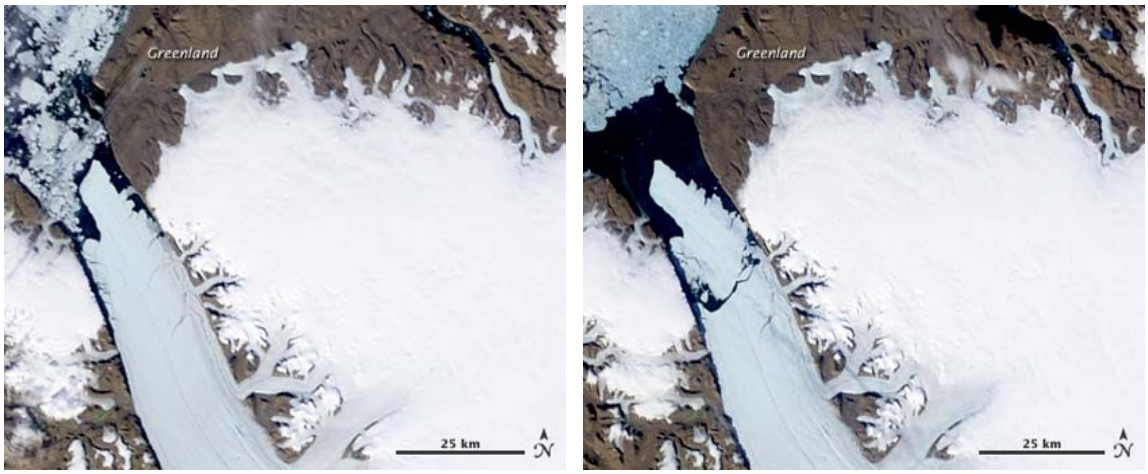

On Aug. 5, 2010, an enormous chunk of ice broke off the Petermann Glacier along the northwestern coast of Greenland. The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured these natural-color images of Petermann Glacier 18:05 UTC on August 5, 2010 (left), and 17:15 UTC on July 28, 2010 (right). The Terra image of the Petermann Glacier on August 5 was acquired almost 10 hours after the Aqua observation that first recorded the calving event. By the time Terra took this image, the oblong iceberg had broken free of the glacier and moved a short distance down the fjord.

Problem 1 - From the scale of the two images, what is the approximate surface area of the portion of the glacier that broke-off in A) square kilometers? B) square miles if 1 km = 0.62 miles?

Problem 2 - From the width of the break line in the August image, what was the speed of drift of the glacier fragment in kilometers/hour?

Problem 3 - Assuming that the fragment is 1000 meters thick, what is the total volume of the fragment in cubic meters?

Problem 4 - If one cubic meter of ice = 917 kilograms 1 gallon of water = 3.8 kg, what is the total amount of fresh water, in gallons, that will eventually be added to the ocean after it melts?

Problem 1 - From the scale of the two images, what is the approximate surface area of the portion of the glacier that broke-off in A) square kilometers? B) square miles if 1 km = 0.62 miles?

Answer: The length of the '25 km' line is about 17 mm so the scale is 1.5 km/mm. Students may approximate the area of the glacier as a triangular portion with sides of 10 and 15 mm (15 km and 22 km) with an area of 1/2 (15)(22) = 165 km^2, and a rectangular part that has a long side on the hypotenuse of the triangle with dimensions of 2 mm x 20 mm (3 km x 30 km) and an area of **90 km^2**. The total area is then approximately 255 km2 . B) the area in square miles is 255 km^2x (0.62 mi/km)(0.62 mi/km) = **98 square miles**.

Problem 2 - From the width of the break line in the August image, what was the speed of drift of the glacier fragment in kilometers/hour?
Answer: Students may have difficulty estimating the width of the 'hairline' fracture in the image, but answers near 0.2 mm are acceptable. Students may use a photocopy machine to increase the magnification of this image, and the resulting scale of the image to get a better estimate.

The information says that this image was taken 10 hours after the separation began, so the speed is 0.2 mm x 1.5 km/mm x (1/10 hours) = **30 meters/hour**.

Problem 3 - Assuming that the fragment is 1000 meters thick, what is the total volume of the fragment in cubic meters?

Answer: 255 km^2 x 1 km = 255 km^3 since 1 km = 1000 meyters, we have 255 km^2 x (1000 meters/km)^3 = **255 billion meters^3 of ice.**

Problem 4 - If one cubic meter of ice = 917 kilograms 1 gallon of water = 3.8 kg, what is the total amount of fresh water, in gallons, that will eventually be added to the ocean after it melts?

Answer: 255 billion m^3 x (917 kg/1 m^3) x (1 gallon/3.8 kg) = **62 trillion gallons**.