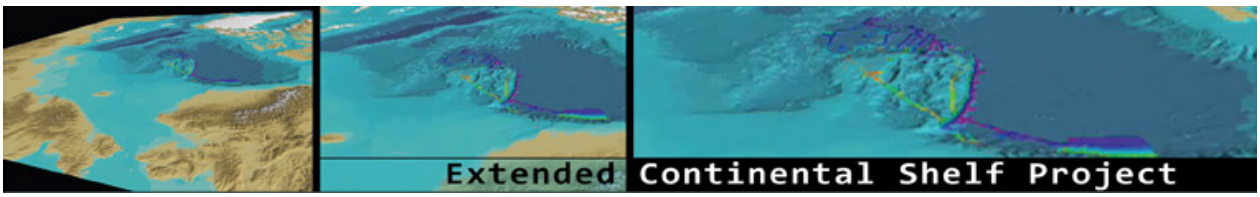
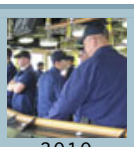


Arctic Seafloor Mapping Project Web Site - arcticseafloormapping.gov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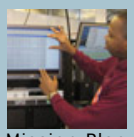
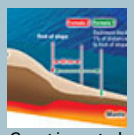

Mission Plan


Law of the Sea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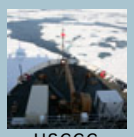
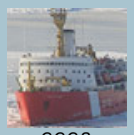

USCGC *Healy*


CCGS *Louis S. St-Laurent*


Healy's Science Team

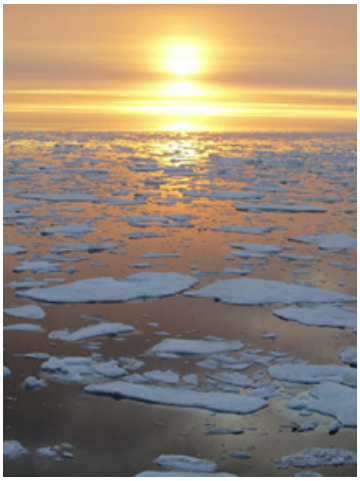

Teachers

First Ice!

August 6, 2010

By Helen Gibbons, Web Coordinator, ECS Project

Date: August 6, 2010
Time: 0607 hours ADT
(Alaska Daylight Time)
Latitude: 71°51.721'N
Longitude: 160°42.619'W
Air temperature: 2.82°C (37.07°F)
Sea temperature: 0.2°C (32.4°F)
Wind speed and direction: 7.2 knots from the east-northeast
Ship's speed over the ground: 9.9 knots
Water depth: 63.9 m



Credit: Helen Gibbons, USGS/ECS Project

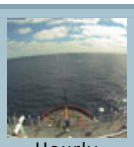
I woke early this morning, around 0420 hrs, and felt the ship quiver. A few seconds later, I felt it again—a motion I'd never felt yet on the trip. Could the ship be hitting pieces of ice? I got out of bed and looked through our porthole, and there it was: a field of white ice floes, ranging from a few feet to perhaps 100 feet across and covering about 50 percent of the sea surface.

Soon I was on my way to the bridge, where I found Pablo Clemente-Colón, Chief Scientist at the National Ice Center (NIC), admiring the ice with MST1 Josh Miller, a NIC Analyst. NOAA Teacher at Sea Caroline Singler was also there, as well as marine mammal observer Justin Pudenz and the Coast Guard watchstanders: CWO John Placido, BM2 Gerry McCann, and SN Dierdre Gray. The sun was rising off the port bow, glowing gold between the clouds and reflecting off the seawater between the floes.

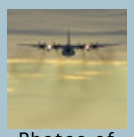
As large pieces of ice bounced off the port bow, some slowly whirled away, others were broken up and their edges pushed beneath the sea surface. The water rushed off the tops and between the sides of the broken pieces. While we sailed through the haze, the sound of the turbulent water was punctuated by blasts from the foghorn.

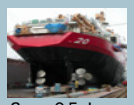
Many of the floes I saw were white on top and pale to deep turquoise beneath the water; they appeared to be as much as several meters thick. According to Pablo, these were pieces of "old" ice, which has survived at least one summer melt. As sea ice ages, it thickens and its color changes. New ice is dark, like the surface of the open water from which it forms. During its first-year, sea ice typically changes from dark to gray to grayish white. Second-year ice tends to have a greenish-blue color; older, multi-year ice is deeper blue.

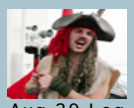
Some of the pieces we saw this morning were sheets of recently formed ice only centimeters in thickness and gray to very dark gray, called


Hourly Photos from *Healy's* Aloft Conn


USCG Logs


Photos of the Day

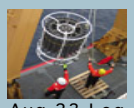

Sep 05 Log


Aug 29 Log


Aug 28 Log


Aug 25 Log


Aug 24 Log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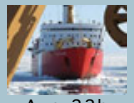

Aug 22b Log

Pablo Clemente-Colón (right) and MST1 Josh Miller discuss the ice. Credit: Helen Gibbons, USGS/ECS Project

Water flows off a piece of ice pushed aside by *Healy's* hull. Click image for larger view. Credit: Helen Gibbons, USGS/ECS Project

Pieces of multi-year ice off *Healy's* port side. Click image for larger view. Credit: Helen Gibbons, USGS/ECS Project

"nilas." Nilas is a thin, elastic crust of ice less than 10 cm thick that easily bends on the waves. The thinnest sheets are "dark nilas." As this ice grows thicker, it takes on a lighter color and is called "light nilas."

The color of the ice is affected by its thickness and by the presence or absence of air bubbles and salt pockets that scatter light. Newer ice has more salt in pockets of brine, whereas older ice has more air bubbles. (Older ice that has survived for several years is commonly used as a source of fresh water for polar expeditions; first-year ice is too salty.) In the absence of salt, sunlight is freer to scatter and reflect off the air bubbles, creating the brighter blue of the multi-year ice.

Seen through the mist, a large floe dark with algae looked like a ship in the distance. Click image for larger view. Credit: Helen Gibbons, USGS/ECS Project

Also among the ice floes we saw this morning were irregularly shaped, relatively dark pieces that looked like compacted, dirty snow. Pablo told me that the dark staining is an indication of algae growth on and within the floes. One large piece looked like a ship in the distance.

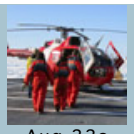
In addition to its deep blue color, a well-defined meltwater-drainage pattern marks this floe as multi-year ice, according to the *Observers Guide to Sea Ice* (pdf format) (National Oceanic and Atmospheric Administration, 2007). Click image for larger view. Credit: Helen Gibbons, USGS/ECS Project

Satellite Views of the Ice

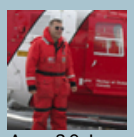
Both the ship's crew and the science team rely on satellite imagery to show them where the ice is and how concentrated it is (what percentage of the sea surface it covers). They use many different types of imagery, depending on such factors as whether the sky is cloudy or clear, and whether they want a broad overview of ice concentration or a high-resolution view to use in navigating through the floes. So far, I've been introduced to two types of satellite imagery used onboard:

A piece of thin, dark nilas (top) and thicker "young" ice (below). Click image for larger view. Credit: Helen Gibbons, USGS/ECS Project

Sea ice concentration maps


Aug 22a Log


Aug 21 Log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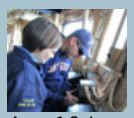
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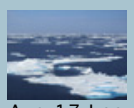
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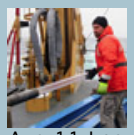
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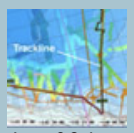
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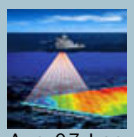
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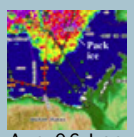
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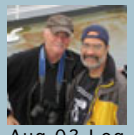
Aug 04 Log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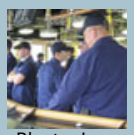
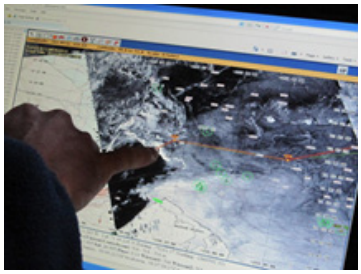


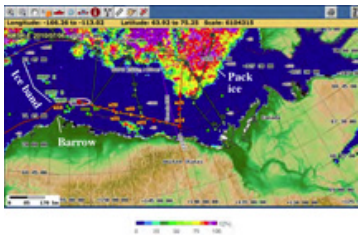
Photo Log

Sea ice concentration maps from the Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E;), carried on the Aqua satellite. These maps have fairly coarse resolution, each pixel = 6 km on a side. They are good for a broad overview of the extent and concentration of the ice.

A piece of multi-year ice, its surface browned by algae. Click image for larger view. Credit: Helen Gibbons, USGS/ECS Project



SAR image on a monitor on the bridge. MST1 Josh Miller points to the band of ice that *Healy* passed through this morning. Credit: Helen Gibbons, USGS/ECS Project.



Healy's tracklines overlaid on sea-ice concentration map from the Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E) carried on the NASA Aqua satellite. Colors correspond to the percent of sea surface covered with ice, also known as sea-ice concentration (see scale). Labels have been added to show the location of Barrow, the band of ice we sailed through this morning, and the large mass of pack ice to which we are headed. Click image for larger view. Credit: *Healy* Map Server/Steve Roberts, National Center for Atmospheric Research.

SAR sea-ice images

SAR (synthetic aperture radar) sea-ice images from the RADARSAT-2 and Envisat satellites. The SAR beams microwaves at the Earth and receives the echoes, also known as "backscatter," imaging a swath of the Earth's surface as it moves through the sky. SAR images have fairly high resolution, with 1 pixel = 100 m on a side; for comparison, *Healy* is 128 m long. These images can be used for picking a path through the ice.

The concentrated band of ice floes we sailed through this morning shows clearly on both types of imagery.

Ice observing and ice analysis are part of the cooperation of this two-icebreaker work. When the two ships rendezvous, one of the U.S. ice observers (Operations Technical Advisor Caryn Panowicz, NIC) will move from *Healy* onto the CCG *Louis S. St-Laurent* (*Louis*), and one of the Canadian ice observers (Ice Services Specialist Erin Clark of the Canadian Ice Service, Environment Canada) will transfer to *Healy*. Opportunities for making field observations to compare with satellite imagery are fairly rare. By working together, the U.S. and Canadian observers and analysts aboard both ships will learn from each other and from the approaches taken by their respective agencies. The skill of the ice observers is essential for picking the clearest paths through the ice with the least amount of ice-breaking, and therefore the least amount of risk to gear that will be towed from *Louis*.