

Preface

It has been over 15 years that the author has now been responsible for the delivery of a modeling module on a graduate studies degree in marine science, latterly the class has included coastal engineering students and this has influenced both the contents and the style of delivery. Two earlier texts Dyke (1996), Dyke (2001) are unashamedly marine science, this one certainly leans more towards coastal engineering. It has definitely benefitted from the existence of these two previous books, and the contents has some overlap.

The motivation for studying how to model coastal sea processes has not really changed since the publication of the second of these books in 2001; it is still by and large environmental protection, although the need for this has if anything moved slightly from the pollution and direct interference by man to global warming and climate change. Even more today is the need to express what are very complicated ideas to important people who lack a technical background. The students for whom this book is intended will by and large have some technical facility but upon graduation these students will almost certainly need to explain the modeling outcomes to journalists, politicians and the like, so the emphasis in this text is on understanding the processes themselves. It has been assumed that readers will have a knowledge of elementary calculus and algebra at least equivalent to that met in the first stages of most physical science or engineering degrees. Even if this is not the case, there are only a few places where not being familiar with this mathematics will inhibit understanding. At all times in this textbook pains have been taken to explain what is happening in terms of plain English and not to rely on equations to do the talking; over the years this author has taught too many biologists and geographers to know not to do this.

The first three chapters contain the background material. This runs

from the modeling and techniques of chapters 1 and 2, to the derivation of the fundamental equations in chapter 3. In the previous texts, this derivation has been avoided, but although this chapter can be skipped if absolutely necessary, the author has taken pains to explain precisely what is going on as expressions are being derived, so it is worth at least some effort to understand. The numerical procedures are explained in chapter 4, and again this is fuller than in the author's previous texts on this subject. Once again the emphasis is on explanation of what is happening. After this, the book is about applying modeling techniques. Chapter 5 is on diffusion, chapter 6 is about modeling waves, sediments and coasts and is definitely core coastal engineering modeling. Chapter 7 is a little different. In the last ten or so years ecosystem and biological modeling has come of age. In this chapter it is believed for the first time, a systematic development is given that is aimed at the modeler whose principal motivation is understanding physical processes but who recognises the important interaction between this and biological processes. No previous biology is assumed (indeed, it is difficult to see how biological knowledge can be much less than that possessed by the author). The final chapter sweeps up various other topics including modeling climate change, modeling storm surges and other flows usually too large for the coastal engineer, but vital for those concerned with shallow sea dynamics.

It is a pleasure to acknowledge all my students over the years for the feedback on the lecture material which has helped a great deal in the selection of the subject matter for this book. Thanks also to the participants at the biennial JONSMOD (JOint Numerical Sea Modeling Group) who have done much to keep me abreast of developments over the past 25 years as the subject has quickly evolved; I single out Alan M Davies of the Proudman Oceanographic Laboratory who has always been extremely helpful especially in explaining to me the application of finite elements to oceanographic modeling. Particular thanks also to colleagues at the Plymouth Marine Laboratory for the indoctrination into biological modeling. Finally a personal thank you to two of my grown up children Adrian and especially Otilie for help with improving the quality of some of the figures.

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December 2006.