COASTAL METEOROLOGY

S.A. HSU



Coastal Meteorology

S. A. Hsu

COASTAL STUDIES INSTITUTE SCHOOL OF GEOSCIENCE LOUISIANA STATE UNIVERSITY BATON ROUGE, LOUISIANA



Academic Press, Inc. Harcourt Brace Jovanovich, Publishers San Diego New York Berkeley Boston London Sydney Tokyo Toronto

Contents

Preface	vii
rejuce	, Louis R. Colon C. C.
Chapter 1 Introduction	
Chapter 1 Introduction	
1.1 Composition of the Atmosphere	
1.2 The Physical Foundation	talist to buy, area to engage of 2
1.3 Scales of Atmospheric Motion	2
1.4 The Air-Sea-Land Boundary	3
1.5 Scope of Coastal Meteorology	4
1.6 Interdisciplinary Approach	4
,	
Chapter 2 Radiation	
2.1 Some Physics of Radiation	5
2.2 Solar and Terrestrial Radiation	6
2.3 Radiation and Heat Balance	7
2.4 Remote Sensing from Space	12
Chapter 3 Atmospheric Thermo	odvnamics
3.1 The Equation of State	15
3.2 Some Principles of Thermodynamics	16
3.3 Some Aspects of Moist Air	18
3.4 Atmospheric Stability	22
Chapter 4 Atmospheric Dynam	nics
4.1 The Continuity Equation	28
4.2 The Equations of Motion	30
4.3 Horizontal Motion under Balance of For	rces 35
4.4 The Equation of Motion in Turbulent Fl	low 40
4.5 Some Kinematics of Fluid Flow	45

vi Contents

Chapter 5 Synoptic Meteorology

o.1 The Genera	1 Circulation	47
5.2 Air Masses	and Fronts	50
5.3 Extratropica	al Cyclones and Cyclogenesis	56
5.4 Tropical Sto		66
	cts of Weather Analysis and Forecasting	85
Chapter 6	Atmospheric Boundary Layers	
Chapter 0		
	and Air-Sea Interaction	
6.1 The Surface	e Boundary Layer	96
6.2 The Logarit	thmic Wind Profile	99
5.3 The Nonadi	iabatic Wind Profile	102
	Temperature and Humidity	108
	ion (or Ekman) Layer	109
	exes of Momentum, Heat, and Moisture	111
	to the state of the following the state of t	114
	s (Drag) Coefficient over Water Surfaces	
5.8 Some Aspec	cts of Air-Sea Interactions across Ocean Fronts	123
Chapter 7	Air-Sea-Land Interaction	
71 7 1 1 (See Dreege Stateme	140
	Sea-Breeze Systems	
7.2 Coastal Up		147
7.3 Coastal Fog		153
7.4 Coastal Jets	S	155
7.5 Other Coas	stal Phenomena	163
Chapter 8	Engineering Meteorology	
	Wind Speeds for Offshore Applications	180
8.2 Estimates o	of Atmospheric Dispersion	188
8.3 Vertical Var	riations of Wind Speed	199
8.4 Radiometeo	prology	203
8.5 Storm Surg	es	211
	Wind Waves and Ocean Currents	218
	port by Wind Action	225
	■ 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	233
8.8 Hallsport 0	of Sea Salts in the Shoreline Environment	23.
Appendix A U	Units, Constants, and Conversions	238
	odine e	
Appendix B T	The Beaufort Wind Scale	240
Appendix C T	The Saffir/Simpson Damage-Potential Scale	243
Appendix D I	Decomposition of the Vector Wind into u and v Components	245
Appendix E L	ist of Symbols for Surface Analyses	24
		ne yet little a
References		248
Index		25