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Book review



Agricultural water management

An International Journal

Aims and scope. The journal is concerned with the publication of scientific papers of international significance to the management of agricultural water. The scope includes such diverse aspects as irrigation and drainage of cultivated areas, collection and storage of precipitation water in relation to soil properties and vegetation cover, the role of ground and surface water in nutrient cycling, water balance problems, exploitation and protection of water resources' control of flooding, erosion and desert creep, water quality and pollution both by, and of, agricultural water, effects of land uses on water resources, water for recreation in rural areas, and economic and legal aspects of water use. Basic soil-water-plant relationships will be considered only as far as is relevant to agricultural water management.

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Book review

Stochastic Processes for Water Scientists, R.T. Clarke, John Wiley & Sons, Ltd., Baffins Lane, Chichester, West Sussex, PO19 1UD, England. 1998. U.S. \$74.95 (cloth). pp. 183. ISBN 0-047-97348-3.

This book is organized into eight chapters. The first two are introductory in nature, chapters 3 and 4 deal with Markov chains, Chapter 5 with stochastic reservoir theory, Chapter 6 – the Poisson process, Chapter 7 – random walks and diffusion processes, and the book ends with a brief chapter on computational methods.

The back jacket states that the focus of the book is on intermittent processes with the aim of encouraging students and research workers to see their environmental problems in the context of a probabilistic framework. This aim is met for a limited set of problems with major emphasis on modeling daily rainfall. Curiously, the entire area of stochastic weather or climate generators used to provide input to a broad class of hydrologic models is almost entirely ignored. This limited scope of the discussion (and, thus, the rather narrow list of references) eliminates detailed discussion of some of the most current and exciting applications of stochastic processes in hydrology and water resources simulation modeling.

The level of presentation in the book is very uneven. For example, the central limit theorem is described and discussed in just 12 lines of text on p. 27, while three pages of text (bottom of p. 34 to p. 37) are devoted to defining the scaled deviance as a log likelihood ratio. Figures and illustrations are infrequent and, when used, are fairly sterile and routine. A good example is Fig. 2.1 on p. 14. The ordinate is scaled from 1 to +1 and the abscissa from 1500 to 2000. Then, the data (occurrence of el Nino events) are plotted as circles along the straight line represented by $y=0$. Altogether, the absence of good graphics and the inclusion of uninformative ones makes the reading slightly difficult.

Chapter 3, *Markov chains: applications to modelling of daily rainfall* provides a brief background, and then a useful discussion of this application of Markov chains. Sample calculations are used to show how transition probabilities are calculated for daily rainfall sequences of wet and dry days and how the resulting model can be used to derive probabilities of sequences of dry days, amount of rainfall occurring in n days, and other quantities of interest in analysis of daily rainfall.

Chapter 4, *More on Markov chains: storage* focuses on the work of Moran in describing water-reservoir storage, using an annual time step. Sixteen pages of text later, the author concludes that applications of the theory are limited though useful.

Chapter 5, *Stochastic reservoir theory applied to rainfall-runoff modelling* starts with the 'linear reservoir' model for a drainage basin and the simple first-order differential equation for continuity of mass as $dS/dt = \text{Inflow} - \text{Outflow}$. Discussion proceeds from here to stochastic representations of storage relationships and how runoff can be calculated from rainfall using these concepts without regard to physical processes. While there are hints here of additional developments such as independent vs. dependent storage elements, nothing new in rainfall-runoff modeling or insights to the fundamental stochastic nature of hydrological properties distributed in space is given.

Chapter 6, *The Poisson and related processes* is more complete and better organized than the other chapters and, thus, easier to read and more interesting. Had this chapter been expanded to encompass the entire text, a broader range of applications and literature citations been included, and the text enriched by inclusion of figures and graphics of standard quality, then the author would have produced a more significant contribution. Nonetheless, this is an interesting chapter and almost worth the price of the book. Its main limitation, in the discussion on modeling annual precipitation, is the exclusive focus on the 1978 work of Eagleson and the non-inclusion of parallel and subsequent developments. Even so, Eagleson's 1978 work was comprehensive and, thus, is appropriate as examples in a text.

The material on random walks and diffusion in Chapter 7 is too brief and elementary to add much to the text and the final chapter on computational methods is even less valuable. The material in Chapter 8 would have been better left out or included as an appendix.

Overall, *Stochastic Processes for Water Scientists* is spotty and weak. It is not comprehensive enough to serve as a desk reference and lacks the breadth of references and degree of synthesis and generality required for an introductory textbook.

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