

## REVIEW

**Applied Environmetrics Oceanographic Tables.** By T. BEER. Applied Environmetrics, 1989. US\$124.95 or A\$149.95.

Now that most scientists have easy access to one, the personal computer has become for many an indispensable tool of their work, for data manipulation, modelling, word-processing activities, and for some as the hub of their communication network. It is therefore surprising to reflect that the publishing of scientific work using magnetic media associated with personal computers is still in its infancy. Some textbooks may contain a supplementary magnetic disc of computer programs or exercises, but still the core of the work is communicated by ink on paper. This volume of oceanographic tables is therefore breaking new ground, in that its primary content resides only on the magnetic medium, and must be accessed using a personal computer. It is accompanied by a printed booklet, but this merely duplicates a small part of the information content of the total package. The author is clearly excited by the opportunities afforded by the medium of 'the computer as a book'. However, it is questionable whether he has in the end achieved anything radically new with this particular publication.

It is a volume of oceanographic tables containing a variety of data useful to practising oceanographers, and is provided on a 5.25 in. MSDOS disc for use on an IBM compatible personal computer. Access to the information is gained by a single command which initiates the controlling program and presents the user with a contents page. This is treated as a menu, using the cursor keys to highlight a particular table, and the 'Enter' key to call it up. Within the environment of each table, the reader is prompted to specify details of the information being sought, for example the temperature at which a particular seawater property is required. In most cases the end result is the screen display of a table of values covering a range of parameters, from which the reader must select, or interpolate, the specific conditions of interest. In a few cases a single value is returned, corresponding to a property which has been uniquely specified. At all stages the user is given clear instructions about how to proceed, and the screen display carries a reminder of how to execute one of three functions – to repeat the current table, to return to the contents page, or to obtain further information about the current table. There is no special provision made for obtaining hardcopy of the tables, but the display has been arranged in single-screen-sized tables, enabling the 'Print Screen' function to be used. There is also a facility provided to extract the screen contents and place them in a file for subsequent editing by word processor. The accompanying booklet contains a printed copy of the text contained on the disc, including the contents page, the introduction, instructions for using the tables and the background information which is supplied for each table.

The contents consist of a variety of oceanographically useful tabulations, such as the information found in Bialek's *Handbook of Oceanographic Tables*, and other material. This includes the density and viscosity of air and pure water, and the consequent fall velocities of particles, the physical properties of seawater (density, freezing temperature, specific heat, sound speed, conductivity ratio), and the solubility of dissolved gases in seawater. Tables of dynamical information include the propagation characteristics of ideal linear surface waves, the spectral properties of

real ocean (wind-driven) waves, calculations of geostrophic currents and the Ekman spiral, wind speed conversions in relation to the Beaufort scale, molecular transport properties, and the calculation of the diffusive spread of a conservative tracer. A program for predicting hourly tidal heights given the dominant harmonic constituents is also provided. So are data of relevance to optical oceanography and remote sensing, such as the evaluation of the Planck function and the tabulation of solar position. Finally some statistical tables are incorporated.

In assembling this range of material in a single volume, the author has served the oceanographic community well, providing a useful reference, not only to the data themselves but also to the derivation methods and sources which are quite well documented in the further information text associated with each table, and also printed in the accompanying booklet. The ordering of the tables is somewhat eccentric, following the similarly erratic sequence of topics in the author's book *Environmental Oceanography* (Pergamon, 1983), for which these tables are intended as a companion, but it is not difficult for the reader to find his way around the table of contents. Whoever needs oceanographic data in tabular form will find this a valuable set of tables, but should not expect to find much more than a convenient collation of material that was already available.

Given the author's lyrical preface in praise of the flexibility offered by the computer as a publishing medium, it came as a great disappointment to discover that, with a few exceptions, there is little more in this publication than could be found in a set of printed tables. The degree of interaction between the user and the computer is minimal, and the mode of presentation of information is constrained entirely to tabular form. The flexibility offered to the user is limited to being able to specify a range of parameters, effectively causing the computer to turn to the correct page of the book of tables. This saves time, and eliminates the bulk of printed tables, but it falls far short of what could have been provided.

For example, given that in most cases the computer is presumably deriving the output values from an algorithm, rather than reading them from memory, it should have been relatively simple to offer the user an output corresponding exactly to specified inputs. Thus I expected to be able to specify temperature, pressure *and salinity*, and to obtain the corresponding density or gas solubility, but was presented only with a table of density or gas concentration variation with salinity for given  $T$  and  $p$ , requiring interpolation. This is no better than Bialek's tables. Why could not an additional option have been provided to perform the interpolation automatically? The same shortcoming is repeated in different forms throughout the tables, and represents an opportunity sadly missed to use the power of the 'computer as a book'. For example, table 5 of ideal wave properties permits only the depth to be specified and tabulates other properties against wavelength. There is no way to specify a particular wavelength in order to obtain the corresponding frequency, or *vice versa*. Table 13, of interface properties, does enable the user to calculate density for any arbitrary value of temperature, salinity and pressure (why was this not provided in table 7?) but only for the upper layer, leaving salinity interpolation required for the lower layer properties. In table 14, to integrate the Planck function across a given spectral window requires running the program twice to obtain the integral from zero to each end point and calculating the difference, when the computer could so easily have been programmed to provide the option to do this directly.

Another shortcoming relates to the recovery of multiple values from the tables. If the user wishes to evaluate a variable at several points, it should be possible to enter a list of the controlling parameter values and to recover a corresponding list of

variables. Instead, to enter each new parameter set requires the rerunning of the whole program sequence for that particular table. This can be irritating when, as in the case of particle fall velocity, the same temperature has to be entered each time, and the desired information still has to be interpolated from a table of specific gravities.

Another opportunity missed is that of presenting the output in graphical form. This is a powerful way in which the computer can improve significantly on the ink-on-paper publication. For example, the computer could be made to plot out a portion of the density curves in  $(T, S)$ -space, or the wind wave spectra could be plotted out for different wind speeds. The most powerful approach would have been to plot out the data graphically, and then to provide the user with the opportunity to interact using a movable cursor to extract a particular value at a point within the parameter space. As it is, far from exploiting the opportunities of the medium, the simple tabular output is hindered by the weakness of the medium, in that text on a screen is never as readable as typeset print on paper, particularly when numerical values are displayed in E-format. It may seem unfair to criticize the absence of facilities which the author never set out to offer, but when the publicity promises 'a radical new format', 'consistent with modern technology', we are entitled to expect substantially more than a conventional book format transferred to the screen. The price of the publication is comparable with an item of commercial software, and yet the presentation, display, and form of user interaction is well below the standard we have come to expect in today's educational and scientific software packages.

The tide tables provide an example of where the medium has been more fully exploited, and in which considerably more has been provided than could be accomplished readily by a printed publication. If the dominant harmonic constituents are known, then the tide predictions for any port on any date can be obtained. The procedure is somewhat limited in that the ten constituents, corresponding to those provided by the French Hydrographic Service, cannot be varied. The use of fixed related constituents, which are presumably derived from the equilibrium tide although this is not explained, is also a potential source of error. Nonetheless this part of the work will provide a convenient access to approximate tidal predictions for a reader who already knows the tidal constituents.

As with any software, users must beware of minor programming errors and should satisfy themselves of the validity of all the calculations. I discovered only one such error, when table 11 failed to generate the correct Beaufort number when a wind speed was specified, although the rest of the table appeared to function properly. Potentially more seriously, I could not make the software function at all on an Amstrad 1640 computer, though it loaded easily onto an IBM PC-AT, both machines operating under DOS 3.3, and it worked well on other IBM-compatible PCs. It is not fair to fault the software for encountering a problem with a particular machine configuration, but this does highlight a weakness with the concept of 'the computer as a book'. It has to be admitted that such problems would be more common if the graphical displays advocated by this review were to be incorporated.

Overall, Tom Beer is to be congratulated on taking a brave step into a new type of publishing, even if he has not developed the concept as far as it should go. His product will certainly be useful as it stands for practising oceanographers and students, but could have been very much more powerful. I shall certainly continue to make use of the copy which I have reviewed, and can recommend it for institutional and educational use, but given its limitations its price will probably deter many oceanographers from purchasing it for their own desktop.

I. S. ROBINSON