

BACKGROUNDER

Arctic Sea Ice

The Media Darling of Climate Change Misrepresentation

BY TIM BALL
SENIOR FELLOW

Executive Summary

- The state of the Arctic sea ice is the topic of voluminous media reports about the effects of climate change.
- An analysis of the coverage shows that several aspects of Arctic phenomena make it a prime candidate for media stories.
 - Media reporting on any issue has a self-sustaining momentum. Once a story has broken, a feedback loop leading to more stories ensues. Reporters know the issue has a waiting audience, and the public seeks reports that fit into its framework of understanding.
 - Contrary to the underlying assumption of uniformitarianism on which Western environmental science is based, the environment regularly goes through significant and non-linear changes. Because we know little about the Arctic (satellite surveillance has only given reliable measurements of Arctic sea ice since 1979), it is very easy to contrast the constantly changing Arctic with the normal expectation of a changeless or incrementally changing environment.
 - The Arctic is home to a number of animals including wolves and polar bears that are regularly used to invoke human pity.
 - Changes in climate tend to create their strongest signals at the temperature-extreme poles.
- Contrary to the cautious and conditional approach of scientific progress, media reports on scientific matters tend to present speculation as fact, and reporters protect themselves against misstatement with neutral admissions of uncertainty.

By examining a typical media story about the Arctic sea ice paragraph by paragraph, we can see how these and other techniques are used to present an emotionally compelling story that is completely disconnected from what scientists actually understand.

Introduction

Few people are aware that four temperature trend changes have occurred since 1900.

My view that climate change is occurring but that humans are not causing it by their addition of CO₂ into the atmosphere is constantly challenged. A frequent argument is that the number of stories in the media is clear proof that something is happening. People then assume it is due to human activity, because that is what they have been led to believe.

It is true there are more stories in the media, but all this shows is that there are more stories in the media. It does not mean there are more events or that even more severe events are occurring. We have all experienced being introduced to somebody, after which we seem to meet or hear about the person frequently. The fact is they were always there; they were just not part of our awareness. The media, which are frequently used by those who want to show that humans are causing climate change, eagerly report on environmental events. The fact is the events were always occurring; they were just not part of most people's awareness.

A second problem is that Western education about science, and especially the environment, assumes uniformitarianism. This is the concept that change is gradual over long periods. In fact, significant change occurs all the time. For example, the orbit of the Earth changes every year primarily because of the gravitational pull of Jupiter, a scientific fact we have known for approximately 150 years. Yet, until recently, most school texts said the orbit is fixed, unchanging and slightly elliptical. Similarly, few people are aware that four temperature trend changes have occurred since 1900. The world warmed from 1900 to 1940, cooled from 1942 to 1980, warmed from 1980 to 2000 and has cooled from 2000 to the present.

Our tendency to remember a media report as unconditional is a third problem. I grappled with this for a long time, because all science reports are conditional. No scientist is 100 per cent certain about anything, which is why they talk about something having a 95 per cent, or some other level, confidence limit. I realized most media reports have the conditional words in the body of the article, but the headlines are invariably active voice and without condition. The headline is what most people remember.

There are other factors involved in the distorted view of the world that is created by the media. The problems identified above exist in the present climate of environmental hysteria. This and subsequent articles will take specific media reports and identify the errors, distortions, lack of context and speculation that is designed grab a headline. I will do this with stories from the print media, but similar practices occur in other media. As Marshall McLuhan said, "The medium is the message." For example, the classic portrayal of air pollution or pollution in general is the factory chimney spewing (notice the connotations of the word) material into the atmosphere. Nowadays, most of it is water vapour condensing to visible water droplets as it hits the cool air. You can see this if you look closely, because there will be a gap between the top of the chimney and the water droplets that appear. A common trick to enhance the effect is to backlight the conditions to make the steam appear menacingly black. It is a classic portrayal, because television has few other ways of showing pollution.

Because of their machinations, some intentional but most out of a lack of understanding or a political bias, the media have created virtual reality. We have a situation where everything is presented out of context in space and time. Natural events are identified or presented as unnatural. Normal events are identified or presented as abnormal. Speculation about more unnatural or abnormal events is self-fulfilling. On a regular basis, I will dissect media reports and identify the errors, the misinformation and the biases.

Why Arctic Sea Ice is a Media Darling

Arctic and Antarctic regions receive a great deal of attention for several reasons: a) we know very little about them b) they are regions where the greatest warming due to human CO₂ is predicted c) they are home to animal species that have been used to exploit our emotions from Walt Disney's false representation of lemmings in *White Wilderness* to Kevin Costner's *Dances with Wolves* to Al Gore's complete misrepresentation of polar bears to the more accurate but very emotional portrayal of Antarctic penguins.

Direct observation of and reports about the Arctic effectively began in the 16th century. Reports from that time are limited, but more importantly, an accurate determination of the extent of the Arctic sea ice did not exist prior to 1979. Climate data for the Arctic Ocean simply does not exist as is shown by the large "No Data" sections in the map from the Arctic Climate Impact Assessment (ACIA) for the period 1954 to 2003. Indeed, the fundamental argument made in that assessment for millions of research dollars was precisely because so little is known.

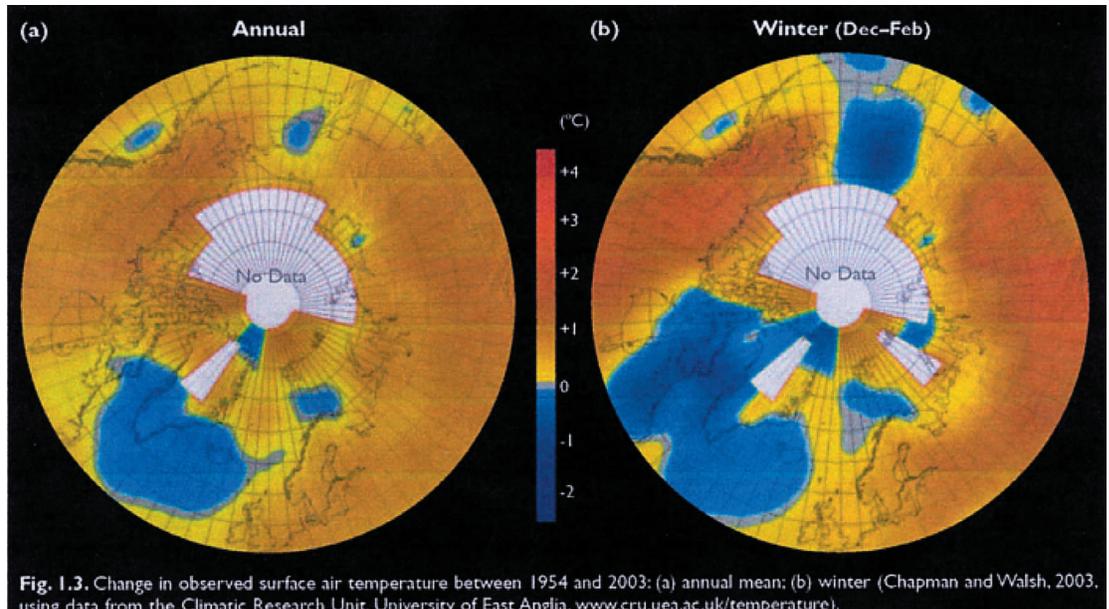
It is important to note that the findings of the ACIA were the basis of understanding, assessment and recommendations for the 2007 Intergovernmental Panel on Climate Change report.

We have a situation where everything is presented out of context in space and time. Natural events are identified or presented as unnatural. Normal events are identified or presented as abnormal.

A Real Canadian Press Story

http://canadianpress.google.com/article/ALeqM5j0pbRGKmCne267H2MV7i_djYHzfw

Read this original article in its entirety before reading the paragraph-by-paragraph comparison of the story (Pg 6) to what scientists actually know.



Huge break off northern ice shelf may not be the last this summer: scientist

Jul 29, 2008

Canada's largest remaining ice shelf could easily shrink further this summer even after losing a vast chunk of itself, say Arctic ice experts.

"It wouldn't surprise me to see more calving this summer," said Derek Mueller of Trent University, who's been studying the Ward Hunt Ice Shelf off the north coast of Ellesmere Island for years.

In a development consistent with climate change theories and happenings elsewhere in the Arctic, an enormous icy plain about 20 square kilometres in size broke free sometime last week and began slowly drifting into the Arctic Ocean. The piece had been a part of the shelf for 3,000 years.

A crack in the shelf was first spotted in 2002. Last spring, a patrol of Canadian Rangers found the weakness had spread into an extensive network of cracks, some 40 metres wide and 18 kilometres long. The crack-riddled section of ice was like a jigsaw puzzle, with the pieces held in place only by each other

It wouldn't have taken much to work a chunk of the shelf free, said Mueller.

"Further changes were likely given the right conditions. We had open water in front of the ice shelf. We had a favourable current and we probably had a favourable wind."

Formed by accumulating snow and freezing meltwater, ice shelves are large platforms of thick, ancient sea ice that float on the ocean's surface. Ellesmere Island was once entirely ringed by a single enormous ice shelf that broke up in the early 1900s.

At 440 square kilometres in size and 40 metres thick, the Ward Hunt shelf is the largest of those remnants - even bigger than the Antarctic shelf that collapsed earlier this year and seven times the size of the Ayles Ice Shelf chunk that broke off in 2005 from Ellesmere's western coast.

Despite a period of stability in the 1980s, the Ward Hunt shelf and its characteristic corrugated surface has been steadily declining since the 1930s, said Mueller. Its southern edge has lost 20 square kilometres over the last six years.

Mueller now believes the Serson Ice Shelf, in an exposed position off Ellesmere's western coast, could be the next to start breaking up.

"It certainly wouldn't surprise me if something happened on the Serson. It's exposed right now. There's no ice around it."

Mueller is careful not to blame the Ward Hunt breakup specifically on climate change, but says it is consistent with the theory. The current Arctic climate certainly isn't reinforcing ice shelves.

"We're in a different climate now," he said. "It's not conducive to regrowing them. It's a one-way process."

It's the same all over the Arctic, said Gary Stern, co-leader of a major international research program on sea ice.

Speaking from the Coast Guard icebreaker Amundsen about 70 kilometres off the Mackenzie Delta, Stern said the Ward Hunt breakup is related to what he's seeing thousands of kilometres away.

He hasn't seen any ice in weeks. Plans to set up an ice camp last February had to be abandoned when usually dependable ice didn't form for the second year in a row.

"Nobody on the ship is surprised anymore," said Stern. "We've been trying to get the word out for the longest time now that things are happening fast and they're going to continue to happen fast."

Many scientists now believe that the Arctic will have ice-free summers by 2013 instead of 2030 as predicted by the International Panel on Climate Change. Annual ice loss since the 1970s has quickened from about 75,000 square kilometres every summer to about 1.4 million square kilometres, said Stern.

"It's all connected to the warming climate. Everything is connected together."

Paragraph-by-Paragraph Analysis

Huge...
In fact, the piece of ice is not huge. It is approximately 20 square kilometres, while the Arctic Ocean is approximately 14 million square kilometres.

The title of the *Canadian Press* article begins the deception. "*Huge break off northern ice shelf may not be the last this summer: scientist.*" In fact, the piece of ice is not huge. It is approximately 20 square kilometres, while the Arctic Ocean is approximately 14 million square kilometres. Even if we consider it as a portion of the 440-square-kilometre Ward Hunt shelf, it is approximately 4.5 per cent and living room of the 19. It is not huge by any measure.

Canada's largest remaining ice shelf could easily shrink further this summer even after losing a vast chunk of itself, say Arctic ice experts.

This is a classic opening used to build up concern. It is not just any old ice shelf, but the "largest remaining." The word "remaining" is irrelevant except it suggests that all the other nearly as large ice shelves are already gone. We also have our first conditional word, "could," which suggests this is just the beginning, which is implied by the word "easily." Of course, it could just as easily not shrink, but this idea is dispelled as unlikely, because the trend is set by the loss of "a vast chunk of itself." The word "vast" is as inappropriate as the word "huge" is in the headline. Finally, all this speculative hyperbole gives credence to the words of unnamed "Arctic ice experts." Who are these people? Only one expert is named in the article, and no opposing views are provided.

"It wouldn't surprise me to see more calving this summer," said Derek Mueller of Trent University, who's been studying the Ward Hunt Ice Shelf off the north coast of Ellesmere Island for years.

Again pure speculation, but given credibility because the author is an expert. In fact, he should not be surprised, because he should know, just as expert Dr. Warwick Vincent knows, that the shelf has been shrinking since at least 1950. *The Globe and Mail* reported it was "the largest on record since 2005 but still small when compared with others."

In a development consistent with climate change theories and happenings elsewhere in the Arctic, an enormous icy plain about 20 square kilometres in size broke free sometime last week and began slowly drifting into the Arctic Ocean. The piece had been a part of the shelf for 3,000 years.

What are the other developments consistent with climate change theories? If they mean conditions in the Arctic are constantly changing, it is a redundant statement. The implication is that the changes are due to global warming, but another news outlet (Yahoo.news¹) provides a different explanation from the same scientist. "*Derek Mueller, a research [sic] at Trent University, was careful not to blame global warming, but said it the event [sic] was consistent with the theory that the current Arctic climate isn't rebuilding ice sheets.*"

1. http://news.yahoo.com/s/ap/20080729/ap_on_re_ca/canada_arctic_ice_shelf

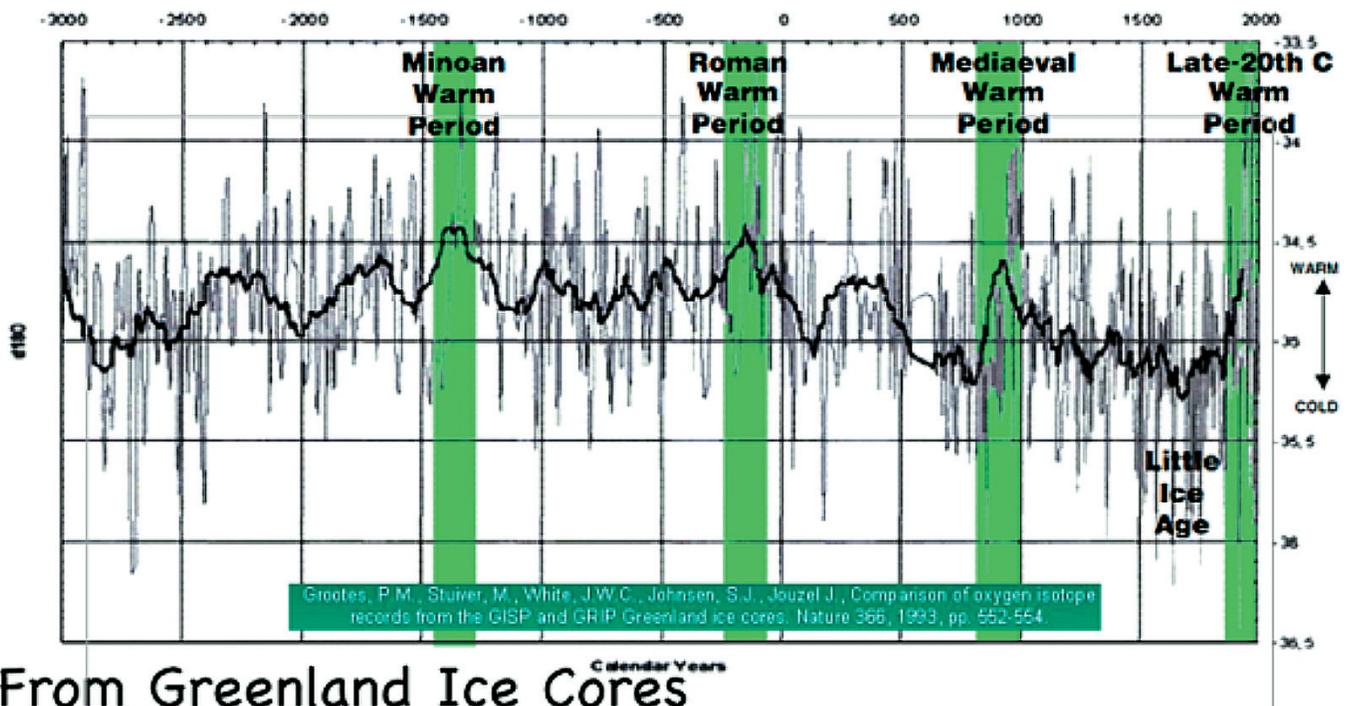
There is no argument with his statement that the recent Arctic climate is not conducive to rebuilding ice sheets, but recent and predicted cooling will cause that to change. The world has generally warmed from the nadir of the Little Ice Age in 1680, and this is not conducive to building ice sheets.

Many studies indicate much more severe conditions that were conducive to the building of ice sheets in the recent past. These include assessments of sea ice conditions from Dunbar (1985) "Sea ice and climatic change in the Canadian Arctic since 1800," through Catchpole and Faurer (1983) "Summer sea ice severity in Hudson Strait, 1751-1870," to most recently Bradley and England (2008).

The issue is not whether warming generally occurred from 1680 to the present, but what is the cause of the warming. However, the CP article assumes it is due to humans and then, in a circular argument, implies the story is proof.

In a larger context, how did the ice shelves fare during the more significant warming that is indicated in this graph of global temperatures, which were derived from ice cores? The simple answer is the ice shelves diminished and even disappeared. Temperature is the major influence on the size of the ice shelves, especially as they melt. However, precipitation on the ice sheet from which they emanate is another factor and one overlooked in the report.

The implication the current warming is abnormal and therefore due to humans is preposterous. This is easily disabused by the following graph, which shows the extent of natural variability and three warmer periods in the last 3,500 years.



“Canadian Rangers (Inuit) ... would not have been surprised by the cracks in the ice. They know that both shelf ice and Arctic sea ice are constantly moving and cracking.”

A crack in the shelf was first spotted in 2002. Last spring, a patrol of Canadian Rangers found the weakness had spread into an extensive network of cracks, some 40 metres wide and 18 kilometres long. The crack-riddled section of ice was like a jigsaw puzzle, with the pieces held in place only by each other.

Canadian Rangers are Inuit hired by the Canadian government to provide security in the Arctic. They would not have been surprised by the cracks in the ice. They know that both shelf ice and Arctic sea ice are constantly moving and cracking. Colourful prose such as “crack-riddled” simply heightens the imagery of failure and collapse; the “jigsaw puzzle” analogy implies a problem to be solved. There is no problem because ice, which is brittle, breaks naturally on an ice shelf because the contributing land-based glacier is advancing or retreating, or because of tidal or wave actions or changing wind patterns. A report last year by NASA showed that different sea ice conditions in 2007 were due to changing wind patterns.

It wouldn't have taken much to work a chunk of the shelf free, said Mueller.

"Further changes were likely given the right conditions. We had open water in front of the ice shelf. We had a favourable current and we probably had a favourable wind."

This statement simply confirms the NASA findings.

<http://wattsupwiththat.wordpress.com/2007/10/03/nh-sea-ice-loss-its-the-wind-says-nasa/>

Formed by accumulating snow and freezing meltwater, ice shelves are large platforms of thick, ancient sea ice that float on the ocean's surface. Ellesmere Island was once entirely ringed by a single enormous ice shelf that broke up in the early 1900s.

The first sentence is inaccurate. It suggests that ice sheets form in the ocean around the island. However, the main cause of shelf formation is when ice from a glacier or ice sheet, such as the one on Ellesmere Island, flows out into the ocean. Accumulating snow and freezing meltwater subsequently affect it. This means the advance or retreat of the glacier or ice sheet affects the behavior of the ice shelf. The second sentence implies this has never happened before, but that is not the case.

At 440 square kilometres in size and 40 metres thick, the Ward Hunt shelf is the largest of those remnants - even bigger than the Antarctic shelf that collapsed earlier this year and seven times the size of the Ayles Ice Shelf chunk that broke off in 2005 from Ellesmere's western coast.

This is another misleading statement. What it should say is that the Ward Hunt shelf is larger than a piece that broke away from the Antarctic ice shelf earlier this year. So what? It is presented with unnecessary hyperbole, using words such as “the largest,” “seven times the size,” “chunk” and “collapsed” to make the event sound far more dramatic and extraordinary than it is.

Despite a period of stability in the 1980s, the Ward Hunt shelf and its characteristic corrugated surface has been steadily declining since the 1930s, said Mueller. Its southern edge has lost 20 square kilometres over the last six years.

The steady decline since 1930 is consistent with temperatures since then, and stability in the 1980s was likely due to the global cooling that occurred from 1942 to 1980. A loss of approximately 3 square kilometres per year over six years is insignificant and likely well within longer-term changes in the extent of the ice shelf.

Mueller now believes the Serson Ice Shelf, in an exposed position off Ellesmere's western coast, could be the next to start breaking up.

"It certainly wouldn't surprise me if something happened on the Serson. It's exposed right now. There's no ice around it."

This is speculation that is likely to be wrong if the cooling trend that started in 2000 continues as is expected.

Mueller is careful not to blame the Ward Hunt breakup specifically on climate change, but says it is consistent with the theory. The current Arctic climate certainly isn't reinforcing ice shelves.

"We're in a different climate now," he said. "It's not conducive to regrowing them. It's a one-way process."

It's the same all over the Arctic, said Gary Stern, co-leader of a major international research program on sea ice.

Speaking from the Coast Guard icebreaker Amundsen about 70 kilometres off the Mackenzie Delta, Stern said the Ward Hunt breakup is related to what he's seeing thousands of kilometres away.

What is he seeing thousands of kilometres away? From the NASA study, we already know wind pattern and sea ice conditions changed in 2007. However, we also know that the sea ice returned to above average levels in the winter of 2007-2008.

He hasn't seen any ice in weeks. Plans to set up an ice camp last February had to be abandoned when usually dependable ice didn't form for the second year in a row.

"Nobody on the ship is surprised anymore," said Stern. "We've been trying to get the word out for the longest time now that things are happening fast and they're going to continue to happen fast."

Stern is at best ingenuous. How would he explain this 1817 report written by the president of the Royal Society to the British Admiralty?

It will without doubt have come to your Lordship's knowledge that a considerable change of climate inexplicable at present to us must have taken place in the Circumpolar Regions, by which the severity of the cold that has for centuries past enclosed the seas in the high northern latitudes in an impenetrable barrier of ice has been during the last two years greatly abated This, with information of a similar nature derived from other sources; the unusual abundance of ice islands that have during the last two summers been brought by currents from Davies Straights into the Atlantic.

“Sea ice returned to above average levels in the winter of 2007-2008.”

This is a far more rapid and expansive change than is currently occurring, and it was long before human CO2 could be a factor.

“It seems that the Arctic is going to be a very different place within our lifetimes, and certainly within our children’s lifetimes.”

Dr. Mark Serreze

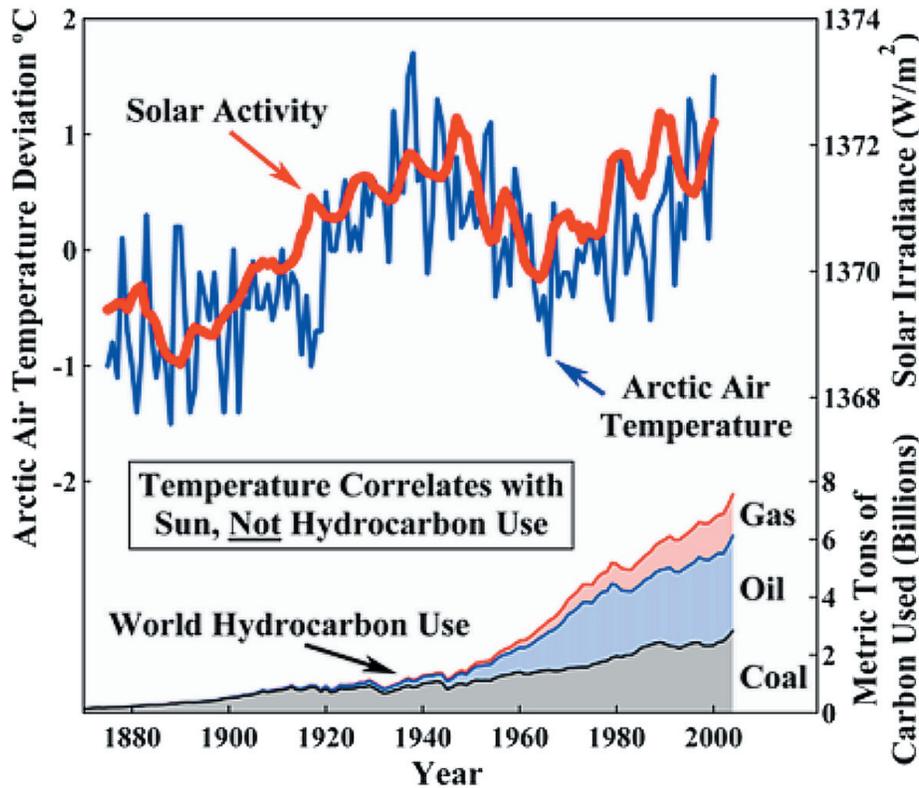
Many scientists now believe that the Arctic will have ice-free summers by 2013 instead of 2030 as predicted by the International Panel on Climate Change. Annual ice loss since the 1970s has quickened from about 75,000 square kilometres every summer to about 1.4 million square kilometres, said Stern.

The Intergovernmental Panel on Climate Change (IPCC) did not predict ice-free summers by 2030. Their February 2007 report said that unless a significant reduction in greenhouse gas emissions occurs, Arctic sea ice would “almost entirely” disappear by the end of the century. The 2030 prediction appears to originate from a story in the British newspaper *The Guardian*.

<http://www.guardian.co.uk/environment/2007/sep/05/climatechange.sciencenews>

Dr. Mark Serreze, an Arctic ice expert with the National Snow and Ice Data Center, said, “If you asked me a couple of years ago when the Arctic could lose all of its ice, then I would have said 2100, or 2070 maybe. But now I think that 2030 is a reasonable estimate. It seems that the Arctic is going to be a very different place within our lifetimes, and certainly within our children’s lifetimes.”

It is not possible to determine that “ice loss since the 1970s has quickened” because accurate satellite measures of Arctic ice only began in 1979. The fact that ice extent reduced from then until 2000 is not surprising since global temperatures were rising during that period. Increase in “ice loss,” stressed by the word “quickened” needs a context. Each year, the change in ice extent is approximately 10 million square kilometres. In summer, there are approximately 5.5 million square kilometres and in winter, 15.5 million square kilometres. Therefore, the percentage that melted increased from 0.75 per cent to 14 per cent, which, although significant, is not outside of long-term, normal variability. For example, how much melting occurred during the Holocene Optimum between 5000 and 3000 BC when global temperatures were at least 4°C warmer than they are now? How much melting occurred from 1910 to 1940 when Arctic temperatures increased more than they did in the period from 1980 to 2000 as illustrated by the following chart (next page)?

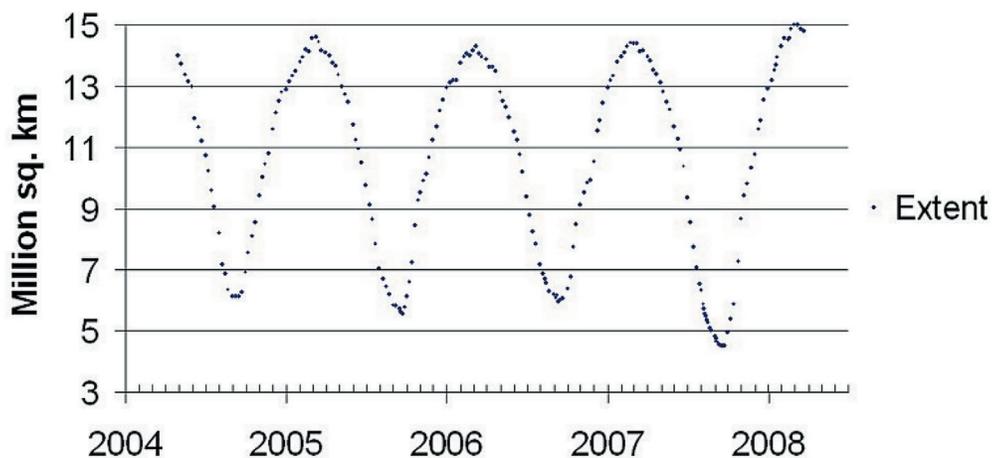


Source: <http://www.oism.org/pproject/s33p36.htm>

Ice disappearing by 2030 or 2013 are simple linear trends and incorrect given the history of fluctuations. There has been slight cooling since 2000, and in the winter of 2008, global temperatures dropped 0.774°C, which exceeds the warming the IPCC claimed has occurred since at least the beginning of the 20th century.

As of March 22, 2008, Environment Canada analysis indicates sea ice cover over the Northern Hemisphere reached its maximum extent and is about 3 per cent above the maximum extent that was reached over the last three years.

Arctic Sea Ice Extent



Source: Environment Canada

"It's all connected" ... It is simply incorrect. Ice melt is not connected to the warming climate, because since 2000 the world has cooled.

By July of 2008, ice conditions were 1 million square kilometres above 2007 levels and at average levels for the period of record since accurate satellite became available in 1979.

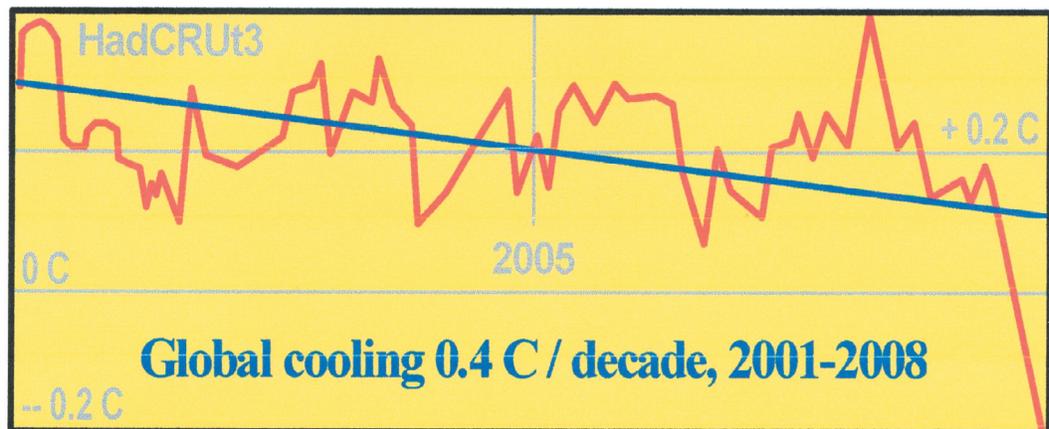
The National Snow and Ice Data Center reported a continuation of this recovery.

Arctic sea ice extent on July 31 stood at 7.71 million square kilometers (3.98 million square miles). While extent was below the 1979 to 2000 average of 8.88 million square kilometers (3.43 million square miles), it was 0.89 million square kilometers (0.35 million square miles) above the value for July 31, 2007. As is normal for this time of year, melt is occurring throughout the Arctic, even at the North Pole.

The pattern of ice melt is different in 2008 from that of 2007. Most of the melting has taken place in the Beaufort Sea and much less in the East Siberian and Laptev Seas.

"It's all connected to the warming climate. Everything is connected together."

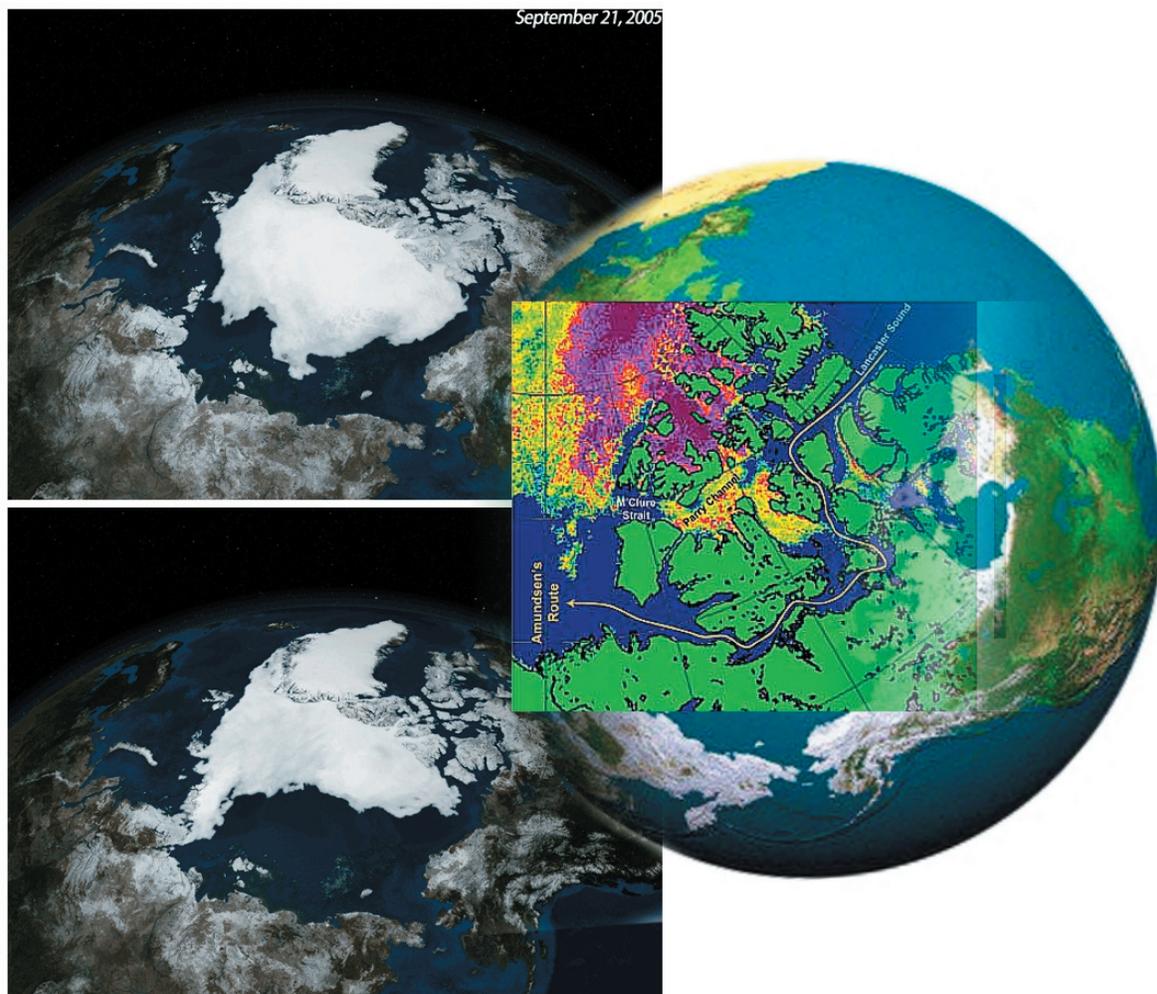
This quote is from Gary Stern co-leader of the international Arctic research program. It is simply incorrect. It is not connected to the warming climate, because since 2000 the world has cooled. Here is a plot from the Hadley Centre for Forecasting/Climate Research Unit (more commonly known as HadCRUT3) for the period from 2001 to 2008 inclusive. Phil Jones, who produced the original claim of 0.6°C unprecedented warming since the beginning of the 20th century, is the director of the Climate Research Unit.



Unpredicted trend: Since late 2001, the trend of global surface temperatures has been downward. "Global warming" paused in 1998; and, though it may resume in future years, the rate of warming is less than that which the models relied upon by the IPCC had projected. Source: Hadley Centre for Forecasting/Climate Research Unit, University of East Anglia.

Conclusion

With a combination of overstatement of speculated possibilities and understatement of uncertainty, it is possible for media reports on scientific matters to present simplistic and emotionally arresting messages that are completely disconnected from what scientists actually understand. The volume of analysis presented here for a relatively short media article is indicative of the amount of detail and uncertainty that can be ignored in the rush to present a headline-grabbing case. When the quality of analysis improves and scientific skepticism is given a greater role in reports of this kind, the public will be able to develop opinions on scientific matters such as the state of the Arctic sea ice and climate change that connect with what scientists truly understand.



More Frontier Backgrounders on the Environment

ENVIRONMENTAL EDUCATION
March 2008

THE URBAN HEAT ISLAND EFFECT
IN WINNIPEG
September 2007

CLIMATE CHANGE IN DISARRAY
An African Perspective
July 2007

CLIMATE CHANGE IN THE RECENT PAST
April 2007

MOSQUITO CONTROL WITH MALATHION:
Are There Public Health Consequences?
August 2005

More Frontier Policy Series on the Environment

QUESTIONING THE GLOBAL WARMING
SCIENCE
March 2008

A THREAD DOWN A FOOTBALL FIELD
December 2007

MANITOBA'S WATER PROTECTION ACT
April 2006

AN ENVIRONMENTAL POLICY FOR THE
21ST CENTURY
October 2005

THE FEDERALIZATION OF PRAIRIE
FRESHWATERS
December 2001

THE CAUSE OF GLOBAL WARMING
January 2001



Smart Green

For more on environmental policy see the SmartGreen Frontiers Project at

www.fcpp.org

ABOUT THE AUTHOR



Tim Ball, Senior Fellow, has an extensive science background in climatology, especially the reconstruction of past climates and the impact of climate change on human history and the human condition. He also has experience in water resources and areas of sustainable development, pollution prevention, environmental regulations and the impact of government policy on business and economics. He is a regular contributing writer for *Country Guide* magazine and the researcher-author of numerous papers on climate, long-range weather patterns, the impact of climate change on sustainable agriculture, ecosystems, historical climatology, air quality, untapped energy resources, silting and flooding problems. He had a long academic career at the University of Winnipeg until he moved to Victoria in 1996. He has a BA from the University of Winnipeg, an MA from the University of Manitoba and a PhD in science from the University of London, England.

The Frontier Centre for Public Policy is an independent, non-profit organization that under-takes research and education in support of economic growth and social outcomes that will enhance the quality of life in our communities. Through a variety of publications and public forums, the Centre explores policy innovations required to make the eastern prairies region a winner in the open economy. It also provides new insights into solving important issues facing our cities, towns and provinces. These include improving the performance of public expenditures in important areas like local government, education, health and social policy.

The author of this study has worked independently and the opinions expressed are therefore his own, and do not necessarily reflect the opinions of the Board of the Frontier Centre for Public Policy.

Frontier Centre for Public Policy

MB: 207-2727 Portage Avenue,
Winnipeg, Manitoba Canada R3J 0R2
Tel: 204 977-5049 Fax: 204 957-1570

SK: 2353 McIntyre Street,
Regina, Saskatchewan Canada S4P 2S3
Tel: 306 352-2915 Fax: 306 352-2938

AB: Ste. 2000 – 444, 5th Avenue SW
Calgary, Alberta Canada T2P 278
Tel: (403) 230-2435

Copyright © 2008 by the Frontier Centre for Public Policy
Online at www.fcpp.org Email: newideas@fcpp.org

