

## Reviews

REES, W.G. 2006. *Remote sensing of snow and ice*. Boca Raton, FL, Taylor and Francis/CRC Press, 285pp. ISBN 0-415-29831-8, hardback, £56.99/US\$99.95.

*Remote sensing of snow and ice* by Gareth Rees is an excellent overview of airborne and space-borne remote-sensing theory and practice as applied to studies of the Earth's cryosphere. The 285-page book consists of ten chapters. The introductory chapter summarizes the main geographical and physical properties of each major component of the cryosphere. Three chapters follow, on remote-sensing instrumentation, image processing and physical properties of snow and ice as needed for interpreting remote-sensing data. The next five chapters discuss scientific applications of remote-sensing observations to snow cover, sea ice, fresh-water ice, glaciers and ice sheets, and icebergs. The author offers some thoughts on future trends and challenges in the concluding chapter. The well-indexed book includes an extensive bibliography that will be useful to students and researchers.

This 2006 book is a nice follow-on to the excellent 1985 text *Remote sensing of ice and snow* by Hall and Martinec, as well as more specialized books including Massom's 1991 book *Satellite remote sensing of polar regions* and Bogorodsky, Bentley and Gudmandsen's *Radioglaciology*. Rees's compact book is well written and reasonably well illustrated. It provides a resource for students and researchers seeking to quickly familiarize themselves with the recent developments in this rapidly changing field.

By design, the text is a broad, descriptive discussion of cyrospheric remote sensing. The introductory chapter is a standard summary of the basic physical characteristics of each component of the cyrosphere. It might have benefited from more recent references to the various geographical facts presented in several charts and a table. The sensors chapter concisely summarizes technical information on most of the current suite of instruments including airborne and space-borne optical and infrared cameras and electro-optical imagers, radar and laser altimeters, passive microwave imagers (atmospheric sounders are not discussed), radio-echo sounders and radar imaging systems including synthetic aperture radar (SAR) and SAR interferometry. The latter is a relatively new topic and not discussed in the previously mentioned books in this field. The chapter on image processing gives a brief introduction to filtering, image enhancement and image classification. The physical properties chapter is a reasonable introduction to the electrical properties of snow and ice forms, including brief discussions of scattering coefficients and emission. The remaining chapters on applications address most of the current scientific themes of interest including methods for determining the seasonal distribution of snow and snow water equivalent; sea-ice concentration, extent and motion;

seasonal behavior of lake and river ice; and finally the physical and dynamical properties of glaciers, ice sheets and icebergs. Altogether, there is enough information on theory and applications to guide the reader towards the more advanced material necessary to extend the concepts outlined in this book into practice.

The book adequately touches on most major aspects of active and passive remote sensing, but there are a few small gaps. Scatterometers and their applications receive slight attention even though these instruments are successfully used for mapping the properties of ice sheets and sea ice. The difficult topic of remote sensing of permafrost, which is included as a topic in the introductory chapter, is largely absent from the text, even though high-resolution optical and thermal infrared data can be used to detect proxies such as patterned ground and characteristic vegetation. In the case of permafrost, the Hall and Martinec book is probably a better choice. One, perhaps debatable, omission is discussion of space-borne gravity field measurements such as those being made by the Gravity Recovery and Climate Experiment satellite launched in 2002. Rees's book focuses on electromagnetic remote sensing, but reference to important and complementary approaches merit some mention, at least, in the summary chapter. There are several attractive color plates included in the volume, but a number of the black-and-white images have very poor contrast. That problem limits the usefulness of some of the figures in the image-processing section. Several references to websites are potential problems with the longevity of the book, given the ephemeral nature of web postings.

In summary, Rees's *Remote Sensing of snow and ice* is an easy-to-read and very informative book. As intended by the author, it will be most useful for advanced undergraduate students and new graduate students entering the field who require an introduction to the techniques and the literature.

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