

Book reviews

Stochastic Integral Equations and Rainfall-Runoff Models by Theodore V. Hromadka II and Robert J. Whitely (Springer-Verlag 1989) ISBN 3 540 51086 9. Pp xviii + 384, DM130.00.

To my knowledge, this is the first book to deal with an important but difficult topic of uncertainty in rainfall-runoff modelling. There are six chapters in the book. The first chapter reviews rainfall-runoff modelling while chapter two reviews basic probability and statistics. The stochastic integral equations are introduced in chapter three onwards. The unit hydrograph is used exclusively in the text and its usage is justified by the fact that it is simple and easy to apply, used by a number of agencies, and produces results comparable to those from more complex models. There are a number of examples within the chapters and study problems at the end of chapters which will help to reinforce the concepts developed in the text.

Chapter one occupies about a third of the book and gives a comprehensive review of rainfall-runoff modelling in flood flow estimation. It briefly describes several methods for determining synthetic flood frequency estimates in the USA giving their applicability, limitations, advantages and disadvantages. Uncertainties in watershed modelling are then discussed with several examples from earlier work on the difficulties in parameter estimation associated with complex models. This is followed by the estimation of rainfall losses in catchments and runoff routing in channel networks.

Chapter two is a concise review of probability and statistics covering standard topics such as probability spaces, random variables, moments, parameter estimation and confidence intervals. The basic concepts are illustrated through examples and I think that this data-based approach will greatly assist the reader in understanding the concepts.

Stochastic integral equations are introduced in chapter three through the development of two simple rainfall-runoff models based on the unit

hydrograph with different channel-routing algorithms. The catchment is represented by a sub-area link-node model and any storage or backwater effects are ignored. At this stage of development, effective rainfall is assumed to be known to simplify the model complexity.

In chapter four, a multilinear rainfall-runoff model is used to estimate the runoff hydrograph with measured rainfall as input. Several loss models were used and the classic unit hydrograph method is modified to include the effects of non-linear response by means of storm classes. The subscripts in the Horton equation are misplaced; the same error was carried to their paper in the *Journal of Hydrology* (1989, Vol. 111, No. 1-4, 321-360).

Chapter five deals with the distribution of T-year values of criterion variables of a rainfall-runoff model. It is almost impossible to read page 284 because of the large number of missing symbols. A worked example with an associated computer program illustrates the method well.

Chapter six addresses issues such as the improvement of rainfall-runoff model structures and estimates of confidence intervals. Three different models with varying degrees of catchment subdivisions are used to illustrate the methodology as well as the effects of subdivision on the final results. The computer listing provided should make it easy to apply the developed method.

In general, the typesetting of the text is not particularly good. Offsetting of the superscripts and subscripts makes it difficult to read. I am amazed by the large number of typographical errors and missing or misplaced symbols which I hope will be rectified in the next edition. In conclusion, I find this book to be useful to anyone in the research field rather than to practising engineers or hydrologists.

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Applied Environmetrics Oceanographic Tables by Tom Beer (Applied Environmetrics, Melbourne, Australia, 1989) ISBN 0 9590809 2 9. 38 pp. plus disk, \$A149.95.

Tom Beer has published a set of tabulated oceanographic information using both conventional and electronic formats. The 'book' comes in two parts. An instruction manual contains detailed 'how to' information that enables the user to wend through the tabulations and calculations which are sourced on a companion 360K 5.25" MSDOS floppy disk. The manual also provides details of the origins of data held in tables and an explanation of the scientific principles underlying the calculation of other derivative quantities. Original data and scientific sources are well documented in the list of references.

The tables cover a comprehensive range of oceanographic quantities, including physical properties of sea-water, interface properties, characteristics of wind-induced currents and waves, tidal prediction tables, basic relevant astronomical data as well as radiation and statistical information. The information has been culled from a large number of well known and well used standard handbooks, such as the *Admiralty Tide Tables*, Abramowitz and Stegun's *Handbook of Mathematical Functions*, the *Shore Protection Manual*, the *Smithsonian Meteorological Tables* and WMO's *Technical Regulations*, to name a few. Quite clearly this publication does not intend to replace all the information available from its source publications, and so a useful but much smaller subset has been gleaned. Fairly extensive explanations of the nature of source publications as well as the rationale and methods used to calculate the various quantities are all easily obtained.

The range of topics covered is good, although I would question how useful some of the choices might be. For example, the section dealing with surface wind waves does not deal with some of the more classic idealised wave energy spectrums. Tabulations of the Pierson-Moskowitz and JONSWAP spectrums would be very useful for anyone involved with wave modelling or forecasting. While I would not question the veracity of the tables, a possible cause for concern is the likelihood that errors were introduced during transcription of data from the original printed sources. These concerns aside, the book is easy to use and a completely uninitiated user is guaranteed to be competently in the driver's seat within a few minutes of loading the disk.

The version I was given was for monochrome display, being white text on a black background.

I particularly liked the user friendliness with regard to the use of units. The user can generally select from a wide range of units, both metric (SI and others) and imperial, to complete calculations for tabulation. On the whole, prompted inputs, for example temperature, pressure or depth for a given tabulation, are easily entered. One exception I found arose when using the Tidal Prediction Table (Item 6). Care has to be taken when entering zero values for either the amplitude or phase of tidal components. The user must enter '000' rather than '0', which seems to be somewhat idiosyncratic and user unfriendly. Prompts are easily identified, although I would have preferred bolding, colour or blinking to separate them from other parts of the screen display. Once identified, the prompts easily lead a path through the tables.

I found the extensive accompanying explanations extremely helpful. However, the display format was somewhat trying on my eyes. This seemed to have resulted from a combination of the dull monochrome and the right justification of the text. Right justification, while appropriate for the printed page, has given these (sometimes lengthy) explanations a very straggly look on the screen. To compound this effect, subject headings or separators are not particularly well spaced or sign-posted through the explanatory text. Again, bolding, italics or even underlines with a few extra blank line separations would have helped.

In a similar vein, the layout of the main on-screen subject index is also a little messy. For some reason the subject reference numbers are scattered across the page instead of being vertically aligned to ease visual referencing.

Hard copy of any part of the tables is easily obtained using the 'Print Scrn' key, or by using simple DOS commands, the program output can be routed to a separate disk file for delayed printing. This enables tables or information to be studied at length. Data saved on disk can also be used as input to other programs, if required. It was noticed that if a page of text (e.g. the index) looked messy on-screen, the hard copy did not look any better.

I would think that this book would appeal to a broad range of users who prefer the convenience that these tables offer. Working scientists, who have relatively easy access to most of the reference material on which the book is based, may decide that their requirements are adequately met by these conventional sources. However, this publication integrates a good deal of useful working information in a way that offers some rather unconventional advantages. Anyone working away from a library (with access to a PC operating under DOS) will appreciate the practically instant availability of data that the tables offer. The manual and disk weigh only a fraction of even one or two of the reference texts, so portability is assured.

At a price of \$149.95 it is unlikely to find a place on every oceanography student's (or oceanographer's) bookshelf, but it would be a valuable addition to a departmental library.

Apart from the untidy presentations and lack of attention to aesthetics, and other criticisms relating to the range of variables tabulated, I would conclude that Tom Beer's *Applied Environmetrics Oceanographic Tables* fills a real need. It should prove a useful addition to many departmental libraries or to the bookshelves of the more affluent workers in marine related areas.

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Applied Environmetrics Meteorological Tables by Tom Beer (Applied Environmetrics, Melbourne, Australia, 1989) ISBN 0 9590809 1 0. 56 pp. plus disk, \$A149.95.

These computer-based tables and explanatory material were designed by the author primarily for fire-weather meteorologists, but also for other meteorological data users as an alternative to printed (e.g. Smithsonian Meteorological) tables. They include values of temperature, pressure and density for various heights and for constant lapse rate conditions, geometric and geopotential heights with a reference atmosphere, clear sky solar radiation intensities and integrals for surfaces with selectable tilts, and black-body radiation levels. Densities, viscosities and fall velocities for particles are given for air and water. Vapour pressure and humidity values for moist air and saturated conditions are available, and also relative humidities and dew-points obtained with wet and dry-bulb temperatures from aspirated and screen psychrometers.

The computer format avoids the need to include numerous tables of unit conversions, as are found in the Smithsonian Tables. Corrections for mercury barometers provided in the latter are not included in these tables. However, in my view they are not essential because most modern pressure instruments use aneroid capsules, diaphragms, etc.

Reductions of pressures to sea level or to other levels can be made by assuming reasonable moisture conditions and a lapse rate for the intervening stratum, and then using the provided pressure-height data.

Sunrise and sunset values are in local mean times, not standard or solar, and are within five minutes only for latitudes of less than 35 degrees because refraction effects have been excluded. Solar elevation and azimuth angles are accurate to one degree, which I expect will be adequate for most users. More accurate time and angle calculations require a nautical almanac or ephemeris tables. Radiation incident on sloping surfaces for eight directions will be useful for architects and engineers, although only clear sky values are provided.

The tables provided for the four fire-danger models appear to be rather less convenient than the circular slide-rules and predictive programs used operationally in fire-weather conditions, as the latter provide a quick assessment of current situations and the probable effect of rapid changes in the conditions. Also, the operational Bureau fire-weather forecasters advise that the McArthur and Rothermal formulae used in the tables are not considered fully appropriate for Australian vegetation types which differ significantly from those used in the derivation of the formulae. However, these models are currently employed, and so the tables will provide good guides for planning or for illustrative purposes.

Care needs to be taken as some data displayed are quoted to a number of decimal places (e.g. 0.0001 hPa for pressure, or 0.01°C for temperature) which represent very small changes in atmospheric conditions which would not be observable with typical meteorological instruments. However, the use of many decimal places does allow calculation of the effects of small changes in independent variables.

The tabular presentations provide a good feel for the results of these changes. A few re-runs of most tables are needed to calculate data for a particular value of a variable, though some (e.g. solar radiation) tables allow entry of a sufficient number of initial conditions to adequately cover most needs. The tables can be modified by using an editor to change the ranges for the independent variables, though this can be cumbersome. Both the displayed and the modified tables can be printed out or placed in disk files for later inclusion into reports, papers, etc.

The software is said to have been tested on a large variety of IBM and compatible computers with problems being found only with a few of these, mainly due to insufficient memory, conflicting resident programs or incompatible operating systems or hardware. The author's company can assist with advice on suitability of computers.

I consider that these tables should be most useful for scientists involved in preparing reports and papers or processing limited amounts of data, but not so useful for those engaged in operational forecasting. Considerable effort has gone into making

program operation both versatile and convenient, with textual comments (available also on the computer screen) provided to give background, content and references. Information provided on the screen is effectively that given in the book for each subprogram. The most recent units, standards and conventions have been utilised to ensure that displayed information is as correct as possible. However, sometimes computer-based tables are not as convenient as printed tables. Fortunately, users can print out particular tables which they frequently need. The restriction of being able to quickly vary only a few independent variables can be a nuisance at times.

Overall, I feel that the cost of the package reflects the amount of work involved with researching references and preparing programs. The

author had sought comment from other professionals in this field on the content and layout, the final version being the last of a series incorporating recommended changes. While users not belonging to a large organisation may prefer to purchase a less costly printed book of tables, they may have difficulty in locating a published equivalent, and would have to forego the availability and convenience of computing particular values of meteorological quantities.

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