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Warming from Arctic Sea Ice Melting More Dramatic than Thought

This pristine photo of Arctic sea ice was taken by scientists from the Alfred Wegener Institute for Polar and Marine Research in German. In the summer of 2012, (Stefan Hendricks, Alfred Wegener Institute)

By Laura Poppick, Staff Writer

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Melting Arctic sea ice has contributed considerably more to warming at the top of the world than previously predicted by climate models, according to a new analysis of 30 years of satellite observations.

Sea ice helps cool the Arctic by reflecting incoming solar radiation back into space. Because of its light color, sea ice has what is known as high albedo, which is the percentage

of solar radiation a surface reflects back to space. Dark ocean water left behind by melting sea ice, on the other hand, has a low albedo, usually measuring less than 20 percent, whereas bare sea ice generally measures between 50 and 70 percent, according to the National Snow and Ice Data Center.

Since as early as the 1960s, scientists have hypothesized that melting sea ice amplifies global warming by decreasing Arctic albedo. Researchers have since devised climate models to demonstrate this phenomenon but, until now, nobody had relied entirely on satellite data to confirm this effect through time. [See Stunning Photos of Earth's Vanishing Ice]

Now, scientists based at the University of California, San Diego have analyzed Arctic satellite data from 1979 to 2011, and have found that average Arctic albedo levels have decreased from 52 percent to 48 percent since 1979 — twice as much as previous studies based on models have suggested, the team reports today (Feb. 17) in the journal Proceedings of the National Academy of Sciences.

The amount of heat generated by this decrease in albedo is equivalent to roughly 25 percent of the average global warming currently occurring due to increased carbon dioxide levels, the team reports.

"Although more work is needed, a possible implication of this is that the amplifying feedback of Arctic sea ice retreat on global warming is larger than has been

reflectiveness of white cloud cover could potentially mitigate a portion of albedo loss due to melting ice; but these new observations show that cloud cover has had a negligible effect on overall Arctic reflectivity, the team says.

While Arctic sea ice will not likely return to 1979 values in the near future, the ice does change from year to year and might still experience some comeback this century, though the extent to which this might happen remains unclear, Eisenman said.

"There are a lot of questions right now as to why the ice is retreating as fast as it is, and why it has the structure that it has is a little hard to say," said Eisenman. "The cause and effects get subtle — ocean currents respond to sea ice and sea ice responds to currents."

The team is now following up this work by studying how the deposition of black carbon — a component of soot — on Arctic ice and snow may be darkening these reflective surfaces and contributing to the decrease in albedo. If this does turn out to be a significant factor in albedo, it could explain the underestimations of previous models that didn't account for black carbon, Eisenman said.

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