

Book reviews

Storm Watchers: The Turbulent History of Weather Prediction from Franklin's Kite to El Niño by John Cox (John Wiley and Sons, 2002) ISBN 0-471-444863. \$41.

This book sets out to capture an historical perspective of 'weather forecasting' through a series of biographical essays on a number of leading figures in the science of meteorology from around 1750.

The book is structured around five parts. The first deals with the early experiments of Benjamin Franklin, the cloud classification scheme developed by Luke Howard, and manned balloon flights by James Glaisher. The second part, titled 'American Storms', covers the work of Redfield, Espy, Loomis, Henry, Maury and Ferrel in identifying some of the characteristics of storms in North America.

The third part traces the early attempts at weather forecasting (Fitzroy in the United Kingdom, Le Verrier in France, Abbe and Finley in the United States); introduces some of the characters involved in the transition of the US Weather Bureau from military control to civilian leadership (Harrington, Cline); describes the work of Walker in linking marked seasonal variations to 'oscillations' in pressure on a global scale; and outlines the advocacy of Meisinger (in the United States) for increased emphasis on measurements of the upper atmosphere.

The fourth part covers the era of the Bergen School in developing conceptual models of extratropical cyclones and attendant weather phenomena (Bjerknes, Bergeron), the application of dynamical theory to weather forecasting (Rossby, Petterssen) and early attempts at numerical weather prediction (Richardson).

The final part deals with several of the leading figures in meteorological research over the past 50 years, including giants like Charney and Lorenz, and brings the reader into the modern era of satellites, computers and the application of global and regional models to weather forecasting.

The book is well written and, as a meteorologist, I found it to be a good read. It will be interesting to learn how a more general audience reacts to it. There are, of course, dangers in writing about historical figures in any discipline – especially in relation to modern history and who should be included. Some of my heroes are not there but will, I am sure, appear in another book at another time.

In this book, Cox has been able to capture some vivid images without the use of a single photograph. Were I his agent, I would be encouraging him to move on to a grander vision and draw upon the vast amount of pictorial and biographical material that is available and which would contribute to an even richer tapestry of the science of meteorology over the past 250 years.

William K. Downey

William Downey was Acting Director of Meteorology at the time this article was written.

Global-Regional Linkages in the Earth System edited by P. Tyson, R. Fuchs, C. Fu, L. Lebel, A.P. Mitra, E. Odada, J. Perry, W. Steffen and H. Virji (Springer-Verlag, 2002). ISBN 3-540-42403-2. \$152.

Global environmental change in general, and climate change in particular, have become familiar subjects in the years since the inception of the International Geosphere-Biosphere Program (IGBP) in 1986. A considerable part of the international research agenda in the earth, environmental and biological sciences has been focused on global change, with increasing emphasis in recent years on the impacts of observed or postulated environmental changes. While much of the research into global change and its impacts has been focused in developed countries, it is the developing countries and regions that are likely to be most vulnerable to those impacts.

Recognising this vulnerability, the System for Analysis, Research and Training (START) was established in the mid-1990s by the IGBP, World Climate Research Programme (WCRP) and International Human Dimensions Programme (IHDP) to build global change research capacity in developing regions. This volume is the first to synthesise some of the regionally-focused global change science that has been facilitated by START. The book reveals the extent to which the START program has succeeded to date, by presenting up-to-date reviews of global change science in four START regions: Southern Africa, South Asia, Southeast Asia and East Asia.

A brief introductory chapter establishes the context for the book, making a case for regional decomposition as an alternative to functional physical system deconvolution as a basis for assessing integrated environmental change. Regional-global linkages are an inherent aspect of the functioning of the Earth system; the best known global change syntheses, the IPCC reports, have taken the global perspective. The regional syntheses in this volume highlight the potential for new and important understanding to be gained by looking at both regional and global views.

Global-regional linkages and their importance for Southern Africa are the focus of the first regional chapter (70 pages). Large-scale atmospheric factors, climate gradients and rapid environmental change events during the last few thousand years are discussed. The chapter on South Asia (30 pages) focuses on biogeochemical cycling, changes in the monsoon, and global change impacts on agriculture and water resources. The chapter on East Asia (40 pages) again takes the perspective of regional-global interactions, reviewing atmospheric and oceanic aspects of environmental change and focusing on past and possible future changes in the monsoon system on which so much of Asia is dependent. The impacts of continuing land cover change in East Asia are also highlighted. In the fifth chapter (40+ pages), the integrated consideration of global change and development in the Southeast Asian region gives a perspective on the interdependence of human and natural systems, and the bi-directional nature of their interactions. A short summary chapter concludes the book, summarising the significant points made for each of the regions.

Each chapter in the book is extensively referenced, forming a useful resource for those interested in regional perspectives on global change. It has more than 150 high-quality illustrations, some in colour, and includes a useful Subject and Geographic index. In general the production is of a consistently high standard.

The 19 lead authors, 58 other contributors and nine editors of this book have made a substantial contribution to the important task of making accessible the substantial body of global change research in the developing world. It is clear that, at least for some regions, considerable progress has been made in the last decade, not least in developing key research projects to answer significant questions relevant to understanding the nature and impacts of global change in these regions. The book provides, for the areas it covers, essential syntheses of available information that can underpin the development of the regionally integrated views that are needed to contribute to policy development and responses. National boundaries are meaningless in the context of natural

systems, and developing the capacity to begin to understand and respond effectively to global change at a regional level is eminently sensible. As this volume demonstrates, the regional view can provide considerable insights into the nature of global change and its impacts, and into possible strategies for mitigation and adaptation.

This book is a significant resource for anyone interested in global change and its impacts in the developing regions of the world, particularly in the four regions that are the focus of the book. It also makes an interesting and useful contribution to the more general area of regional-global linkages and the importance of systems-based approaches in developing our understanding of the Earth system and its functions. It contains sufficient detail to be of interest to specialists in global change and its impacts, but is written in a style that should be accessible to the non-specialist or generalist seeking an overview of global change issues in the developing world. I recommend it as a reference text for students from undergraduate to postgraduate level, in any course that touches on aspects of human-environment interactions, development and sustainability; and for anyone undertaking global change-related research. Every academic library should have a copy.

Janette Lindesay

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Spectral Imaging of the Atmosphere by Gordon G. Shepherd (Academic Press, 2002). ISBN 0-126-394814. \$134.

This book is published as volume 82 of the International Geophysics series from Academic Press. This series has featured notable contributions in the area of atmospheric radiation since the first volume appeared in 1959, not the least being Kondratyev's *Radiation in the Atmosphere* of 1969, a standard text in the discipline.

The present volume adds an important ingredient to the series, in providing a comprehensive account of the development of atmospheric spectroscopy. It does so by building on the author's dedicated work in this field over a career spanning four decades.

The book opens with a comprehensive account of the generation and transmission of radiation in the atmosphere, with discussion of both continuum radiation and spectral lines. This is followed by a description of methods used to determine the spatial and temporal distribution of gaseous species, such as multi-spectral sampling in a spectral region of changing absorption, and viewing through the atmosphere along slant paths. While clearly set out, this material presupposes an understanding of the motivating scientific issues underlying the work such as climate change, ozone depletion and electromagnetic propagation. For example, the gravity waves evident in the airglow difference images of Figure 1.4 are intriguing, but are not put into the context of how this enhances our understanding of dynamics of the upper atmosphere. Although some applications accompany descriptions of specific instruments later in the volume, a clearer statement at the outset would have been valuable.

Chapter 2 presents the mathematical tools needed to underpin subsequent analysis, with emphasis squarely on the Fourier transform and related functions. Chapter 3 introduces yardsticks by which instrument performance can be compared, primarily that of 'superiority', the product of resolving power and acceptance solid angle. The subsequent chapter contrasts different satellite scanning strategies, and concludes with an informative discussion of state of the art detector technologies.

Chapters 5 and 6 present an in-depth analysis of the Fabry-Perot etalon and the Michelson interferometer, the workhorse instruments of most atmospheric spectroscopy. In both cases the author's familiarity with the wide range of ingenious methods developed to adapt these techniques to various applications is impressive, although the tuneable Fabry-Perot etalon pioneered by CSIRO in the last decade was overlooked. This method uses an etalon material whose refractive index depends on the electric field, so that tuning is possible by varying the voltage applied across the etalon.

The inventory of ingenious devices continues in Chapter 7, where multiplexors and modulators are considered. Perhaps the best known of these is the Pressure Modulation Radiometer (PMR), a device for measuring trace gas concentrations by diverting the incident beam through a cell containing the gas species to be measured, and successfully flown on the Upper Atmosphere Research Satellite (UARS) in the early 1990s.

As well as mapping the distribution and amount of gaseous species, a major challenge is the mapping of wind fields through detection of the doppler shift. Techniques developed to meet this challenge occupy most of Chapter 8. Operational examples of various spectral imagers are discussed in the next chapter, beginning with the Wind Image Interferometer (WINDII) and concluding with MOPITT (Measurement of Pollution in the Troposphere), the latter showing an impressive capacity to map carbon monoxide globally. The final chapter discusses spectrometers based on diffraction gratings, including well-known operational sensors such as TOMS (Total Ozone Mapping Spectrometer) and SAGE (Stratospheric Aerosol and Gas Experiment).

The book is well written, and the author has been successful in leavening the text with a sprinkling of personal and historical anecdotes. Michelson's reluctance to accept the result of his famous experiment with Morley is an interesting example. Inevitably, the author's discipline focus on upper atmospheric physics leads to a bias favouring instruments targeting phenomena at 30 km and above, although reasonable space is accorded to instruments concerned with the lower atmosphere. The editorial quality is high with only a handful of residual typographic errors. At a list price of \$134, the book is definitely in the reference category, and would form a useful addition to the libraries of scientific institutions and universities with an atmospheric science component. The problems set at the end of each chapter make it a useful text for later undergraduate and graduate course work. Finally, the book contains a comprehensive list of acronyms that many readers, including the reviewer, will find useful in negotiating this increasingly complex maze.

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