

Oceans: An Illustrated Reference

By Dorrik Stow, University of Chicago Press, 2006, 256 pages, ISBN 0226776646, Hardcover, \$55 US

REVIEW BY TOM GARRISON

One test of a book is to leave it on your desk for a time and see what happens when somebody picks it up. In the case of Dorrik Stow's *Oceans, an Illustrated Reference*, curious examiners wanted to know if it was a textbook, a cyclopedic reference, or a coffee table book.

The answer depends on who's asking the question. For me, a teaching professor and textbook writer, leafing through this beautiful book for the first time triggered emotions of envy—the clear and easily understood graphics and excellent image selection sent me running for more post-it notes to mark pages from which I could learn better presentation techniques. For my family, the effective illustration program and information on marine animals generated the most interest. For my office partner, a marine geologist, the organization of the book and the currency and clarity of the writing were the most attractive points.

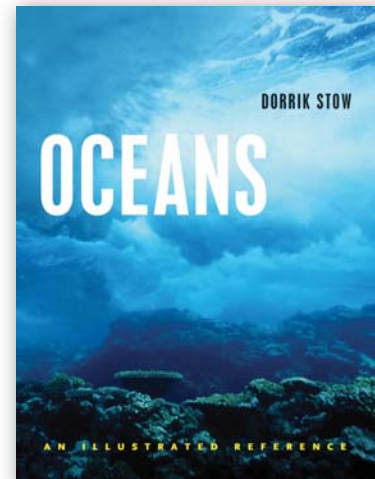
So here is a very rare book: a skillfully written, current, and unusually attractive presentation of ocean science that does not talk down to the audience, that unapologetically uses genus names and the SI system of measurements, and that maintains a balance between the living and non-living aspects of the ocean world.

Stow has divided the work into two

major parts: Ocean Systems and Ocean Life. Following an effective preface by Charles Kennel, former director of Scripps Institution of Oceanography, the author launches these large subjects with a series of short essays. One of these, “The Lure of the Sea,” effectively makes the point that the ocean did not prevent the spread of humanity—by the time the European explorers set out to “discover” the world, virtually every spot capable of supporting stable human populations was doing so. In the next essay, “Great Voyages of Discovery,” we inevitably hear about Columbus, but we also find information on the astonishing voyages of Admiral Zheng He and the Ming treasure ships.

The systems approach the author takes in the book's two primary sections is an ideal way to explain the complex interaction of sea, land, and atmosphere. Process and relationships are emphasized. The discussion of plate tectonics in Chapter 1 is especially effective, and the illustrations are models of clarity. The photo of Iceland's Thingvillir region is the best I've seen. Chapter 5 in this section, “Hidden Riches of the Ocean,” is superb in its balanced coverage of actual and potential marine energy sources. A chapter containing data for each major ocean basin with clear, well-drawn maps ends this section.

Refreshingly, a solid evolutionary approach underlies the second major section, “Ocean Life.” Beginning with an exposition of theories on the origin of life, the author moves through marine



biology with his now familiar systems integration approach. Again, illustrations and graphics effectively emphasize the points being made.

Dorrik Stow is Professor of Ocean and Earth Science at Southampton Oceanography Center. In addition to his own synthesis, he has integrated contributions from experts in interlocking fields to produce a book that accomplishes the near-impossible: It could be used as a text (it has a useful glossary and index); it could grace anyone's coffee table (the cover photo demands one pick up the book); it could sit happily on a reference shelf (where its charts and tables would be in considerable demand).

Is this book perfect? Not quite. My one quibble is with the title. With such a thorough systems approach, I wish the author had titled the book: “The Ocean...” There is, after all, only one.

Tom Garrison (tomgarrison@sbcglobal.net) is an instructor at Orange Coast College, Costa Mesa, CA, USA and one of *Oceanography's Education* columnists.

Introduction to the Physics and Techniques of Remote Sensing

By Charles Elachi and Jakob van Zyl,
Wiley, 2006, 584 pages, ISBN
0471475696, Hardcover, \$145 US

REVIEWED BY HOWARD A. ZEBKER

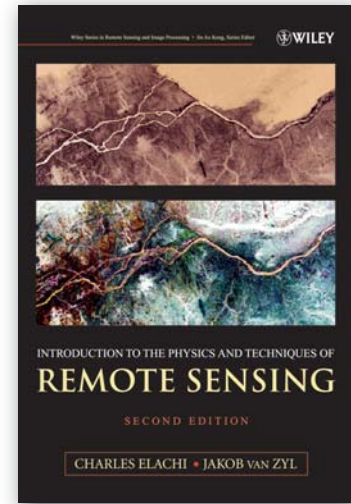
Introduction to the Physics and Techniques of Remote Sensing is an excellent reference or first-year graduate text on remote sensing. Concentrating on the principles underlying remote sensing and descriptions of many operational remote sensing systems, the text provides the reader with the necessary background to understand and interpret remote-sensing data and is amply illustrated with example image data. The only real weakness in the book is relevant to the present context—not much space is devoted to ocean and ice remote sensing. This limitation is not a weakness for readers looking for a fundamental understanding of the physics of remote sensing in general, but may be of consequence for oceanographers seeking a direct application of these principles to their area of expertise.

Nonetheless, the text presents all of the major physical effects that relate processes of the Earth system to satellite-observable quantities. The early chapters describe the nature of electromagnetic radiation and its interaction with matter. Various regions of the spectrum are discussed, from ultraviolet, visible, and near infrared wavelengths that characterize reflected solar energy, to longer wavelengths in the thermal infrared portion of the spectrum dominated by Earth's emission, to microwave wavelengths sensitive to surface structure. Short sec-

tions for parts of the spectrum outside of these regions are included for completeness, but as these are not so often used in remote-sensing studies, they are appropriately terse.

Descriptions of the observable phenomena include most of the basic equations needed to quantify the measurements and relate them to the physical properties of the area under study, although the depth of explanation varies from section to section. Many times the equations are simply stated, without a lengthy derivation and occasionally without reference. This terseness can be a little frustrating for the reader interested in fully understanding the phenomenon. In other instances, more information than is required is presented. For example, when describing blackbody radiation, the authors go into a fair amount of detail on equipartition of energy and the derivation of Planck's equation, while the jump from Maxwell's equations to detailed properties of wave observables such as polarization and Doppler shifts is abrupt for a reader starting out in E&M. Yet, for the most part, the authors strike an appropriate balance for those interested in how to use remote sensing to learn about the Earth and planets.

The text is well organized and systematic in the treatment of various remote-sensing methods, progressing through the spectrum from short to long in discussions of solid surface remote sensing over a series of four chapters. When each chapter requires additional background material, it is included so that many chapters can stand alone with few references to the theory presented earlier.



This is a useful approach for working scientists using the book as a reference, but perhaps less helpful for students looking to grasp the full field. A similar multi-chapter development is used for atmospheric remote sensing, starting with radiative transfer theory and then addressing sensing systems and methods from long to short wavelengths. It is a bit confusing as to why material is organized in order of increasing wavelength for solid surfaces and decreasing wavelength for the atmosphere, but each section taken on its own is logically presented.

Of the book's 12 chapters and four appendices, only one chapter is expressly related to ocean remote sensing. For any audience other than the present, this would not be a significant issue. Because so much remote-sensing activity was developed for oceanographic applications, and because the ocean community remains one of the largest users of remote-sensing data, the scant attention here to the 75 percent of the Earth covered by water is perhaps surprising. Yet, the principles so well described for solid Earth and atmospheric applications apply to the ocean as well, and readers willing to spend the extra time can benefit from the material as presented. Unfortunately, im-

portant methods for ocean study, such as sonar and satellite bathymetry systems, are not discussed, and the methods that are presented are illustrated with land and air applications rather than those for ocean science. What is missing for the present audience is a discussion of the special issues related to sensing the ocean surface and depths, including a review of the major needed observables. Readers needing to put remote sensing within the oceanographic context immediately might look for a review more centered on their specific set of problems.

One of the major strengths of the book is the plethora of example data and systems used to collect remote-sensing observations of the Earth and of other planetary bodies. While this tends to date the book and requires updates—the current text is a second edition of a text published in 1987—the descriptions are a valuable reference for historical data sets and give a sense of the progress made in the field since remote sensing first became widely used 40 years ago. Again, most of the examples are for land

remote sensing and arguably many major applications of significance have been over the ocean and atmosphere.

Production values in this text are somewhat mixed. There is a nice set of color plates inserted in one section that shows off the acquired images well. It is of course difficult to quantify, but the visual appeal of remote sensing data is one of its real strengths. Examination of a color scene more often than not suggests analysis methods that might be hard to discern by staring at mathematical equations on a page. The rest of the text contains many figures that likely for cost reasons are reproduced in black and white, severely limiting their instructional value and making it more difficult to appreciate their value. But in these days of \$200 textbooks, the authors have made a reasonable decision as to how much material to include in color.

In summary, this book is an excellent reference work and could easily be the primary textbook for a graduate course in remote sensing. All of the fundamental physics is here, along with a bit of

chemistry. Mathematical relations coupling the physical processes to remote-sensing observables are given, even if not always fully described, and explain why existing systems are designed as they are. The full range of topics covered is beyond the needs of any specific discipline, yet the material is all relevant and very handy to have all in one place. Yet, the text gives rather scant attention to the ocean, so it may not be the first choice for ocean scientists looking to apply remote sensing to their work. Too many practical details of ocean remote sensing are omitted for this book to serve as the primary oceanographic reference. For professionals in the field and for students, where a thorough understanding of the physics and math underlying the acquisition and analysis of remote sensing data is required, this book satisfies the need well.

Howard A. Zebker (zebker@stanford.edu)
is Professor of Geophysics and Engineering,
Stanford University, Stanford, CA, USA.

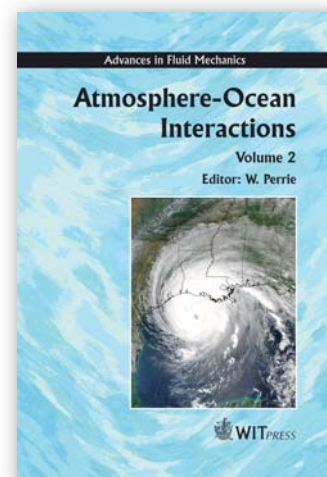
Atmosphere-Ocean Interactions (Vol. 2)

Edited by W. Perrie, WIT Press,
2006, 240 pages, ISBN 1853129291,
Hardcover, \$142 US

REVIEW BY PETER WADHAMS

This multi-author work is the latest (vol. 39) in an *International Series on Advances in Fluid Mechanics* published by WIT Press, the publishing arm of the Wessex Institute of Technology, near

Southampton, UK. The stated objective of the series is to bring advances in the field, made by exceptional researchers, to the attention of the broad international community by means of volumes of invited contributions. Its purpose therefore seems to resemble that of *Annual Review of Fluid Mechanics*, but how does it shape up? First, *Atmosphere-Ocean Interactions (Volume 2)* is much shorter (224 pages compared with 600 or so for ARFM).



Second, *Atmosphere-Ocean Interactions (Volume 2)* is more expensive; \$142 is a lot to pay for such a short book.

There are eight chapters in the series, and the editor makes it clear that the special area of interest of this volume is to review mechanisms that are important for the development of marine storms. Most chapters focus on the parameterization of atmosphere-ocean processes. Chapter 1, by W.M. Drennan, reviews the parameterizations of air-sea fluxes, using eddy-correlation fluxes drawn from eight field experiments to investigate traditional bulk flux parameterizations (wind-speed-dependent momentum coefficients, constant sensible and latent heat coefficients) and to suggest new algorithms. Chapter 2, by M.A. Bourassa, deals with satellite-based observations of surface turbulent stress during severe weather. Chapter 3, by Y. Toba and colleagues, considers the challenge of deriving a better parameterization for the CO₂ transfer between the atmosphere and the oceans, a topic of great importance when we seek to track the path of CO₂ through the global system in order to improve understanding of the take-up of anthropogenic CO₂. They consider the nonlinear coupling of waves with local wind drift and turbulence, and the use of the windsea Reynolds number, a concept introduced by Toba himself.

Chapter 4 was the chapter that I found most interesting and original. By T.D. Sikora and others, it deals with applications of synthetic aperture radar (SAR) in marine meteorology. There is a fascinating set of illustrations showing how SAR images not only ocean surface variability, but also atmospheric phenomena and their impact on the ocean. We see examples of microscale cellular convection, microscale roll vortices, microscale

gravity waves, mesoscale gravity waves, mesoscale convection, polar and tropical mesoscale cyclones, macroscale fronts, and extratropical cyclones. This information is a boon for all those who have gazed at a SAR image of the ocean and concluded either that it is telling us too much, or that it is showing us something that is not really there. My only complaint is that the many beautiful images would have looked better reproduced on glossy paper rather than on the standard uncoated paper chosen for the book.

Chapter 5, by L.K. Shay and S.D. Jacob, deals with the relationship between oceanic energy fluxes and surface winds during tropical cyclone passage; Chapter 6, by the editor, W. Perrie, and others, deals with mid-latitude storm impacts on air-sea CO₂ fluxes; and Chapter 7, by J.L. Evans and R.E. Hart, deals with the extratropical transition of tropical cyclones in the North Atlantic. The final chapter, by X.L. Wang and V.R. Swail, is an interesting study of the historical and possible future changes of wave heights in northern hemisphere oceans. They

show how significant increases have been, and will be, occurring as one consequence of global warming.

Atmosphere-Ocean Interactions (Volume 2) is a respectable collection of worthwhile papers, of interest mainly to serious researchers in air-sea interaction. Casual readers will be put off by the price.

Peter Wadhams (pw11@cam.ac.uk) is Professor of Ocean Physics, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK.

WIT Press is offering a 30% discount to TOS members on orders placed within two months of the date of this issue. To claim the discount, place your order directly with the WIT Press USA office (WIT Press, 25 Bridge St., Billerica, MA, 01821, USA. Phone: +1-978-667-5841. Fax: +1-978-667-7582. Please refer to code 9291TOS.

UPCOMING BOOK REVIEWS

The Agulhas Current

by Johann R.E. Lutjeharms, Springer, 330 pages

Lagrangian Fluid Dynamics

by Andrew Bennett, Cambridge University Press, 286 pages