Quick Facts on Arctic Sea Ice

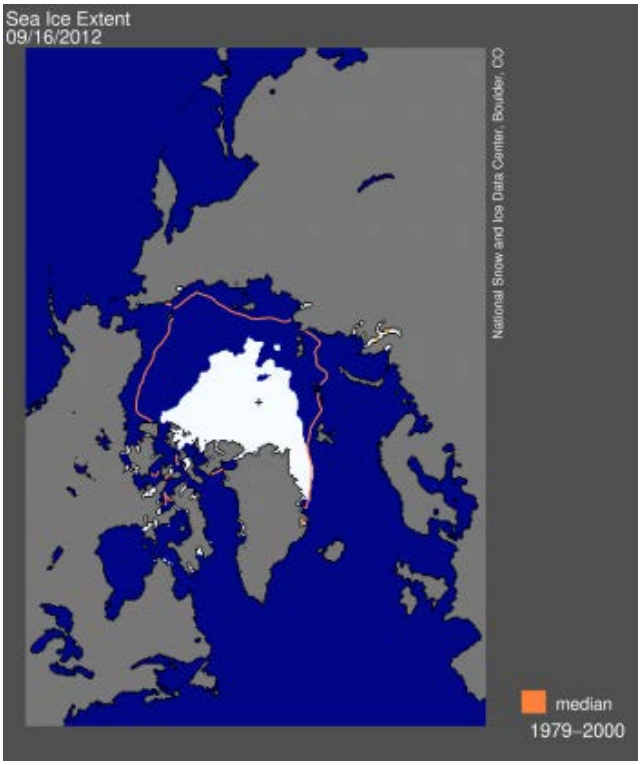
Sea ice can take on a variety of textures. When waves buffet the freezing ocean surface, characteristic "pancake" sea ice forms.

What is sea ice?

Sea ice is frozen ocean water. It forms, grows, and melts in the ocean. In contrast, icebergs, glaciers, and ice shelves float in the ocean but originate on land. For most of the year, sea ice is typically covered with snow.

Why is Arctic sea ice important?

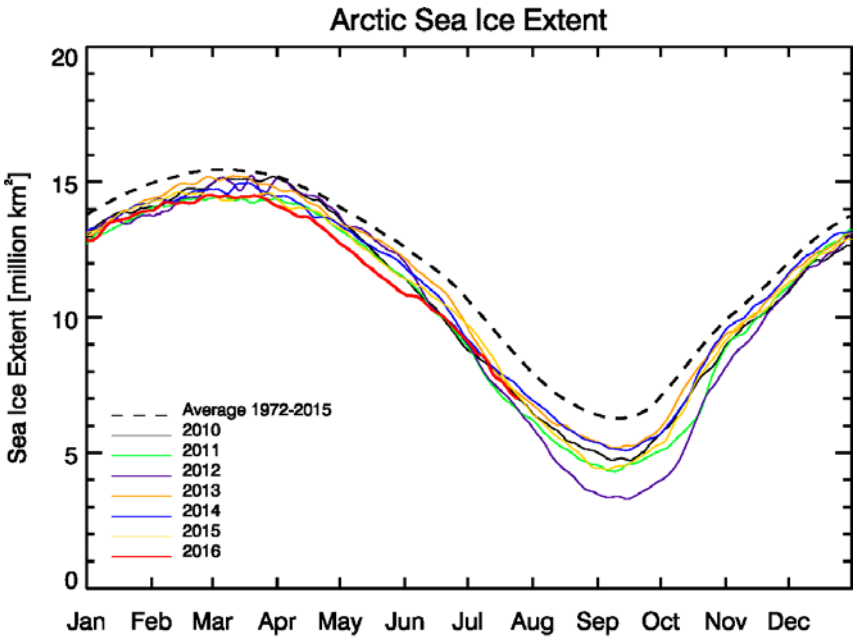
Arctic sea ice keeps the polar regions cool and helps moderate global climate. Sea ice has a bright surface; 80 percent of the sunlight that strikes it is reflected back into space. As sea ice melts in the summer, it exposes the dark ocean surface. Instead of reflecting 80 percent of the sunlight, the ocean absorbs 90 percent of the sunlight. The oceans commences to heat up, although initially the surface temperature remains close to 0º C as the sunlight melts the ice. When all the ice has melted the deep ocean starts warming.



A small temperature increase at the poles leads to still greater warming over time, making the poles the most sensitive regions to climate change on Earth. According to scientific measurements, both the thickness and extent of summer sea ice in the Arctic have shown a dramatic decline over the past thirty years, as is shown on the accompanying plot. This is consistent with observations of a warming Arctic. The loss of sea ice also has the potential to accelerate global warming trends and to change climate patterns.

What is sea ice extent, and why do you monitor that particular aspect of sea ice?

Sea ice extent is a measurement of the area of ocean where there is at least some sea ice. Usually, scientists define a threshold of minimum concentration to mark the ice edge; the most common cutoff is at 15 percent. The choice of the 15 percent cutoff provides the most consistent agreement between satellite and ground observations.
Scientists tend to focus on Arctic sea ice extent more closely than other aspects of sea ice because satellites measure extent more accurately than they do other measurements, such as thickness.



The annual variation in the sea ice extent is shown in the accompanying diagram.

The maximum extent generally occurs in March, the minimum extent in September. Sea ice extent in 2015 (yellow) fell well below the 1972 to 2015 long-term average (dashed) and was above 2012 (purple), in which the lowest summer minimum to date occurred. Prior to 2016 the lowest Arctic sea ice extent was on 16 September 16 2012.

The 2016 annual variation, January to July, suggests that September 2016 could be a new record.

The Arctic sea ice maximum marks the day of the year when Arctic sea ice reaches its largest extent. The sea ice maximum occurs at the end of the winter cold season. It has been observed that Arctic sea ice has been recovering less in the winter, meaning the sea ice is already "weak" when the summer melting season arrives. A possible cause is that the underlying ocean is warmer.

How do scientists monitor the Arctic sea ice?

Obtaining reliable measurements of sea ice as it changes was difficult until the satellite era began in the early 1970s. To monitor Arctic sea ice, the National Snow and Ice Data Center primarily has used the Japanese Advanced Microwave Scanning Radiometer (AMSR-E) instrument on the NASA Aqua satellite and the Special Sensor Microwave/Imager (SSM/I) instrument on the Defense Meteorological Satellite Program (DMSP) satellite. The satellites pass over the polar region several times each day to gather data; researchers can then form the data into images for analysis and publication. Because the AMSR-E instrument is no longer functioning, NSIDC now relies on DMSP data.

Useful satellite data concerning sea ice began in late 1978 with the launch of NASA's Scanning Multichannel Microwave Radiometer (SMMR) satellite. When scientists compare average sea ice conditions between years, they often use a 30-year reference period of 1981 to 2010. This reference period allows a consistent comparison of changes in extent over individual years.

Is Antarctic sea ice important, too? Is it shrinking?

Scientists monitor both Arctic and Antarctic sea ice, but Arctic sea ice is more significant to understanding global climate because much more Arctic ice remains through the summer months, reflecting sunlight and cooling the planet.

Sea ice near the Antarctic Peninsula, south of the tip of South America, has recently experienced a significant decline. The rest of Antarctica has experienced a small increase in Antarctic sea ice.

Antarctica and the Arctic are reacting differently to climate change partly because of geographical differences. Antarctica is a continent surrounded by water, while the Arctic is an ocean surrounded by land. Wind and ocean currents around Antarctica isolate the continent from global weather patterns, keeping it cold. In contrast, the Arctic Ocean is intimately linked with the climate systems around it, making it more sensitive to changes in climate.

(Contributed by Dr Graham Elford. Graham was a lecturer and researcher in the Adelaide University Physics Department from 1949 until his retirement in 1988. He was for a time President of the International Astronomical Union Commission on Interplanetary Dust and has an asteroid named after him [Elford 4974]. Since his retirement he has continued his upper atmosphere research but has in recent years focussed much of his attention on Climate Change - its causes, impacts and how the church needs to respond. Graham has been a corresponding member of the Environmental Action Group since its inception in 2014.)