

Book reviews

Thor's Legions: Weather Support to the U.S. Air Force and Army, 1937–1987 by John F. Fuller (American Meteorological Society, 1990) ISBN 0 933876 88 2. US\$65.00 (non-AMS members), US\$45 (AMS members)

This 443–page book is a worthy addition to the American Meteorological Society's Historical Monograph Series. Apart from its contribution to meteorological history it provides a valuable insight into the work of one of the world's largest meteorological services (19,161 personnel in World War II; about 5000 in 1987), often overlooked because it is not a member of WMO.

The author is well qualified for his task — he holds a B.A. in history and an M.A. in military history. He served six years as a pilot with the US Air Force and 18 years as the historian of the Air Weather Service.

Although the subtitle of the book is 'Weather Support to the U.S. Air Force and Army 1937–1987', the first 25 pages of the text provide a good background to the origins of the Air Weather Service (AWS) from the weather observations taken by Army Captain Lewis during the Lewis and Clarke expedition to the Pacific back in 1804–1806, to 1890 when America's National Weather Service was transferred to the new United States Weather Bureau, to the work of US Army meteorological units in the Great War and on until the birth of the Air Weather Service in 1935. (Indeed this reviewer found this part of the book the easiest to read contrasting with the ever increasing detail of the later chapters, particularly those covering the period of the author's work with the AWS).

The book also provides a different and interesting view of major American military operations, from the Allied invasion of Europe during World War II, through the abortive attempt to rescue hostages in Iran in 1980, and to the US operations in Grenada in 1983. However these are considered mainly from the American point of view and readers, such as this reviewer, seeking details of interaction with other weather services may be disappointed. Cooperation with the RAAF Meteorological Service during World War II is scarcely mentioned. The book states that when the 15th Weather Squadron arrived in Australia in August 1942, it took over American weather men serving US tactical units with no mention that they, along with Netherlands weather men from the then Dutch East Indies, were then under the

control of Group Capt. H.N. Warren, Director of the RAAF Meteorological Service. The only other, albeit oblique, mention of that service is in connection with the attack on Lae in 1943 with the statement that Australian meteorologists were of immense help to their American counterparts. This praise is immediately qualified with a reference to complete disagreement on the forecast for the day of the initial assault.

The author has drawn heavily on AWS command or unit histories but there is a risk of bias in these because, understandably, such histories endeavour to present their military formations in the best possible light. For example the disastrous failure of the US bombing raids on Ploesti, Roumania, in 1943 (the 'Charge of the Light Brigade' of the US Air Force) is attributed to weather on the way to the target destroying the formations' discipline. No mention that sandstorms at the North African bases caused many planes, including the lead navigator's, to abort due to engine damage and that subsequent navigational errors by the mission leader were the prime cause of the disaster.

In his conclusion to the book the author appears as anything but a detached historian and indeed the Preface states that the culmination of his efforts was that his manuscript was censored, he received a letter of reprimand and was removed from his position of AWS historian.

With its wealth of detail including the names of the participants — not only commanders and commissioned officer meteorologists but also the non-commissioned and airmen observers and technicians — the work would have the greatest appeal to former members of the AWS as a reminder of old comrades and battles (both against the enemy and the bureaucracy) won and lost. Others who invest the US\$45 or more in the book will find accounts not only of meteorological activities associated with American military campaigns but also of the major involvement of the AWS in such fields as observing and forecasting jet stream winds, clear air turbulence and severe weather. And, of course, its major contribution to tropical storm reconnaissance.

In short, the book is not for everyone but it will appeal to those, such as this reviewer, who may like to review, from a different perspective, events which they can remember.

Don Handcock

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Physical Processes in Atmospheric Models edited by D.R. Sikka and S.S. Singh (Wiley Eastern Limited, New Delhi, 1992) ISBN 81-224-0384-0. Rs.550.00.

This book is the proceedings of an Indian-US seminar on parametrisation of subgrid-scale processes in dynamical models, held in Pune, India in 1990. It contains 35 papers collected under seven themes: 'Cumulus convection and parameterization', 'Planetary boundary layer, land surface processes and air-sea interaction', 'Radiation and the radiative effects of clouds', 'Orography and gravity wave drag', '4-D Data assimilation and systematic errors of operational models', 'Sensitivity studies', and 'Biosphere and land surface processes'. Most of the papers have an element of 'review' about them; though often it is a review purely of that author's work. The authors representing the US side to the symposium include many leaders in the field such as Arakawa, Alan Betts, Chris Bretherton, Graeme Stephens, Dave Randall, Peter Webster and others.

One of the main strengths of the book is the collection of so many papers in the one volume, as it gives a good feel for the state of the science of parametrisation as of 1990 and of the major themes and ideas being worked on. Approximately half the papers are by Indian scientists, so the book presumably presents a summation of the major work in the field by that group.

On the negative side, it suffers the weaknesses one would expect *a priori* in a 'published conference proceedings': much of the contents appears elsewhere in slightly different form; and as far as new results are concerned, the quality of papers is below that in the refereed literature. This latter 'fault' is balanced, however, by the more tutorial and accessible style of the articles compared to the usual literature. The listed price is Rs. 550, which converts to less than Australian \$30, so it should be bought by the libraries of the major meteorological institutions.

John McBride

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Synoptic-Dynamic Meteorology in Midlatitudes Volumes I and II by Howard B. Bluestein (Oxford University Press, 1992) ISBN 0-19-506267-1, 0-19-506268-X. US\$59.95, US\$65.00.

Professor Bluestein has attempted in this two-

volume book to provide a modern replacement for Petterssen's classic *Weather Analysis and Forecasting*. These books have evolved from (originally) Fred Sanders's course notes at MIT, and subsequently Professor Bluestein's course notes from the University of Oklahoma. Carlson's recent *Mid-latitude Weather Systems* covers much of the same subject matter, and also evolved from a set of course notes at Pennsylvania State University, and so perhaps a buyer should compare the two works.

Volumes I and II are subtitled 'Principles of Kinematics and Dynamics', and 'Observations and Theory of Weather Systems'. With the luxury of two volumes, the flavour of a set of course notes has been preserved, rather than being presented as a very dry textbook, and in many places one can sense the author lecturing; his love of the subject comes through very strongly. The parenthesised puns and 'one-liners' may irritate some people, but others may feel that they provide a human touch to the book.

Volume I commences with four chapters which in turn present a definition of concepts, units and coordinate systems, scalar fields and their kinematics, the kinematics of the wind field, and an introduction to atmospheric dynamics and thermodynamics. This part of the book has some apparent parallels with the early chapters of Petterssen's books. Much of these sections is clearly undergraduate, but does present a very sound definition and derivation of basic principles. Those who have already done their introductory meteorology courses may find them a little slow, however, the kinematics are well illustrated with clear graphical examples, and a sound basis is built for the later chapters. The dynamics chapter derives the equations of motion, the continuity and the thermodynamic equations in height, pressure and isentropic coordinates, and also in cartesian and natural coordinate systems. This may be seen by some as an indulgence, but does provide a good reference source, particularly as the advantages and disadvantages of the respective systems are discussed. The various forms of the vorticity equation are derived and its physical interpretation discussed in the latter part of Chapter 4.

Chapter 5, the last chapter of Vol. I, occupies over 100 pages, and presents a very thorough discussion of quasi-geostrophic theory, commencing with a scale analysis of the thermodynamic and vorticity equations to arrive at the quasi-geostrophic versions of these equations, and proceeding through to the quasi-geostrophic omega and height-tendency equations. The various forms of the omega equation (Holton, Trenberth, Q-vector) are discussed and compared, and both a physical and a mathematical interpretation of the equations are presented. I enjoyed the balance and detail of this chapter.

Volume II has only three chapters, although these are large and have many subsections. The first chapter, 'The behaviour of synoptic scale, extra-tropical systems', covers the formation and movement of surface and upper-level pressure systems. The quasi-geostrophic framework developed in Volume I is applied throughout this discussion, and this then leads to a discussion of baroclinic instability, using Sanders's analytic model as an example. Again a large number of graphical examples are presented, but this time there are a large number of weather maps as well, showing real examples of the concepts being discussed. The latter part of this chapter describes the evolution of the classic mid-latitude cyclone using in turn the quasi-geostrophic framework, the balance equation, a generalised height tendency equation, and using isentropic potential vorticity (IPV) thinking. Here, too, the balanced discussion was refreshing, and I enjoyed this section of the book. In this chapter a large number of diagrams from published case studies are presented in some detail to illustrate the concepts being discussed.

Chapter 2 of this Volume is entitled fronts and jets. One of the things I liked about the early part of this chapter is the examples of 'real' fronts over the US, which show fronts are far more complex than can be explained by simple conceptual models. From a parochial viewpoint, it was nice to see Australian cold fronts acknowledged on p. 267. In this chapter the necessity of introducing the geostrophic momentum approximation is discussed, and the semi-geostrophic equations are derived in some detail (the synoptic charts disappear to be replaced with pages of algebra), but the comparison of quasi and semi-geostrophic frontogenesis is well summarised in tables. The discussion of jet streaks and circulations surprised me by its (relative) brevity.

The final chapter, 'Precipitation systems in the mid-latitudes', I felt was addressing a rather different audience than the remainder of the two-volume set. Most of this chapter is devoted to convection, and thus leans heavily on the US Great Plains experience. Again, though, a large number of well-presented diagrams illustrate the concept being discussed.

How do I think the book worked? There are many things I liked about the books. The derivation of quasi-geostrophic theory and the discussion of mid-latitude cyclogenesis unifying the different diagnostic approaches was useful. The many graphical illustrations were excellent (of course, generally for the northern hemisphere), and I expect to see them (or adaptations of them) used in talks in the next few years. The detail

given in many sections was excellent (a luxury made possible by the decision to publish in two volumes, preserving some of the character of a set of course notes). For this reason the books will make a good reference. The many exercises at the end of each chapter are valuable undergraduate exercises, and would well reinforce the subject matter.

There are some things which were irritating about the books. A great deal of care should be given to eliminating the many typographical errors which occur throughout the books if a second edition is to be issued. While many of these are obvious, I did find some less obvious and more important ones: e.g. 'upstream' and 'downstream' were confused in a description of divergence patterns associated with upper waves in one place, and an occasional error in the algebra. With nearly 1000 pages in the two volumes, there are undoubtedly errors which I have missed, even though I feel I found rather too many. One should thus be careful in following some of the more detailed discussions, although the detail presented is probably sufficient to enable an interested reader to correctly follow the arguments. Professor Bluestein does introduce some words which I had not previously met (e.g. 'evaporization' and 'jetogenetical') — time will tell if future synoptic meteorologists talk of jetogenesis as they now do of frontogenesis.

The other feature of the work which reminded me of my own undergraduate courses was the inclusion of short sections near the end of several of the chapters which did not balance that well with the detail of the bulk of the chapter. It is as though these sections were included in order to alert the students to these concepts, but I feel that some of them could have been excluded without detracting from the worth of the book.

Apart from the weakness in the proofreading though, the above criticisms are personal opinions. The bottom line is 'would I use these books?' I think the answer is yes. Definitely anyone who is active in teaching, researching or forecasting mid-latitude weather systems would find value in having the books available for reference. Whether they eventually have the impact that Pettersen's books had is yet to be determined.

G.A. Mills

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