# Reviews

LUBIN, D. and MASSOM, R. 2006. *Polar remote sensing. Vol. 1: Atmosphere and ocean.* Berlin, etc., Springer-Verlag/ Chichester, Praxis Publishing Ltd. Published in association with the Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart, Australia. 775pp. ISBN 3 540 43097 0, hardback, €179.95/£138.50.

The polar regions are remote, harsh environments. Field-going polar researchers endure ice and cold winds, rough seas and long periods of isolation, and there is a significant element of danger. Ships and field gear need to be rugged. These regions are not easy places in which to work, yet it is these regions, the cold end-member of the Earth's heat engine, that are experiencing the brunt of ongoing global warming, and this trend is expected to accelerate. The fate of the extensive ice sheets is of major concern to us all. The polar ice ecosystems are increasingly stressed and the global climate system would be altered if the sea-ice distribution and the mode of deep ocean ventilation were to change. There is a real need to build a quantitative understanding of the polar regions and to faithfully simulate them in regional and global models.

Attaining this quantitative understanding has been aided by the advent of polar-orbiting-satellite-based observations which, in the last four decades or so, have opened up the polar regions for daily viewing. Orbiting satellites have advanced our knowledge of the Earth system at all latitudes, but arguably the polar latitudes have profited most of all by this technology. Before satellite observations, we knew about the outer edge of the sea-ice fields but little about the interior of the sea ice. Satellites now reveal information about the full waxing and waning of the polar sea-ice concentrations, and polynyas along the coastal lines and occasionally in the deep ocean. Before satellite observations, polar scientists had to piece together a view of the polar environment from observations dispersed widely in space and time; now we have effectively synoptic views of the Arctic and Antarctic polar environments.

Remote sensing from space is well past the 'gee-whiz' phase. Now we gather quantitative information, and we can see the slow and steady changes of the polar environment. A sense of the fantastic advances in quantifying the polar atmosphere and ocean from satellite observations is presented in volume 1 of Lubin and Massom's two-volume work, *Polar remote sensing*.

The book consists of five chapters, each with its own extensive reference list. Each chapter is a thorough review of its subject. The Introduction includes an account of Charles Wilkes' United States Exploring Expedition of 1838–42. The authors dub this expedition as the NASA of the 19th century. This interesting addition to the book gives the reader an appreciation of the challenges and hardships of polar exploration. Within chapter 3 there is a reference to the 'curse of Captain Wilkes' (Wilkes' offshore survey of the coastline of Antarctica was flawed by strong near-surface temperature inversions) when discussing NASA and the 'Antarctic ozone hole' detection, first made public in 1985. In this regard the authors say 'NASA scientists noticed [prior to 1985] the low ozone values early on, but were reluctant to publish them until they were fully confident with their instrument's performance and validation'. Chapter 1 also includes a section on the present polar orbiting missions of NASA.

Chapter 2 provides a useful discussion of the physics of radiation and satellite-borne sensors. This provides a sense of the tremendous technological accomplishments required to gather reliable (calibrated) data from space, and send the data back home. The next two chapters deal with the stratosphere, meteorology and climate, and chapter 5, which accounts for nearly 75% of the book, deals with sea ice. The remote sensing of the ocean is mainly discussed in the sea-ice chapter. The appendices at the book's end provide information, in tabular form, on a powerful polar sensor, the synthetic aperture radar. While both polar regions are discussed, the southern polar region gets more pages and figures. Of course, reflecting this reviewer's bias, that's about right, though maybe some more information about the non-ice-covered polar ocean would have been welcome.

The material presented is quantitative, including a fair amount of mathematics, to be useful to scientists and students. It's hard to conceive of an observational polar research study that does not make some use of satellite-derived data. This book serves as a valuable research tool and primer. It covers the topics on the physics of remote sensing, details of the satellite-borne sensors and the polar environment. The color figures, mostly linked to the sea-ice chapter, are bundled together between chapters 4 and 5. While this is a cost-saving method, and the book is already quite pricey, dispersing the color figures within the appropriate text would be preferable.

Dan Lubin and Robert Massom are to be congratulated on their achievement in bringing into one book, albeit a 775-page book, a detailed account of remote sensing of the atmosphere and ocean in the polar regions. They acknowledge a long list of those that have helped in the preparation of the book. It is a 'who's who' list of those that brought satellite data into the standard toolkit of the observational polar researcher.

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