Book review

Review of *Frozen oceans: the floating world of pack ice*, by David N. Thomas (2004). London: Natural History Museum. 224 pp. ISBN 0-565-09188-3.

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D. N. Thomas's book, *Frozen oceans*, concerns pack ice—and, to an extent, fast ice—in both the Arctic and the Antarctic. It is organized in 10 chapters. There is in addition a map of each polar region, a glossary, an index and information on relevant literature and websites. After an introductory chapter (1), two chapters (2 and 3) explain the fundamentals of sea ice physics, how sea ice forms, which processes it is exposed to and how it decays. Chapter 3 describes some of the main regions where sea ice regularly appears. The core of the book (chapters 4-8) deals with sea ice biology and the ecosystem, including detailed descriptions of life above, in and below sea ice, from algae up to mammals and birds. The last two chapters discuss the ways scientists study sea ice: chapter 9 is an excursion into the history of sea ice research (though information on historical activities is not confined to this chapter 9; for example, Fridtjof Nansen's expedition with the *Fram* is mentioned both at the beginning of chapter 1 and in chapter 3); and chapter 10 concerns the future threats, potentials and challenges in connection with sea ice which can be expected with human impacts. The overall structure of the book is generally logical and sound. However, another author might have chosen to start the book with the historical review.

There are many books in which sea ice plays a major role, such as those concerning explorers' and adventurers' journeys in the polar regions, as well as general books about the Arctic and Antarctic, with no special focus. *Frozen oceans* fills a gap in presenting this important topic to a broad audience, including laymen interested in the polar regions, climate research, and polar issues in general, politicians and decision-makers as well as students and scientists. Sea ice biologists may be the only group not to learn much new in large parts of the book, but sea ice physicists and other polar scientists, such as modellers and remote sensing specialists, whose research relates to sea ice but who do not work physically with sea ice will benefit from *Frozen oceans*.

In this well illustrated book, many photographs show how scientists study sea ice and the complex logistics that are necessary to do research in the harsh environment of the polar regions. However, in some of the photographs it is not easy to estimate the actual sizes of objects since scaling objects or rulers are absent (for example thin sections of ice, images of micro-organisms). Furthermore, some photographs have been reproduced as mirror images, i.e. left-right reversed, including the photograph of the RV *Polarstern* on the front cover (in the UK edition; the US edition has a different cover picture) and images on pages 58 and 84.

Almost inevitably, there are some (mostly insignificant) errors, discrepancies and lacunae, for example:

- First year ice is usually defined (see sea ice nomenclature of the World Meteorological Organization) as sea ice that is the result of one winter freezing, not ice that has survived one summer melt (which in fact becomes second year ice), as presented on page 38.
- Where the CryoSat mission is mentioned (p. 47), the fact that radar altimetry is going to be used should have been stated.
- Thule, Greenland, is described as the northernmost human settlement (p. 180), although Ny-Ålesund, Svalbard, is further north.
- The Russian drift station programme (p. 195), started in 1937, can only have been interrupted by WWII, not by both world wars, as the author states.
- The Ronne Filchner Ice Shelf is not indicated in the map on page 211.

Some large-scale research, monitoring and management programmes and initiatives, such as the Arctic Climate Impact Assessment, the International Arctic Buoy Programme and the World Climate Research Programme, could have received (more) attention.

I participated in one of the expeditions in which the author was also a member and from which material is included in the book. I find the selection of pictures and facts included in the book give readers a good grounding in the broad range of subjects addressed in polar sea ice research. The fact that the author, a specialist in marine bioge-

ochemistry, has considerable experience in interdisciplinary work must have facilitated the preparation of *Frozen oceans*, an undertaking that was clearly carried out with great care and thoroughness.

The problems noted in this review are all minor and I would recommend the book for readers who are interested in the field of sea ice, from laymen and students to scientists working in polar research. Perhaps some sea ice physicists will become inspired by this book and will publish complementary volumes which will give more weight to the glaciological and oceanographic aspects of sea ice research.