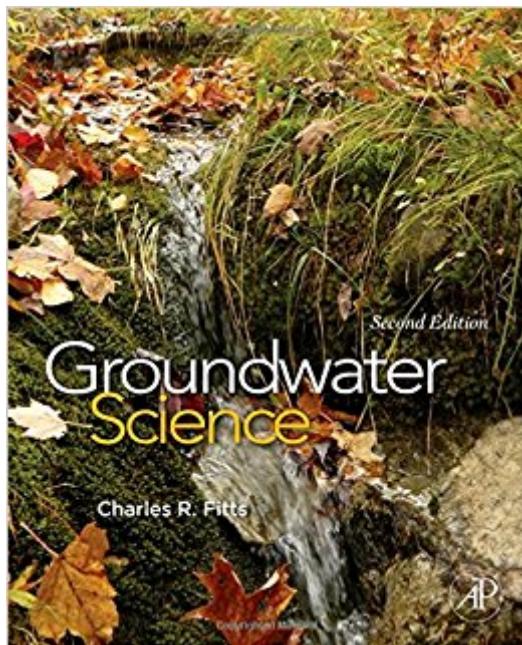


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# Groundwater Science, Second Edition



## Synopsis

Groundwater Science, Second Edition - winner of a 2014 Textbook Excellence Award (Texty) from The Text and Academic Authors Association - covers groundwater's role in the hydrologic cycle and in water supply, contamination, and construction issues. It is a valuable resource for students and instructors in the geosciences (with focuses in hydrology, hydrogeology, and environmental science), and as a reference work for professional researchers. This interdisciplinary text weaves important methods and applications from the disciplines of physics, chemistry, mathematics, geology, biology, and environmental science, introducing you to the mathematical modeling and contaminant flow of groundwater. New to the Second Edition: New chapter on subsurface heat flow and geothermal systemsExpanded content on well construction and design, surface water hydrology, groundwater/ surface water interaction, slug tests, pumping tests, and mounding analysis.Updated discussions of groundwater modeling, calibration, parameter estimation, and uncertaintyFree software tools for slug test analysis, pumping test analysis, and aquifer modelingLists of key terms and chapter contents at the start of each chapterExpanded end-of-chapter problems, including more conceptual questionsWinner of a 2014 Texty Award from the Text and Academic Authors AssociationFeatures two-color figuresIncludes homework problems at the end of each chapter and worked examples throughoutProvides a companion website with videos of field exploration and contaminant migration experiments, PDF files of USGS reports, and data files for homework problemsOffers PowerPoint slides and solution manual for adopting faculty

## Book Information

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## Customer Reviews

"The 2nd edition of Groundwater Science by Charles R. Fitts includes a wealth of new and updated materials both in the book and on the web... Fitts' book is excellently written for use in an introductory groundwater course, particularly at the undergraduate level. A Groundwater science has the benefit of an author with an engineering background..." - *Groundwater*, 2013, vol. 51(5), p. 655.

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Praise for the first edition: "Groundwater Science would serve well as the text for an introductory groundwater course... The graphics are crisp and explanatory. Data sets needed to work some of the problems in the book are available as text files from the book's Web Site... I found these files to be complete and easy to understand. The references are up to date... concise, well-written, and well-illustrated..." --Sean A. McKenna, Sandia National Labs, *EOS TRANSACTIONS*, July 2003

"Groundwater Science is presented in a clear, logical manner, with attractive, effective typeset, and crisp diagrams... I strongly endorse this book for those entering the world of groundwater science for the first time." --David Sharpe, Geological Survey of Canada

*Episodes*, December 2002 "The writing is clear and accurate without being wordy... The figures, references, and indexing are also well done. The references include both classics and recent papers, with broad coverage... It's not easy to do so many topics well, but Fitts' book succeeds."

--Laura Toran, for *GROUND WATER*, 2003 "Fitts takes a decidedly lean and focused approach to the subject. The figures have a crisp and uncluttered look to them. The writing and presentation is clear and economical. Fitts stresses concepts over formal development, avoiding derivations and mathematics where possible. I found his approach to be very effective, and expect it would appeal to the learning style of most students who need to first establish a simple, concrete foundation, supported by their own intuition, before they can abstract concepts in mathematical expressions... Groundwater Science is a good text for an introductory course in groundwater."

--Roger Beckie, University of British Columbia, for *VADOSE ZONE JOURNAL*, November 2003 "This text should find a suitable market in ground water science, especially with those instructors who prefer more mathematical or engineering perspectives to the subject. Although the text stresses mathematical modeling and contaminant flow, the overall balance provided by the geological perspective from Chapter 4 makes it a suitable choice for any instructor needing a comprehensive, visually appealing, well organized, and well supported textbook on ground water."

--Robert A. Vargo, Department of Earth Science, California University, for the *Journal of the*

Charles R. Fitts is a professor at the University of Southern Maine with research interests in hydrogeology, contaminant migration, and applied mathematics. He earned an MS in engineering geology at Cornell and a PhD in civil engineering at the University of Minnesota. He has consulted for various geotechnical and groundwater companies, and is author of several groundwater modeling software packages: AnAqSim (analytic aquifer simulator) and TWODAN for groundwater flow, and SOLUTRANS for solute transport.

Just what my son needed for his class.

I don't have any other books on groundwater with which to compare it, but this book is well organized and clearly written.

Good book. Explains everything really well!!!

Very useful for a complete understanding of the subject

Super Fresh !

NO PAGE NUMBERS!!! in ebook edition to correspond to printed edition page assignments and discussions in class!!! Wake up publishers!!

It's difficult to rate this book. It's not a bad book at all but it's an unusual book to me. In the beginning, I thought this could be a new kind of introductory book into theoretical and applied hydrogeology. But it's not. It can't be an introduction into "hydrogeology" (in a broad sense, and the book title should have told me) because it goes too fast and jumps to conclusions that are not self-intuitive for a beginner. For instance, in chapter 2, page 25, the fact that at the bottom of a well the "pressure is equals the weight density of water times the water column H" is only stated in a practical example that shows how incompressible water is. There is no previous paragraph which explains this fact and why it is so and terminology-wise weight density is for me specific weight. A quick refresh in physics mechanics would be necessary. In Chapter 2.6 (Measuring Hydraulic Head with Wells and Piezometers) the initial and mid part are a bit overcomplicated to understand to me -

why not mentioning the height of water column in the well which is something everybody can see? - and perhaps with the example Nr. 20 at the end of the chapter. On the other side, the rest of same chapter is excellent in informing the reader that the water level in a newly installed piezometer is not the same as in the surroundings because the system needs to adjust itself. In chapter 3, the Darcy Law is explained but quickly again. Concerning "Heterogeneity and Anisotropy of the Hydraulic Conductivity" (Ch. 3.5), anisotropy and heterogeneity are almost synonyms in the chapter ("In a heterogeneous material the value of  $K$  varies spatially" - "Anisotropy implies that the value of  $K$  at a given location depends on directions" page 59). Instead, my understanding is that anisotropy (and isotropy) applies to hydraulic conductivity  $K$  only while heterogeneity applies to more parameters such as hydraulic conductivity  $K$ , porosity and so on. As a consequence, there are three different types of aquifers due to geology: homogeneous and isotropic, homogeneous and anisotropic, heterogeneous and anisotropic. But the book has many more chapters (12) and most of the book is about applied hydrogeology from an engineer point of view (the author is an engineer) with experience in site remediation and groundwater pollution, I understand, and going through all the necessary chapters which cover (sometimes quickly) all relevant aspects of, yes, the book's title says it, "Groundwater Science" : so field exploration, quantitative hydrogeology, pumping test, hydrology, modelling, one can only name it. You want to know one or two ways how to measure a river flow for instance? You get it (Chapter 5.2, Surface Water Hydrology, page 132;). I was surprised to see also a generous chapter on slug test exclusively which was "distilled" (p.307, ch.8) from a famous book on the topic, state of the art so to say. This is in the end what made me consider what this book is all about: a distillation of all knowledge about and around groundwater. Or better, again, yes, Groundwater Science. And there is even a chapter (12), the last one, about "Subsurface Heat Flow and Geothermal Energy". Each chapter of the book has got examples and exercises within the text and at the end of the chapter (with solutions for parts of the exercises at the end of the book for the latter). For time reasons, I could only check some of the problems in Chapter 2 and 3 and found the exercises ok but a bit too quickly explained and solved which was the same approach for the exercises within the text of the chapters. With the book, comes a companion website which should be enriched with more materials in my opinion (for instance there are no videos, nor links, nor else for chapter 2, "Physical properties", including hydrostatic) and other chapters could be richer in content, too. In the end, I think that this book is for an advanced beginner or a professional in need for a quick overview of a topic. Above all, the book is excellent at giving key reference texts and papers. The author knows probably everything relevant which has been done and written in the field and he is a guide to look at. However, the book is not always easy if the

subject is completely new or, alternatively, one will tend to consider reading the reference material as well for a deeper understanding. I gave three stars because of that. I cannot recommend this book to a total beginner (the classic Fetter's "Applied Hydrogeology" or Freeze et al. "Groundwater" are probably better), and an expert professional will probably rather consult a book on a specific topic (e.g. Batu's "Aquifer Hydraulics") or read fundamental scientific articles. The book is very good for expanding one's knowledge in a single attempt. After all it can easily be carried around and read through with real pleasure because it is graphically appealing, dense and concise.

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