

Book Review

Ian SIMMERS (Ed.): *Understanding Water in a Dry Environment – Hydrological Processes in Arid and Semi-arid Zones.*– IAH International Contributions to Hydrogeology 23, 341 pages, 137 figures, 40 tables, A.A. Balkema Publishers, Lisse/Abingdon/Exton (PA)/Tokyo, 2003, ISBN 90 5809 618 1.

The book entitled “Understanding Water in a Dry Environment – Hydrological Processes in Arid and Semi-arid Zones” was published in 2003 as an outgrowth of the integrated water management in arid and semiarid zones identified by UNESCO as a priority theme within its IHP-V program (1996–2001). The book is intended to focus attention on the hydrological process in arid and semiarid area, mainly on the state-of-the-art methods for solving hydrological problems, technological challenges encountered and experiences gained. It also illustrates the interrelationships between the hydrological processes and water resource management practices used to solve the water shortages, which these zones of the world are currently encountering or continue to face in the future. The book consists of eight chapters written by twelve experts from around the world. Each chapter is self-contained and comprises illustrative case studies from different parts of the globe.

The book begins with an introductory chapter by the editor that does an excellent job in describing world distribution of the arid and semiarid-arid regions and the degree of water stress, which these areas are currently encountering and going to experience in the future, and in underlining the effects of water shortage on both water supply and development perspectives. Also the organizational setup of the book and contents of each of the eight chapters of the book have been briefly described. As a way forward for solving the water shortage persisting in arid and semiarid areas, it is recommended to concentrate on the conjunctive use of surface water, groundwater, and reuse of wastewater. It has also been stressed that the basis for such actions is (a) increased understanding of the physical processes governing precipitation-infiltration transfers (b) improved monitoring and processing of data for the varying hydrological and climatic regimes and (c) the creation of hydrological, hydrogeological and extraction method data bases.

The following six chapters, i.e. chapter 2 to chapter 7, focus specifically on the understanding the arid and semi-arid hydrological process. Chapter 2 gives an overview of rainfall types and mechanisms, general circulation aspects and meso-scale climatic systems, a brief account on conventional precipitation measurement techniques and on the use of remote sensing in rainfall estimation, and an outline of rainfall frequency analysis and of recent research relevant to hydrological variability at multiple time scales. Chapter 3 summarizes the rapidly developing ways and techniques of estimating actual evapotranspiration and compares the various methods with regard to operational procedures and costs. Chapter 4 considers surface runoff processes and techniques for quantifying surface runoff and sediment dynamics. Within this frame direct measurements of flow and sediment load are compared with indirect estimation methods, the latter providing valuable alternatives in areas with missing data. Chapter 5 concentrates on water flow processes that are of interest for the evaluation of groundwater recharge, and the

large spatial and temporal variability of these water fluxes. It further discusses the use of numerical, physical and environmental tracer models for the determination of water flow processes in the vadose zone. Chapter 6 presents a series of analytical, statistical and physically-based (1-,2-, 3-D) methods for analysing aquifer dynamics related to either natural or anthropogenic changes under given boundary conditions and climate. Groundwater level fluctuations are concluded to be the most important primary source of diagnostic information. Chapter 7 describes, principally based on experiences gained from North Africa, the various hydrogeochemical techniques used to solve water quality problems and to understand the chemical pathways of water through the hydrological cycle. It further identifies potential tracers and their application within vadose and saturated zone studies, and underlines the need for conjunctive measurement of different tracers (e.g. chemical and isotopic; inert and reactive tracers) for most water resources studies.

Chapter 8 illustrates the inter-relationships between hydrological process and the operational water resources management practices, involving a wider spectrum of activities: surface water development; urbanization, industrial pollution and waste water reuse; irrigation, drainage, dry land salinity and land cover change; water harvesting and artificial recharge; groundwater over-exploitation; drought management, climate variability and conjunctive use of surface- and groundwater.

The present book makes a major contribution to the better understanding of hydrological processes in arid and semiarid zones. Although I. SIMMERS notes in the introductory chapter that “the information contained in the book represents an appraisal of arid and semiarid zone hydrological processes and does not aspire to being the ultimate word on the subject”, the numerous references listed at the end of each chapter however facilitate the reader to explore the large amount of knowledge, to keep abreasted of the recent methodological developments and water management practices in arid and semiarid areas accumulated in various journals, manuscripts, textbooks, and reports. The book is also an authoritative source of guidance as to which methods and software packages in current use are appropriate for a given task. It contains relevant Internet Sites, too, where detailed information on important documents, guidelines and software relevant to water management issues of arid and semiarid regions can be found.

The well-structured and clearly presented book is therefore an excellent reference for water resource management issues in arid and semiarid regions and appeals to three basic audiences: (1) practitioners who are trying to solve particular problems, (2) supervisors reviewing the work of others or consultants and policy makers in government agencies, (3) students, researchers and professionals from various fields (hydrology, hydrogeology, meteorology, engineering, soil science, agriculture, ecology etc.).

Beyene YEHDEGHO