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The Global Cryosphere, Past, Present and Future

Author: Ackley, Stephen F.

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Book Reviews

THE GLOBAL CRYOSPHERE, PAST, PRESENT AND FUTURE. By Roger Barry and Thian Yew Gan. New York: Cambridge University Press, 2011. 472 pp. $80.00 (soft cover). ISBN: 978-0-521-15685-1.

In the preface to THE GLOBAL CRYOSPHERE is the following: ''This is the first textbook to address all the components of the Earth's cryosphere—all forms of snow and ice, both terrestrial and marine. It provides a concise but comprehensive summary of cryospheric processes for courses at upper undergraduate and graduate level. . ..'' I couldn't agree more.

The book is divided into four parts. The first two provide the main topical coverage: the Terrestrial Cryosphere has chapters on ''Snowfall and Snow Cover,'' ''Avalanches,'' ''Glaciers and Ice Caps,'' ''Ice Sheets,'' ''Frozen ground and Permafrost,'' and ''Freshwater Ice;'' and in the Marine Cryosphere, ''Sea Ice'' and ''Ice Shelves and Icebergs.'' The final two parts discuss the Cryosphere Past and Future, and Applications.

Because there are glowing but general endorsements of the value of the text on the back cover, I chose a different approach for this review by taking a particular topic that I am relatively unfamiliar with, Avalanches, and took a student's view. That is: What did I learn that I didn't know before about avalanches? I learned that there are five basic concepts or features of avalanches: a trigger of avalanche initiation, a starting zone where the slide starts, the slide path where it flows, a runout zone where it comes to rest, and a debris deposit (the accumulated mass of avalanche snow and what it has picked up along the way). The mechanics are governed by the type of snow, nature of the failure, sliding surface, slope angle, direction, and elevation. There are two types of dry snow avalanches, loose or fluid snow and slab (blocky) avalanches. Avalanches are hard to forecast, since they can accumulate several weak layers before being triggered in a delayed action way. There are climate, mechanical, and statistical models, with the SNOWPACK simulation model from the Swiss Federal Institute for Snow and Avalanche Research currently the most sophisticated.

In summary, I know a lot more about avalanches than I did before I studied the chapter and there are references, websites, tables, and figures that I can refer to for more details.

The whole book is of the same ilk, concise, but comprehensive, and giving much more than the usual lip service to cryospheric processes that never seem to go beyond sound bites. (How many times have we either said or heard that Antarctica is the highest, driest, coldest, windiest place on Earth?) Of high importance are the descriptions of how research is conducted on the cryosphere. Anyone in the specific fields therefore can learn a lot about other fields from reading this book.

However, the most important use for the book will be, according to the authors' design, as a course text for upper-level undergraduates, including an important audience, K–12 science teachers either in training or in continuing education. Educating that group in cryospheric science will fulfill a major aim of the International Polar Year (IPY), that of increasing polar literacy, as each teacher educated will be in contact with thousands of students themselves over their teaching careers.

Just prior to IPY, in a webinar conducted for teachers that I participated in, it was voiced that a ''Polar Sciences 101'' course would be of high value. We thought about doing this, but were locked into the realities of higher academic teaching, that is, a new course is all consuming and without a text to work from, and would be highly difficult to get relief from other courses in order to develop the material fully. This is especially true in our and in most colleges and universities where there may be only one, or at most a few of the cryospheric disciplines present. Yet, at the same time, we were besieged by requests from good students in small colleges and universities to participate in research expeditions, but all without any background in the cryospheric sciences.

By providing this textbook, Roger Barry and Thian Yew Gan have given us exactly what we need, a basis for offering an undergraduate course in polar sciences. I hope that many particular specialists in colleges and universities will start using this textbook in new courses in Cryospheric Sciences, as I am. It will go a long way toward achieving the rightful place of the cryosphere in the full pantheon of earth sciences. The authors are to be commended for a truly significant contribution to the cryospheric sciences community.

STEPHEN F. ACKLEY

Geological Sciences Department
University of Texas at San Antonio
1 UTSA Circle, San Antonio, Texas 78249, U.S.A.

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CHANGING COLD ENVIRONMENTS: A CANADIAN PERSPECTIVE. Edited by Hugh French and Olav Slaymaker. Chichester, U.K.: Wiley-Blackwell, 2012. 340 pp. (hardcover). ISBN 978-0470699683.

With continuing reports of the decline of Arctic sea ice and concerns over the susceptibility of high-latitude environments to climatic change, this is a timely volume and one to be welcomed by anyone with an interest in polar science. It is a compilation of 15 chapters, mainly from Canadian scientists and others with extensive experience in the high-latitude environments of North America.

As befits a contribution from geographers, CHANGING COLD ENVIRONMENTS has a broad scope, both spatially and temporally. Its contents are grouped in three parts covering the present variability of Canada's cold environments; the changing cryosphere, and the changing scenery of the North. The first of these includes an introductory, scene-setting chapter from the editors. From that it proceeds to reviews of late Quaternary glaciation in Canada, the history of tundra and polar desert ecosystems, and snow climatology and remote sensing. The second section of the book includes 5 chapters which review successively the changing climate; hydro-

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