PREFACE

This book is intended to bring hydrological analysis to life by means of examples in which the author has been involved, either directly in solving problems or in terms of review. It is not intended to take the place of standard textbooks, and indeed this book presupposes a reasonable knowledge of basic hydrology. There are many excellent textbooks and papers in which methods of analysis are presented: examples which spring to mind are the World Meteorological Organization's *Guide to Hydrological Practices* (fifth edition, 1994), Linsley, Kohler & Paulhus: *Hydrology for Engineers* (1958), Chow: *Handbook of Applied Hydrology* (1964), Chow, Maidment & Mays: *Applied Hydrology* (1988), Maidment: *Handbook of Hydrology* (1993), Wilson: *Engineering Hydrology* (fourth edition, 1990), Shaw: *Hydrology in Practice* (third edition, 1994), Ward & Robinson: *Principles of Hydrology* (fourth edition, 2000). More specialised topics are covered in such publications as Beven: *Rainfall–Runoff Modelling: The Primer* (2001), Abbott & Refsgaard: *Distributed Hydrological Modelling* (1996), Vieux: *Distributed Hydrological Modeling Using GIS* (2001), Bras & Rodriguez-Iturbe: *Random Functions and Hydrology* (1994), Rushton: *Groundwater Hydrology: Conceptual and Computational Models* (2003), Eagleson: *Ecohydrology*, (2002), Shahin: *Hydrology and Water Resources of Africa* (2002), and Newson: *Land, Water and Development* (1992). Textbooks usually concentrate on accepted methods of analysis, which are followed by accounts of examples. The intention here is to reverse this procedure, and to describe the problem and then the approach chosen in the particular example. There are usually several approaches which could be used to solve a problem, and to some extent the method of analysis depends on the context of the problem. Different methods are likely to be appropriate at different stages of a project; the detailed analysis required for a final design is not needed for a preliminary study to determine whether a project is likely to be viable in hydrological and economic terms.

It is a fact of modern financial pressure that the time available for hydrological investigation and analysis has decreased greatly over the years. It could be argued that the greater availability of records and the power of modern computing facilities compensate for the shorter time scale of investigations; however, the time available for a study affects the type and depth of analysis which can be carried out. The most appropriate method may have changed over the years as new techniques have been developed. However, the solution which seemed appropriate when the work was carried out is described here, with some comment on how a similar problem would now be approached.

It is the belief of the author that the application of a water balance is essential to the understanding of most problems in applied hydrology. The position of the project area on the scale between the humid and arid ends of the climate spectrum will determine the relative importance of the different components and will affect the

complexity of the problem. At the outset of his career, he was confronted with situations as dissimilar as the swamps of the upper Nile, the water balance of the semi-arid Alborz mountains in Iran, the seasonal balance of the central highlands of Kenya, and the humid regime of the forested and snow-fed volcanic uplands of the North Island of New Zealand. The context of each study varied. The first was an early environmental study of the Jonglei Canal, for which a team of some ten professionals was able to devote four years of research. The others included a study of runoff and groundwater recharge in Iran, a comparison between upstream and downstream water use in Kenya, and the investigation of hydroelectric development in New Zealand. The common factor was the application of a water balance approach, which provided estimates of the variables of direct interest in each case.

A career spanning over 50 years has included an alternation of rapid applied investigations and longer periods of research into problems at greater depth. The range of climates covered has varied from the arid or semiarid conditions of Botswana, Bahrain and Yemen, through the seasonal conditions of central India and the countries of West Africa, to the more humid climates of Sri Lanka, the mountains of Bosnia and the Patagonian foothills of the Andes.

Although the early studies would have been made easier with the help of personal computers, as the more recent investigations have been facilitated, the fundamental problems of understanding and quantifying the physical processes have not changed. Modern technology may enable more complex means of estimating the components of the water balance to be used, but these are not always appropriate to developing countries where data are limited. Many of the examples come into this category, and it is unfortunately true that the quantity of hydrological records is decreasing in many countries. It is hoped that accounts of the problems encountered in areas as diverse as the Nile (1950s), Iran (1960s), India (1970s), West Africa (1980s) and Sarajevo and central Europe (1990s) will provide an illustrated complement to the more formal examples in the literature.

In the studies leading to this book, acknowledgements are due to a large number of colleagues over the years, especially those with whom the author has worked at the Institute of Hydrology (now CEH), Wallingford, and at Sir Alexander Gibb & Partners (now Jacobs), Reading, UK. This collaboration is illustrated by the number of co-authors cited in the references. It has always been the author's policy to publish the results of a project where it seemed interesting or useful to others. Many references are made to these previous publications as more details are often given there. Thanks are also due to hydrologists and meteorologists in many countries.

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