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REVIEWS

Applied Environmetrics Meteorological Tables. By T. Beer. Applied Environmetrics (118 Gordon St., Balwyn, Australia 3103), 1990. 56 pp. US $124.95.

These tables follow closely the companion publication on Oceanographic tables in its style of presentation. The author's aim is to produce a set of tables as definitive as the *Smithsonian Meteorological Tables* (1949), but also to extend and update the Smithsonian tables for use on personal computers. However, a selection criterion is required to enable a sub-set of the information to be placed on a single 360K MSDOS disc and to be run on a PC with at least 256K of RAM. The author's criterion is that the information should be relevant to the needs of a fire meteorologist, which includes atmospheric moisture, winds, smoke plumes, and heat and mass transfer in fires. Fortunately for the wider community of meteorologists this criterion is not applied too narrowly, and the majority of the information presented was found by this reviewer to be more generally useful.

There are 15 sets of tables and programs presented, of which the first 10 tables are essentially the Smithsonian tables in the new format. The notes accompanying each table are clearly presented with an introduction to the material and units used, which generally includes both CGS and SI systems. This is followed by a résumé of the background theory and sources of reference material where appropriate. Finally a listing of a file which contains a tabulation of the independent variables for each table is given, and this can be edited by the user to produce the desired table. One of the virtues of this presentation is the care and attention to detail. For instance the terminal velocity for particles (table 9) includes warnings that in the limits of high and low Reynolds number Newton's law and Stokes law (on which the table is based) break down. The geostropic wind (table 6) has a clear warning when applied to within 10° of the Equator. It is therefore a good publication for students studying meteorology and oceanography at undergraduate level in Universities and Colleges as it will help them to use more carefully the empirical information on which much of the science is based.

This reviewer has, however, a couple of criticisms of the tables which relate to the previous reviewer's comments (see *J. Fluid Mech.* vol. 217, 1990, p. 661) on the mode of presentation. For example, in table 11 dew point, vapour pressure and wet-bulb temperature are presented for a given dry-bulb temperature. The user therefore has to interpolate from his measured wet-bulb temperature to find the vapour pressure or relative humidity. In my opinion it would have been more useful to allow the user to input both the dry- and wet-bulb temperatures, which are the most commonly measured humidity values, from which the other moisture parameters could be obtained directly. A more general criticism is that there is a constant requirement for the user to interpolate from the tables, which is unnecessary when the PC could do this task so efficiently.

The remaining five tables include the wind profile in the surface atmospheric boundary layer (between a height of 2 cm and 100 m), as a function of the wind speed at 10 m and the vertical stability as measured by the Monin–Obukhov lengthscale. The tables on diffusion and dispersion in addition to the molecular viscosities and thermal diffusivities include a simple Gaussian diffusion model for a continuous source. Finally a set of fire-weather tables are presented which give an index of fire danger for grassland and the rate of spread of a fire front as a function of atmospheric parameters such as temperature, humidity and wind speed and the moisture content of the grasses. Another model determines the fire-front spread as a function of the fuel loading, the fuel depth and the surface-to-volume ratio of the fuel as well as the wind speed at 2 m above the ground or mid-flame height. To this reviewer these models provided an interesting demonstration of an application of boundary meteorology to a very important problem in many countries. The notes on the tables provide some background explanation of the models but not sufficient for a good understanding of the subject. Unfortunately the background references are in government reports which may not be easily accessible to the interested student. Finally two sets of statistical tables are provided, one for normal and chi-distributions and the other for a Weibull distribution. The latter distribution is widely used for wind-energy studies, though here its use for the probability distribution of time intervals between fires is discussed. These are standard statistics tables which are not significantly enhanced by the new format.

In conclusion, the publication is a useful first step in the presentation of meteorological tables and models in a PC-based format. In addition there is considerable evidence of care and attention to detail which is a necessary prerequisite for such a publication. For these two reasons it deserves to be used in the laboratory and field by both students and researchers as well as the fire meteorologist.

N. WELLS

Cavitation. By F. RONALD YOUNG. McGraw-Hill, 1989. 418pp. £45.

The author is well-known for his research on sonoluminescence and hydrodynamic cavitation. In this book he attempts a comprehensive treatment of most of the major topics of cavitation. There are chapters on bubble dynamics, acoustic cavitation, hydrodynamic cavitation, sonoluminescence, sonochemistry, bubble spectrum analysis and applications. To cover all of these topics is a daunting task, and the author has based chapters outside his immediate experience very directly on other people's writings. This is freely admitted in the Preface and most sections start with a phrase such as 'the following treatment is due to...'. The result is that the book is a valuable piece of librarianship with the material ordered systematically and logically and well referenced. Unfortunately, what is lacking is a critical assessment of the various topics, both individually and as a group, from a physical viewpoint. It has been a characteristic of the field of cavitation that (as the author warns us in the Preface), the definition of certain terms has not been rigorous. Multiple forms exist in the literature, devised by workers to meet a variety of situations. As this work draws directly from the literature on many occasions, the reader tends to encounter descriptions of a given phenomenon, and multiple definitions, throughout the text. It would have been better had the author been more critical in his descriptions and definitions and taken the opportunity to provide his reader with only one distilled discussion of each phenomenon by reviewing the problems in the established literature. For example, there is some confusion about the definitions of stable and transient cavitation. Those on pages 6 and 38 agree with each other, but confusion can arise when compared with the definition on page 43 (section 3.2.3), which contains several ambiguous or misleading statements – transient cavities are not necessarily larger than stable cavities, contrary to the impression the author gives. In addition, it is often not clear, when he describes growth, whether he is talking about the expansion phase of the bubble oscillation or about rectified diffusion. By 'original size' does he mean the equilibrium bubble radius about which oscillation occurs, or the size of the source nuclei from which the bubble grew by rectified diffusion? Better discussions of these processes exist in articles by Neppiras (*Phys. Rep.* vol. 61, 1980, p. 159) and Walton & Reynolds (*Adv. Phys.* vol. 33, 1984, p. 595). The section on Bjerknes forces (3.11.1) is copied directly from Walton & Reynolds (1984) which is itself wrong at this point. Critical reading of this review paper should have revealed the error: as it is, the author follows the derivation through to the resulting equations (3.67) and (3.68) which cannot explain why small bubbles go to the pressure antinodes and large to the pressure nodes. The author's $\cos kx$ factor should, in fact, be $0.5 \sin 2kx$ (for a recent discussion of this point see Leighton *et al.* (*Eur. J. Phys.* vol. 11, 1990, pp. 45–50). Bearing in mind the problems mentioned above, subsequent critical references to the primary sources would be necessary for complete ease of mind. In many cases, the primary source is not the paper quoted by the author, who himself often relies on review articles (Neppiras; Walton & Reynolds, etc). The references in the book are given by number. I personally find this significantly less useful (when trying to trace a particular author's work) than the name and date system with references collected alphabetically. However, the author has added many attractive features to his book with lists of symbols, notes on dimensions, parameters and units, a guide (p. 37) on how to obtain more obscure reports and a list, with comments, (pp. 409–11) on key reference books. Finally, there is a valuable discussion of the state of cavitation research in a foreword to the book by Professor Wesley Nyborg. In brief, a valuable reference book but the reader will frequently need to seek out the original references to get a full picture.

J. E. FIELD

Principles of Magnetoplasma Dynamics. By L. C. WOODS. Oxford University Press, 1987. 521 pp. £70.

The dynamics of charged particles in a magnetized plasma is a formidable topic in plasma theory, embracing many diverse phenomena ranging from solar flares to controlled thermonuclear fusion. In this weighty book, Woods addresses a comprehensive number of theoretical aspects of topical interest.

Beginning with a condensed exposition of the basic concepts, the first chapter is concerned with the fundamentals of fluids and the associated tensor analysis, thermodynamics and the basic elements of plasma theory. The author then proceeds to give detailed and thorough (though concise) accounts of magnetohydrodynamics, charged-particle dynamics, transport theory in a magnetized plasma, shock waves, and finally transport in tokamaks. In every chapter, the fundamental principles underlying each physical concept are stated clearly and concisely, serving as a foundation for the subsequent theoretical development of the topic. In this way, the text is largely self-contained.

An especially attractive feature of the book is the use of explanatory asides (termed Mathematical Notes) in the main text in order to elaborate some particular point of analysis. This technique is exploited to good effect, maintaining the reader's momentum and interest, without the interruption of having to consult separate appendices.

The breadth of topics covered is substantial and much new work, hitherto unpublished, is included. Of particular note are the discussion of the 'paradoxes' arising in the context of guiding centre motion, and the development of a new second-order transport mechanism applied to transport and instabilities in tokamaks, with proposed explanations of the sawtooth instability (including 'giant' sawteeth) and tokamak disruptions.

Certain aspects of the book are open to criticism. For example, the list of references cited contains comparatively few contemporary papers (excepting the final chapter on tokamaks), and little attention is paid to the contribution of numerical simulation to the understanding of the topic.

This is not an easy book to read: it is not for the beginner. However, as an authoritative reference text, it is a valuable addition to any collection.

D. A. DIVER