

# We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

186,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index  
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?  
Contact [book.department@intechopen.com](mailto:book.department@intechopen.com)

Numbers displayed above are based on latest data collected.  
For more information visit [www.intechopen.com](http://www.intechopen.com)

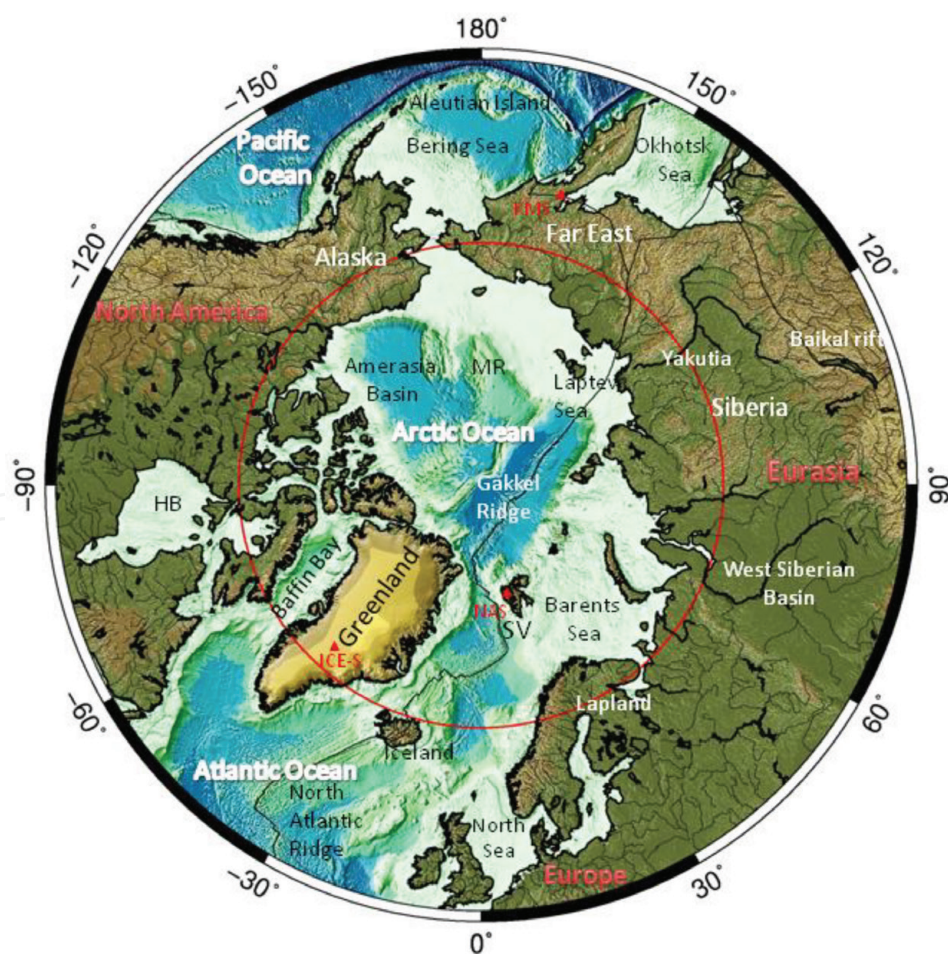


# Introductory Chapter: Arctic Studies - A Proxy for Climate Change

Masaki Kanao

## 1. Introduction

The Arctic region is a keystone to understand the present status of the currently ongoing Earth system, such as the climate change, together with to predict future images of our planet as viewed from the northern high latitude. The Arctic region, composed by the ice-covered Arctic Ocean in its center and surrounding fragmentation of major continents, has been rapidly investigated during the last half century



**Figure 1.** Surface topography and bathymetry in the Arctic (ETOPO1, [6]) with major geographic location names treated in this review paper. Plate boundaries are after [7]. Red solid circle represents the “Arctic circle” (66.6°N). Abbreviations of representative local names are as follows: SV, Svalbard; MR, Mendeleev Ridge; HB, Hudson Bay; red solid triangles are the permanent stations; KMS, Kamenskoye Station; NAS, Ny-Alesund Station; ICE-S (south). (Original figure prepared for this InTech Book: Arctic Studies).

by all kind of scientific studies including bioscience, physical sciences, geosciences, oceanography, and environmental studies, together with the technological domain. Major location names in the Arctic region are illustrated in **Figure 1**.

## **2. Scope of the book**

This book covers the topics on recent development of all kinds of scientific researches in and around the Arctic region, with a viewpoint to monitor the current variations in the extreme environment, affected by remarkable changes in temperature and sea-ice extent, mass loss of ice-sheet and glaciers, and variations in marine and terrestrial ecosystem including human activities. Multidisciplinary and interdisciplinary approaches are beneficial in polar researches, focusing on the interrelated perspectives which will be needed to understand and quantify their connections with the prediction of future climate system change.

In this concern, particularly the cryosphere system is likely to be influenced by temporal-spatial variations in surface environmental conditions in the Arctic, and continuous researches of their variability provide direct evidence of climate change. For instance, large glacial-involved earthquakes are the most prominent phenomena found particularly around Greenland [1–3]; the new innovative studies conducted by glaciological and geophysical investigations are strikingly encouraged by long-term monitoring observations under extreme conditions in the area.

The most exciting initiative in the Arctic region was the International Polar Year (IPY) in 2007–2008, which had been conducted at the 50th anniversary of the International Geophysical Year (IGY 1957–1958). The IPY was a big international program composed of multidisciplinary science branches: upper atmosphere, meteorology, glaciology, geosciences, oceanography, and biosciences conducted by a significant number of polar scientists involved [4]. The initiative significantly enhanced the exchange of ideas across nations and scientific disciplines to unveil the status and changes of planet Earth. This kind of interdisciplinary approach helps us understand and address grand challenges such as rapid environmental change and its impact on human society.

The recent seismological research achievements in the polar region, for instance, are compiled in the special issue on “Polar Science” [5]. By taking into account the above concerns, however, this book partially aims to collect many discipline achievements by a significant number of involved projects at the IPY and post era, primarily focusing on surface environmental variations associated with climate change such as global warming.

It is also mentioned that, moreover, the contents in this book intend to appeal not only to the polar scientists but also to all general public who are interested in the present status of the Arctic region. It is hopeful that this book could provide remarkable knowledge and new understanding regarding current environmental variations and the past Earth's history within the global dynamics. The book could surely attain fruitful information on an advance of frontier researches in the Arctic region which are currently suffering significant effects by climate change within the global system.

IntechOpen

IntechOpen

### **Author details**

Masaki Kanao

National Institute of Polar Research (NIPR), Organization of Information and Systems (ROIS), Midori-cho, Tachikawa-shi, Tokyo, Japan

\*Address all correspondence to: [kanao@nipr.ac.jp](mailto:kanao@nipr.ac.jp)

### **IntechOpen**

© 2018 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

## References

- [1] Ekström G, Nettles M, Tsai VC. Seasonality and increasing frequency of Greenland glacial earthquakes. *Science*. 2006;**311**:1756-1758
- [2] Nettles M, Ekström G. Glacial earthquakes in Greenland and Antarctica. *Annual Review of Earth and Planetary Sciences*. 2010;**38**:467-491
- [3] Clinton JF, Nettles M, Walter F, Anderson K, Dahl-Jensen T, Giardini D, et al. Real-time geophysical data enhance Earth system monitoring in Greenland. *Eos, Transactions American Geophysical Union*. 2014;**95**:13-24
- [4] Krupnik I, Allison I, Bell R, Cutler P, Hik D, Lopez-Martinez J, et al. Understanding Earth's Polar Challenges: International Polar Year 2007-2008—Summary by the IPY Joint Committee. Edmonton, Alberta: Art Design Printing Inc; 2011. pp. 457-476
- [5] Kanao M, Zhao D, Wiens DA, Stutzmann E. Recent advance in polar seismology: Global impact of the international polar year—overview. *Polar Science*. 2015;**9**:1-4. DOI: 10.1016/j.polar.2014.12.003
- [6] Amante C, Eakins BW. ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis. NOAA Technical Memorandum NESDIS NGDC-24, National Geophysical Data Center, NOAA; 2009. DOI: 10.7289/V5C8276M
- [7] Bird P. An updated digital model of plate boundaries. *Geochemistry, Geophysics, Geosystems*. 2003;**4**:1027. DOI: 10.1029/2001GC000252