
Introduction to Coastal Processes and Geomorphology

Second Edition

Robin Davidson-Arnott

University of Guelph

Bernard Bauer

University of British Columbia

Chris Houser

University of Windsor



CAMBRIDGE
UNIVERSITY PRESS

Contents

<i>Preface</i>	<i>page xi</i>
<i>Acknowledgements</i>	<i>xv</i>
Part I Introduction	I
<hr/>	
I Introduction	3
1.1 Humans and the Coastal Zone	3
1.2 Approaches to the Study of Coasts	5
1.3 Information Sources	6
<hr/>	
2 Coastal Geomorphology	9
2.1 Definition and Scope	9
2.2 The Coastal Zone	11
2.3 Controls on Coastal Form and Evolution	18
2.4 Shoreline Mapping and Technological Innovation	19
2.5 Understanding and Modelling Coastal Dynamics	21
2.6 Uncertainty in Predicting Coastal Evolution	25
<hr/>	
Part II Coastal Processes	29
<hr/>	
3 Sea Level	31
3.1 Synopsis	31
3.2 Defining Mean Sea Level	32
3.3 Changes in Mean Sea Level	36
3.4 Astronomical Tides	43
3.5 Short-Term Dynamic Changes in Sea Level	55
3.6 Climate Change and Sea Level Rise	63
<hr/>	
4 Wind-Generated Waves	75
4.1 Synopsis	75
4.2 Wave Definition and Description	76
4.3 Wave Generation	80
4.4 Wave Measurement and Parameterisation	86
4.5 Wave Prediction	101
4.6 Wave Climate	105
<hr/>	
5 Wave Dynamics	109
5.1 Synopsis	109
5.2 Wave Theory	110

5.3 High-Order Wave Theories	118
5.4 Wave Transformations in Intermediate Water Depths	122
5.5 Wave Breaking	128
5.6 Wave Groups and Low-Frequency Modes of Energy	148
<hr/>	
6 Surf Zone Circulation	157
6.1 Synopsis	157
6.2 Undertow	158
6.3 Rip Cells	164
6.4 Longshore Currents	174
6.5 Wind and Tidal Currents	177
<hr/>	
7 Coastal Sediment Transport	183
7.1 Synopsis	183
7.2 Sediment Transport Mechanisms, Boundary Layers and Bedforms	183
7.3 Cross-Shore Sediment Transport	194
7.4 Longshore Sand Transport	200
7.5 Littoral Sediment Budget and Littoral Drift Cells	211
<hr/>	
Part III Coastal Systems	227
<hr/>	
8 Beach and Nearshore Systems	229
8.1 Synopsis	229
8.2 Beach and Nearshore Sediments and Morphology	230
8.3 Nearshore Morphodynamics	249
8.4 Beach Morphodynamics	263
<hr/>	
9 Coastal Sand Dunes and Aeolian Processes	280
9.1 Synopsis	280
9.2 Morphology and Structure of Coastal Dunes and Dune Fields	282
9.3 Foredune Morphodynamics and Maintenance	295
9.4 Aeolian Processes on Beaches and Dunes	302
9.5 Flow Modification and Wind Steering by Topography	317
9.6 Geometric Controls on Sand Delivery to Foredunes	324
9.7 Prediction of Long-Term Sediment Delivery to Foredunes	327
9.8 Long-Term Foredune Evolution and Beach–Dune Interaction	328
<hr/>	
10 Barrier Systems	343
10.1 Synopsis	343
10.2 Barrier Types and Morphology	344

10.3 Barrier Dynamics: Overwash and Inlets	350
10.4 Barrier Spit Morphodynamics	370
10.5 Barrier Islands	375
10.6 Anthropogenic Impacts and Natural Hazards	381
<hr/>	
11 Saltmarshes and Mangroves	395
11.1 Synopsis	395
11.2 Saltmarsh and Mangrove Ecosystems	395
11.3 Saltmarshes	398
11.4 Mangroves	430
<hr/>	
12 Coral Reefs and Atolls	444
12.1 Synopsis	444
12.2 Corals and Reef Formation	445
12.3 Geomorphology and Sedimentology of Coral Reefs	450
12.4 Impacts of Disturbance on Coral Reefs	466
<hr/>	
13 Cliffed and Rocky Coasts	476
13.1 Synopsis	476
13.2 Cliffed Coast Morphology	477
13.3 Cliffed Coast Erosion System	480
13.4 Erosion of Soft Rock Cliff Coasts	488
13.5 Hard Rock Coasts	504
 <i>Index</i>	 517