BOOK REVIEWS

Review of "HYDROLOGICAL FORECASTING" edited by M. G. Anderson and T. P. Burt and published by Wiley

This thick book, with 604 pages in 16 chapters, and author and subject indexes is the edited work of some 24 authors, many of whom are well known internationally for their contributions to hydrology. With these vital statistics and a price tag of £36.50 the reader could and should expect much from the book.

The task of producing a comprehensive book on hydrological forecasting (mercifully the editors have resisted calling it "hydrologic forecasting") is ambitious, as many of the chapter topics could warrant a book in their own right. Although each chapter is written by a different author the styles do not clash. Several of the more successful chapters have an introduction and review of the chapter topic before concentrating on a particular "state of the art" development. Unfortunately this approach will tend to cause the book to date. In most of the book many of the authors do not discriminate between forecast and prediction, regarding any form of estimate of what "might happen if . . . " as being a forecast.

The material presented in the book falls under the broad headings of process studies e.g. snowmelt, and whole catchment modelling. In addition there is a brief introductory chapter by the editors; a chapter on radar measurement of precipitation and a concluding chapter on management forecasting requirements. The book generally treats process studies before catchment models and simple models before more complicated ones. Each chapter is largely self-contained with little between-chapter referencing or overlap of material. The earlier chapters are marred by poor proof reading and lack of clarity of expression. The mathematical notation is neither completely defined nor consistent. These chapters also lack an emphasis on forecasting, concentrating instead on hydrology. Fortunately for the book as a whole the later chapters do much to redress the balance.

The first chapter on soil water modelling is primarily concerned with simulating the effects of agricultural vegetation on soil moisture. Approximately half the chapter is spent discussing a model called PLANTGO which was originally developed around 1974. The description of the model does not succeed in convincing the reader that the model could be widely applied to conditions beyond those for which it was built. There a lack of authoritative references by other than the chapter's author: 13 of the 19 references feature the author while, of the remaining 6, none is more recent than 1977. The flow of the chapter is disrupted by more than a fair share of minor errors in the equations and notation. For example in equation 2.1 the letter S is used for the change in soil water storage with time while in equation 2.9 dO/dt is used for the same quantity. Later the symbol S is used for relative solution concentration. In a chapter of 21 pages I found a dozen or so examples of inconsistent notation, missing definitions and incorrect formulae e.g. equation 2.11. This chapter raises serious questions about reliability of the proof reading of the final script and of the review process that passed such elementary faults as undefined mathematical symbols.

Chapter 3 on hillslope hydrology, while not open to such serious criticisms,

is marred by a poor review of the text and even worse examples of proof reading errors. For example, on page 44 a complete line is repeated, while there is no mathematical way of deriving equation 3.24 from equation 3.21.

Chapter 4 on the use of radar for precipitation measurements continues the sad saga of poorly reviewed material. The style of many of the equations is unusual and deserves some explanation as does much of the radar jargon. How one gets from equation 4.18 to 4.19 is a mystery that either requires elucidation or correction.

The fifth chapter deals with the remote sensing of soil moisture. Although less frequent, many of the flaws of earlier chapters persist and detract from an otherwise informative narrative. Perhaps the biggest complaint relates to undefined symbols and terms. What are "e" (Table 5.1), T_{SKY}, T_{SOIL}, T_{ATM}, (equation 5.7), a "radiative transfer model" and a "specular window"?

By now I was beginning to curse the journal editor who had persuaded me to review a book that appeared to have been put together with the haste of a daily newspaper. However, Chapter 6 on modelling changes in forest evapotranspiration signalled the beginning of a general improvement in the quality of the book. Chapter 6 concentrates on the PROSPER model a 1-dimensional model which calculates evapotranspiration from data on the atmosphere, vegetation and soils. While the subject matter has much in common with chapter 2 (which deals with soil moisture and agricultural crops) it deals with the effects of afforestation. The chapter describes the sorts of conclusions that can be reached using the model to estimate the consequences of forestry activities.

Chapter 7 on snow and ice is thoughtfully put together and informative. The chapter contains almost as many equations as in the whole of the preceding six chapters but with few errors. However, the writing of empirical equations with the units of the constants as an integral part of the equation takes a little getting used to.

Chapter 8 examines runoff generation in arid and semi-arid zones. The authors describe a qualitative model for simulating runoff for desert conditions which uses a proprietary modelling package to synthesise runoff using ground surface properties and a Hortonian approach to infiltration. Some minor inconsistencies occur in the units used in the figures and the text. The two authors fail to comment on the work of Zaslavski and the "thatched roof" approach to arid and semi-arid zone runoff.

Chapter 9 is a gem. It is a cogent account of using groundwater models for forecasting. The first part of the chapter examines using models to forecast water table changes, the second part the forecasting of solute transport in groundwater systems. Applications of technology are well described. Forecasts are compared with field results taken many years after the forecast to investigate discrepancies. While common in river-channel flood forecasting, for groundwater systems with response times measured in years this has seldom been reported.

The author of the tenth chapter looks at forecasting water quality variations. He examines a range of programs, from defining a standard against which to judge future changes, to river quality models. The physical and chemical aspects of water quality dominate the account which reviews the success of a series of models in providing reliable forecasts. At one point the text almost reduces to a straight catalogue of techniques but in view of the tremendous

range of subject matter covered, the author is to be congratulated on an interesting and useful account. It contains some sage advice — "avoiding the pitfall of actively seeking problems or of scoping or redefining a problem" to fit the model.

Chapter 11 focusses on lumped catchment models and a comprehensive account is given of the Institute of Hydrology's lumped model. So well documented is the model that it should be possible to build a replica without difficulty. This chapter is the only one to explicitly discuss automatic fitting and objective measures of goodness-of-fit, albeit at a 1970s rather than 1980s level. The chapter concludes with practical applications, including the use of models in the quality control of data collection and the filling-in of missing records. Overall it is a useful and practical account of lumped modelling.

Much of Chapter 12 on variable source models is spent describing and justifying the variable source area concept. Such a model is used to simulate runoff from two small basins in the United States. Although results from the first basin are encouraging those from the second are less so and are attributed to a lack of satisfactory spatial definition of catchment properties. This is another interesting chapter. A minor complaint is figures using inconsistent sets of units.

Chapter 13 provides an up-to-date review of distributed models work by one of the leaders in the field. The account includes the Systeme Hydrologique Europeen, the Institute of Hydrology Distributed Model and the Finite Element Storm Model. Applications of the models are illustrated and the chapter concludes with a look at the future for this type of model.

Chapter 14 on channel routing begins with a informative and succinct review of different types of routing techniques in order of increasing complexity. The bulk of the chapter is, however, devoted to a comprehensive account of a hydraulic model called FLDWAV which arose out of two widely used models, DWOPER and DAMBRK. The result seems to be able to handle most routing problems including estuaries, deltas, flow around islands and flood waves generated by dam failure. The chapter effectively documents FLDWAV through 269 error-free equations. The chapter concludes with examples on the Mississippi River, the Columbia River and Teton Dam-break flood. This author is to be congratulated on an account of what must surely become the "industry standard".

Chapter 15 focusses on real time forecasting through the use of stochastic methods. Up to section 15.3.3, the chapter is readable and proceeds at a pace that those unfamiliar with the subject should be able to follow, although unfortunately proof reading "blues" reappear. Beyond section 15.3.3 the pace accelerates to the point where most readers will really have to work doggedly to get much out of the text.

A chapter on management needs from forecasts rounds off an ambitious book by putting earlier chapters into perspective.

On reflection many will find something of use or interest in this book. Regrettably, however, the phrase that most readily comes to mind is the one about "spoiling the ship for a hap'orth of tar".

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Review of "INTRODUCING GROUND WATER", by M. Price, published by Allen and Unwin, 1985, 195 pp. (Soft cover $26.95 in New Zealand)

The stated intention of the author is to provide the non-specialist with a readable introduction to the subject of groundwater. In this he has succeeded admirably.

The emphasis is on principles rather than detail. Technical terms are kept to a minimum and where used are carefully explained. These terms are printed in bold type and with the lucid text the book is rather like a narrative glossary: coverage is very full. The book begins with the place of ground water in the hydrologic cycle and its global significance as a resource. There is a logical progression of topics from the movement of water through soil and the unsaturated zone, movement through the aquifer proper, the various types of aquifer which occur and the interaction of groundwater with surface water. This last chapter should be read by surface hydrologists also.

Subsequent chapters describe water wells, measurements (not overlooking divining) and models, water quality and an outline of situations where ground water is a problem rather than a resource, ie, mine dewatering, etc.

There are some shortcomings. The section on modelling is rather inadequate and dated. More could have been included on the modern problems of groundwater contamination. For the New Zealand reader the British orientation is largely irrelevant, but these are only quibbles on what is a very good little book which I recommend to all who wish to improve their understanding in this field.

H.R. Thorpe,
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PUBLICATIONS RECEIVED

1. "Advances in water engineering", THY Tebbutt (ed). Elsevier Applied Science Publishers, 1985, 361p.
2. "Water in urban areas", TNO Committee on Hydrological Research, Proceedings and Information No. 33, The Hague, 1985, 267p.
3. "IAHS Yearbook 1983-1987" International Association of Hydrological Sciences, 1984, 46p.
4. "Quarternary period in Saudi Arabia, Volume 2" (Sedimentological, hydrogeological, hydrochemical, geomorphological and climatological investigations in Western Saudi Arabia). Abdul Raof Jado and JG Zolt (eds). Springer-Verlag, 1984, 361p.
5. "Physical aspects and determination of evaporation in deserts applying remote sensing techniques" Report No. 10 (special issue), Institute for Land and Water Management Research (ICW), Wageningen, 1984, 202p.
6. "RAFTS Runoff analysis and flow training system (Version 1-2), Detailed documentation and user manual." Willing and Partners Pty Ltd, Canberra.
7. "Soils and Quaternary geology of the Southwestern United States" DL Weide (ed), Special paper 203, Geological Society of America, 1985, 150p.
8. "Mastodon-bearing spring and late Quaternary geochronolgy of the lower Pomme de Terre Valley, Missouri" by CV Hayes Jr, Special paper 204, Geological Society of Americal, 1985, 35p.

FUTURE EVENTS

(Details available from the editor)

Nov 1986: Annual Symposium, NZ Hydrological Society, New Plymouth.

Oct. 16–17, 1986: "Focus on national water problems" American Institute of Hydrology, Washington, DC.

March–June 1987: Graduate course in hydrology, University of NSW, Sydney.

March 30–April 3, 1987: "International conference VSGP '87, Vulnerability of soil and groundwater to pollutants" Noordwijk Aan Zee, The Netherlands.

April 9–22, 1987: XIX General Assembly of the International Union of Geodosy and Geophysics, Vancouver. IAHS Symposia include;

S1: Large scale effects of seasonal snow cover.
S2: Forest hydrology and watershed management.
S3: The influence of climate changes and climatic variability on hydrological regime and water resources.
S4: Irrigation and water allocation.
S5: The physicall basis for ice sheet modelling.

IAHS Workshops include:

W1: Methods of runoff and streamflow simulation applied to various physiographic and climate conditions.
W2: Spatial variability and representativeness of hydrogeological parameters.
W3: Estimation of areal evapotranspiration.
W4: Remote data transmission.
W5: River ice.
W6: Erosion and sediment transport,
a. Debris torrents,
b. Erosion and sediment transport resulting from volcanic eruptions,
c. Morphological measurements of sediment transport,
d. Fluvial transport of sediment-associated nutrients and contaminants,
W7: Hydrological sciences in developing countries.
W8: Estimation of natural baseline conditions as a basis for detecting changes in water quality.

April 24–29 1988: "International symposium on hydrological processes and water management in urban areas" Duisberg.

May 29–June 3 1988: "VIth World water congress on water resources" Ottawa.