

October 2, 2007

## Arctic Melt Unnerves the Experts

By [ANDREW C. REVKIN](#)

The Arctic ice cap shrank so much this summer that waves briefly lapped along two long-imagined Arctic shipping routes, the Northwest Passage over Canada and the Northern Sea Route over Russia.

Over all, the floating ice dwindled to an extent unparalleled in a century or more, by several estimates.

Now the six-month dark season has returned to the North Pole. In the deepening chill, new ice is already spreading over vast stretches of the Arctic Ocean. Astonished by the summer's changes, scientists are studying the forces that exposed one million square miles of open water — six Californias — beyond the average since satellites started measurements in 1979.

At a recent gathering of sea-ice experts at the [University of Alaska](#) in Fairbanks, [Hajo Eicken](#), a geophysicist, summarized it this way: “Our stock in trade seems to be going away.”

Scientists are also unnerved by the summer's implications for the future, and their ability to predict it.

Complicating the picture, the striking Arctic change was as much a result of ice moving as melting, many say. A new study, led by Son Nghiem at [NASA's Jet Propulsion Laboratory](#) and appearing this week in *Geophysical Research Letters*, used satellites and buoys to show that winds since 2000 had pushed huge amounts of thick old ice out of the Arctic basin past Greenland. The thin floes that formed on the resulting open water melted quicker or could be shuffled together by winds and similarly expelled, the authors said.

The pace of change has far exceeded what had been estimated by almost all the simulations used to envision how the Arctic will respond to rising concentrations of greenhouse gases linked to [global warming](#). But that disconnect can cut two ways. Are the models overly conservative? Or are they missing natural influences that can cause wide swings in ice and temperature, thereby dwarfing the slow background warming?

The world is paying more attention than ever.

Russia, Canada and Denmark, prompted in part by years of warming and the ice retreat this year, ratcheted up rhetoric and actions aimed at securing sea routes and seabed resources.

Proponents of cuts in greenhouse gases cited the meltdown as proof that human activities are propelling a slide toward climate calamity.

Arctic experts say things are not that simple. More than a dozen experts said in interviews that the extreme summer ice retreat had revealed at least as much about what remains unknown in the Arctic as what is clear. Still, many of those scientists said they were becoming convinced that the system is heading toward a new, more watery state, and that human-caused global warming is playing a significant role.

For one thing, experts are having trouble finding any records from Russia, Alaska or elsewhere pointing to such a widespread Arctic ice retreat in recent times, adding credence to the idea that humans may have tipped the balance. Many scientists say the [last substantial warming](#) in the region, peaking in the 1930s, mainly affected areas near Greenland and Scandinavia.

Some scientists who have long doubted that a human influence could be clearly discerned in the Arctic's changing climate now agree that the trend is hard to ascribe to anything else.

"We used to argue that a lot of the variability up to the late 1990s was induced by changes in the winds, natural changes not obviously related to global warming," said [John Michael Wallace](#), a scientist at the [University of Washington](#). "But changes in the last few years make you have to question that. I'm much more open to the idea that we might have passed a point where it's becoming essentially irreversible."

Experts say the ice retreat is likely to be even bigger next summer because this winter's freeze is starting from such a huge ice deficit. At least one researcher, [Wieslaw Maslowski](#) of the Naval Postgraduate School in Monterey, Calif., projects a blue Arctic Ocean in summers by 2013.

In essence, Arctic waters may be behaving more like those around Antarctica, where a broad fringe of sea ice builds each austral winter and nearly disappears in the summer. (Reflecting the [different geography and dynamics](#) at the two poles, there has been a slight increase in sea-ice area around Antarctica in recent decades.)

While open Arctic waters could be a boon for shipping, fishing and oil exploration, an annual seesawing between ice and no ice could be a particularly harsh jolt to polar bears.

Many Arctic researchers warned that it was still far too soon to start sending container ships over the top of the world. “Natural variations could turn around and counteract the greenhouse-gas-forced change, perhaps stabilizing the ice for a bit,” said [Marika Holland](#), of the [National Center for Atmospheric Research](#) in Boulder, Colo.

But, she added, that will not last. “Eventually the natural variations would again reinforce the human-driven change, perhaps leading to even more rapid retreat,” Dr. Holland said. “So I wouldn’t sign any shipping contracts for the next 5 to 10 years, but maybe the next 20 to 30.”

While experts debate details, many agree that the vanishing act of the sea ice this year was probably caused by superimposed forces including heat-trapping clouds and water vapor in the air, as well as the ocean-heating influence of unusually sunny skies in June and July. Other important factors were warm winds flowing from Siberia around a high-pressure system parked over the ocean. The winds not only would have melted thin ice but also pushed floes offshore where currents and winds could push them out of the Arctic Ocean.

But another factor was probably involved, one with roots going back to about 1989. At that time, a periodic flip in winds and pressure patterns over the Arctic Ocean, called the Arctic Oscillation, settled into a phase that tended to stop ice from drifting in a gyre for years, so it could thicken, and instead carried it out to the North Atlantic.

The new NASA study of expelled old ice builds on previous measurements showing that the proportion of thick, durable floes that were at least 10 years old dropped to 2 percent this spring from 80 percent in the spring of 1987, said [Ignatius G. Rigor](#), an ice expert at the University of Washington and an author of the new NASA-led study.

Without the thick ice, which can endure months of nonstop summer sunshine, more dark open water and thin ice absorbed [solar energy](#), adding to melting and delaying the winter freeze.

The thinner fresh-formed ice was also more vulnerable to melting from heat held near the ocean surface by clouds and water vapor. This may be where the rising influence of humans on the global climate system could be exerting the biggest regional influence, said [Jennifer A. Francis](#) of [Rutgers University](#).

Other Arctic experts, including Dr. Maslowski in Monterey and [Igor V. Polyakov](#) at the University of Alaska, Fairbanks, also see a role in rising flows of warm water entering the Arctic Ocean through the Bering Strait between Alaska and Russia, and in deep currents running north from the Atlantic Ocean near Scandinavia.

A host of Arctic scientists say it is too soon to know if the global greenhouse effect has already tipped the system to a condition in which sea ice in summers will be routinely limited to a few clotted passageways in northern Canada.

But at the university in Fairbanks — where signs of northern warming include sinkholes from thawing permafrost around its Arctic research center — Dr. Eicken and other experts are having a hard time conceiving a situation that could reverse the trends.

“The Arctic may have another ace up her sleeve to help the ice grow back,” Dr. Eicken said. “But from all we can tell right now, the means for that are quite limited.”

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