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Abstract

**Arctic Sea Ice:
What We Have Learned From Satellite Passive-Microwave Observations**

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Arctic sea ice extends over a vast and remote area of the Earth's north polar region. Because of its size and remoteness, along with the severity of the polar conditions, monitoring the Arctic ice cover as a whole was totally impractical prior to the advent of satellite technology, hence preventing a detailed Arctic-wide record prior to the 1970s. However, since the late 1970s, scientists have been able to monitor the ice cover quite routinely due to the many advantages created through passive-microwave instrumentation on polar orbiting satellites. The record obtained has yielded considerable information about the seasonal cycle of the ice cover, as it advances unevenly from its minimum ice extent in September to its maximum extent in March, then decays unevenly through the spring and summer months, but more importantly it has also yielded information on the longer term changes as the ice responds to the warming that has been occurring through much of the Arctic region. Although the ice cover fluctuates considerably from year to year, with major regional differences, the overall Arctic ice cover has measurably decreased since the late 1970s. In fact the summertime ice has decreased so much that many scientists expect the Arctic to be ice-free at the end of summer sometime within the next few decades and perhaps even within the next few years. This is by no means certain, as the climate system has oscillations that could result in a reversal of the current trends. However, an end-of-summer ice-free Arctic is well enough within the range of possibilities that considerable concern has been raised regarding the likely impacts on polar bears, ringed seals, Arctic foxes, and other species whose lifestyles depend heavily on the ice cover. Quantitatively, the wintertime ice, with an ice extent of approximately 15,000,000 square kilometers (1.5 times the area of Canada), has decreased at a rate of about 2 % per decade since the late 1970s, and the summertime ice, with an extent of approximately 5,000,000-7,000,000 square kilometers, has decreased at the far faster rate of about 8 % per decade.

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