BOOK REVIEWS

THE MATHEMATICS OF HYDROLOGY AND WATER RESOURCES, ed. E H Lloyd, T O'Donnell and J C Wilkinson, pub. Academic Press, London and New York, 1979. (Price $US20.50).

This book of 138 pages contains the principal papers given to a conference aimed primarily at interesting mathematicians in hydrological and water resource problems. Many of the authors of the seven papers presented belong to a group of well-known activists in the field of mathematical hydrology and have played important roles in applying mathematical techniques to hydrological and water resource problems.

The book begins with Professor J C I Dooge initiating his account of deterministic input/output models by running over the basics of the hydrological cycle and how these basics have been reflected in deterministic models. Singling out "Black-box" and simple conceptual models Professor Dooge gives a lucid account of their development and use. He then concentrates on the different derivations of the response function or finite period unit hydrograph and discusses in published form Bruen's examination of the reliability of the various methods of producing response functions. Also included is an account of Dooge's work using Meixner polynomials.

Dooge's paper is followed by one on the application of operations research methods to the operation of multipurpose schemes in the water industry. In this account Dr C Wilkinson deals with some case studies and uses them to illustrate areas into which mathematical reearch would be valuable. Unfortunately, for the reader unfamiliar with dynamic programming techniques the equations presented add little to the text. Notation and its explanation and use in equations could have been improved.

There is then an excellent account of stochastic storage problems by Mr B Rydz from the water manager's point of view. The paper describes the decisions that have to be made by the water manager and illustrates these by examining a particular example. Use of a map in the example would have been helpful.

The problems posed by Mr Rydz naturally lead into Professor E H Lloyd's paper on stochastic storage problems. This paper concentrates on the single reservoir problem, but brings together advances made by being able to use input series with Markovian and ARMA structure.

The next paper by Professor Amorocho is largely a qualitative account of the complexity involved in spatially distributed variables in hydrological modelling. It is followed by the most mathematically and statistically involved paper of the seven. This paper by Drs Ord and Rees looks at recent developments of spatial processes and their application to hydrology. It brings together and puts into context much work recently reported in the hydrological literature on spatial processes. The mathematics of the paper are involved and the explanation of equations such as 2.17 and 2.18 would have been helped by definition of all the symbols used.

In the last paper Mr R Clarke shows how the sometimes esoteric results

of earlier papers can be used to improve practical solutions. Mr Clarke introduces some intriguing new techniques for improving variance estimates of measures of system performance. This most readable paper neatly concludes the volume.

As noted at the beginning these papers were part of a conference and it is only natural for their quality to vary. All are aimed at mathematicians or statisticians and while their approach varies from descriptive to mathematically involved they represent a useful contribution to the literature to which hydrologists, water resource managers and planners will refer.

It is with regret, however, that the reviewer has noted that by using camera-ready manuscripts much editorial quality control has been by-passed. Particular examples include:

a incorrect equation numbers on page 21 plus other possible errors which obscure the clarity of the text;

b many examples of inconsistancies between dates of references in the text and the dates in the reference lists;

c missing, incomplete and out-of-order references;

d differences in the way reference lists are set out.

With the exception of these blemishes the editors have compiled an interesting and readable volume in which most hydrologists with a mathematical bent will find something stimulating.

R P Ibbitt

"HYDROLOGICAL FORECASTING". Procedings of the Oxford Symposium, April 1980. 571 + xii p.; published April 1980 by the International Association of Hydrological Sciences as IAHS Publication No. 129. (Price $US75).

"Hydrological Forecasting" is the proceedings of an international symposium on recent developments in hydrological forecasting and their application in operations resource management. The symposium was held at Oxford, UK, at the invitation of the Royal Society, London, and co-sponsored by IAHS, UNESCO and WMO. Its specific aims were: to review hydrological data acquisition for forecasting; to discuss methods for forecasting hydrological variables (including water quality); and to look at applications of recent forecasting techniques, particularly their success and their limitations.

The volume contains 72 papers from 22 countries, representing all continents, and many climates, and presenting a wide variety of precipitation-runoff models. The papers are grouped into five categories: data acquisition and network design (14); model structure for off-line calibration (34); on-line estimation of parameters and updating of forecasts (11); models for real time control of water resource systems (7); and case studies (6). Even with sorting into these categories, the mass of papers makes solid fare, especially those on model structure.

Possibly the categories "on-line estimation . . .", and "models for real time control . . ." will be of most interest. These are areas of much recent progress through the adaptation of control theory to tackle hydrological

forecasting problems in situations where advances in telemetry have made field information quickly available at central offices and where, in theory, real time forecasting may be possible using small computers.

In a large part the papers in these proceedings are concerned with the theory, and as such the symposium undoubtedly succeeded in its first two aims. Actual experience in operating hydrological models coupled with telemetry equipment however, is reported in only a handful of papers. Amongst these is a report on the Dee River in North Wales, the subject of an extensive forecasting and river control study. Although some papers are concerned with medium or long term forecasts which do not require telemetry, the small number of reports of case studies on short term forecasting (frequently of floods), is probably a fair reflection of the current state-of-play. The combination of skills necessary to formulate the hydrology of a basin in terms of a suitable forecasting model, to program the model into a small computer and to tie this in with data gathering equipment in situations where forecasts are actually required by the river authority responsible would appear to be achieved rarely. The difficulty in assembling these skills in a productive working environment should not be underestimated.

Models for representing the run-off response of basins to rainfall may be broadly classified as empirical and conceptual. That there are many models in each class suggests that no one type offers clear superiority, and that the choice of model in large part, is determined by the preferences of the modeller.

Nevertheless, for anyone concerned with forecasting basin response, study of this volume will repay handsome dividends.

A I McKerchar