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## Scientists Report Severe Retreat of Arctic Ice

By ANDREW C. REVKIN

The cap of floating sea ice on the Arctic Ocean, which retreats under summer's warmth, this year shrank more than one million square miles -- or six Californias -- below the average minimum area reached in recent decades, scientists reported Thursday.

The minimum ice area for this year, 1.59 million square miles, appeared to be reached Sunday. The ice is now spreading again under the influence of the deep Arctic chill that settles in as the sun drops below the horizon at the North Pole for six months, starting Friday.

The findings were reported by the National Snow and Ice Data Center in Boulder, Colo., and posted online at [www.nsidc.org](http://www.nsidc.org).

While satellite tracking of polar sea ice has been done only since 1979, several ice experts who have studied Russian and Alaskan records going back many decades said the ice retreat this year was probably unmatched in the 20th century, including during a warm period in the 1930s. "I do not think that there was anything like we observe today" in the 1930s or 1940s, said Igor Polyakov, an ice expert at the University of Alaska, Fairbanks.

The ice retreat has been particularly striking this year. The Alaskan side of the Arctic Ocean has stretches of thousands of square miles of open water; the fabled Northwest Passage through the islands of northern Canada was free of ice for weeks; and the sea route between the Atlantic and Pacific Oceans north of Russia was nearly clear a week ago, with one small clot of ice around a group of Siberian islands.

Mark Serreze, a senior researcher at the snow and ice center, said it was increasingly clear that climate change from the buildup of greenhouse gases was playing a role in the Arctic warming, which is seen not only in the floating ice but also in melting terrestrial ice sheets, thawing tundra and warming seawater.

"We understand the physics behind what's going on," Dr. Serreze said. "You can always find some aspect of natural variability that can explain some things. But now it seems patterns that used to help you don't help as much anymore, and the ones that hurt you hurt you more."

"You can't dismiss this as natural variability," he said. "We're starting to see the system respond to global warming."

Still, he and other scientists acknowledged that both poles were extraordinarily complicated systems of ice, water and land, and that the mix of human and natural influences was not easy to clarify.

Sea ice around Antarctica has seen unusual winter expansions recently, and this week is near a record high.