

THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

Oceanography

CITATION

Wadhams, P. 2006. Review of *Ocean Sciences: Bridging the Millennia—A Spectrum of Historical Accounts*, edited by S. Morcos, M. Zhu, R. Charlier, M. Gerges, G. Kullenberg, W. Lenz, M. Lu, and E. Zou, and English editor G. Wright. *Oceanography* 19(1):198–199, <http://dx.doi.org/10.5670/oceanog.2006.109>.

DOI

<http://dx.doi.org/10.5670/oceanog.2006.109>

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Chapter 4, they introduce the so-called “primitive equations,” using height (z) as a vertical coordinate. This is never done in climate models. The material needed for you to understand climate models is covered much better in several other monographs. Chapter 5 discusses several operational forecasts plus a strange set of miscellaneous topics, ranging from reanalysis, to transport of lead, to altimeters and tides, to climate scenarios. Chapter 6 explores the concepts of hypothesis testing and reduced models. Chapter 7 returns to philosophy.

The appendices are quick reviews of

Fluid Dynamics (A), Numerics (B), Statistical Analysis (C), and Data Assimilation (D). Appendix A looks at several aspects of fluid dynamics, including boundary layers. Appendix B is a primer for numerical methods. Appendix C is an excellent, but short, explanation of advanced statistical methods. Appendix D on data assimilation is too brief to help newcomers with the complex subject. The two examples used in this last appendix are tides and climate. Tidal models are straightforward because tides are deterministic; decent climate models are extremely complex and demanding

because few data are available for validation. The experienced climate modeler will find little to help improve Earth system models.

I will enjoy owning the book and comparing my approach to the authors’ approach. Most libraries should invest in this book for completeness.

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Ocean Sciences: Bridging the Millennia

A Spectrum of Historical Accounts

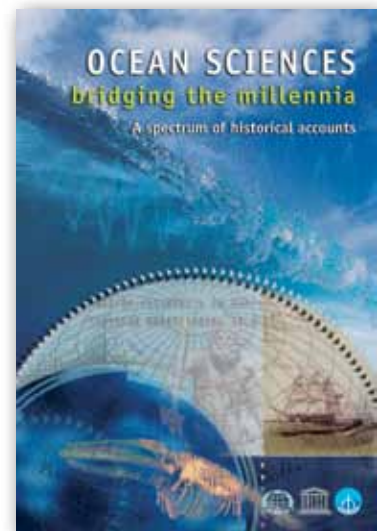
Edited by S. Morcos, M. Zhu, R. Charlier, M. Gerges, G. Kullenberg, W. Lenz, M. Lu, and E. Zou and English editor G. Wright, UNESCO Publishing, Paris, and China Ocean Press, Beijing, 2004, 508 pages, ISBN 9231039369 and ISBN 7502761195, Hardcover, \$80.95 US

REVIEWED BY PETER WADHAMS

This book is based on papers selected and edited from those presented at the Sixth International Congress on the History of Oceanography (ICHO VI), held at Qingdao, People’s Republic of China, from August 15–20, 1998. The manuscript was produced as a result of a three-year joint project between the First Institute of Oceanography (FIO, Qingdao) of

China’s State Oceanographic Administration (SOA), and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

By publishing the volume, IOC and FIO seek to inform scientists and the general public about the development of our knowledge of the sea and its resources. The ICHO VI Editorial Panel, a wide-ranging group of senior scientists led by Selim Morcos, struggled hard to organize a manuscript in which the rather disparate contributions from the conference were given shape and continuity, and in particular, the English-language technical editor and coordinator, Gary Wright of UNESCO Publishing, did a fine job in achieving an acceptable English style to many of the contributions and in add-



ing explanatory and connecting material. The result is a book which is worth dipping into, which in places is fascinating, illuminating many interesting byways of oceanographic science, but which inevitably reflects the rather specialized set of interests of those who attended the meeting in Qingdao.

The book begins with six biographical chapters on famous oceanographers,

covering Joseph Louis Gay-Lussac, Otto Pettersen, Victor Hensen and Claude ZoBell. To one who remembers school physics classes on the gas laws, it is surprising to see Gay-Lussac in the company of pioneer oceanographers, but he was in fact the first person to accurately measure the salinity of seawater (which he called “saltness”) and to speculate on its uniformity of properties. The article by William Wallace describes him as “the first chemical oceanographer.”

Next come six chapters of more orthodox historical oceanography on various expeditions and explorations. Rosalind Rolfe Gunther Marsden—a descendant of Rolfe Gunther—describes the economic and political background to the Discovery Committee work in the Southern Ocean during the 1925–1939 exploration of Southern Ocean water structure and biology where until now the political story has remained untold. In another surprising and interesting contribution, Selim Morcos describes the almost-forgotten Anglo-Egyptian work of the *Mabahiss* Expedition to the Indian Ocean in 1933–1934. The work was not in fact repeated until the International Indian Ocean Expeditions of the 1960s. Interestingly, much of the data were never published, and some were spirited away by the scientists involved, only to be reunited decades later (after death in fact) and finally analyzed to reconstruct the 1930s state of the ocean. Yha Yhang describes the explorations of Zhen He in the 1420s, leader of the great Chinese sea voyages to the seas of south Asia and east Africa, and there are several articles on the history of Russian marine exploration in the Arctic and Pacific.

A section on regional and bilateral co-

operation reveals the surprising amount of personal jealousy, malice, and politics that surrounded the birth of the International Council for the Exploration of the Sea (ICES), even in those supposedly serene pioneer days of a century ago. Selim Morcos, Jens Smed, and Artur Svansson tell the amusing story of how the mistaken search for the origin of eel larvae in the Mediterranean led to a big boost for the oceanography of that sea. Also amusing are the two quite different accounts by two scientists of the development of marine biological institutions around the Black Sea, one from a Russian viewpoint (Alexandru S. Bologna) and the other from the viewpoint of the nation in which these institutes are now found, the Ukraine (Yuri N. Tokarev). The section ends with two papers on how German marine research before the First World War affected developments in South Africa, and in China via the observatory built at Tsingtau.

“Man and the Sea” has three of the most interesting papers. Charlier et al. deal thoroughly with the development of varied concepts for sea defenses, showing that fashion as much as experience has dictated changes in design—this paper has since been republished in a marine engineering journal. Yuan-ou Xin describes how traditional Chinese navigation (good old Zhen He again) was helped by advanced Chinese technology such as the compass, of course, but also the ability of Zhen He’s ships to make progress against the wind by the use of leeboards and the junk rig, which allows sailing closer to the wind than European square sails while being easier to manage than Arab lateen sails. Charlier et al. (again) deal with the history of the tide

mill. I was amazed to discover how prevalent these mills were in the tidal waters of Britain and Atlantic France during the Middle Ages and beyond. Some have been restored to working order, including one on the Isle of Wight, while others are now museums, but the authors make a plea to bring them back. Why not? Even though they are no longer needed for grinding corn, they could still be an emission-free method of generating small-scale electricity for local purposes.

The final sections are less interesting in that they deal with national themes of the conference participants. Clearly China is strongly represented here, and we learn from many authors of the development of marine research and marine industries in the Peoples’ Republic. So rapid is China’s economic development and so quickly do new laboratories spring up that probably these accounts are already out of date.

To say that the quality of this book is variable would be an understatement. However, there are many pleasurable and erudite accounts of interesting facets of marine science history. Historical oceanography is a subject that is clearly well founded, is sometimes very useful (as when it brings to light unpublished data from past expeditions), and is certain to grow as oceanography changes into a mature (though hopefully not moribund) science.

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