Chapter 1

Introduction

This guide is roughly divided into three parts.

We start with a description of the most important processes governing the morphological evolution of our coasts at some relevant time and space scales: from individual storms to long-term evolution and from tens of metres to large tidal basins. Chapters 2, 3, 4 and 5 are devoted respectively to waves, currents, sediment transport and morphology. The processes considered are wave propagation and dissipation, currents driven by tides, waves and winds. Here, we are not concerned with where and how these waves or winds or tides were generated, but with what happens in the coastal area only. We shall thus assume that there is ample information on tidal water levels, large-scale wind fields, wave conditions and river discharges at the landward boundaries and at, say, twenty metres depth, from monitoring stations, buoys or regional and global models. Our main objective here will be to understand some typical flow situations and to be able to estimate current patterns and strengths by analysing the balance of the most relevant terms in the governing equations.

The next chapters discuss modeling approaches in general (Chapter 6), after which we have separate discussions on coastal profile models (Chapter 7), coastline models (Chapter 8) and 2DH/3D coastal area models (Chapter 9). By models we mean model concepts rather than software systems, proprietary or otherwise, and we will try to keep the discussions generic by using easy-to-understand Matlab programs where possible, as in the case of profile and coastline models. For the more complex 2DH/3D models we will stay away from particularities of the different systems but rather describe relevant concepts, boundary conditions, typical schematization procedures and then the interesting morphological phenomena that can result. When we want to describe a particular phenomenon, we will try to find the simplest model that can generate it and explain how it works. Each situation can be seen as a subset of all the processes that can happen in complex models used in practice. By isolating the processes responsible for a given phenomenon we learn what is the minimum set required to represent it.

In Chapter 10 we discuss some case studies grouped around common coastal problems. Again, we want to stimulate thinking about the coastal processes and

how they can be effectively modeled and we do that using different model concepts for different purposes.

In Chapter 11 we provide an attempt at a systematic procedure for modeling studies, like an extended checklist, based on our own experience and studies we have seen carried out around us. This is followed by a discussion on modeling philosophy in Chapter 12 focusing on the given mismatch between the model representation and reality and still be able to use these complex morphodynamic models to make useful predictions.

All Matlab scripts and functions referred to in this book are available through OpenEarth.nl, an open-source initiative by Deltares. After a simple registration procedure you can download, among many other tools, our code under Tools, directory matlab/applications/CoastalMorphologyModeling.