

# Journal of Sedimentary Research

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*Estuaries—Monitoring and Modeling of the Physical System*, by Jack Hardisty, 2007. Blackwell Publishing Ltd, 9600 Garsington Road, Oxford, OX4 2DQ United Kingdom. Hardback, 176 pages, 183 illustrations. Price GBP 34.99; USD 59.95. ISBN 978-1-4051-4642-5.



Estuaries are complex environments in which the water motion and sediment transport are influenced by tides, salinity, and temperature. Hardisty aims to combine the latest theoretical and empirical results to build and test a new integrated and transparent model that simulates these estuarine processes. The book covers a large range of processes and time-scales that affect estuarine hydrodynamics and sediment dynamics, from the Milankovitch cycle to turbulent mixing, and deals with observations as well as modeling. In a book of this size, it is obvious, however, that the items cannot be discussed in great detail.

The book is composed of six sections. The first is a very basic introduction to estuaries (Holocene evolution, estuarine classification), and to monitoring of estuarine systems. The following five sections deal with the main components of estuaries, being the morphology, tides, currents, density (temperature and salinity), and sediment concentration. Each of these sections is composed of a descriptive part explaining the basic theory, and a modeling part in which the specific component is added to the numerical model. The basic theory is very clear, with an introduction, background, concise theory, and a summary. The author takes the reader by the hand in setting up a 1-D numerical model in Excel, simulating tidal water levels and currents, salinity, temperature and sediment transport. All components, starting from an (analytically computed) bathymetry, are added step by step. The numerical implementation is basically typing data and equations in Excel. However, each chapter can also be found completed in digital format on the book's website. It should be noted that the numerical part may be a bit troublesome for those not having an English version of Excel. In addition to the estuary model, the separate modules are also implemented in a set of toolboxes, available on the book's website as well.

The tidal section deals with basic tidal theory and harmonic analysis, explaining the spring/neap tidal cycle, being the interaction of the M2 and S2 tidal components, and the main source of tidal asymmetry, being the generation of the M4 overtide. The basic physics of estuarine currents are explained, starting from very basic fluid mechanics, with emphasis on characteristic numbers as the Reynolds, Richardson, and Froude numbers. Unfortunately, estuarine mixing and stratification are not dealt with, save for the introduction of typical numbers to classify estuarine flow, such as the Estuary number, stratification number, and the layer Richardson number. Also the origin and implications of standing or progressive tidal waves are described only shortly. The attention to salinity and temperature in estuaries is restricted to a Gaussian description, while the actual mechanisms (mixing, stratification) are not treated. The sediment chapter shortly introduces erosion and sedimentation fluxes, and the formation of estuarine turbidity maxima.

The book provides a useful set of simple equations to describe the basic hydrodynamics and sediment dynamics of estuaries. Although these can, of course, also be found elsewhere in the literature, this book is very comprehensive and easy to read. Some minor points are that there is a very strong focus on Britain (especially the Humber estuary), that it is very introductory, and that it heavily depends on Excel, which may provide problems for those not possessing an English Excel version. Coming back to the original aim of the book, I have to say that the author partly accomplished his objectives. The theory—and therefore the model—brought forward in this book is not particularly new, although references are up-to-date. The model is integrated and very transparent, however, which is the strength of this book. Readers wishing to deepen their knowledge on estuarine physics are probably better off with, for instance, Dyers 1986 or 1997 book. However, it is a very accessible introduction to estuarine physics, and especially in combination with the Excel model that goes with the book, it can be very useful as an introductory textbook for students (especially considering its low price), but also as a practical guide for engineers.

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