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An Introduction to its Physics, Chemistry, Biology and Geology
Springer Nature
Based on the proceedings of the NATO Advanced Study Institute on Air-Sea-Ice Interaction held September 28-October 10, 1981 in Acquafredda di maratea, Italy. Intent is to present the topic of sea ice in the broad and interdisciplinary context of atmospheric and oceanographic

science.
Sea of Ice
Morgan & Claypool Publishers
This book provides an advanced introduction to the science behind automated prediction systems, focusing on sea ice analysis and forecasting. Starting from basic principles, fundamental concepts in sea ice physics, remote sensing, numerical methods, and statistics are explained at an accessible level. Existing operational automated prediction systems are described and their impacts on information providers and end clients are discussed. The book also provides insight into the likely future development of sea ice services and how they will evolve from mainly manual processes to increasing automation, with a consequent increase in the diversity and information content of new ice products. With contributions from world-leading experts in the fields of sea ice remote sensing, data assimilation, numerical modelling, and verification and operational prediction, this comprehensive reference is ideal for students, sea ice analysts, and researchers, as well as decision-makers and professionals working in the ice service industry.
The Meaning

of Ice
Springer Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 180. This volume addresses the rapid decline of Arctic sea ice, placing recent sea ice decline in the context of past observations, climate model simulations and projections, and simple models of the climate sensitivity of sea ice. Highlights of the work presented here include An appraisal of the role played by wind forcing in driving the decline; A reconstruction of Arctic sea ice conditions prior to human observations, based on proxy data from sediments; A modeling approach for assessing the impact of sea ice decline on polar bears, used as input to the U.S. Fish and Wildlife Service's decision to list the polar bear as a threatened species under the Endangered Species Act; Contrasting studies on the existence of a "tipping point," beyond which Arctic sea ice decline will become (or has already become) irreversible, including an examination of the role of the small ice cap instability in global warming simulations; A significant summertime atmospheric response to sea ice reduction in an

atmospheric general circulation model, suggesting a positive feedback and the potential for short-term climate prediction. The book will be of interest to researchers attempting to understand the recent behavior of Arctic sea ice, model projections of future sea ice loss, and the consequences of sea ice loss for the natural and human systems of the Arctic.

Arctic Sea Ice Decline

Springer Science & Business Media

The Arctic sea ice is characterized by profound changes caused by surface melting processes and the formation of melt ponds in summer. Melt ponds contribute to the ice-albedo feedback as they reduce the surface albedo of sea ice, and hence accelerate the decay of Arctic sea ice. To quantify the melting of the entire Arctic sea ice, satellite based observations are necessary. Due to different spectral properties of snow, ice, and water, theoretically, multi-spectral optical sensors are necessary for the analysis of these distinct surface types. This study demonstrates the potential of optical sensors to detect melt ponds on Arctic sea ice. For the first time, an Arctic-wide, multi-annual melt pond data set for the years 2000-2011 has been

created and analyzed.

Brave New Arctic

Cambridge University Press

Sea Ice: Physics and Remote Sensing addresses experiences acquired mainly in Canada by researchers in the fields of ice physics and growth history in relation to its polycrystalline structure as well as ice parameters retrieval from remote sensing observations. The volume describes processes operating at the macro- and microscale (e.g., brine entrapment in sea ice, crystallographic texture of ice types, brine drainage mechanisms, etc.). The information is supported by high-quality photographs of ice thin-sections prepared from cores of different ice types, all obtained by leading experts during field experiments in the 1970s through the 1990s, using photographic cameras and scanning microscopy. In addition, this volume presents techniques to retrieve a suite of sea ice parameters (e.g. ice type, concentration, extent, thickness, surface temperature, surface deformation, etc.) from space-borne and airborne sensor data. The breadth of the material on this subject is designed to appeal to researchers and users of remote

sensing data who want to develop quick familiarity with the capabilities of this technology or detailed knowledge about major techniques for retrieval of key ice parameters. Volume highlights include: Detailed crystallographic classification of natural sea ice, the key information from which information about ice growth conditions can be inferred. Many examples are presented with material to support qualitative and quantitative interpretation of the data. Methods developed for revealing microstructural characteristics of sea ice and performing forensic investigations. Data sets on radiative properties and satellite observations of sea ice, its snow cover, and surrounding open water. Methods of retrieval of ice surface features and geophysical parameters from remote sensing observations with a focus on critical issues such as the suitability of different sensors for different tasks and data synergism. Sea Ice: Physics and Remote Sensing is intended for a variety of sea ice audiences interested in different aspects of ice related to physics, geophysics, remote sensing, operational monitoring,

mechanics, and cryospheric sciences. **A Perspective Across Scales** John Wiley & Sons The processes and consequences of climate change are extremely heterogeneous, encompassing many different fields of study. Dr David Rind in his career at the NASA Goddard Institute for Space Studies and as a professor at Columbia University has had the opportunity to explore many of these subjects with colleagues from these diverse disciplines. It was therefore natural for the Lectures in Climate Change series to begin with his colleagues contributing lectures on their specific areas of expertise.This first volume, entitled Our Warming Planet: Topics in Climate Dynamics, encompasses topics such as natural and anthropogenic climate forcing, climate modeling, radiation, clouds, atmospheric dynamics/storms, hydrology, clouds, the cryosphere, paleoclimate, sea level rise, agriculture, atmospheric chemistry, and climate change education. Included with this publication are downloadable PowerPoint slides of each lecture for students and teachers around the world to be better able to understand various aspects of

climate change.The lectures on climate change processes and consequences provide snapshots of the cutting-edge work being done to understand what may well be the greatest challenge of our time, in a form suitable for classroom presentation.

Sea Ice in the Arctic

American Geophysical Union

When humans first walked the world and learn to live in an exotic new world of mystery and danger.

The Wreck of the Endurance

Springer

This book provides an overview of the current state of knowledge of Arctic ice shelves, ice islands and related features. Ice shelves are permanent areas of ice which float on the ocean surface while attached to the coast, and typically occur in very cold environments where perennial sea ice builds up to great thickness, and/or where glaciers flow off the land and are preserved on the ocean surface. These landscape features are relatively poorly studied in the Arctic, yet they are potentially highly sensitive indicators of climate change because they respond to changes in atmospheric, oceanic and glaciological conditions. Recent fracturing and breakup events of ice shelves in the Canadian High

Arctic have attracted significant scientific and public attention, and produced large ice islands which may pose a risk to Arctic shipping and offshore infrastructure. Much has been published about Antarctic ice shelves, but to date there has not been a dedicated book about Arctic ice shelves or ice islands. This book fills that gap.

The Untold Story of the Melting North John Wiley & Sons Overview of sea ice growth and properties / Chris Petrich & Hajo Eicken -- Sea ice thickness distribution / Christian Haas -- Snow in the sea-ice system : friend or foe? / Matthew Sturm & Robert A. Massom -- Sea ice and sunlight / Donald K. Perovich -- The sea ice-ocean boundary layer / Miles G. McPhee -- The atmosphere over sea ice / Ola Persson & Timo Vihma -- Sea ice and arctic ocean oceanography / Finlo Cottier, Mike Steele & Frank Nielsen -- Oceanography and sea ice in the southern ocean / Michael P. Meredith & Mark A. Brandon -- Methods of satellite remote sensing of sea ice / Gunnar Spreen & Stefan Kern -- Gaining (and losing) antarctic sea ice : variability, trends and mechanisms / Sharon Stammerjohn & Ted Maksym

Maria V. Gavrilo -- Birds and antarctic sea ice / David Ainley, Eric J. Woehler & Amelie Lescroel -- Sea ice is our beautiful garden : indigenous perspectives on sea ice of sea ice in the arctic / Henry P. Huntington, Shari Gearheard, Lene Kielsen Holm, George Noongwook, Margaret Opie & Joelie Sanguya -- Advances in palaeo sea-ice estimation / Leanne Armand, Alexander Ferry & Amy Leventer -- Ice in subarctic seas / Hermanni Kaartokallio, Mats A. Granskog, Harri Kuosa & Jouni Vainio

Introduction to the Physics of the Cryosphere

Springer Science & Business Media

The Second Edition of The Drift of Sea Ice presents the fundamental laws of sea ice drift which come from the material properties of sea ice and the basic laws of mechanics. The resulting system of equations is analysed for the general properties of sea ice drift, the free drift model and analytical models for ice drift in the presence of internal friction, and the construction of numerical ice drift models is detailed. This second edition of a much lauded work, unique on this topic in the English language, has been revised, updated and expanded with much new information

and outlines recent results, in particular in relation to the climate problem, mathematical modelling and ice engineering applications. The current book presents the theory, observations, mathematical modelling techniques, and applications of sea ice drift science. The theory is presented from the beginning on a graduate student level, so that students and researchers coming from other fields such as physical oceanography , meteorology, physics, engineering, environmental sciences or geography can use the book as a source book or self-study material. First the drift ice material is presented ending with the concept of ‘ice state’ – the relevant properties in sea ice dynamics. Ice kinematics observations are widely presented with the mathematical analysis methods, and thereafter come drift ice rheology – to close the triangle material – kinematics – stress. The momentum equation of sea ice is derived in detail and its general properties are carefully analysed. Then follow two chapters on analytical models: free drift and drift in the presence of internal friction: These are very important tools in understanding the dynamical

behaviour of sea ice. The last topical chapter is numerical models, which are the modern tool to solve ice dynamics problem in short term and long term problems. The closing chapter summarises sea ice dynamics applications and the need of sea ice dynamic knowledge and gives some final remarks on the future of this branch of science.

Report on Sea Ice Conditions in the Arctic, Summer 1956

University of Alaska Press

Finalist for the 2020 PEN / E.O. Wilson Literary Science Writing Award

Acclaimed on its hardcover publication, a global journey that reminds us "of how magical the planet we're about to lose really is" (Bill McKibben) With a new epilogue by the author After nearly a decade overseas as a war reporter, the acclaimed journalist Dahr Jamail returned to America to renew his passion for mountaineering, only to find that the slopes he had once climbed have been irrevocably changed by climate disruption. In response, Jamail embarks on a journey to the geographical front lines of this crisis—from Alaska to Australia's Great Barrier Reef, via the Amazon rainforest—in order to discover the consequences to nature and to humans of

the loss of ice. In The End of Ice, we follow Jamail as he scales Denali, the highest peak in North America, dives in the warm crystal waters of the Pacific only to find ghostly coral reefs, and explores the tundra of St. Paul Island where he meets the last subsistence seal hunters of the Bering Sea and witnesses its melting glaciers. Accompanied by climate scientists and people whose families have fished, farmed, and lived in the areas he visits for centuries, Jamail begins to accept the fact that Earth, most likely, is in a hospice situation. Ironically, this allows him to renew his passion for the planet's wild places, cherishing Earth in a way he has never been able to before. Like no other book, The End of Ice offers a firsthand chronicle—including photographs throughout of Jamail on his journey across the world—of the catastrophic reality of our situation and the incalculable necessity of relishing this vulnerable, fragile planet while we still can.

Sea Ice

National Academies

An insider account of how scientists unraveled the mystery of the thawing Arctic In the 1990s, researchers in the Arctic noticed that floating summer sea ice had begun receding. This was accompanied

by shifts in ocean circulation and unexpected changes in weather patterns throughout the world. The Arctic's perennially frozen ground, known as permafrost, was warming, and treeless tundra was being overtaken by shrubs. What was going on? Brave New Arctic is Mark Serreze's riveting firsthand account of how scientists from around the globe came together to find answers. In a sweeping tale of discovery spanning three decades, Serreze describes how puzzlement turned to alarm as researchers concluded that the Arctic is rapidly thawing due to climate change—and humans are to blame.

Studies and Applications

Sea Ice

Published by the American Geophysical Union as part of the Geophysical Monograph Series, Volume 68. Human activities in the polar regions have undergone incredible changes in this century. Among these changes is the revolution that satellites have brought about in obtaining information concerning polar geophysical processes. Satellites have flown for about three decades, and the polar regions have been the subject of their routine surveillance for more than half that time. Our

observations of polar regions have evolved from happenstance ship sightings and isolated harbor icing records to routine global records obtained by those satellites. Thanks to such abundant data, we now know a great deal about the ice-covered seas, which constitute about 10% of the Earth's surface. This explosion of information about sea ice has fascinated scientists for some 20 years. We are now at a point of transition in sea ice studies; we are concerned less about ice itself and more about its role in the climate system. This change in emphasis has been the prime stimulus for this book.

Our Warming Planet: Topics In Climate Dynamics

World Scientific

Following a decision by the Arctic Ocean Sciences Board (AOSB) in July 1996 the then chainnan, Geoffrey Holland, wrote a letter of invitation to a meeting to plan a "Symposium on the Freshwater Balance of the Arctic". The meeting was held in Ottawa on November 12-13 1996 and was attended by representatives of various organisations, including the U.S. National Science Foundation (NSF), as well as individual scientists. Results of this meeting included: •

Co-sponsorship with AOSB by the Scientific Committee on Ocean Research (SCOR), the Arctic Climate System Study (ACSYS) and the Global Energy and Water Cycle Experiment (GEWEX). • A decision to apply for funding as a Advanced Research Workshop (ARW) of the North Atlantic Treaty Organisation (NATO) Scientific Affairs Division. • That expenses would be covered in part by funds available through an existing NSF grant to the SCOR Executive offices in Baltimore, MD. • The appointment of myself to be Chairman/Manager for the Symposium. • Provision of a recommended list of Scientific Advisors to assist the Chainnan in selecting key speakers.

The Geophysics of Sea Ice

Springer Science & Business Media

The book on sea ice ecology is the ecology of sea ice algae and other microorganism as bacteria, meiofauna, and viruses residing inside or at the bottom of the sea ice, called the sympagic biota. Organisms as seals, fish, birds, and Polar bears relies on sea ice but are not part of this biota. A distinct feature of this ecosystem, is the disappearance (melt) every summer and

re-establishing in autumn and winter. The book is organized seasonally describing the physical, optical, biological, and geochemical conditions typical of the seasons: autumn, winter, and spring. These are exemplified with case studies based on author's fieldwork in Greenland, the Arctic Ocean, and Antarctica but focused on Arctic conditions. The sea ice ecosystem is described in the context of climate change, interests, and effects of a decreasing summer ice extent in the Arctic Ocean. The book contains an up to date description of most relevant methods and techniques applied in sea ice ecology research. This book will appeal to university students at Masters or PhD levels reading biology, geosciences, and chemistry.

An Integrated Approach from Climate Change Perspectives
Oxford University Press
As much as one-tenth of the world's oceans are covered with sea ice, or frozen ocean water, at some point during the annual cycle. Sea ice thus plays an important, often defining, role in the natural environment and the global climate system. This book is a global look at the changes in sea ice and

the tools and techniques used to measure and record those changes. The first comprehensive research done on sea-ice field techniques, this volume will be indispensable for the study of northern sea ice and a must-have for scientists in the field of climate change research.
A Report on Sea Ice Conditions in the Eastern Arctic
Princeton University Press

Based on five decades of research and observation, a haunting and unsparing look at the melting ice caps, and what their disappearance will mean. Peter Wadhams has been studying ice first-hand since 1970, completing 50 trips to the world's poles and observing for himself the changes over the course of nearly five decades. His conclusions are stark: the ice caps are melting. Following the hottest summer on record, sea ice in September 2016 was the thinnest in recorded history. There is now the probability that within a few years the North Pole will be ice-free for the first time in 10,000 years, entering what some call the "Artic death spiral." As sea ice, as well as land ice on Greenland and Antarctica, continues to melt, the rise in sea levels will devastate coastal communities across the world. The collapse of

summer ice in the Artic will release large amounts of methane currently trapped by offshore permafrost. Methane has twenty-three times greater greenhouse warming effect per molecule than CO2; an ice-free arctic summer will therefore have an albedo effect nearly equivalent to that of the last thirty years. A sobering but urgent and engaging book, A Farewell to Ice shows us ice's role on our planet, its history, and the true dimensions of the current global crisis, offering readers concrete advice about what they can do, and what must be done.

Sea-Ice and Iceberg Sedimentation in the Ocean

Springer Science & Business Media

ICe in the Ocean examines sea ice and icebergs and their role in the global climate system. It is comprehensive textbook suitablefor students, pure and applied researchers, and anyone interested in the polar oceans; the distribution of sea ice; the mechanisms of growth, development and decay; the thermodynamics and dynamics of sea ice; sea ice defo

A Summary of Physical Phenomena

Elsevier

Understanding Present and Past Arctic Environments: An Integrated Approach from Climate

Change Perspectives provides a fully comprehensive overview of the past, present and future outlook for this incredibly diverse and important region. Through a series of contributed chapters, the book explores changes to this environment that are attributed to the effects of climate change. The book explores the current effects climate change has had on Arctic environments and ecosystems, our current understanding of the effects climate change is having, the effects climate change is having on the atmospheric and ocean processes in this region. The Arctic region is predicted to experience the earliest and most pronounced global warming response to human-induced climatic change, thus a better understanding is vital. Presents a thorough understanding of the Arctic, it’s past, present and future Provides an integrated assessment of the Arctic climate system, recognizing that a true understanding of its functions lies in appreciating the interactions and linkages among its various components Brings together many of the world's leading Arctic researchers to describe this

diverse environment and its ecology

The End of Ice John Wiley & Sons

This book provides in-depth information about the sea ice in the Arctic at scales from paleoenviron mental variability to more contemporary changes during the past and present centuries. The book is based on several decades of research related to sea ice in the Arctic and its variability, sea ice process studies as well as implications of the sea ice variability on human activities. The chapters provide an extensive overview of the research results related to sea ice in the Arctic at paleo-scales to more resent scales of variations as well as projections for changes during the 21st century. The authors have pioneered the satellite remote sensing monitoring of sea ice and used other monitoring data in order to study, monitor and model sea ice and its processes.

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