Book Reviews

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BOOK REVIEW

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Coastal Erosion: Response and Management (Lecture Notes in Earth Sciences). Roger H. Charlier, Christian C.P. De Meyer, 1998. Heidelberg and Berlin: Springer Verlag, xvi + 343p. ISBN 78-3-540-600-22-1. Bibliography, index, glossary, appendices illustrated. Softbound, EUR 69.00; USD 159.00.

The Belgian-American lead author headed a team of Belgian scientists sent by the Belgian Government cooperative program to Indonesia. Both countries have to cope with coastal erosion, even if on different scales. Thus a month-long course of theoretical presentations, laboratory exercises, and some field trips was organized at Bandung Technological University (Java). The major part of the course has been put in book form, resulting in an essentially practical presentation.

Although the volume encompasses five "parts," two major themes dominate the text; they constitute parts III and IV. Part I, Coastal Management, expands thoughts offered in the Introduction and considers protection, preservation, and environmental equilibrium.. The authors ventured the thought that management of processes might be more important than management of uses, suggesting that planning could be facilitated by carving up the coastal zone into survey units. Environmental implications of adaptive measures, discussed in Part I, lead in Part II, Coastal Management and Coastal Defense, to the examination of (1) the economic, (2) the social and cultural, and (3) the legal and institutional implications of the same adaptive steps proposed. The priorities for adaptive responses conclude that Part.

Part III is entirely a study of sediment transport. It is divided into five chapters dealing respectively with bed material suspension and transport, steady uniform currents and uniform waves, the detection of suspended sediment, sediment transport, and coastal morphology. The latter chapter deals with profiles and models, which will not sit well with geologists allergic to quantitative approaches. The math presents quantitative approaches to the problems of coastal erosion and methods for coping with it, and it describes steps that have been taken in the past, as well as newer approaches are often currently favored.

Part IV, Retreating Shoreline, in four chapters, covers the principal aspect of costal erosion and protection, introduces sediment budget analysis, and evaluates effects and interactions, including the beach-dune system. The traditional methods that can be traced back to the Frisii and their earthen-and-mud mounds—those wretched creatures described by Pliny—and the medieval Lowlanders and their dykes, is designated the hard defense approach. If it has the merit of providing local, even regional, relief and holds the sea back, it has been shown that it merely transfers the problem to another geographical site. Hard defenses come in a variety of shapes and forms; they are expensive to build and to maintain, but they have been favored for a long time.

The so-called soft defenses include several systems, artificial beach nourishment being one. Belgium was first in trying it out on a very large scheme through an unusual course of circumstances: the extension of the coastal harbor of Zeebrugge. The dredged material was used to rebuild the fashionable beaches nearby. The U.S. Army Corps of Engineers has followed that approach in several sites on U.S. coasts. The method is now widely used. It is expensive and requires maintenance (replenishment), but it is successful. The book goes over other soft methods to cope with coastal erosion, such as by-passing and back-passing and even includes some artisanal (do-it-yourself cheaply) schemes.

However, sea level rise seems to pose a threat that could require even more drastic measures. Hence, coastal nations are considering yielding back to the sea territory they wrought away from it. Polders are one case, and in northern France and on the western coast of Belgium, protective structures are no longer repaired, and the sea is allowed to return to its ancestral channels. Attenuation of erosion has, apparently, ensued. The idea that by building the delta (in Dutch, *Maeslandkering*) the sea would never be a threat to The Netherlands might well be fallacious. Thence, on a much bigger scale than their southern neighbors, the Dutch are considering surrendering land to the sea where possible—evidently not in or near urbanized areas.

The appendices provide condensed information on beach profiles; address swell and storm; brief the reader on theoretical analysis, offshore motion, and transport of materials; and briefly examine the sources of beach fill and the sediment budget. Other littoral environment and dune considerations close the volume. An 11-page glossary proves helpful for nongeologists who might not know the meanings of some terms.

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Estuaries: Monitoring and Modeling the Physical System. Jack Hardisty, 2007. Blackwell Publishing, xiv+157p. US $79.95. ISBN 978–1-4051–4642-5.

Essentially, all models are wrong, but some are useful.
George Edward Pelham Box (b. 18 October 1919–)

By virtue of their characteristics and location, estuaries have been of great interest to coastal geomorphologists, physical oceanographers, and coastal engineers ever since the 1950s. To

further improve our understanding of the movement of fluxes between the different components of the land, air, and ocean phases, estuarine process is one of the components of the Natural Environmental Research Council's Land–Ocean Interactions in the Coastal Zone (LOICZ) project in the United Kingdom from 1992 to 1998. This slim volume mainly arises out of Jack Hardisty's work on the LOICZ Study Program.

From the very start of his scientific career, Jack Hardisty was concerned with explaining the general physics of seas, water waves, beaches, and estuaries. And as I look back in memory, in the fall–winter of 1991, it was Jack Hardisty (together with John S. Pethick) who had first introduced me to the basic concept and overall structure of the turbulent boundary layer of unidirectional tidal flow at the University of Hull. I am pleased to receive Hardisty's fourth new book for review.

The book is divided into six parts. The first part gives an overview of evolution and monitoring in estuaries. Chapter 1 presents an introduction to estuarine systems. For the first half part of this chapter, from the geomorphological perspective, taking the Humber River estuary as an example, a description is given of the Holocene evolution of the Humber River estuary, U.K. For the second half of this chapter, a description is made of modern estuarine processes and estuarine classification. Chapter 2 summarizes the development of estuarine monitoring techniques with a total of 17 illustrations, including electromagnetic flow sensors, optical methods, and acoustic methods.

The second part of the book focuses on the bathymetry of estuaries. To a coastal geomorphologist's mind, this part would be retitled as morphological change of estuaries or estuarine morphology. In Chapter 3 it is interesting to read a brief history of hydrography in England. Chapter 3 also contains a discussion of equilibrium cross section in estuaries. Chapter 4 emphasizes the use of Microsoft Excel running in Windows in modeling estuarine bathymetry. Estuarine width, depth, and cross section are well modeled for the Humber River estuary. Such a simple modeling approach would be welcome by those students who major in geography. De Swart and Zimmerman (2009) discussed the morphodynamics of tidal inlet systems including the intertidal zone of tidal flats and salt marshes. Their final conclusion is that the stirring of sediment by wind waves on tidal flats is crucial in explaining the height of the tidal flats. This part of Hardisty's book seems to exclude the complex bathymetry due to the extensive intertidal tidal flats and salt marshes in the Humber River estuary.

The third part of the book deals with tides in estuaries. Chapter 5 contains a brief history of tidal theory. It has been known that the harmonic analysis of tide was mainly developed by William Thomson (Lord Kelvin) (b. 26 June 1824–d. 17 December 1907) and Sir George Darwin (b. 9 July 1845–d. 7 December 1912) starting 1867, following an earlier suggestion by Pierre-Simon, marquis de Laplace (b. 23 March 1749–d. 5 March 1827) along similar lines. Studies of tidal hydraulics in estuaries can be dated back to the 1950s (Pillsbury, 1956). In Chapter 5, three major tidal constituents, S_2, M_2, and M_4, are taken into account. Conventionally, the semidiurnal tidal constituent, M_2, should be the first, as is also the case with the Humber River estuary, which is mainly semidiurnal. The fundamental assumption is that the constantly changing water depths can be adequately represented by the addition of sinusoidal functions for the two main tidal constituents and by the growth of the lunar quarter-diurnal. Chapter 6 contains a description of modeling spring-tide amplitudes and M_4 amplitudes in the Humber River estuary. Such a simple model is useful. Notably, wind waves have been excluded throughout the book.

The fourth part of the book provides a very brief introduction to currents in estuaries. Chapter 7 describes the Reynolds, Froude, and Richardson numbers. Among them, the Richardson number, Ri, is a measure of the potential for mixing by currents. Richardson (1920) first introduced a dimensionless number, effectively the reciprocal of the familiar Ri number, which was proposed by Paescke (1937 as quoted by Lettau [1939], pp. 54–55) and became well known in Germany. This was answered by Richardson himself in his last publication (Richardson, 1952, p. 422—a reply to a letter by Swinbank). Richardson (b. 11 October 1881–d. 30 September 1953) also comments on the difference between his derivation of a critical number (approximate unity) based on energy balance and the stability analysis of Taylor and others (for unstable profiles like jets or shear layers, where Ri_{crit} is approximately 1/4). We now know that there is a different value even for uniform shear layers, where Ri_{crit} is approximately 1/3 (Hanazaki and Hunt 2003; Julian Hunt, pers. comm.). This chapter also contains descriptions of progressive tidal wave, standing tidal wave, and stage-discharge relationships. Chapter 8 simply assumes that the changing water depths lead to known discharges through known cross sections so that the mean current (the ratio of the volume discharge to the cross section) can be determined. This has been well implemented for the Humber River estuary. In addition, Chapter 8 contains modeling of the upstream volume changes, the tidal flow, the freshwater flow, and the total flow in the Humber estuary. Modeled and measured results are in reasonable agreement.

The fifth part of the book also contains the two loosely associated water properties mentioned in Chapter 1, namely the temperature and salinity of estuaries. In Chapters 9 and 10 the Gaussian distribution is used for modeling the estuarine temperature and salinity. Chapters 9 and 10 also contain a discussion of the intratidal temperature winter case, intratidal temperature summer case, longitudinal temperature winter case, and longitudinal temperature summer case. In fact, MacCready and Geyer (2010) recently presented an overview of mainly our understanding of estuarine circulation and salinity. They conclude that the complex interactions of turbulence, stratification, and advection are now understood well enough to motivate a new generation of physically plausible mixing parameterizations for the tidally averaged equations.

The final part of the book, made up of Chapters 11 and 12, is concerned with problems involving suspended particulate matter in estuaries. Chapter 11 presents a brief literature review of the suspension, transport, and deposition of particular matter in estuaries. Turbidity maximum is indeed characteristic of fine sediment dynamics in estuaries. Chapter 12 contains a discussion of estuarine turbidity maximum

in the Humber River estuary. In general, the modeled results are reasonable but can be further elaborated by examining details of a number of small-scale processes. Most importantly, flocculation of fine sediments will be very complicated and important in the Humber River estuary.

On the whole, the book is a fine graduate and professional reference book in the general field of coastal geomorphology, physical oceanography, coastal engineering, and marine environmental engineering. Unlike the standard textbooks, namely those by Dyer (1977) and Officer (1976), Hardisty's book is the one with many of the models, calculations, diagrams, and Internet references available and updated through the book's Web site. Save for the sparse treatment of the dynamics and the mathematical theories of estuaries, one finds little wanting. The qualities of the photographs and diagrams can be improved in a few cases. The 132 references are selectively cited in the bibliography at the end of the book. The index is helpful.

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