Emissions Linked to End of 2,000-Year Arctic Trend

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Scientists walk on an iceberg, 36 metres above the water surface of Kane Basin August 6, 2009. A team of scientists are onboard the Arctic Sunrise ship for the first leg of Greenpeace's three-month-long Arctic Impacts expedition. The expedition aims to document the effects of climate change on the Arctic environment, ahead of the Copenhagen summit which will be held in December 2009. (Nick Cobbing - Reuters)

Human-generated greenhouse gas emissions have helped reverse a 2,000-year trend of cooling in the Arctic, prompting warmer average temperatures in the past decade that now rank higher than at any time since 1 B.C., according to a study published Thursday in the online version of the journal Science.

The analysis, based on more than a dozen lake sediment cores as well as glacier ice and tree ring records from the Arctic, provides one of the broadest pictures to date of how industrial emissions have shifted the Arctic's long-standing natural climate patterns. Coupled with a separate report on the region issued Wednesday by the World Wildlife Fund, the studies suggest human-induced changes could transform not only the Arctic but climate conditions across the world.

"It's basically saying the greenhouse gas emissions are overwhelming the system," said David Schneider, a visiting scientist at the National Center for Atmospheric Research and one of the Science article's co-authors.

The historical study involved 30 researchers from the United States, Britain, Denmark, Norway, Canada and Finland and reconstructed the Arctic's climate in the distant past. The World Wildlife Fund, by contrast, published a forward-looking report detailing how current warming there is likely to shift global weather patterns and affect agriculture, forestry and water supplies in the United States, Europe and elsewhere. Martin Sommerkorn, the lead author of the WWF report, said recent Arctic warming "has triggered effects that will come back and affect the rest of the world, in terms of climate change."

The paper in Science sheds light on several key scientific questions, including how Earth's orbital pattern around the sun affects our climate, and the extent to which current computer climate models mirror real-world conditions. Some climate skeptics have argued that Earth's wobbling on its axis of rotation has helped determine recent warming, rather than human activities. But the new study shows that this wobble -- which affects how much sunlight Earth receives in the middle of the summer -- actually accounts for a long-term cooling trend in the Arctic that has been reversed only in the past half-century.

Northern Arizona University professor Darrell S. Kaufman, the study's lead author, notes that this rotation means Earth was 620,000 miles closer to the sun in midsummer 2,000 years ago and

continues to move farther away. The cooling trend that resulted, he said, "should have continued through the 21st century." Instead, summer temperatures in the Arctic are now 2.5 degrees Fahrenheit warmer than would be expected under the natural cycle.

Until now, the most comprehensive paleo-climate analysis of the Arctic covered just the past 400 years. The new analysis reaches back further in time by incorporating data from six new lake sediment cores. Unlike glaciers or tree ring samples, Arctic lakes are more widely distributed throughout the region, so they can provide a more comprehensive look at the area's past. Researchers were able to analyze everything from annual glacier melt to how much algae grew in an ice-free season, Kaufman said.

John Smol, an Arctic lake expert at Queen's University in Kingston, Ontario, said the region's lake sediments act as "a black box for the ecosystem" because they remain pristine and contain both biological and physical data that has accumulated every year. "You still have some of these natural laboratories," he said. "We have really strong barometers of what's happening in the Arctic."

Mark Serreze, director of the National Snow and Ice Data Center at the University of Colorado at Boulder, said the study is significant because it helps confirm scientists' understanding of how Earth's climate has changed over millennia.

"It's not that we don't know how the climate works, it's just we didn't have anyone at that time measuring the climate forcing then," he said. "Climate doesn't change all by itself for no good reason. Something has to force it."

Fred Singer, a prominent climate-change skeptic who heads the Science and Environmental Policy Project, questioned the Science study, saying it does not properly reflect other researchers' findings about the Medieval Warm Period. That period, between A.D. 800 and 1300, had "higher temperatures than even the past 30 years," he said.

But documentation of the Medieval Warm Period is primarily about Europe, and natural records indicate average Arctic temperatures during that time were not as high. There was a brief period in the early 5th century in which temperatures in the Artic came close to being as high as those in the most recent summers.

Robert Corell, chairman of the Arctic Climate Impact Assessment, said the paper in Science will probably "in the long haul become a seminal piece in the scientific literature" because it allows other climate researchers "to set their work in a long time scale."

The group's findings also mesh with computer modeling of how Arctic temperatures have changed over time. Kaufman noted that this gives researchers "confidence in our predictive abilities" to model future warming in the Arctic and other parts of the world.

Sommerkorn said that unless countries make a concerted effort to cut their emissions in the next few decades, higher Arctic temperatures could cause the release of massive amounts of

greenhouse gases from permafrost as well as further reductions in the sea ice that reflects warming sunlight.

"If we don't do it, and do it now, we can really not keep these Arctic feedbacks under control in the coming decades," he said.

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