



Greenhaven Press's At Issue series provides a wide range of opinions on individual social issues. Each volume focuses on a specific issue and offers a variety of perspectives—eyewitness accounts, governmental views, scientific analysis, newspaper and magazine accounts, and many more—to illuminate the issue. Extensive bibliographies and annotated lists of relevant organizations point to sources for further research. Enhancing critical thinking skills, each At Issue volume is an excellent research tool to help readers understand current social issues and prepare reports.



Visit Greenhaven Press
online at gale.cengage.com/greenhaven
Visit our corporate website
at cengage.com

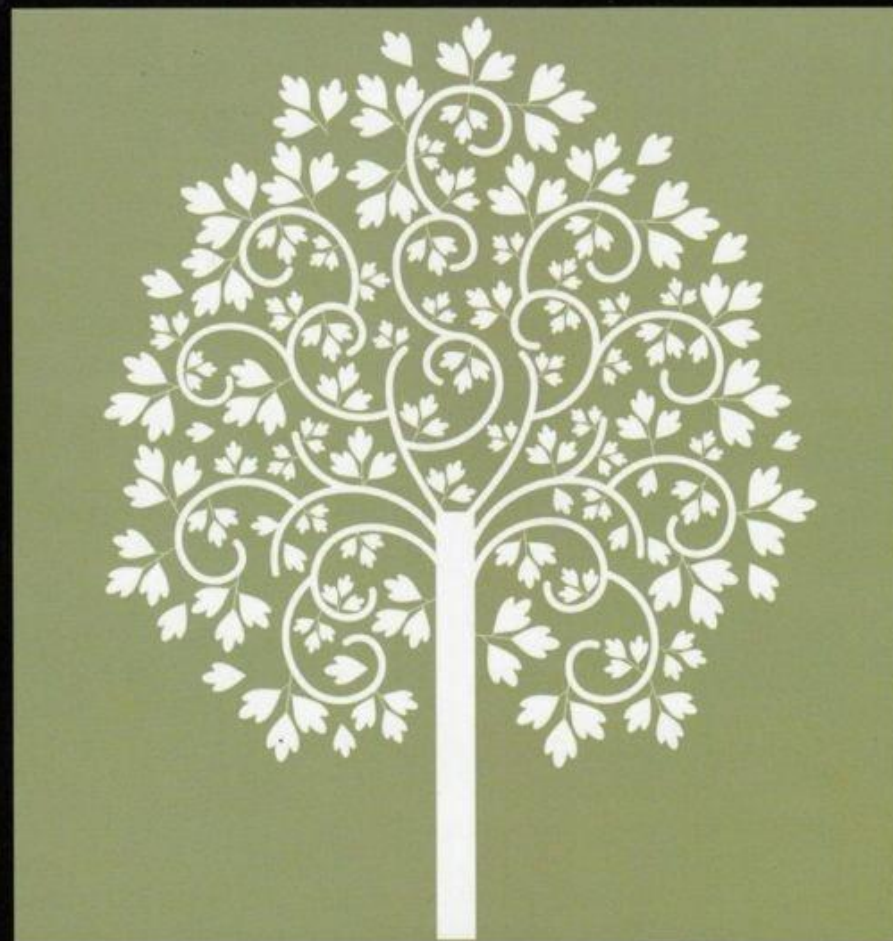
ISBN-13: 978-07377-6826-8

ISBN-10: 07377-6826-6



9 780737 768268

Can Glacier and Ice Melt Be Reversed?



at  issue
ENVIRONMENT



At Issue

| Can Glacier and Ice Melt Be Reversed?

Roman Espejo, Book Editor

GREENHAVEN PRESS

A part of Gale, Cengage Learning

Elizabeth Des Chenes, *Director, Content Strategy*
Cynthia Sanner, *Publisher*
Douglas Dentino, *Manager, New Product*

© 2014 Greenhaven Press, a part of Gale, Cengage Learning.

WCN: 01-100-101

Gale and Greenhaven Press are registered trademarks used herein under license.

For more information, contact:

Greenhaven Press

27500 Drake Rd.

Farmington Hills, MI 48331-3535

Or you can visit our Internet site at gale.cengage.com

ALL RIGHTS RESERVED.

No part of this work covered by the copyright herein may be reproduced, transmitted, stored, or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitizing, taping, Web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher.

For product information and technology assistance, contact us at

Gale Customer Support, 1-800-877-4253

For permission to use material from this text or product, submit all requests online at www.cengage.com/permissions

Further permissions questions can be e-mailed to permissionrequest@cengage.com

Articles in Greenhaven Press anthologies are often edited for length to meet page requirements. In addition, original titles of these works are changed to clearly present the main thesis and to explicitly indicate the author's opinion. Every effort is made to ensure that Greenhaven Press accurately reflects the original intent of the authors. Every effort has been made to trace the owners of copyrighted material.

Cover image © Debra Hughes 2007. Used under license from Shutterstock.com.

LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Can glacier and ice melt be reversed? / Roman Espejo, book editor.
pages cm. -- (At issue)

Includes bibliographical references and index.

ISBN 978-0-7377-6826-8 (hardcover) -- ISBN 978-0-7377-6827-5 (pbk.)

1. Glaciers--Climatic factors--Arctic regions. 2. Glaciers--Climatic factors--Polar regions. 3. Climatic changes--Environmental aspects--Arctic regions. 4. Climatic changes--Environmental aspects--Polar regions. 5. Sea ice--Arctic regions. 6. Sea ice--Polar regions. 7. Global warming--Arctic regions. 8. Global warming--Polar regions. I. Espejo, Roman, 1977- editor of compilation.

QC903.2.A68C36 2014

551.31--dc23

2013037190

Contents

Introduction	7
1. The Melting of Glaciers Cannot Be Reversed <i>Tim Appenzeller</i>	10
2. Glaciers Are Growing, Not Melting <i>Robert Felix</i>	22
3. Third-World Stove Soot Is Target in Climate Fight <i>Elisabeth Rosenthal</i>	30
4. The Melting of Arctic Ice Cannot Be Reversed <i>Fen Montaigne</i>	36
5. The Media Exaggerates the Extent of Ice Melt in the Arctic <i>Ben Pile</i>	43
6. Ice Sheets Are Melting at an Increasing Rate <i>Irene Quaile</i>	52
7. The Melting of Glaciers Cannot Be Reversed with Global Warming <i>Bharat Raj Singh and Onkar Singh</i>	56
8. Ice Sheets Are Not Collapsing <i>Cliff Ollier</i>	64
9. Antarctica Is Melting <i>Erik Conway</i>	71

10. Antarctica Is Not Melting	76
<i>Marc Sheppard</i>	
11. Global Warming: Impact of Receding Snow and Ice Surprises Scientists	82
<i>Pete Spotts</i>	
12. Permafrost Is Melting	86
<i>Ben Cubby</i>	
13. Permafrost Warming Is Widely Misunderstood	93
<i>Guido Grosse et al.</i>	
Organizations to Contact	97
Bibliography	104
Index	108

The Melting of Glaciers Cannot Be Reversed with Global Warming

Bharat Raj Singh and Onkar Singh

Bharat Raj Singh is a professor and director of School of Management Sciences, Technical Campus, Lucknow, Uttar Pradesh, India. Onkar Singh is a professor at Harcourt Butler Technological Institute, Kanpur, Uttar Pradesh, India.

Ice sheets and glaciers are more vulnerable to climate change than previously estimated. According to a recent study, the Greenland ice sheet may completely melt if a temperature threshold of 1.6 degrees Celsius above preindustrial levels is reached—a rise of 0.8 degrees Celsius has already been recorded. Satellite images also reveal that Arctic sea ice has retreated to a record low in August 2012, and scientists predict that it will disappear during the summers in two decades. Research reveals that 70 percent of sea ice loss in the Arctic results from man-made climate change. These findings are an alarm call for significant reductions in carbon emissions and a focus on renewable energy sources.

Earth's climate changes naturally and such changes in the intensity of sunlight reaching the earth cause cycles of warming and cooling that have been a regular feature of the Earth's climatic history. Some of these solar cycles—like the four glacial-interglacial swings during the past 400,000 years—

Bharat Raj Singh and Onkar Singh, "Chapter 2: A Study About Realities of Climate Change: Glacier Melting and Growing Crises," *Climate Change—Realities, Impacts Over Ice Cap, Sea Level and Risks*, inTech Publisher, 51000 Rijeka, Croatia, 2013, pp. 42, 45–50. Copyright © 2013 by Bharat Raj Singh and Onkar Singh. All rights reserved. Reproduced by permission.

extend over very long time scales and can have large amplitudes of 5 to 6°C. For the past 10,000 years, the earth has been in the warm interglacial phase of such a cycle. Other solar cycles are much shorter, with the shortest being the 11 year sunspot cycle. Other natural causes of climate change include variations in ocean currents (which can alter the distribution of heat and precipitation) and large eruptions of volcanoes (which can sporadically increase the concentration of atmospheric particles, blocking out more sunlight). Still, for thousands of years, the Earth's atmosphere has changed very little. Temperature and the balance of heat-trapping greenhouse gases have remained just right for humans, animals and plants to survive. But today we're having problems keeping this balance, because we burn fossil fuels to heat our homes, run our cars, produce electricity, and manufacture all sorts of products, we're adding more greenhouse gases to the atmosphere. By increasing the amount of these gases, the warming capability of the natural greenhouse effect is enhanced. It's the human-induced enhanced greenhouse effect that causes environmental concern, because it has the potential to warm the planet at a rate that has never been experienced in human history. . . .

Greenland Ice Sheet May Melt Completely with 1.6 Degrees of Global Warming

The Greenland ice sheet is likely to be more vulnerable to global warming than previously thought. The temperature threshold for melting the ice sheet completely is in the range of 0.8 to 3.2 degrees Celsius of global warming, with a best estimate of 1.6 degrees above pre-industrial levels, shows a new study by scientists from the Potsdam Institute for Climate Impact Research (PIK) and the Universidad Complutense de Madrid. Today, already 0.8 degrees of global warming has been observed. Substantial melting of land ice could contribute to

long-term sea-level rise of several meters and therefore it potentially affects the lives of many millions of people.

The time it takes before most of the ice in Greenland is lost strongly depends on the level of warming. "The more we exceed the threshold, the faster it melts," says Alexander Robinson, lead-author of the study now published in *Nature Climate Change*. In a business-as-usual scenario of greenhouse-gas emissions, in the long run humanity might be aiming at 8 degrees Celsius of global warming. This would result in one fifth of the ice sheet melting within 500 years and a complete loss in 2000 years, according to the study. "This is not what one would call a rapid collapse," says Robinson. "However, compared to what has happened in our planet's history, it is fast. And we might already be approaching the critical threshold."

If the global temperature significantly overshoots the threshold for a long time, the ice [in Greenland] will continue melting and not regrow—even if the climate would, after many thousand years, return to its pre-industrial state.

In contrast, if global warming would be limited to 2 degrees Celsius, complete melting would happen on a timescale of 50,000 years. Still, even within this temperature range often considered a global guardrail, the Greenland ice sheet is not secure. Previous research suggested a threshold in global temperature increase for melting the Greenland ice sheet of a best estimate of 3.1 degrees, with a range of 1.9 to 5.1 degrees. The new study's best estimate indicates about half as much.

"Our study shows that under certain conditions the melting of the Greenland ice sheet becomes irreversible. This supports the notion that the ice sheet is a tipping element in the Earth system," says team-leader Andrey Ganopolski of PIK. "If the global temperature significantly overshoots the threshold

for a long time, the ice will continue melting and not re-grow—even if the climate would, after many thousand years, return to its preindustrial state.” This is related to feedbacks between the climate and the ice sheet: The ice sheet is over 3000 meters thick and thus elevated into cooler altitudes. . . . When it melts its surface comes down to lower altitudes with higher temperatures, which accelerates the melting. Also, the ice reflects a large part of solar radiation back into space. When the area covered by ice decreases, more radiation is absorbed and this adds to regional warming.

The scientists achieved insights by using a novel computer simulation of the Greenland ice sheet and the regional climate. This model performs calculations of these physical systems including the most important processes, for instance climate feedbacks associated with changes in snowfall and melt under global warming. The simulation proved able to correctly calculate both the observed ice-sheet of today and its evolution over previous glacial cycles, thus increasing the confidence that it can properly assess the future. All this makes the new estimate of Greenland temperature threshold more reliable than previous ones. . . .

Arctic Sea Ice Shrinks to Smallest Extent Ever Recorded

Sea ice in the Arctic has shrunk to its smallest extent ever recorded, smashing the previous record minimum and prompting warnings of accelerated climate change. Satellite images show that the rapid summer melt has reduced the area of frozen sea to less than 3.5 million square kilometres this week from 27 August 2012—less than half the area typically occupied four decades ago. Arctic sea ice cover has been shrinking since the 1970s when it averaged around 8m sq km a year, but such a dramatic collapse in ice cover in one year is highly unusual.

A record low in 2007 of 4.17 million sq km was broken on Monday, 27 August 2012; further melting has since amounted to more than 500,000 sq km. The record, which is based on a five-day average, is expected to be officially declared in the next few days by the National Snow and Ice Data Centre (NSIDC) in Colorado. The NSIDC's data shows the sea ice extent is bumping along the bottom, with a new low of 3.421m sq km on Tuesday, which rose very slightly to 3.429m sq km on Wednesday and 3.45m sq km on Thursday. . . .

Scientists have predicted on 31st August 2012 that the Arctic Ocean could be ice-free in summer months within 20 years, leading to possibly major climate impacts. "I am surprised. This is an indication that the Arctic sea ice cover is fundamentally changing. The trends all show less ice and thinner ice," said Julienne Stroeve, a research scientist with the NSIDC.

The disappearance of Arctic ice is the most visible warning sign of the need to tackle climate change and ensure we have a world fit to pass on to the next generation.

"We are on the edge of one of the most significant moments in environmental history as sea ice heads towards a new record low. The loss of sea ice will be devastating, raising global temperatures that will impact on our ability to grow food and causing extreme weather around the world," said John Sauven, director of Greenpeace UK.

Sea ice experts said that they were surprised by the collapse because weather conditions were not conducive to a major melt this year. The ice is now believed to be much thinner than it used to be and easier to melt.

Arctic sea ice follows an annual cycle of melting through the warm summer months and refreezing in the winter. The

sea ice plays a critical role in regulating climate, acting as a giant mirror that reflects much of the Sun's energy, helping to cool the Earth.

David Nussbaum, chief executive of WWF-UK, said: "The disappearance of Arctic ice is the most visible warning sign of the need to tackle climate change and ensure we have a world fit to pass on to the next generation. The sheer scale of ice loss is shocking and unprecedented. This alarm call from the Arctic needs to reverberate across Whitehall and boardrooms. We can all take action to cut carbon emissions and move towards a 100% renewable economy."

Ed Davey, the UK climate and energy secretary, said: "These findings highlight the urgency for the international community to act. We understand that Arctic sea-ice decline has accelerated over recent years as global warming continues to increase Arctic temperatures at a faster rate than the global average.

"This Government is working hard to tackle climate change and we are working closely with our international partners not to exceed 2 degrees above pre industrial levels. I am calling for the EU to increase its emission target from 20% to 30% and will be taking an active lead at the UNFCCC [United Nations Framework Convention on Climate Change] Climate change talks in Doha later this year, where I will push for further progress towards a new global deal on climate change and for more mitigation action now. The fact is that we cannot afford to wait."

Canadian scientists said that the record melt this year could lead to a cold winter in the UK and Europe, as the heat in the Arctic water will be released into the atmosphere this autumn, potentially affecting the all-important jet stream. While the science is still developing in this area, the Met Office said in May that the reduction in Arctic sea ice was contributing in part to the colder, drier winters the UK has been experiencing in recent years. . . .

Loss of Arctic Sea Ice Mostly Due to Human Causes

[The] study finds only 30% of radical loss of summer sea ice is due to natural variability in Atlantic—and it will probably get worse. Since the 1970s, there has been a 40% decrease in the extent of summer sea ice. The radical decline in sea ice around the Arctic is at least 70% due to human-induced climate change, according to a new study, and may even be up to 95% [due] to humans—rather higher than scientists had previously thought. The loss of ice around the Arctic has adverse effects on wildlife and also opens up new northern sea routes and opportunities to drill for oil and gas under the newly accessible sea bed. . . . The reduction has been accelerating since the 1990s and many scientists believe the Arctic may become ice-free in the summers later this century, possibly as early as the late 2020s.

“Since the 1970s, there’s been a 40% decrease in the summer sea ice extent,” said Jonny Day, a climate scientist at the National Centre for Atmospheric Science at the University of Reading, who led the latest study.

“We were trying to determine how much of this was due to natural variability and therefore imply what aspect is due to man-made climate change as well.”

To test the ideas, Day carried out several computer-based simulations of how the climate around the Arctic might have fluctuated since 1979 without the input of greenhouse gases from human activity.

He found that a climate system called the Atlantic multi-decadal oscillation (AMO) was a dominant source of variability in ice extent. The AMO is a cycle of warming and cooling in the North Atlantic that repeats every 65 to 80 years—it has been in a warming phase since the mid-1970s.

Comparing the models with actual observations, Day was able to work out what contribution the natural systems had made to what researchers have observed from satellite data.

“We could only attribute as much as 30% [of the Arctic ice loss] to the AMO,” he said. “Which implies that the rest is due to something else, and this is most likely going to be man-made global change?”

Previous studies had indicated that around half of the loss was due to man-made climate change and that the other half was due to natural variability. Looking across all his simulations, Day found that the 30% figure was an upper limit—the AMO could have contributed as little as 5% to the overall loss of Arctic ice in recent decades.

The research is published online in the journal *Environmental Research Letters*. Day said that there are a number of feedback effects that could see the Arctic ice loss continue in the coming years, as the Earth warms up. “[There is] something called the ice-albedo feedback, which means that when you have less ice, it means there’s more open water and therefore the ocean absorbs more radiation and will continue to warm,” he said.

“It’s unclear what will happen—it definitely seems like it’s going in that direction.”