Arctic sea ice reaches record minimum

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On September 16, the Arctic sea reached its minimum extent for 2007 at 4.13 million square kilometers, breaking the record set on September 21, 2005 of 5.32 million square kilometers. The difference between the previous record and the present one, 1.19 million square kilometers, represents roughly the same area as Texas and California combined. It is a 22 percent loss in extent since 2005.

Every year Arctic sea ice extent grows during the winter months and shrinks during the summer months. At the end of the summer melt season, usually in September, the sea ice reaches a minimum.

This summer saw an unprecedented rates of loss, with large portions of the Arctic opening up that were previously covered by perennial (permanent) sea ice. The Northwest Passage—the sea route across the Arctic Ocean along the northern coast of North America—has opened as a consequence, and several small islands have been discovered.

Contributing to the record losses this year were unusually clear skies in the Arctic during June and July, and high-pressure patterns bringing warm air into the Arctic. The dramatic loss of ice cover this season is also the result of longer-term trends and processes in effect since the 1970s and before.

Global warming is a primary driver of the climate change in the Arctic. Warmer global temperatures caused by greenhouse gasses have accelerated the melting process. The melting process itself is enhanced by the ice-albedo feedback effect—surfaces covered by ice are replaced by open water, which absorbs more solar radiation, which in turn causes warmer global temperatures.

The melting of Arctic ice is also evident in the thinning of ice that has not melted. Earlier this month, scientists at the German-based Alfred-Wegener Institute for Polar and Marine Research reported that large areas of sea ice are presently only one meter thick—a thinning of approximately 50 percent since 2001. Scientists speculate that the replacement of older thicker perennial sea ice with newer thinner ice began in 1970s. Maintenance of the older thicker ice is essential to the stability of perennial sea ice cover.

Measurements of sea ice thickness have been less systematic then sea ice extent. Most large-scale measurements have come from the sonar of military submarines. Nonetheless, there has been a significant observable decline in sea ice thickness seen in this data and other measurements. Using data from submarine cruises, Drew Rothrock, a scientist at the University of Washington, and others estimated that sea ice thickness declined an average of 1.3 meters over the past 30 to 40 years.

Another factor in the decline of sea ice is change in the phase of Arctic oscillation, a see-saw pattern of alternating atmospheric pressure at polar and mid-latitudes. The positive phase produces a strong polar vortex and shifts the mid-latitude jet stream northward. From 1989 to 1995, the Arctic oscillation entered a strong positive pattern that is thought to have flushed out older thicker sea ice from the Arctic.

There is debate among scientists about the amount of sea ice cover that can be expected in the future. A study by the federal National Oceanic and Atmospheric Administration (NOAA) from earlier this month estimates that the sea will shrink by 40 percent by 2050. The climate models accepted for the study, however, only took into account observations from 1979 through 1999. The study does not take into account the more rapid decline in sea ice extent seen in the past seven years, and in particular the very rapid decline witnessed this year.

However Mark Serreze, a scientist at the University of Colorado's National Snow and Ice Data Center, recently told the Associated Press that based on the latest observations, summer Arctic sea ice could

disappear completely by 2030.

The projections of future sea ice extent have a strong impact on the modeling of features of the Arctic, such as the future polar bear population. A series of studies released by the United States Geological Survey (USGS) this month gives projections of the future polar bear populations. The study notes that the overriding factor in determining the projections is the decline in ice habitat—the decline in sea ice extent.

The USGS study estimates a loss of two-thirds of the world's polar bear population within 50 years based on more conservative models of sea ice loss. The study predicts the extinction of 19 polar bear populations by 2050, and another three by 2075. As striking as these figures may be, in actuality the extinction of all polar populations could occur much sooner, taking into account the more rapid decline in sea ice seen recently.

The USGS study was produced at the request of the secretary of the interior to aid the US Fish and Wildlife Service in determining whether the polar bear should be considered an endangered species. This decision, which will be made in January, will affect other federal agencies in activities such as the approval of oil and gas leases.

The decline in sea ice extent this year signals a shift that is taking place in the climate system. The rapidity with which the ice is melting, exceeding previous projections, is an indication that global warming could have even more severe and immediate consequences than current models project.