

# Book review

## **Weather and Climate of the Antarctic** by W. Schwerdtfeger. (Elsevier Science Publishers 1984) Pp xii + 262, \$A48.00

This is a book which Schwerdtfeger is uniquely qualified to write. A distinguished member of a distinguished group at the University of Wisconsin, deeply interested in the meteorology of the high southern latitudes, and with a lifetime of background experience, the author has, for the past twenty years or so, guided a succession of Wisconsin students through studies on Antarctic meteorology. What he has now done is to draw together the threads of individual efforts to provide the reader, who does not need to be a specialist in polar meteorology, with a very clear picture of the weather and climate of the Antarctic as presently understood. But, as the author would say, more on this later.

To those familiar with the author's previous discussion 'The Climate of the Antarctic' in the *World Survey of Climatology* (1970), the layout of the six chapters of this book will come as no surprise. The 'Introduction' briefly describes the continental topography, the observing network and its limitations — particularly for synoptic meteorological purposes — and notes the changes brought about by, and the benefits arising from, meteorological satellites, automatic weather stations, drifting ocean buoys, and acoustic sounders. Chapter 2 gives a broad overview of the gains and losses of radiative energy at the surface of the Antarctic continent, and variations in radiative energy fluxes as a background to understanding the continental surface temperature regime — two major features of which are the nature of the annual temperature cycle (very short summer/long winter), and the very strong winter-time surface inversion.

Chapter 3, the longest in the book comprising about one-third of the total text, gives a comprehensive account of the surface wind regime. Although close attention is given to the wind behaviour on the continent, with a full discussion of the 'inversion' wind in the interior, and the katabatic wind on the steep coastal slopes and on the coastline itself (including the development of a numerical model to explain the extraordinary katabatic winds on the Adélie Land coast), the role of the Antarctic Peninsula mountain chain in the development of 'barrier' and foehn winds, together with that of the Transantarctic Mountains in relation to barrier winds on the western side of the Ross Ice Shelf, are also examined in some detail. The chapter is completed by a short discussion of wind variability and extreme values, the effects of blowing snow on visibility, and the wind chill problem.

In the fourth chapter ('Atmospheric Circulation and its Disturbances') the main characteristics of the southern hemisphere polar vortex are discussed, and the general nature of pressure systems over both the oceans and the continental coastline, as well as their structure over the plateau, are briefly outlined. The asymmetric nature of the vortex relative to the geographic pole, and the fields of (time-averaged) vertical motion (downward over East, upward over West Antarctica) are pointed out. Unlike the troposphere, there is a summertime wind circulation reversal in the stratosphere. The limitations imposed by data deficiency on the analysis of daily synoptic charts are recognised; the vertical structure of some coastal cyclones considered, and some particular features of storms in the early autumn are mentioned. On the plateau, uncertainties of terrain elevation and surface pressure reduction are stressed.

Water in its solid, liquid, and gaseous phase is the topic addressed in Chapter 5. After discussing the water vapour content of polar air, and an attempt to estimate the amount available for deposition and accumulation on a substantial sector of East Antarctica, clouds and fogs are considered, followed by precipitation/accumulation. The discussion of cloud is general, and brief, mention being made of the very dangerous optical phenomenon — 'white-out'. The problems of precipitation measurement on the continent, and the importance of ice-crystal precipitation which occurs under cloudless conditions in the high interior, are made clear. The procedures used to assess accumulation are described, and the resulting accumulation map shows that annual values are less than  $5 \text{ gm cm}^{-2}$  over a large part of the east Antarctic plateau.

In the final chapter some selected problems of Antarctic climatology are addressed: the ice-mass budget (it appears uncertain whether the ice-cap is growing or shrinking, the extent of annual calving appearing to provide the 'sign of the budget'); the effect on climate of ice moving from the Antarctic into lower latitudes (the Weddell Sea sector appears most important); temperature fluctuations (over the past century or so only small temperature 'oscillations' appear to have occurred); periodic pressure variations (a marked air mass increase occurs over the continent between October and December), and finally a brief comparison of the south and north-polar climates.

A series of appendixes which includes a list of stations, temperature, radiation and (limited) pressure

values, and the mathematical details used in the numerical modelling experiment complete the work.

It was stated earlier that Schwerdtfeger has provided a most readable account of Antarctic weather and climate. However, he has also clearly exposed the serious deficiencies in our knowledge of Antarctic meteorology. This is most evident in Chapter 4 where he refers to 'the lack of an adequate network of weather stations' (p. 129); the absence of 'a homogeneous series of baric synoptic charts' (p. 138), and likely improvements to the understanding of the cyclones over the Southern Ocean and the Antarctic coast within a few years (p. 141). How can these (reasonable) comments be reconciled, for example, with a belief that the nature of the coastal katabatic wind phenomenon is at all well understood,

when the behaviour and effects of the coastal depressions have yet to be even reliably documented?

This book must therefore be recognised as a very useful introduction to the weather and climate of the Antarctic, and the author has made a major contribution to the southern polar literature. However, progress now depends on the unique nature of the problems of weather analysis and forecasting close to, and over, the Antarctic continent being recognised and energetically addressed.

Overall, the book (No. 15 in the 'Developments in Atmospheric Science' series) is reasonably well produced. Diagrams are clear, but more attention to the layout, particularly of the tables, would have assisted the reader. Some typographical errors are evident, two in Table 3.5.

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