Book reviews

Windows on Meteorology edited by Eric Webb (CSIRO Publishing, 1997). ISBN 0-643-06038-3. 342 pp., $49.95.

How does one describe a book with a range of subjects spanning Aboriginal seasonal calendars, burrowing frogs, dinosaurs, floods, droughts, weather systems, meteorological history, instrumentation, satellites and aircraft? It is certainly something different. I was asked to review *Windows on Meteorology* from the perspective of an informed lay person and found it a difficult book to categorise because of the great diversity of subjects it contains. Unlike the curate's egg, however, the book is all good, although I liked it more in some parts than others.

The sections dealing with aboriginal culture come as quite a surprise in a book like this. They provide a fascinating insight into how the indigenous people view the relationship between the passing seasons, food supplies and weather, clearly showing their holistic approach to nature and their sense of the interconnectedness of everything. The article by Debbie Rose shows this interconnectedness well in describing how the Yarralin people view the coming of rain, which they explained in the following manner. Flying foxes live in the bush feeding on the nectar of flowering eucalypts. As the flowers dry up, the foxes migrate to the rivers and roost in the pandanus. Their presence alerts the Rainbow Snake(s) that live in waterways to the fact that the land is drying up and food is becoming scarce, so the Rainbow rises up, causing lightning and rain. The first rains cause tadpoles to hatch and frogs to sit up and call on the Rainbow to send more rain. Observations of plants, animals and weather are combined with mythology and brought together in a view that embraces the 'wholeness' of nature. The seasonal calendars are very interesting and the knowledge on which the calendar is based doubtless serves the indigenous people very well in ensuring a continuous supply of food throughout the year. The two articles on Tasmanian Aborigines are also fascinating: Brian Plomley's for the historical accounts of early white contact with the natives, and Richard Cosgrove's for piecing together from archaeological discoveries a picture of indigenous occupation through the last Ice Age.

The section on history is excellent. I particularly enjoyed reading about the birth of meteorology in Australia by Bill Gibbs, and the development of instruments and observing networks by Brian Bradshaw. These chapters are real gems, describing the earliest endeavours to build a new scientific discipline in a brand new community. This was a true pioneering era and we are fortunate that it happened at a time when all such things were well recorded for posterity. I was surprised at the variety of dubious thermometer enclosures used in the early days; I had always assumed that the Stevenson Screen had been the standard for centuries. Somehow they just have that look about them.

Neville Nicholls's two chapters on 'A healthy climate' and "The centennial drought' are likewise very enlightening. His article on drought yielded my favourite lines from the book. In reference to the drought which devastated the country in the late 1880s: 'Dr. A. Campbell MLC, believed that the dryness of the continent was due to gum trees. Replacing these moisture conserving trees with cabbages or other plants with higher rates of evapotranspiration would moisten the dry atmosphere, resulting in more rain'. And T.W. Hickson, a New Zealander, offered the following advice to Victorians: 'Annihilate your gums and there is no reason why Victoria should not possess and enjoy the same freedom from drought, the same delightful climate, the same luxuriant pastures, the same semi-tropical forest vegetation and clear ever running streams, that are the common possession of North Island New Zealanders'. Simple really!

Len Deacon's chapter on turbulent fluxes in the lower atmosphere gives a clearly written account of a complex subject. He explains the physics of the lower boundary layer and describes the early field experiments, the instrumentation and the data analysis methods used at the time. It reads like a chronological account of the turbulence measuring program carried out by the CSIRO Division of Meteorological Physics for two decades from about 1950. It was pioneering work and generated such camaraderie among the troops that when I joined the Division in 1970, the field experiments and instrument work were still talked about in nostalgic terms. The writing style is more science-formal than the other contributors, and the article thankfully stands alone in the book for its reliance on graphs, symbols and formulae to describe the subject matter. It is characteristic of Mr. Deacon as I remember him (I only ever knew him as Mr. Deacon): a reserved, slightly aloof gentleman, every inch a scientist, highly respected by his peers and affectionately remembered for his classic verbal responses of ...hmmm. I suspect that 'hmmm' might have been a device to avoid having to give a quick answer, because when asked a question he would sometimes remain silent for an agonisingly long time while he considered the matter.

Arch Dyer's contribution further on in the book deals with the same subject as Len Deacon's, the measurement of turbulent fluxes. This article describes the evo-

lution of the instrumentation used to measure turbulent fluxes, which in essence is the struggle to reduce the response time of instruments to changes in temperature, wind, etc. Two of the instruments developed by Arch's team, the Evapotron and Fluxatron, were household names in the field at the time. The article spans the period of instrument development from the valve era of electronics where the instrument consumed 1 kW of power, to the transistorised era where consumption was reduced to 100 W or less. A number of photographs show the exquisite mechanical instrumentation built in the CSIRO workshop, ranging from a web of incredibly fine resistance wires to sensitive wind vanes. As with Deacon's work, those involved with Dyer's projects seemed to enjoy a sense of pioneering camaraderie.

A particularly enjoyable chapter is 'The saga of the Australian morning glory cloud lines' by Reg Clarke. I had a tenuous connection with the field campaigns in that I lent Reg Clarke some time-lapse film equipment on which to capture the events, and also knew some of the participants. In the article, Reg successfully conveys the excitement of being involved in pioneering scientific work. His richness of knowledge of the subject going back decades and his sense of the unfolding saga comes across strongly and contrasts with the more bland two- dimensional appreciation that support staff often have of an activity. Reading it, I realised that scientists have a depth of feeling for their work that is not visible to their support staff. And I wondered whether an undertaking such as this would be possible in today's bean-counting scientific environment. Reg Clarke carried out the field work post-retirement, an indication of his love for the subject and for scientific endeavour.

The two chapters dealing with satellite meteorology (Griersmith and Wilson, and Ian Barton) were technically interesting and explained a lot of things I only ever had the barest understanding of, but they left me reeling from the prolific use of acronyms. At last I know the meaning of TIROS, AVHRR and McIDAS (I always wondered who McIdas was and now I know -- it isn't anyone). After reading these chapters I was moved to actually go back and count the number of acronyms (including repetitions and captions) in each article. Griersmith and Wilson tallied up 143 in 19 pages while Barton totalled 100 in 10 pages. From this it is but a short step to developing a new acronym which I shall call NAD (Normalised Acronym Density per page). Griersmith and Wilson score 7.53 NAD while Barton comes in a clear winner at 10 NAD. Ian also wins a minor award by achieving a score of 16 SAT (Successive Acronym Total) for his use of ASTR 16 times in four successive paragraphs.

There were just a few things that niggled me about the book. The photo of a northern hemisphere cyclone taken by NASA has no place on the cover of a book on Australian meteorology, no matter how spectacular the picture might be. And some of the black and white prints towards the back of the book are curiously poor in quality, as if they have been printed through a screen. The colour plates irritated me for being grouped together at the back of the book, something I associate with cheap publications or text books which make no pretence at being reader-friendly. I found that constantly having to search the back of the book for colour plates referred to in the text broke the flow of reading and seemed to be at odds with the style of the book. But that's all of the gripes.

In summary, I enjoyed all of the book, but I liked the historic pieces the most. It is a wonderful thing that a few scientists are willing to devote some of their energy to recording scientific history, otherwise it could all too easily get lost in the rush forward. I learned the meaning of a lot of acronyms (but have since forgotten them again) and discovered a lot about the research carried out at the place where I have spent the best part of three decades. All the articles are well written and mostly understandable to a lay person with an interest in things scientific. The inclusion of extensive references for each article is a good idea and will enable the book to be used as a tool for further research into the diverse subject matter it contains. It is an interesting book that will broaden every reader's knowledge in one way or another.

George Scott

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Antarctic Meteorology and Climatology

by J. C. King and J. Turner (Cambridge University Press, 1997). ISBN 0-521-46560-5. 409 pp., $145.

This is the first English-language monograph devoted to the subject of Antarctic meteorology (defined here as the region south of 60°S) since W. Schwerdtfeger's *Weather and Climate of the Antarctic* (Elsevier, 1984). As such, it is most welcome, not only updating Schwerdtfeger, but also providing a more systematic and comprehensive overview than that excellent, but somewhat 'quirky' 1984 volume.

Knowledge of Antarctic climate and meteorological

processes is based on a much shorter data base than for that of any other continental mass. Historically, the study of Antarctic meteorology has gone through three distinct stages: the description of basic surface climatological features from the patchy data of expeditions in the first half of this century and earlier; the preliminary understanding of Antarctic weather systems, and the first continental-scale operational analyses and forecasts that developed with the increased observational network available during and after the International Geophysical Year (IGY, 1957-58); and, since the advent of meteorological satellites in the late 1960s, inclusion of Antarctic meteorology as an integral part of the World Weather Watch. This latter stage includes the advances made as part of the First Global GARP Experiment (FGGE) in 1979. Schwerdtfeger (1984) summarised knowledge of Antarctic weather and climate up until FGGE. This new book includes subsequent progress that has arisen not only from the increased length of record since then, but which is also based on the development and deployment of unmanned observing systems (drifting buoys and automatic weather stations), increasingly quantitative satellite data from new sensor technologies, and the increasing sophistication of numerical models.

Brief biographical sketches of the authors are not included in the book. Both are active research meteorologists within the Ice and Climate Division of the British Antarctic Survey, and both have extensive practical experience of the Antarctic, predominantly in the UK region of activity around the Antarctic Peninsula. John King's recent work includes boundary layer and turbulent transfer studies, katabatic modelling, and research on gravity waves. John Turner has a background in synoptic studies and his research topics have included Antarctic precipitation and moisture transport, and mesoscale cyclones. Turner played a lead role in the FROST program (First Regional Observing Study of the [Antarctic] Troposphere), an assessment of the accuracy of current operational analyses and forecasts that was done under the auspices of the Scientific Committee on Antarctic Research. He is presently president of the International Commission for Polar Meteorology.

The first chapter summarises the physiography of the Antarctic continent, provides a brief history of Antarctic meteorology, and places Antarctic meteorological processes in context in the global climate system. This is followed by a chapter focussing on the peculiarities of observations and instrumentation required in the Antarctic, and providing information on the sources of a variety of datasets. This section is out of place in the main body of the book, and much of the information in these 55 pages would be better in an Appendix. The chapter detracts from the main thrust of describing the climate and the meteorological processes of the region and, although it was relatively up to date when prepared, technological development in satellite sensors and automatic data systems is already dating this section more quickly than most of the rest. Similarly, data sources are rapidly expanding, and many datasets are becoming accessible through World Wide Web sites, a source that has expanded explosively since preparation of the book. An important 'hard copy' data source, omitted in the ocean data section of the book is the compilation of historic Southern Ocean hydrographic data (up to 1986) by Olbers, Gouretski, Seiss and Schröter (Bremerhaven, Alfred Wegener Institute, 1992).

Antarctic physical climatology is reviewed in Chapter 3. The surface radiation budget is discussed for the three contrasting sites: Faraday, Halley and Vostok. A minor irritant here is that the annual cycles of albedo and absorbed short wave radiation are shown plotted for a northern hemisphere year (starting in July), while all other radiation components are shown for the year commencing with January. The geographical and seasonal variation of temperature and humidity; of pressure, geopotential and wind; and of clouds and precipitation are discussed in the subsequent sections. The precipitation (strictly snow accumulation) distribution over the continent obtained from glaciological data is also presented. The chapter concludes with a brief but useful overview of Antarctic sea- ice and its variability, and of the broadscale characteristics and circulation of the Southern Ocean. Because of their importance to ocean-atmosphere interaction, a more complete discussion of the sea-ice thickness and its variability, and of sea-ice dynamics that plays a major role in determining the ice distribution, would be warranted. In general, this is a descriptive chapter, and the reader interested in climatological detail would be advised, for completeness, to also consult Schwerdtfeger (1984), with its appended tabulations of temperature, radiation and pressure at selected stations. It would also have been useful to introduce here some comparison with the Arctic climate regime.

Chapters 4, 5 and 6 deal respectively with meteorological processes at the large-scale, synoptic-scale, and the mesoscale. The mechanisms of the large-scale processes are considered from discussion of the heat budget, vorticity budget, and moisture budget of the South Polar atmospheric cap, defined as the region generally south of 70°S, and between the surface and the top of the atmosphere. For the heat budget, estimates of the net radiation loss at the top of the atmosphere are available from satellite data, but surface energy balance estimates over inhomogeneous surfaces must be extrapolated from sparse observations, and it is difficult to estimate representative regional averages. Atmospheric transport across the boundaries is also difficult to estimate from sparse radiosonde data, although estimates of the components of this suggest that the mean meridional circulation is somewhat more effective in transporting

heat than are eddies. The large-scale atmospheric circulation is strongly constrained by the horizontal transport required to balance the heat budget, and further constrained by the low-level 'katabatic' outflow from the centre of the ice sheet. So in Chapter 4 the simple Ball model of katabatic flow is introduced before considering upper-level circulation forced by this low-level flow. The large-scale water vapour budget has been estimated from radiosonde data, analogously to the heat budget, and these estimates are discussed in the context of the ice sheet mass balance, and compared with glaciological accumulation estimates. The more recent estimates of precipitation minus evaporation derived from moisture convergence in numerical analyses, however, are not discussed. Chapter 4 finishes with a brief discussion of the representation of Antarctica in Atmospheric General Circulation Models and of the application of Limited Area Models to the region.

Chapter 5, the largest chapter in the book, deals with synoptic-scale processes, and operational analysis and forecasting. It includes a discussion of the role of depressions, cloud signatures, cyclogenesis, fronts and frontal development, and a number of case studies of individual systems. The climatology of synoptic systems in the Antarctic and Southern Ocean that is presented here is based largely on the work of Simmonds and co-workers at Melbourne University. The section on operational forecasting deals in particular with the problem of producing analyses over the interior of the East Antarctic ice sheet, where the surface is close to the 700 hPa level, and the use of alternative analysis techniques is required. Finally, the performance and accuracy of numerical weather prediction systems in the Antarctic are assessed from the results of the FROST study. Chapter 6, on mesoscale processes, comprises a somewhat heterogeneous mixture of sections on local winds, internal gravity waves, turbulent transport in the atmospheric boundary layer (including blowing snow), and a large section on mesocyclones, short-lived, subsynoptic-scale systems that can cause severe weather. The section on local wind systems provides a more rigorous investigation of katabatic flow, including the effects of local topography and local thermal forcing, katabatic-synoptic interactions, dissipation of katabatic flow; and a discussion of the Barrier Winds of the Peninsula.

The final chapter in this book deals with climate variability and change in the Antarctic. This includes an assessment of change and variability of temperature and precipitation in the existing short historical record, brief reference to the longer proxy record obtainable from ice cores, and predictions of the response of the Antarctic climate and ice sheet mass budget to 'greenhouse'-induced change. Also dealt with here are the connections between Antarctica and low latitude circulation, and particularly the potential links between Antarctic processes and ENSO. Appended are two chronological lists, one of manned meteorological observing stations and another of Antarctic automatic weather stations.

The book is well presented, with adequate figures and photographs, including black and white satellite imagery. Some data tables would be clearer if they had been better formatted (e.g. Table 4.6), and there are a number of small factual errors throughout, probably arising from inadequate proofreading rather than misconception. Neither of these minor faults detract from the value of the volume, which is additionally enhanced by an extensive bibliography of almost 500 references (up to 1995). The substantial Australian contribution to the study of Antarctic meteorology and climatology is evident from references throughout the volume.

In summary, this is a valuable and long-awaited overview of Antarctic meteorology and climatology. It will be an essential background reference for meteorological professionals specialising in the region. Although some sections assume considerable prior knowledge of meteorology, it will also be a valuable source for Antarctic and Southern Ocean scientists and postgraduate students in a wide range of geophysical, environmental, and life sciences.

Ian Allison

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Radiation and Water in the Climate System: Remote Measurements edited by Ehrhard Raschke (Springer, 1996). ISBN 3-540-61459-1. 614 pp., DM 138.

This book is the proceedings of the NATO Advanced Study Institute on 'Remote Sensing of Processes Governing Energy and Water Cycles in the Climate System', held in May 1995. The chapters are modified versions of the presentations at the ASI, with each chapter being essentially self-contained. The effect is more of a conference proceedings than a coherent and unified

textbook. Despite a few glaring errors, the overall production quality is quite high.

The book has three main sections: introductory background; the remote sensing of clouds, radiation and precipitation; and remote sensing of surface properties and processes. The first chapter is an overview by Raschke, outlining what can be measured from space. Del Genio describes observational requirements for validating climate models and for improving predictions of climate change.

Albertson et al. give a good introduction to surface fluxes and present some results from an improved version of the inertial-dissipation method of measurement. This work was interesting and new to me but seems marginal to the overall theme of the book. Courtier gives an introduction to NWP assimilation, including 4D variational assimilation, that again is interesting but marginally relevant.

Fouquart and Vesperini give a good introduction to the principles of remote sensing, describing radiative transfer, scattering, absorption etc. Stewart describes the structure of extratropical cyclones, particularly their water transport. Stuhlmann describes the effect of clouds on the earth's radiation budget. This presents results from ERBE and ISCCP and includes both top of atmosphere and surface cloud forcing. However, it was written too soon to report on the recent controversy on surface shortwave cloud forcing and the possible excess cloud absorption.

Rossow contributes chapters on atmospheric water vapour and clouds and the principles of their remote sensing. These are mainly summaries of observations rather than descriptions of techniques. Weitkamp gives a very good description of lidar, including differential absorption and Raman lidars. This is illustrated with case studies of several instruments. Simmer outlines the problem of measuring precipitation from satellites, concentrating on passive instruments. This is followed by two chapters on ground-based radar remote sensing. Joe describes a range of techniques for rainfall, while Clothiaux et al. give a detailed description of the use of the Penn. State University radar for measuring cloud properties, including water path and drop size distributions.

Paloscia describes techniques for the remote sensing of soil moisture, based on the change in the dielectric properties and hence emissivity as a function of water content. These are promising, but there are still problems due to varying vegetation and surface roughness. Bastiaanssen et al. and Schlüssel describe remote sensing of evaporation over land and ocean respectively. The former calculates the latent heat flux as the residual of the surface energy budget, with the sensible heat flux estimated from remotely sensed surface and near surface air temperatures. Over ocean, the evaporation depends on remotely sensed sea-surface temperature, surface wind speed and near-surface humidity. Given the many steps involved in both these calculations, the results seem remarkably good. For example, over the ocean, monthly mean latent heat fluxes can be determined to 10 Wm^{-2}. Katsaros outlines remote sensing of properties of ocean weather systems. Hallikainen describes the physical basis for remote sensing of ice and snow, detailing their physical properties and the algorithms used.

The book concludes with two chapters on new developments. Del Genio describes the Tropical Rainfall Measuring Mission, reminding us how poorly even global mean precipitation rates are presently known. This satellite, launched in late 1997, will also include the CERES instrument, a successor to ERBE. Noll et al. describe a new Multi-frequency Imaging Microwave Radiometer due to fly in about the year 2000. This is a successor to the SSM/I instrument.

There are a number of good individual articles in this book, but overall I was a little disappointed with the collection. It might just be the bias of a climate modeller, but there seemed relatively little on ERBE and ISCCP given how much current work is based on their results. There is also very little on the remote sensing of atmospheric aerosol. There isn't enough new in the book to make it vital reading for an expert in the field. While the level of articles is right for it to be an adjunct to an advanced course, the coverage is too patchy for it to be considered a textbook. On a positive note, the price is reasonable for a book of this nature.

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Turbulence and Diffusion in the Atmosphere: Lectures in Environmental Sciences by Alfred K. Blackadar (Springer, 1997). ISBN 3-540-61406-0. 185 pp., $77.00.

An understanding of the turbulent nature of the flow in the atmospheric boundary layer is important for a large class of environmental problems. Prof. Alfred Blackadar of The Pennsylvania State University has developed his class lecture notes on turbulence and diffusion in the atmosphere into an introductory textbook. The book assumes that the students have no previous

experience in these areas, but do have a basic knowledge of hydrodynamics. The aim is to provide a current overview of the field and to gain exposure in the use of the important tools of tensor invariants, dimensional analysis and scale analysis in order to obtain insight into the governing physical relationships.

He begins with a discussion of the nature of turbulence, differentiating between two-dimensional mid-latitude vortices (cyclones and anticyclones) and three-dimensional turbulence. The focus of the book is confined to three-dimensional turbulence in which energy is transferred 'down the gradient' from large scale to small scale. Other basic concepts discussed include the importance of the Reynolds number, the uses of Reynolds averaging, conservation of fluid properties, the closure problem (the turbulent equations have a greater number of variables than the number of equations and this creates a problem in solving them) and first-order closure (K-theory). This is followed by a short chapter on the Navier-Stokes equations in which the stress-rate of strain relation is derived.

The next five chapters deal with the turbulence energy equation and a description of the atmospheric boundary layer (in neutral conditions, diabatic conditions, stationary and homogeneous conditions, and unconstrained conditions). The discussion begins with the simplest case: the neutral boundary layer. The logarithmic profile is derived and illustrated with data from the Great Plains Field Experiment at O'Neill, Nebraska. The concepts of momentum roughness length, the zero-plane displacement, and bulk transfer coefficients are explained, and the power-law profile, favoured by engineers to estimate winds at different heights, is introduced. He concludes this chapter with some critical remarks about the deposition velocity, a concept that is widely used by the air pollution community to define the downward flux of a pollutant near the surface, but which is inconsistent with the bulk transfer flux relationship.

Before discussing diabatic surface conditions, Blackadar introduces the topics of thermodynamics and energy transformations. A heuristic treatment of these concepts is given in the text, while a more rigorous treatment is given in an appendix. Unlike the classical discussion normally presented in meteorological texts, Blackadar deals with open thermodynamical systems (turbulent motions cause transfer into and out of the system). Thermal stability is then characterised by the Richardson number and the criterion for turbulence to exist is examined. This leads to the concept of what Blackadar calls the 'Monin length' (although Obukhov derived this length earlier) and to the Monin-Obukhov similarity theory. He presents both the Dyer-Businger profile functions and the older KEYPS interpolation equation. He also shows that the power law expression for the wind profile is not consistent with Monin-Obukhov similarity. Dimensional analysis and scaling principles are pursued further in an appendix, including an interesting application involving turkey eggs.

Blackadar then turns his attention to the entire atmospheric boundary layer and derives the Ekman spiral, following the approach of G.I. Taylor (but using a scaled form of the equations). Taylor assumed slip at the lower boundary (the scaled height $Z = 0$ refers to the height of the surface wind observations, usually about 10 m). The assumption of a constant eddy viscosity cannot be valid from the actual surface to the top of the boundary layer; however, a two-layer model with a logarithmic surface layer and a constant eddy viscosity layer above it can satisfy the theoretical requirements. Blackadar shows that such a model yields good agreement with observations for the Kazanski-Monin resistance laws. Further discussion of the resistance laws and matching principles is given in an appendix.

The effects of change in surface roughness and the diurnal evolution of the boundary layer profiles are briefly described in Chapter 7. Much of our present understanding of the nocturnal boundary layer goes back to analysis of the early U. S. Weather Bureau kite data (obtained between 1916 and 1918) and the O'Neill data. Blackadar first elucidated the mechanism of the low-level jet in 1957. He has augmented his discussion in the text with a floppy disk containing his one-dimensional boundary layer model. The programs, written in Quick Basic, are designed for use on a PC with Windows 3.1 or Windows 95, and include colour graphics. The user can choose to run the model with the default values or may vary 22 parameters or options, and thus discover the sensitivity of the predictions to particular parameters. Several datasets are included (e.g. Wangara Day 33, O'Neill low-level jet, Gifford's observations of nocturnal bursts of surface temperature rise, bogus data showing a cloud-topped boundary layer). Details of the model are given in an appendix.

The next two chapters deal with a statistical representation of turbulence. The first of these introduces definitions of various scales and summarises the scaling methodology used for the surface layer, forced and free convection, and local scaling in the nocturnal boundary layer. Profiles of scaled variances are then discussed. The second chapter introduces the basic concepts relating to the spectrum and cross spectrum and the theoretical work of Kolmogorov. Observations of scaled spectra and cross spectra in the surface layer and the mixed layer conclude the chapter.

The last chapter is devoted to diffusion from discrete sources. Gaussian plume theory, Taylor's Lagrangian theory and the use of Pasquill-Gifford diagrams are briefly outlined. The elements of Monte Carlo diffusion theory are given and a second floppy disk is provided containing a Monte Carlo model. The disk allows the

user to explore the effects of stability on dispersion characteristics and ground impact position and time. A set of problems accompanies each chapter.

I recommend this book for anyone who is looking for a short, concise introduction to the field. I liked the fact that Blackadar reminds us of the value of some of the older field experiments. What really sets this book apart from others in the field, though, is the inclusion of his models on floppy disks. These enable readers to explore physical relationships on their own. Just a couple of minor points. I regret that appropriate references where subjects could be investigated in greater detail were not explicitly indicated at the end of each chapter. Also, some of the work referred to in the text, such as that of Reynolds, Roll, Charnock, von Karman, Munk and Motzfeld, is not listed in the references.

Dale Hess

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