

SERREZE, M.C. and R.G. BARRY. 2005. *The arctic climate system*. Cambridge, Cambridge University Press. 385pp. ISBN 0 521 81418 9, hardback. £80.

The climate of the Arctic has received a lot of attention in recent years, in large part due to the fact that the Arctic has warmed faster than other parts of the world, except the Antarctic Peninsula, and that impacts of climate change have begun to be observed there. These changes have been summarized in an Intergovernmental Panel on Climate Change chapter on the polar regions (Houghton and others, 2001, ch. 16) and in a comprehensive international Arctic Climate Impact Assessment, which was initiated by the Arctic Council (ACIA, 2005). It has been argued that the Arctic is the 'canary in the mine', indicating what might be in store for the rest of the world.

A comprehensive look at the arctic system in the form of a book therefore seems very appropriate since no similar book has been published in recent years. The book under review here sets out to describe the arctic climate system as a whole. 'System' has been defined as a set or arrangements of things so related or connected as to form a unity or organic whole. The climate system has many components and complex connections and the book addresses these in a thorough and systematic manner. Mark Serreze and Roger Barry are old arctic hands; they know the topic very well and are well qualified to write this book.

There are 11 chapters, starting with the evolution of knowledge about the Arctic and its climate and ending with recent climate variability, trends and the future. In between is detailed information on the physical characteristics and basic climate features, the basic atmospheric heat budget, atmospheric circulation, the surface energy budget, precipitation and river discharge, ocean–sea–ice–climate interactions, the climate regimes of the Arctic, modeling the arctic climate system, and arctic paleoclimates.

A detailed discussion of each chapter is beyond the scope of this review, but here are a few examples of the level of information that can be found in each chapter. The introductory chapter gives an interesting and excellent summary of the early sporadic historical exploration of the Arctic, which was eventually followed by more systematic observations starting with the first International Polar Year (IPY) in 1882/83. The modern era began with the establishment of many weather stations and the advent of satellites. This finally provided the year-round region-wide information necessary to begin to understand the complex arctic weather and climate machine.

The chapter on atmospheric circulation starts with a discussion of the thermal structure, dynamics and circulation of the stratosphere. Maps of the mean 30 hPa geopotential height for 4 months are given, followed by vortex statistics and maps of sudden stratospheric warming. Ozone characteristics and changes in ozone levels from the 1960s to the 1990s are shown. Similarly, tropospheric characteristics, circulation and temperature are mapped. The major centers of action, the Siberian high, Icelandic low, and Aleutian low, and their seasonal variation are discussed. Maps of cyclone frequency and cyclogenesis, and frontal frequencies are followed by seasonal cross-sections from the equator to the pole of mean zonal winds and meridional temperature gradients. The chapter ends with a discussion and satellite photos of polar lows.

The chapter on arctic ocean–sea–ice–climate interactions has a good discussion on sea-ice formation, growth and melt, and also on ice zones, ice concentrations and the mean circulation of the ice. Satellite images show ice features and ice extent, and color maps give ice concentrations and anomalies. Sea-ice motion is explained in terms of the various components of the momentum balance, and ice drift in relation to sea-level pressure is illustrated in several maps. An important feature of the ice circulation is the Fram Strait outflow. This and the thermohaline circulation (THC) are discussed and illustrated in some detail. The debates on whether the THC is sensitive to disruption, as some models have indicated, continue, and the 'Great Salinity Anomaly' (GSA) of 1968–82 provides some observational evidence that it is. The GSA and its likely causes are discussed at the end of the chapter.

The chapter on climate regimes is brief and relies on material previously presented in chapter 2 but it does address Greenland, which has received less attention in the past, in greater detail. The surface melt regime of the Greenland ice sheet is particularly interesting since it shows increases in the size of the melt area, as determined from satellite passive microwave measurements. Also discussed are the polar deserts, maritime Arctic, central Arctic Ocean, and mountains and uplands. Graphs and descriptions of seasonal variations of temperature, radiation, clouds and precipitation are given for four representative sites: Resolute, Northwest Territories; Barrow, Alaska; and a site each on Svalbard and in the central Arctic Ocean. There is also a good discussion of urban modifications of local climate, including city heat islands and the infamous ice-fog episodes observed in places like Fairbanks, Alaska.

References to further reading are liberally scattered throughout the book, and are compiled in a comprehensive 41-page bibliography. The numerous graphs and illustrations are well done, with eight color plates bunched together in the middle of the book. Other useful features include a detailed seven-page subject index and a page of selected websites. The book is at a technical level that is intended, as the authors state, for advanced undergraduate and graduate students, but it should be equally useful for researchers in different fields in which the arctic climate plays a part, as well as for climate researchers themselves. The authors demonstrate their expert knowledge and understanding of the topic of climate and provide a comprehensive coverage of this topic, which is likely to appeal to and be useful to many readers.

REFERENCES

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P.O. Box 216, Foster,
Victoria 3960,
Australia

E-mail: gandsweller@bordernet.com.au

Gunter WELLER