Contents

Pr	eface		<i>page</i> ix
Ac	knowle	edgements	xi
No	te on r	nathematics and model codes	xiii
1	Prelu	de to modeling coastal basins	1
	1.1	Coastal basins	1
	1.2	Geomorphic classification of ocean basins	2
	1.3	Distinctive features of coastal basins	10
	1.4	Types of model	23
	1.5	Terminology in the sciences of water flow	29
	1.6	Further reading	31
2	Curre	ents and continuity	32
	2.1	Position of a point	32
	2.2	Height datum and map projections	35
	2.3	Velocities	35
	2.4	Fluxes	38
	2.5	Two-dimensional models	41
	2.6	Volume continuity equation	42
	2.7	Sources and sinks	47
	2.8	Linearized continuity equation	52
	2.9	Potential flow	54
	2.10	Conformal mapping	61
	2.11	Further reading	66
3	Box a	and one-dimensional models	67
	3.1	The value of box models	67
	3.2	Multi box models and one-dimensional models	68
	3.3	Examples of box models	68
	3.4	One-dimensional models	86
	3.5	Simple models of chemical and biological processes	92
	3.6	Further reading	101
4	Basic	hydrodynamics	102
	4.1	Motion of a particle	102

v

CAMBRIDGE

Cambridge University Press 978-0-521-80740-1 - The Dynamics of Coastal Models Clifford J. Hearn Table of Contents <u>More information</u>

vi		Contents	
	4.2	Basic dynamics in hydrodynamic models	102
	4.3	Pressure	103
	4.4	Shear stress	113
	4.5	Oscillators	116
	4.6	Effects of a rotating Earth	125
	4.7	Further reading	138
5	Simp	le hydrodynamic models	139
	5.1	Wind blowing over irrotational basin	139
	5.2	Ekman balance	154
	5.3	Geostrophic balance	166
	5.4	Isostatic equilibrium	173
	5.5	Further reading	175
6	Mode	eling tides and long waves in coastal basins	176
	6.1	Introduction	176
	6.2	Astronomical tides	176
	6.3	Long waves	186
	6.4	One-dimensional hydrodynamic models	189
	6.5	Two-dimensional models	203
	6.6	Model speed and the cube rule	214
	6.7	Horizontal grids	218
	6.8	Vertical structure of model grids	223
	6.9	Further reading	227
7	Mixi	ng in coastal basins	228
	7.1	Introduction	228
	7.2	Theory of mixing	228
	7.3	Vertical mixing time	246
	7.4	Examples of mixing	247
	7.5	Mixing processes and spatial scale	248
	7.6	Vertical mixing of momentum	254
	7.7	The logarithmic layer	255
	7.8	Friction and energy	265
	7.9	Turbulence closure	268
	7.10	Dispersion in coastal basins	271
	7.11	A closer look at the logarithmic boundary layer	275
	7.12	Coefficients of skin friction	281
	7.13	Further reading	284
8	Adve	ection of momentum	286
	8.1	Introduction	286
	8.2	Coordinates for many-particle models	287
	8.3	Role of advection in coastal basins	294
	8.4	Hydraulic jumps	305
	8.5	Further reading	319

CAMBRIDGE

Cambridge University Press	
978-0-521-80740-1 - The Dynamics of Coastal	Models
Clifford J. Hearn	
Table of Contents	
More information	

	Contents	V
9 A	Aspects of stratification	32
	9.1 Solar heating	32
	9.2 Effect of stratification on vertical mixing	33
	9.3 Wind-driven currents in stratified basins	34
	9.4 Classification based on vertical stratification	34
	9.5 Further reading	34
10	Dynamics of partially mixed basins	34
	10.1 Transport of heat and salt	34
	10.2 Taylor shear dispersion	34
	10.3 Convection	35
	10.4 Convective transport due to lateral shear	36
	10.5 Flow through tidal channels	36
	10.6 Sub-classification of partially mixed basins	36
	10.7 Dispersion and exchange rates in basins	36
	10.8 Age of particles	37
	10.9 Large-scale climate cycles	37
1	0.10 Stommel transitions	38
1	0.11 Further reading	39
11	Roughness in coastal basins	39
	11.1 Introduction	39
	11.2 Skin and form drag	39
	11.3 Scales of spatial variability	39
	11.4 Models of reef growth	40
	11.5 Nutrient uptake	40
	11.6 Hydrodynamics of coral reefs	40
	11.7 Coastal roughness and trapping	43
	11.8 Further reading	43
12	Wave and sediment dynamics	43
	12.1 Introduction	43
	12.2 Wave models	43
	12.3 Sediment particle size	44
	12.4 Littoral drift and tidal channels	45
	12.5 Coastal classification based on waves and shorelines	45
	12.6 Critical shear stress	45
	12.7 Box model of sediment processes	46
	12.8 Turbulent mixing and settlement	46
	12.9 Further reading	46
Refe	rences	47
Inde:	Υ	47