CLIMATE CHANGE

Is Battered Arctic Sea Ice Down For the Count?

A few years ago, researchers modeling the fate of Arctic sea ice under global warming saw a good chance that the ice could disappear, in summertime at least, by the end of the 21st century. Then talk swung to summer ice not making it past mid-century. Now, after watching Arctic sea ice shrink back last month to a startling record-low area, scientists are worried that 2050 may be overoptimistic.

"This year has been such a quantum leap downward, it has surprised many scientists," says polar researcher John Walsh of the University of Alaska, Fairbanks. "This ice is more vulnerable than we thought." And that vulnerability seems to be growing from year to year, inspiring concern that Arctic ice could be in an abrupt, irreversible decline. "Maybe we are reaching the tipping point," says Walsh.

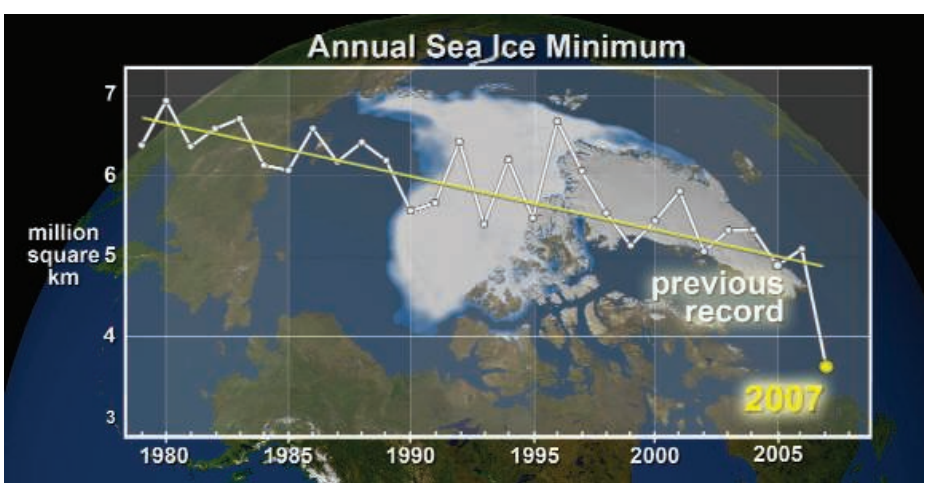
There's no doubt that 2007 was a special summer melt season. The ice area remaining in September—the year's low point—had been shrinking since satellite monitoring began in 1979. Some years it recovered a bit, others it declined further, but overall it shrank 8.6% per decade. In 2005, it hit a record low of 5.6 million square kilometers, down 20% from 1979. But last month, "we completely blew 2005 out of the water," says sea ice specialist Mark Serreze of the University of Colorado, Boulder. Ice area plummeted to 4.13 million square kilometers, down 43% from 1979. That's a loss equivalent to more than two Alaskas. The new low is more than one Alaska below the trend line. Nothing else like that appears in the satellite record or, for that matter, in monitoring from ships and planes during the rest of the 20th century, says Walsh.

An immediate cause of the record-breaking year is clear enough. As Serreze explains, an unusually strong high-pressure center sat over the central Arctic Ocean while a strong low hovered over Siberia. This weather pattern allowed more solar heat through the clear skies beneath the high-pressure center and pumped warm air up from the south between the high and the low.

The vicissitudes of weather may have enhanced ice loss this year, but there's more going on than that, scientists are realizing. For one thing, their models underestimate how fast summer ice has been disappearing in the warming Arctic. "It's very alarming the way things are changing so fast," says polar oceanographer D. Andrew Rothrock of the University of Washington (UW), Seattle. "We've thought we have the important physics in the models, but … it seems our models aren't very good in the Arctic."

Researchers say the models probably lack some realistic feedbacks, natural processes that can amplify a climatic nudge—whether natural or humanmade—into a shove. And that shove could send the ice past a tipping point. "You get a kick in the right direction," says Serreze, "and it sends the ice over the edge" and into a meltdown from which it cannot recover.

Last December, researchers reported finding that at least one climate model includes feedbacks that can accelerate sea ice into a ▶



CREDIT: NASA/GODDARD SPACE FLIGHT CENTER SCIENTIFIC VISUALIZATION STUDIO; (DATA) ROB GERSTON, GSFC

Bad sign. Arctic sea ice (gauged here using NASA's measurement techniques) has been declining, but 2007's unfavorable weather drove the increasingly vulnerable ice to a new record low.

In the Navy

The University of Hawaii (UH) is moving ahead with plans to build a Navy-affiliated research laboratory near one the system's 10 campuses. Approval by the university's Board of Regents last week followed more than 4 years of controversy over the Applied Research Laboratory (ARL), which is expected to bring in as much as $10 million per year for 3 to 5 years in research funds from the Navy and other agencies, including NASA and the National Institutes of Health. The ARL will be the fifth such University Affiliated Research Center; other hosts include sites at Johns Hopkins and Pennsylvania State universities.

But finalizing the Hawaii deal amidst opposition by community, student, and faculty groups wasn't easy; in 2005, anti-ARL protestors took over the university president's office for 6 days. Pressure from opponents led the university to specify in the contract that no classified research would occur during the first 3 years of operation. UH vice president for research James Gaines says the lab will raise the school's profile. Critics, however, accuse UH of disregarding what UH, Manoa, plant scientist Hector Valenzuela calls "general overwhelming opposition." The center, he says, "is against what the university is all about."

–BENJAMIN LESTER

Leszek is More

Leszek Borysiewicz is the new chief executive of Britain's Medical Research Council (MRC). Borysiewicz, an immunologist who helped develop vaccines against cervical cancer, was most recently deputy rector at Imperial College London. He takes over as MRC is attempting to respond to a government report last year that called for more emphasis on research with clinical and commercial applications. But Borysiewicz says that does not mean short-changing basic research. "We're not going to improve our translational science without keeping the basic research strong," he says.

Meanwhile, he will oversee the controversial relocation of the National Institute for Medical Research (NIMR) from the London suburb of Mill Hill into the city. NIMR researchers fought the original plans, saying the proposed site was too small (*Science*, 18 February 2005, p. 1028). But now MRC has joined forces with the Wellcome Trust/Cancer Research U.K. and University College London to bid for a site near the British Library that would eventually house 1500 scientists. The government, which is selling the property, should announce a decision on the sale in the coming weeks.

–GRETCHEN VOGEL

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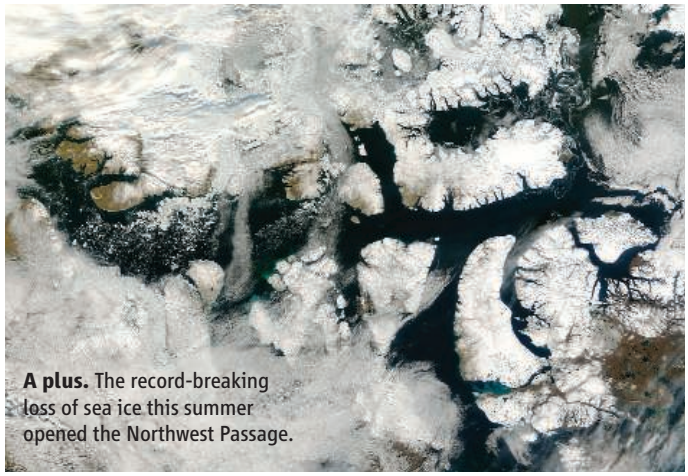
tipping point. Modeler Marika Holland of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, and colleagues wrote in *Geophysical Research Letters* (*GRL*) that when NCAR's Community Climate System Model, version 3—which has one of the most sophisticated ice components available—is run under a strengthening greenhouse, sea ice loss can suddenly accelerate, in one case cutting ice area by two-thirds in a decade and wiping out September ice by 2040.



A plus. The record-breaking loss of sea ice this summer opened the Northwest Passage.

Such accelerations were driven by two feedbacks in the model. In one, thinner ice one year made ice melt more easily the next year. In another, when white, highly reflective ice melted, the darker, more absorptive open water that replaced it absorbed more solar energy. The added heat could help melt more ice and keep new ice thinner that year—and even the next, if the heat lingered through the winter.

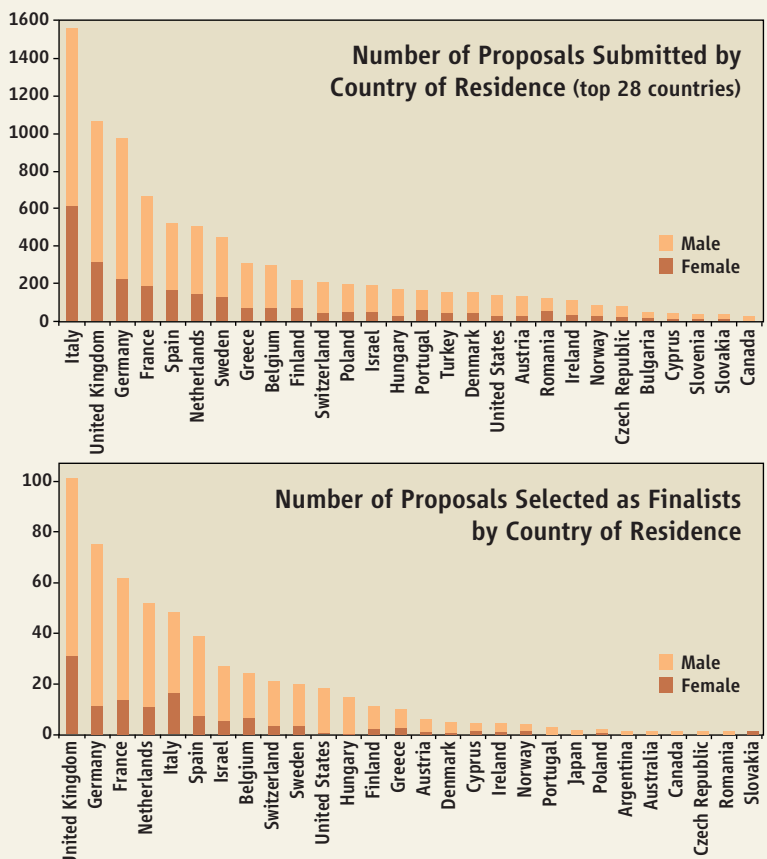
Holland and her colleagues "showed that in models, these abrupt changes can occur," says Walsh. Now, "this is the first time we may have seen it" in the real world.

In an in-press *GRL* paper, polar researcher Donald Perovich of the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire, and colleagues report estimates of increasing solar heating of the Arctic Ocean. They found that a large area of Arctic waters north of the Bering Strait had been absorbing increasing amounts of solar heat since 1979 as summer ice retreated, suggesting that the ice-reflectivity feedback has been operating there.

And in a paper appearing in *GRL* this week, Son Nghiem of the Jet Propulsion Laboratory in Pasadena, California, and colleagues report a continuing decline in the thicker, older ice that tends to persist from year to year. Much of the decline in perennial ice, they found, was due to winds blowing it out of the Arctic Ocean. But thinning from added heat had made it easier for the wind to blow the ice out. That would add a dynamical feedback to the thermal feedback of ice reflectivity.

Researchers suspect that these and other feedbacks are eroding sea ice's ability to resist the warming of recent decades. "Might we lose summer sea ice by 2030?" asks Serreze. "That is not unreasonable." Next September could tell whether natural variability just made for one bad year in the Arctic or whether it is pushing the ice over the edge. Meteorologist Ignatius Rigor of UW is worried. Given the beating the ice has taken of late, he says, "the chances of another extreme next year are pretty high."

–RICHARD A. KERR



European Science by the Numbers

The first round of peer-reviewed grants from the European Research Council (ERC) is out, and the agency's analysis of applicants and finalists paints a revealing picture of Europe's scientific landscape. Nearly 9000 applications flooded in this spring (*Science*, 4 May, p. 672); review panels narrowed these down to just 559 finalists. The ERC will select about 250 young scientists from the list by January 2008 and award each of them roughly €1 million ($1.4 million). This week, the ERC released new figures about where the applicants come from and where they hope to work. Italians far outpaced all other nationalities, submitting more than 1700 applications—a sign, says ERC Vice President Helga Nowotny, of the dire lack of support for young researchers there. Italians were fairly successful, too: 70 made it to the final round, although just fewer than 50 plan to work in Italy. The U.K. has the best "brain-gain" statistics: More than 100 of the finalists work in the U.K. but just 42 are British. The big surprise, Nowotny notes, is Poland. Just three Polish researchers are finalists, and none plans to work in Poland. Michal Kleiber, president of the Polish Academy of Sciences and a member of the ERC scientific council, sees the results as disappointing; he thinks they reflect the salary caps in Poland that spur top applicants to work elsewhere. He also notes that although Poland has 8% of the E.U. population, its science budget accounts for less than 1% of overall E.U. research spending. More details are available at: http://erc.europa.eu/pdf/erc-stg-statistics-stage1-20071001_en.pdf

–GRETCHEN VOGEL

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