

## BOOK REVIEW

Review of *Climate change in the polar regions*, by John Turner & Gareth J. Marshall (2011). Cambridge: Cambridge University Press. 434 pp. ISBN 978-0-521-85010-0.

In this ambitious, cross-disciplinary volume, British Antarctic Survey scientists John Turner and Gareth Marshall synthesize what is known about climate change in the Arctic and Antarctic and compare the changes that have occurred in the two polar regions. The authors examine recent changes in light of those that have taken place over the course of the last million years and tackle the difficulties involved in teasing apart natural from anthropogenic change.

The book is arranged in eight sections: an introduction; polar climate data and models; high-latitude climates and mechanisms of change; the last million years; the Holocene; the instrumental period; predictions for the next 100 years; and a summary.

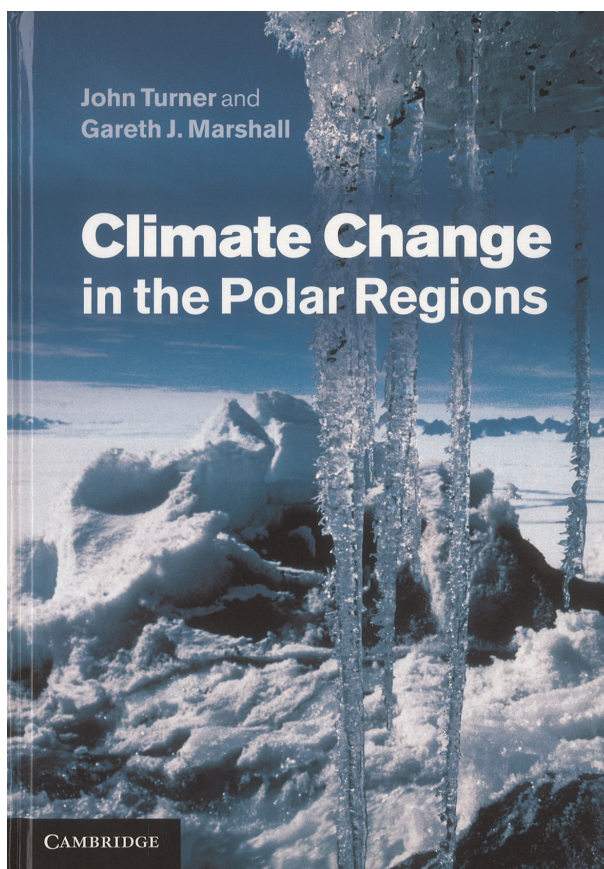
Strengths of the chapter on climate data and models include discussions of errors in interpretation, although in other places the text covers instruments and results, without making the reader aware of any problems. There is no mention, for example, of the heated debates surrounding what satellite-borne instruments are revealing in terms of changes in ice-sheet mass and elevation.

The chapters covering climate change from a million years ago and into the future present a good synthesis of our knowledge, though there is considerable repetition in the four chapters. Moreover, the chapter on the instrumental period is somewhat outdated. This is particularly notable for the coverage of the rapid changes that have taken place in the Northern Hemisphere in very recent years. In the book, diagrams of volume changes in Arctic glaciers only extend to the late 1990s; likewise records of sea-ice thickness. The most recent year represented in the diagram of mean snow cover is 2005. There are more up-to-date data series available for all these measures.

Throughout the book, I encountered statements that gave me pause, as the following examples illustrate. The sunrise and sunset at the poles is said to take place “on the equinoxes of 21 September and 21 March.” In fact, the refraction of the Earth’s atmosphere at very low temperatures means that the sun may be seen as much as two days before the equinox, the date of which varies.

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Seventy percent seems to be too high for the albedo of glacier ice. The Antarctic sea ice that persists over the summer is said in the Introduction to be found along the coast of East Antarctica and the Weddell Sea; fortunately, on p. 151 it is correctly described as being found off the coast of West Antarctica and in the Weddell Sea. The “huge” increase in Antarctic tourists (p. 9), based on statistics from 2006/07 season, is not borne out by more recent numbers, which have levelled off. According to the authors, “the central parts of the ... Greenland ice sheet are always extremely cold, so increases of temperature of several degrees or more will not result in any melting...” (p.12). Actually, the summer temperature—which is what matters—in central Greenland is not very far below 0°C, and melting in extensive high-elevation areas of the ice sheet has been observed in recent years. Diamond dust precipitation is characterized as an important part of Arctic precipitation, which is not the case. The authors suggest that precipitation in the Arctic is very low, contrasting

115 mm/yr at Barrow, Alaska, with the 600 mm that London is inundated with every year. It should be pointed out that other parts of the Arctic receive considerably more precipitation than Barrow, which illustrates the pitfalls of applying generalities to such a disparate region. The book repeatedly states that there has been a small significant increase in sea-ice extent around Antarctica. That may have been true in 2008, but is not so today. The discussion of sea level and ice on land also lacks references to published findings from the last four to five years and does not refer to the influence of the ice sheets' gravitational pull on regional sea level.

The authors' initial geographic boundary of the Arctic and Antarctic—the "polar" circles at 66° 33' 39" latitude—causes difficulties when they describe the Arctic in general terms: the region north of this latitude has a wide range of climates and encompasses areas where farming and commercial forestry are undertaken. I would have expected the book to employ from the outset a commonly used climate-based definition, such as the one that defines the Arctic as that part of the north where the mean temperature of the warmest month does not exceed +10°C. As northern parts of the Antarctic continent lie outside 66° 33' 39" S, later in the book the authors adopt the limit of the Antarctic Treaty (60° S) to define the southern polar region.

These flaws notwithstanding, the authors—both very highly regarded climatologists—have brought together a wealth of information within two covers. Their discussions, especially related to the atmosphere and

climatology, are worth reading. I wonder, though, whether the book could not have been more useful if it had been more focused. Its broad scope is both a strength—no other books synthesize, compare and contrast our knowledge of the climate in the Arctic and Antarctic—and a weakness, in that some topics are treated sparingly or with a very broad brush, presumably because of length limitations. The book is intended for researchers and advanced students. I suspect that it will be most useful for the latter group.

My biggest complaint is that Turner and Marshall did not make use of more up-to-date information. This gap is most noticeable in the chapter on recent climate change, which, along with the chapter on predictions for the future, may be considered by many readers to be the most topical section of the volume. The book might well have included early results stemming from the vast body of research carried out under the banner of the International Polar Year, which concluded a couple of years before *Climate change in the polar regions* was published.

Therefore, I conclude with an unexpected insight gained from reading the book: the polar regions are now changing so rapidly, and so much research is being undertaken, that it may be practically impossible to publish an up-to-date book on this crucially important subject, given the long production time needed to bring it out. I doubt that this would have been an issue 20 years ago. The very "out-of-dateness" of *Climate change in the polar regions* illustrates the dynamics of climate change in the polar regions.