

Quantitative Hydrogeology Groundwater Hydrology For Engineers

A synthesis of years of interdisciplinary research and practice, the second edition of this bestseller continues to serve as a primary resource for information on the assessment, remediation, and control of contamination on and below the ground surface. Practical Handbook of Soil, Vadose Zone, and Ground-Water Contamination: Assessment, Prevention, and Remediation, Second Edition includes important new developments in site characterization and soil and ground water remediation that have appeared since 1995. Presented in an easy-to-read style, this book serves as a comprehensive guide for conducting complex site investigations and identifying methods for effective soil and ground water cleanup. Remediation engineers, ground water and soil scientists, regulatory personnel, researchers, and field investigators can access the latest data and summary tables to illustrate key advantages and disadvantages of various remediation methods.

This volume is meant to provide the practitioner with information on the natural mixing processes occurring in aquifers as well as to describe basic strategies that can be implemented to enhance mixing in particular cases. For example, when it comes to mixing miscible liquids, one can speed up mixing in the formation by manipulating the flow such as through the use of recirculation wells. Furthermore, much of the mixing can be achieved partially within recirculation wells themselves, where contaminated water is admixed with additives, volatile products may be removed through a vapor mass exchanger, etc. Thus, adding mixing wells can significantly increase the performance of the delivery and mixing system and speed up the process of remediation.

This book focuses on scientific and technological aspects of groundwater-resources assessment and surveillance. It describes relevant risks and investigates selected techniques for the monitoring and mitigation of the individuated threats to groundwater quality. The authors discuss the concepts of groundwater-resources protection and offer examples of both geogenic and anthropogenic degradation of groundwater quality, such as heavy metals from mining activities and natural water-rock interactions, as well as risk of contamination due to geological CO₂ storage practices etc. The volume also covers non-invasive monitoring techniques and briefly addresses innovative sensor technologies for the online assessment of water quality. Furthermore, the role played by geochemical techniques, the potential of environmental isotopes and the support provided by physical modelling are highlighted. The chapters guide the reader through various viewpoints, according to the diverse disciplines involved, without aiming to be exhaustive, but instead picking representative topics for their relevance in the context of groundwater protection and control. This book will be of interest to advanced students, researchers, policy-makers and stakeholders at various levels.

Why is groundwater the predominant drinking water source in Hawaii? Why are groundwater sources susceptible to pesticide contamination? How long does it take for water in the mountains to journey by land and underground passages to reach the coast? Answers to questions such as these are essential to understanding the principles of hydrology—the science of the movement, distribution, and quality of water—in Hawaii. Due to the humid tropical climate, surrounding ocean, volcanic earth, and high mountains, many hydrologic processes in the Islands are profoundly different from those of large continents and other climatic

zones. Management of water, land, and environment must be informed by appropriate analyses, or communities and ecosystems face great uncertainty and may be at risk. The protection of groundwater, coastal waters, and streams from pollution and the management of flood hazards are also significant. This volume presents applications of hydrology to these critical issues. The authors begin by outlining fundamental hydrologic theories and the current general knowledge then expand into a formal discussion specific to Hawaii and the distinctive elements and their interrelations under natural and human-influenced conditions. They include chapters on rainfall and climate, evaporation, groundwater, and surface runoff. Details on the quantification of hydrologic processes are available to those with more technical knowledge, but general readers with an interest in the topic—one of singular importance for the Hawaiian Islands—will find much in the volume that is timely and accessible.

Groundwater theme is a component of Encyclopedia of Water Sciences, Engineering and Technology Resources in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. Groundwater is water located beneath the ground surface in soil pore spaces and in the fractures of lithologic formations. This theme presents a perspective of the field of groundwater and an overview of the important aspects of the subject such as, natural origin and distribution, characteristics under diverse climates and surrounding rocky environments, exploration and management, natural quality and human related sources of contamination, sustainable exploitation of resources, protection and current research trends. The content of the theme on Groundwater is organized with state-of-the-art presentations covering several topics: Origin, Distribution, Formation, and Effects; Typical Hydrogeological Scenarios; Transport Processes in Groundwater; Transport Phenomena and Vulnerability of the Unsaturated Zone; Groundwater Development; Groundwater Use and Protection; Groundwater Management: An Overview of Hydro-geology, Economic Values and Principles of Management; Special Issues in Groundwater, which are then expanded into multiple subtopics, each as a chapter. These three volumes are aimed at the following five major target audiences: University and College students Educators, Professional practitioners, Research personnel and Policy analysts, Managers, and Decision makers and NGOs

This book provides comprehensive coverage on the assessment and management of groundwater. It contains the work of international experts in the field of groundwater resource evaluation, characterization, augmentation, restoration, modeling and management.

The hydrogeologic environment of fractured rocks represents vital natural systems, examples of which occur on every continent. This book discusses key issues, methodologies and techniques in the hydrogeology of fractured rocks, summarizing recent progress and anticipating the outcome of future investigations. Forty-four revised and updated papers w

This book reviews the sources of soil and groundwater contamination and the potential remediation technologies. It focuses on remediation technologies that are commonly utilized in practice, and discusses a number of innovative technologies that show promise for special problem circumstances.

This is the first groundwater hydrology book composed entirely of genuine, applied problems covering a range of

groundwater hydrology topics. **KEY TOPICS:** Includes 21 exercises that help sharpen quantitative skills, require data analysis and concept exploration, and incorporate current image and graphic technologies. Uses a unique case-study approach to common groundwater problems and current situations; applies exercises to well-documented case studies that use intriguing story lines to provide a central issue for each exercise. Features EXCEL based problems, encouraging readers to apply concepts to complete the exercises with immediate graphical and quantitative feedback. **MARKET:** A useful reference for groundwater engineers.

This textbook employs a technical and quantitative approach to explain subsurface hydrology and hydrogeology, and to offer a comprehensive overview of groundwater-related topics such as flow in porous media, aquifer characterization, contaminant description and transport, risk assessment, and groundwater remediation. It describes the characterization of subsurface flow of pristine and polluted water and provides readers with easily applicable tools for the design of water supply systems, drinking-water source protection, and remediation interventions. Specific applications range from groundwater exploitation as a drinking water supply to the remediation of contaminated aquifers, from the definition and safeguarding of drinking-water sources to the assessment of human health risks in connection with groundwater contamination events. The book represents an ideal learning resource for upper-undergraduate and graduate students of civil engineering, environmental engineering, and geology, as well as practitioners in the fields of water resource management and environmental protection who are interested in groundwater engineering and technical hydrogeology.

"One of the world's great karstic aquifer systems, the Edwards aquifer system supplies water for more than 2 million people and for agricultural, municipal, industrial, and recreational uses. This volume reviews the current state of knowledge, current and emerging challenges to wise use of the aquifer system, and some technologies that must be adopted to address these challenges"--

A comprehensive account of the state of the science of environmental mass transport Edited by Louis J. Thibodeaux and Donald Mackay, renowned experts in this field, the Handbook of Chemical Mass Transport in the Environment covers those processes which are critically important for assessing chemical fate, exposure, and risk. In a comprehensive and authoritative format, this unique handbook provides environmental chemists, geoscientists, engineers, and modelers with the essential capabilities to understand and quantify transport. In addition, it offers a one-stop resource on environmental mass transfer and mass transport coefficient estimation methods for all genres. The book begins by discussing mass transport fundamentals from an environmental perspective. It introduces the concept of mobility — key to environmental fate, since transport must occur prior to any reaction or partitioning within the natural multimedia compartments. The fugacity approach to environmental mass transfer and the conventional approach are examined. This is followed by a

description of the individual mass transport processes and the appropriate flux equations required for a quantitative expression. The editors have identified 41 individual processes believed to be the most environmentally significant, which form the basis for the remainder of the book Using a consistent format for easy reference, each chapter: Introduces the specific processes Provides a detailed qualitative description Presents key theoretical mathematical formulations Describes field or laboratory measurements of transport parameters Gives data tables and algorithms for numerical estimates Offers a guide for users familiar with the process who are seeking a direct pathway to obtain the numerical coefficients Presents computed example problems, case studies and/or exercises with worked-through solutions and answers The final chapter presents the editors' insight into future needs and emerging priorities. Accessible and relevant to a broad range of science and engineering users, this volume captures the state of the transport science and practice in this critical area.

First published in 1995, the award-winning Civil Engineering Handbook soon became known as the field's definitive reference. To retain its standing as a complete, authoritative resource, the editors have incorporated into this edition the many changes in techniques, tools, and materials that over the last seven years have found their way into civil engineering research and practice. The Civil Engineering Handbook, Second Edition is more comprehensive than ever. You'll find new, updated, and expanded coverage in every section. In fact, more than 1/3 of the handbook is new or substantially revised. In particular you'll find increased focus on computing reflecting the rapid advances in computer technology that has revolutionized many aspects of civil engineering. You'll use it as a survey of the field, you'll use it to explore a particular subject, but most of all you'll use The Civil Engineering Handbook to answer the problems, questions, and conundrums you encounter in practice.

Quantitative Hydrogeology Groundwater Hydrology for Engineers Introduction to Hydrogeology Unesco-IHE Delft Lecture Note Series CRC Press

Fractured bedrock aquifers have traditionally been regarded as low-productivity aquifers, with only limited relevance to regional groundwater resources. It is now being increasingly recognised that these complex bedrock aquifers can play an important role in catchment management and subsurface energy systems. At shallow to intermediate depth, fractured bedrock aquifers help to sustain surface water baseflows and groundwater dependent ecosystems, provide local groundwater supplies and impact on contaminant transfers on a catchment scale. At greater depths, understanding the properties and groundwater flow regimes of these complex aquifers can be crucial for the successful installation of subsurface energy and storage systems, such as deep geothermal or Aquifer Thermal Energy Storage systems and natural gas or CO₂ storage facilities as well as the exploration of natural resources such as conventional/unconventional oil and gas. In many scenarios, a robust understanding of fractured bedrock aquifers is required to assess the nature and extent of connectivity between such engineered subsurface systems at depth and overlying receptors in the shallow subsurface.

Impacts of developed tools of heterogenous characterization on the hydrodynamics of flow and the transport mechanisms are illustrated in this text through a series of extensive numerical simulations consisting of single and multiple-realizations (Monte Carlo method).

Riverbank Filtration (RBF) has gained popularity in the past decade as an excellent source of high quality water for public water supply. This text compliments the existing literature on RBF water quality, and provides much-need guidance in the design and operation of RBF facilities. RBF has proven effective in many hydrogeological settings worldwide, and can be an excellent solution to water supply problems in both developed and developing countries. Topics covered include surface stream hydrology, particle clogging, and biological/geochemical processes. Data and case histories are provided from dozens of installations, providing much-needed practical information regarding RBF design, operation, and performance. This book provides the necessary tools to evaluate potential RBF sites, and is a must-have if you are considering RBF as a source of water supply.

Leading the way in this field, the Encyclopedia of Quantitative Risk Analysis and Assessment is the first publication to offer a modern, comprehensive and in-depth resource to the huge variety of disciplines involved. A truly international work, its coverage ranges across risk issues pertinent to life scientists, engineers, policy makers, healthcare professionals, the finance industry, the military and practising statisticians. Drawing on the expertise of world-renowned authors and editors in this field this title provides up-to-date material on drug safety, investment theory, public policy applications, transportation safety, public perception of risk, epidemiological risk, national defence and security, critical infrastructure, and program management. This major publication is easily accessible for all those involved in the field of risk assessment and analysis. For ease-of-use it is available in print and online.

Introduces the fundamental principles of applied Earth science needed for engineering practice, with case studies, exercises, and online solutions.

Providing an introduction to the crucially important topic of groundwater, this text covers all major fields of hydrogeology and includes outlines of the occurrence of groundwater in various rock types, the movement and storage of groundwater, the formulation of groundwater balances, the development of groundwater chemistry, as well as the practical application of hydrogeology for groundwater development. Following a unique systems approach to describe and connect its various elements, the text also explores a large selection of examples of groundwater cases from various parts of the world. In addition, theoretical sections and examples are illustrated with a number of drawings, photos and computer printouts. Suitable for education in hydrogeology at postgraduate and graduate level, the text is also a useful reference tool for professionals and decision-makers involved in water or water-related activities. In the revised paperback edition of Introduction to Hydrogeology (February 2006), suggestions of reviewers, students and collaegues have been taken into account. This means that more attention is paid to the processes in the unsaturated zone, especially those relating to groundwater recharge. Also, in the revised edition, the investigation methods are highlighted in the sections where the related theory is dealt with, and they are not presented in the last chapter on groundwater management. Chapter titles are re-named and some definitions are adjusted. The References and Bibliography section is also extended, some figures are improved, and the inevitable 'typing errors' are corrected as well.

Praise for Aquifer Hydraulics . . . "Very easy to understand and follow, even for complicated applications . . . this book will be a significant addition to the library of individuals who are practicing in the field of geohydrology." -Professor M. M. Aral, Georgia Institute of Technology "A valuable source of information for every student and practitioner of quantitative hydrogeology. I commend Dr. Batu for the thorough research and dedicated effort that went into the preparation of this book." -Stavros S. Papadopoulos, Chairman, S. S. Papadopoulos & Associates, Inc.

This book offers the most detailed and comprehensive coverage available of aquifer hydraulics, testing, and analysis for a wide range of aquifer and well types under differing conditions. It presents the theoretical foundations and limitations of existing analytical models for each ground water system, along with an in-depth examination of hydrogeologic data analysis methods. Translating theory into practice, detailed examples illustrate the real-world application of well test techniques-an invaluable aid to readers in the design, execution, and analysis of their own field tests. With an accompanying computer disk packed with data analysis programs, Aquifer Hydraulics is an essential tool for practicing and aspiring hydrogeologists, environmental engineers, and others involved in aquifer evaluation and protection.

This book from the NATO ASI on "Overexploitation and Contamination of Shared Groundwater Resources Management, (Bio)technological, and Political Approaches to Avoid Conflicts" is written by authors from different disciplines and regions of the world. The aim of the book is to contribute to the knowledge of shared groundwater resources management to avoid conflicts by considering multi-disciplinary approaches based on effective and equitable water sharing for all water users.

Understanding groundwater recharge is essential for successful management of water resources and modeling fluid and contaminant transport within the subsurface. This book provides a critical evaluation of the theory and assumptions that underlie methods for estimating rates of groundwater recharge. Detailed explanations of the methods are provided - allowing readers to apply many of the techniques themselves without needing to consult additional references. Numerous practical examples highlight benefits and limitations of each method. Approximately 900 references allow advanced practitioners to pursue additional information on any method. For the first time, theoretical and practical considerations for selecting and applying methods for estimating groundwater recharge are covered in a single volume with uniform presentation. Hydrogeologists, water-resource specialists, civil and agricultural engineers, earth and environmental scientists and agronomists will benefit from this informative and practical book. It can serve as the primary text for a graduate-level course on groundwater recharge or as an adjunct text for courses on groundwater hydrology or hydrogeology. For the benefit of students and instructors, problem sets of varying difficulty are available at http://www.brr.cr.usgs.gov/projects/GW_Unsat/Recharge_Book/

FEFLOW is an acronym of Finite Element subsurface FLOW simulation system and solves the governing flow, mass and heat transport equations in porous and fractured media by a multidimensional finite element method for complex geometric and parametric situations including variable fluid density, variable saturation, free surface(s), multispecies reaction kinetics, non-isothermal flow and multidiffusive effects. FEFLOW comprises theoretical work, modeling experiences and simulation practice from a period of about 40 years. In this light, the main objective of the present book is to share this achieved level of modeling with all required details of the physical and numerical background with the reader. The book is intended to put advanced theoretical and numerical methods into the hands of modeling practitioners and scientists. It starts with a more general theory for all relevant flow and transport phenomena on the basis of the continuum approach, systematically develops the basic framework for important classes of problems (e.g., multiphase/multispecies non-isothermal flow and transport phenomena, discrete features, aquifer-averaged equations, geothermal processes), introduces finite-element techniques for solving the basic balance equations, in detail discusses advanced numerical algorithms for the resulting nonlinear and linear problems and completes with a number of benchmarks, applications and exercises to illustrate the different types of problems and ways to tackle them successfully (e.g., flow and seepage problems, unsaturated-saturated flow, advective-diffusion transport, saltwater intrusion, geothermal and thermohaline flow).

Due to the increasing demand for adequate water supply caused by the augmenting global population, groundwater production has acquired

a new importance. In many areas, surface waters are not available in sufficient quantity or quality. Thus, an increasing demand for groundwater has resulted. However, the residence time of groundwater can be of the order of thousands of years while surface waters is of the order of days. Therefore, substantially more attention is warranted for transport processes and pollution remediation in groundwater than for surface waters. Similarly, pollution remediation problems in groundwater are generally complex. This excellent, timely resource covers the field of groundwater from an engineering perspective, comprehensively addressing the range of subjects related to subsurface hydrology. It provides a practical treatment of the flow of groundwater, the transport of substances, the construction of wells and well fields, the production of groundwater, and site characterization and remediation of groundwater pollution. No other reference specializes in groundwater engineering to such a broad range of subjects. Its use extends to:

- The engineer designing a well or well field
- The engineer designing or operating a landfill facility for municipal or hazardous wastes
- The hydrogeologist investigating a contaminant plume
- The engineer examining the remediation of a groundwater pollution problem
- The engineer or lawyer studying the laws and regulations related to groundwater quality
- The scientist analyzing the mechanics of solute transport
- The geohydrologist assessing the regional modeling of aquifers
- The geophysicist determining the characterization of an aquifer
- The cartographer mapping aquifer characteristics
- The practitioner planning a monitoring network

A thorough, up-to-date guide to groundwater science and technology Our understanding of the occurrence and movement of water under the Earth's surface is constantly advancing, with new models, improved drilling equipment, new research, and refined techniques for managing this vital resource. Responding to these tremendous changes, David Todd and new coauthor Larry Mays equip readers with a thorough and up-to-date grounding in the science and technology of groundwater hydrology. Groundwater Hydrology, Third Edition offers a unified presentation of the field, treating fundamental principles, methods, and problems as a whole. With this new edition, you'll be able to stay current with recent developments in groundwater hydrology, learn modern modeling methods, and apply what you've learned to realistic situations. Highlights of the Third Edition

- * New example problems and case studies, as well as problem sets at the end of each chapter.
- * A special focus on modern groundwater modeling methods, including a new chapter on modeling (Chapter 9), which describes the U. S. Geological Survey MODFLOW model.
- * Over 300 new figures and photos.
- * Both SI and U.S. customary units in the example problems.
- * Expanded coverage of groundwater contamination by chemicals.
- * New references at the end of each chapter, which provide sources for research and graduate study.

Student and instructor resources for this text are available on the book's website at www.wiley.com/college/todd.

This book contains the results and findings of the advanced research carried out in a pilot area with a thorough investigation of the structure and functioning of an aquifer in a granitic formation. It characterizes the hard rock aquifer system and examines its properties and behavior as well as systematically details the geophysical, geological and remote sensing applications to conceptualize such an aquifer system. Groundwater represents an important supply source for municipal and irrigation uses in Far West Texas. The City of El Paso receives about 50 percent of its municipal water supply from surface water and 50 percent from local groundwater. Groundwater pumping in El Paso is from the Hueco Bolson and the Mesilla Bolson. Historic groundwater pumping in the Texas portion of the Mesilla Bolson has not resulted in significant changes in groundwater levels or groundwater quality in existing wells. Historic pumping in the Hueco Bolson has resulted in lowered groundwater levels and brackish groundwater intrusion. The groundwater level declines have resulted in the intrusion of brackish groundwater into areas that historically pumped fresh groundwater. A 1979 assessment concluded that El Paso would deplete fresh

groundwater in the Hueco Bolson by 2030 if groundwater pumping continued to increase. Partly as a result of the 1979 assessment, El Paso reduced its groundwater pumping from the Hueco Bolson by increasing surface water diversions from the Rio Grande, increasing conservation efforts, and increasing reclaimed water use. As a result, groundwater levels in many parts of the Hueco Bolson have stabilized. Brackish groundwater intrusion remains an issue, and is being addressed with a brackish groundwater desalination plant, currently under construction. The new wells and existing wells that will supply this desalination plant will also assist in the management of brackish groundwater intrusion by intercepting the brackish groundwater before it can flow towards existing fresh groundwater wells. The 2006 Far West Texas Regional Water Plan contemplates a groundwater transfer project to meet increasing demands in El Paso County beginning about 2030, mostly from the Dell City area in Hudspeth County, Texas. Groundwater management in the Dell City area is governed by a groundwater conservation district that has established limits on groundwater pumping based on existing and historic uses. Groundwater pumping for irrigation began in the Dell City area in 1948, and groundwater levels have been essentially stable for since the 1980s. Future planning for a groundwater transfer project will require a detailed understanding of the hydrogeology of the groundwater in the Dell City area. International experts from around the globe present a rich variety of intriguing developments in time series analysis in hydrology and environmental engineering. Climatic change is of great concern to everyone and significant contributions to this challenging research topic are put forward by internationally renowned authors. A range of interesting applications in hydrological forecasting are given for case studies in reservoir operation in North America, Asia and South America. Additionally, progress in entropy research is described and entropy concepts are applied to various water resource systems problems. Neural networks are employed for forecasting runoff and water demand. Moreover, graphical, nonparametric and parametric trend analyses methods are compared and applied to water quality time series. Other topics covered in this landmark volume include spatial analyses, spectral analyses and different methods for stream-flow modelling. Audience The book constitutes an invaluable resource for researchers, teachers, students and practitioners who wish to be at the forefront of time series analysis in the environmental sciences.

Arid and semi-arid regions face major challenges in the management of scarce freshwater resources under pressures of population, economic development, climate change, pollution and over-abstraction. Groundwater is commonly the most important water resource in these areas. Groundwater models are widely used globally to understand groundwater systems and to guide decisions on management. However, the hydrology of arid and semi-arid areas is very different from that of humid regions, and there is little guidance on the special challenges of groundwater modelling for these areas. This book brings together the experience of internationally leading experts to fill a gap in the scientific and technical literature. It introduces state-of-the-art methods for modelling groundwater resources, illustrated with a wide-ranging set of illustrative examples from around the world. The book is valuable for researchers, practitioners in developed and developing countries, and graduate students in hydrology, hydrogeology, water resources management,

environmental engineering and geography.

Is it not generally believed that our town is a healthy place . . . a place highly commended on this score both for the sick and for the healthy? . . . And then these Baths - the so-called 'artery' of the town, or the 'nerve centre' . . . Do you know what they are in reality, these great and splendid and glorious Baths that have cost so much money? . . . A most serious danger to health! All that filth up in Melledal, where there's such an awful stench - it's all seeping into the pipes that lead to the pump-room! Henrik Ibsen, *An Enemy of the People*, 1882 Henrik Ibsen gave the 'truth about mineral water' more than 100 years ago in *An Enemy of the People*. His examples came not from the decadent bathing spas of Bohemia or Victorian Britain, but from the very edge of polite society, subarctic Norway! His masterpiece illustrates the central role that groundwaters and, in particular, mineral waters have played in the history of humanity: their economic importance for towns, their magnetism for pilgrims searching for cures, the political intrigues, the arguments over purported beneficent or maleficent health effects and, finally, their contamination by anthropogenic activity, in Ibsen's case by wastes from a tannery. This book addresses the occurrence, properties and uses of mineral and thermal groundwaters. The use of these resources for heating, personal hygiene, curative and recreational purposes is deeply integrated in the history of civilization.

HYDROGEOLOGY *Hydrogeology: Principles and Practice* provides a comprehensive introduction to the study of hydrogeology to enable the reader to appreciate the significance of groundwater in meeting current and future environmental and sustainable water resource challenges. This new edition has been thoroughly updated to reflect advances in the field since 2014 and includes over 350 new references. The book presents a systematic approach to understanding groundwater starting with new insights into the distribution of groundwater in the Earth's upper continental crust and the role of groundwater as an agent of global material and elemental fluxes. Following chapters explain the fundamental physical and chemical principles of hydrogeology, and later chapters feature groundwater field investigation techniques in the context of catchment processes, as well as chapters on groundwater quality and contaminant hydrogeology, including a section on emerging contamination from microplastic pollution. Unique features of the book are chapters on the application of environmental isotopes and noble gases in the interpretation of aquifer evolution, and a discussion of regional characteristics such as topography, compaction and variable fluid density on geological processes affecting past, present and future groundwater flow regimes. The last chapter discusses future challenges for groundwater governance and management for the long-term sustainability of groundwater resources, including the role of managed aquifer recharge, and examines the linkages between groundwater and climate change, including impacts on cold-region hydrogeology. Given the drive to net-zero carbon emissions by 2050, the interaction of groundwater in the

exploitation of energy resources, including renewable resources and shale gas, is reviewed. Throughout the text, boxes and a set of colour plates drawn from the authors' teaching and research experience are used to explain special topics and to illustrate international case studies ranging from transboundary aquifers and submarine groundwater discharge to the hydrogeochemical factors that have influenced the history of malting and brewing in Europe. The appendices provide conversion tables and useful reference material, and include review questions and exercises, with answers, to help develop the reader's knowledge and problem-solving skills in hydrogeology. This highly informative and accessible textbook is essential reading for undergraduate and graduate students primarily in earth sciences, environmental sciences and physical geography with an interest in hydrogeology or groundwater topics. The book will also find use among practitioners in hydrogeology, soil science, civil engineering and landscape planning who are involved in environmental and resource protection issues requiring an understanding of groundwater.

Space, structure, and randomness: these are the three key concepts underlying Georges Matheron's scientific work. He first encountered them at the beginning of his career when working as a mining engineer, and then they resurfaced in fields ranging from meteorology to microscopy. What could these radically different types of applications possibly have in common? First, in each one only a single realisation of the phenomenon is available for study, but its features repeat themselves in space; second, the sampling pattern is rarely regular, and finally there are problems of change of scale. This volume is divided in three sections on random sets, geostatistics and mathematical morphology. They reflect his professional interests and his search for underlying unity. Some readers may be surprised to find theoretical chapters mixed with applied ones. We have done this deliberately. GM always considered that the distinction between the theory and practice was purely academic. When GM tackled practical problems, he used his skill as a physicist to extract the salient features and to select variables which could be measured meaningfully and whose values could be estimated from the available data. Then he used his outstanding ability as a mathematician to solve the problems neatly and efficiently. It was his capacity to combine a physicist's intuition with a mathematician's analytical skills that allowed him to produce new and innovative solutions to difficult problems. The book should appeal to graduate students and researchers working in mathematics, probability, statistics, physics, spatial data analysis, and image analysis. In addition it will be of interest to those who enjoy discovering links between scientific disciplines that seem unrelated at first glance. In writing the book the contributors have tried to put GM's ideas into perspective. During his working life, GM was a genuinely creative scientist. He developed innovative concepts whose usefulness goes far beyond the confines of the discipline for which they were originally designed. This is why his work remains as pertinent today as it was when it was first written.

This practical training guidebook makes an important contribution to karst hydrogeology. It presents supporting material for academic courses worldwide that include this and similar topics. It is an excellent sourcebook for students and other attendees of the International Karst School: Characterization and Engineering of Karst Aquifers, which opened in Trebinje, Bosnia & Herzegovina in 2014 and which will be organized every year in early summer. As opposed to more theoretical works, this is a catalog of possible engineering interventions in karst and their implications. Although the majority of readers will be professionals with geology/hydrogeology backgrounds, the language is not purely technical making it accessible to a wider audience. This means that the methodology, case studies and experiences presented will also benefit water managers working in karst environments.

[Copyright: 5b5d4470d32f0cc36ef30dfcaf5c10dc](#)