Polar Ice Caps Can Recover from Warmer Climate-Induced Melting, Study Shows

ScienceDaily (Aug. 18, 2011) — A growing body of recent research indicates that, in Earth's warming climate, there is no "tipping point," or threshold warm temperature, beyond which polar sea ice cannot recover if temperatures come back down. New University of Washington research indicates that even if Earth warmed enough to melt all polar sea ice, the ice could recover if the planet cooled again.

Freshwater ponds appear atop the Arctic ice cap during the summer melt in this image taken on July 12. The NASA-funded Impacts of Climate on Ecosystems and Chemistry of the Arctic Pacific Environment project has been examining the ponds and the ice around them this summer. (Credit: NASA)

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In recent years scientists have closely monitored the shrinking area of the Arctic covered by sea ice in warmer summer months, a development that has created new shipping lanes but also raised concerns about humans living in the region and the survival of species such as polar bears.

In the new research, scientists used one of two computer-generated global climate models that accurately reflect the rate of sea-ice loss under current climate conditions, a model so sensitive to warming that it projects the complete loss of September Arctic sea ice by the middle of this century.

However, the model takes several more centuries of warming to completely lose winter sea ice, and doing so required carbon dioxide levels to be gradually raised to a level nearly nine times greater than today. When the model's carbon dioxide levels then were gradually reduced, temperatures slowly came down and the sea ice eventually returned.

"We expected the sea ice to be completely gone in winter at four times the current level of carbon dioxide but we had to raise it by more than eight times," said Cecilia Bitz, a UW associate professor of atmospheric sciences.

"All that carbon dioxide made a very, very warm planet. It was about 6 degrees Celsius (11 degrees Fahrenheit) warmer than it is now, which caused the Arctic to be completely free of sea ice in winter."

Bitz and members of her research group are co-authors of a paper about the research that is to be published in *Geophysical Research Letters*. The lead author is Kyle Armour, a UW graduate student in physics, and other co-authors are Edward Blanchard-Wrigglesworth and Kelly McCusker, UW graduate students in atmospheric sciences, and Ian Eisenman, a postdoctoral researcher from the California Institute of Technology and UW.

In the model, the scientists raised atmospheric carbon dioxide 1 percent each year, which resulted in doubling the levels of the greenhouse gas about every 70 years. The model began with an atmospheric carbon dioxide level of 355 parts per million (in July the actual figure stood at 392 ppm).

In that scenario, it took about 230 years to reach temperatures at which Earth was free of sea ice during winter. At that point, atmospheric carbon dioxide was greater than 3,100 parts per million.

Then the model's carbon dioxide level was reduced at a rate of 1 percent a year until, eventually, temperatures retreated to closer to today's levels. Bitz noted that the team's carbon dioxide-reduction scenario would require more than just a reduction in emissions that could be achieved by placing limits on the burning of fossil fuels. The carbon dioxide would have to

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