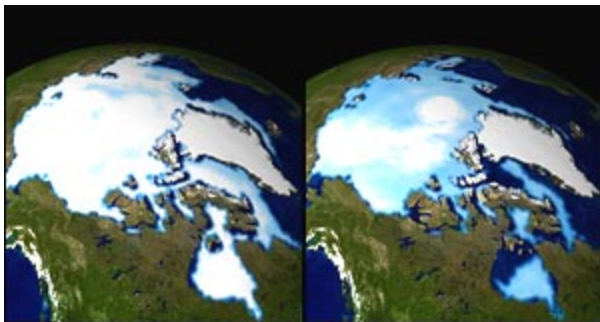


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Monday, 9 December, 2002, 12:34 GMT

[News Front Page](#)

Record ice loss in Arctic



Satellites have tracked the retreat of perennial sea ice in the Arctic

By **Molly Bentley**

BBC News Online in San Francisco

Melting was so severe on the Greenland ice sheet in June that field researcher Konrad Steffen wondered just how he would get off the continent.

"We had come in with a fixed-wing aircraft landing on skis," said the University of Colorado climatologist. "If that snow is melting then you cannot leave. As it was, we had to charter a helicopter."

“ [Natural variability] can't explain everything ”

Dr Mark Serreze

Greenland's unusual summer slush was part of a record-breaking year of northern polar ice loss, reported by Dr Steffen and other scientists this weekend at the American Geophysical Union (AGU) conference in San Francisco.

According to scientists, surface melt on Greenland was the highest in recorded history - and extended to elevations previously untouched by melt - while the amount of Arctic sea ice also reached a record low.

While some of the accelerated melting appears to be linked to natural atmospheric oscillations, human influence could not be ruled out, said the scientists.

Glacier 'lubrication'

Greenland glacier and sea ice melt, combined with disappearing permafrost, the northern expansion of vegetation, and increased fresh water run-off present a "compelling case that something is going on," said Larry Hinzman, of the University of Alaska, Fairbanks.

Measurements of the Greenland ice sheet taken from passive microwave satellite sensors show 685,000 square kilometres of melt, an area more than double that of 1992.

Such melting encourages further ice loss. The excess water weight pushes down on the

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glacier at the same time that water seeps through cracks to the underside.

The combination accelerates the glacier's flow to the sea.

Dr Steffen attributes the increased melt to an unusual low-pressure system that "came earlier and stayed longer" on the island to create unseasonable warm temperatures.

Ozone depletion

Such a low-pressure system is characteristic of the Arctic Oscillation, an atmospheric sea-sawing that produces warm weather and is also partly responsible for this year's dramatic Arctic sea ice melt, according to Mark Serreze, a researcher at the National Snow and Ice Data Center in Boulder, Colorado.

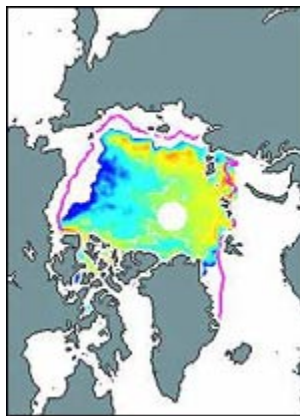
He calculates that warming has produced roughly 20% loss in Arctic sea ice since 1978. But not all warming is due to natural variability.

"The Arctic Oscillation can't explain everything," said Dr Serreze.

To what extent these may be human-induced changes is very difficult to say, and Arctic Oscillation itself is subject to human influence, he said.



Meltwater flows into a large moulin on Greenland and down to the bedrock to "lubricate" the sheet



Sea ice in September: Lavender line indicates a more typical ice extent (median for 1988-2000)

Stratospheric ozone depletion can exacerbate the system by cooling the upper atmosphere, which in turn changes wind and ocean circulation patterns.

Dr Serreze suspects that just such an aberrant Arctic Oscillation was behind unusual circulation patterns last winter that weakened sea ice.

Positive feedback

Changes in the winter wind field broke up floating sea ice to create cracks that suggest the "opening of a Venetian blind," said Dr Serreze. The breaks in the ice allow it to absorb more solar radiation.

This triggered an early spring melt, which made the ice vulnerable to the impact of high summer temperatures.

"It was like a one-two punch," said Dr Serreze.

The loss of Arctic sea ice is "big news", according to University of Alaska, Fairbanks, researcher Larry Hinzman.

"Polar sea ice has an important function in moderating the global energy balance," he said. He explained that sea ice has albedo of 0.8. That is, it reflects 80% of the solar radiation. When the sea ice melts you have water, which has an albedo of 0.2.

"The sea ice goes from absorbing 20% of solar radiation to absorbing 80%," said Dr Hinzman. This creates positive feedback for further warming.

In total, the arctic warming is an unprecedented trend, according to Dr Hinzman.

"We're experiencing the most rapid increase in temperature in recorded history," he said.

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