## Contents

Preface and acknowledgements		Хi	3.3	Adiabatic temperature changes in tur-	
Introduction		1		bulent eddies	25
			3.4	The relationship between the environ-	
Chap	ter 1 Physical geography in perspective			mental lapse rate and adiabatic rates:	
1.1	The nature and position of physical			stable and unstable atmospheric	
	geography	1		conditions	27
1.2	Explanation in physical geography	2	3.5	Retrospect	31
1.3	The systems approach to physical			•	
	geography	4	Chapt	er 4 Evaporation and evapotranspiration	n
1.4	Morphologic, cascading, process-		4.1	Evaporation and transpiration	
	response and control systems and			processes	33
	ecosystems	5	4.2	Meteorological factors affecting	
1.5	Open, closed and isolated systems	6		evaporation and evapotranspiration	34
1.6	Positive and negative feedback in		4.3	Environmental factors and the rate of	
1.0	systems	6		evaporation and evapotranspiration	31
1.7	Thresholds, lag times and relaxation	U	4.4	Retrospect	39
1.,	in systems	6			
1.8	Retrospect	7	Chapt	er 5 Condensation and precipitation	
1.0	Retrospect	,		The condensation process	40
			5.2		10
Part	I Atmospheric energy and mass		٥.2	earth's surface	42
systems			5.3	Condensation forms in the	42
sysic	1113		3.5	troposphere, away from the earth's	
Chan	ter 2 Characteristics of mass and energy			surface	45
inputs			5.1	Retrospect	50
	Mass cascades	11	J. <del>T</del>	Retrospect	50
	Global radiative energy cascades	14	Chant	on 6 Subsumbos water transfer in the	
	Global turbulent energy cascades	17		er 6 Subsurface water transfer in the logic cycle	
2.4	Diurnal turbulent energy cascades at	1,	6.1	Subsurface water and infiltration	53
2.4	the earth's surface	18		The occurrence and types of	3.
2.5	Retrospect	21	0.2	groundwater	-
2.3	Retrospect	21	6.2	Groundwater balance	55
Cham	ton 3 Ventical motion and mass/anonary				57
_	ter 3 Vertical motion and mass/energy		0.4	Retrospect	58
chang	<b>-</b>	22	Chart	on 7 Conform water transfer in th	
3.1	Types of vertical motion	22		ter 7 Surface water transfer in the	
3.2	Vertical distribution of temperature in	22		logic cycle	
	the troposphere	23	/.1	The runoff process	60

7.2 7.3	Types of river flow Factors affecting runoff distribution	62 63	Chapt weath	ter 13 Secondary circulations and disturer	rbed
7.4	Retrospect	65	13.1	The changing models of the middle- latitude depression	114
			13.2	Cyclogenesis in middle latitudes	116
Part	II Atmospheric circulation system	ns	13.3	Life-history of a model frontal	
ı aıı	11 Timospheric enculation system			depression	118
Chan	ter 8 Horizontal air flow near the surfa	ce	13.4	Complex frontal lows	120
8.1			13.5	The tropical hurricane	121
0.1	pressure gradient	69	13.6	Retrospect	124
8.2	Earth rotation and the Coriolis force	70	12.0	z.c.i.ospec.	
8.3	The geostrophic balance	71	Chap	ter 14 Mesoscale circulations	
8.4	Surface friction and the Ekman spiral	72	14.1	Thermal circulations – coastal breezes	126
8.5	Curved flow and the gradient wind	73	14.2	Thermal circulations – slope winds	
8.6	The restless wind	74	- · · ·	and along-valley winds	127
8.7	Retrospect	74	14.3	Thermal circulations – urban winds	128
0.7	Retrospect	/-		Thunderstorm circulations	128
Chan	ter 9 Upper-air flow		14.5	Tornadoes	129
9.1	Thermal winds and the upper westerlies	76	_	Forced circulations	130
9.2	Upper-air charts and their meanings	78	14.7	Föhn winds	131
9.3	Rossby waves	79	14.8	Retrospect	133
9.3	Jet streams	81	14.0	Retrospect	155
		83			
9.5	Retrospect	02	Dart	III Sadiment Transport systems	
Chan	ton 10. Development of programs systems		1 ai t	III Sediment Transport systems	
	ter 10 Development of pressure systems  Basic themes	85	Chan	ton 15 Introduction to codiment transpo	
				ter 15 Introduction to sediment transpo	
10.2	Vorticity Variations on basic themes – low	86	86 systems: the influence of endogenic process base-level changes		
10.3		00			120
10.4	pressure systems	88		Endogenic changes	138
10.4	Variations on basic themes – high	90		Eustasy and isostasy	140
10.5	pressure systems	89	15.5	Effects of rock structure on stratified	1.11
10.5	Retrospect	90	16.4	rocks	141
<b>C</b> 1	4 44 775		15.4	Retrospect	144
_	ter 11 The global circulation	00	<b>C</b> 1	. 44 75	
11.1	The observed circulation	92		ter 16 Parent rocks, weathering and	
11.2	Classical circulation models	94		nering products	1.15
11.3	Collapse of the classical models	95		Parent rocks	145
11.4	The fluctuating circulation	96		Weathering processes	147
11.5	Global circulation and world climates	99		Rates of weathering	149
11.6	Retrospect	102	16.4	<i>B</i> <b>F</b>	149
			16.5	Retrospect	151
	ter 12 Air masses and fronts				
12.1	Air-mass genesis and classification	103		ter 17 Strength of materials and their	
12.2	Air-mass boundaries and frontogenesis	104	_	s-strain behaviour	
12.3	Frontal models	105	17.1	Introductory ideas of force and	
12.4	Air masses and fronts in Europe	107		resistance	153
12.5	Air masses and fronts in North		17.2	Force and resistance on a slope	154
	America	108	17.3		156
12.6	Australian air masses	111	17.4		157
12.7	Failure of air-mass and frontal		17.5	Fluid motion and effects of applied	
	concepts in the tropics	112		stress	158
12.8	Retrospect	112	17.6	Retrospect	161

Chap	ter 18 Sediment transport by mass		Part IV Soil systems	
	ments			
18.1	Shallow translational slides	162	Chapter 24 Soil physical properties and	
18.2	Deep-seated slides	163	morphology	
18.3	Rock falls and rock avalanches	165	24.1 Composition of mineral soils	214
18.4	Flows	166	24.2 Density and pore spaces of mineral	
18.5	Slow mass movements	167	soils	215
18.6	Retrospect	168	24.3 Soil structure	216
	-		24.4 Soil micromorphology	217
Chap	ter 19 Sediment transport on and with	in	24.5 Soil profile morphology and	
slopes	s by water			218
19.1	Rainsplash	170	24.6 Retrospect	219
19.2	Surface wash	172	•	
19.3	Subsurface water erosion	175	Chapter 25 Soil organisms and organic matte	er
19.4	Retrospect	178	25.1 The decay of organic residues	222
	•		25.2 Soil organisms	223
Chap	ter 20 Sediment transport by water in		25.3 The trophic sequence	225
chanr			25.4 Soil organic matter decomposition	225
20.1	Solute transport	179		227
20.2	Initiation of particle movements	181	25.6 Organic matter and climate	228
20.3	Bed material transport	182		229
20.4	Suspended load transport	183	1	
	Channel response	184	Chapter 26 Soil-forming processes	
	Bedrock channels	187	26.1 Cation exchange	230
20.7	Floodplains	189	26.2 Soil processes characteristic of main	
20.8	Retrospect	190	climatic zones	231
			26.3 Intrazonal soil processes	237
Chan	ter 21 Aeolian transport systems		26.4 Retrospect	240
	Principles of aeolian transport	191	2017 21011000000	
	Sources of wind-blown materials	193	Chapter 27 Soils and plant growth	
21.3	Accumulation features	194	27.1 Soil factors controlling the growth of	
21.4	Aeolian abrasion	195	higher plants	241
	Retrospect	196	27.2 The main mineral nutrients	244
21.5	Retrospect	170	27.3 The cycling of nutrients	246
Chan	ter 22 Sediment transport by glaciers		27.4 Retrospect	249
	Deformation of ice	197	27.1 Retrospect	247
	Glacier movement	199		
22.3	Sediment erosion	201	Part V Vegetation systems	
	Transport of material within ice	202	Tare V regetation systems	
22.5	Deposition of glacial materials	202	Chapter 28 Biogeography, ecology and	
22.6	Retrospect	203		
22.0	Retrospect	205	ecosystems 28.1 Biogeography and ecology:	
Chan	ter 23 Ground ice and nival transport			253
syster			development and scope 28.2 Ecosystems and their relationship	233
23.1	Frozen ground and ground ice	205	with general systems	255
23.2	Thermokarst	207	28.3 The components and processes within	255
23.3	Nival processes	208	ecosystems	255
23.4			•	255
<i>4</i> 3.4	Retrospect	209	28.4 Ecosystem stability or ecosystem	251
			homeostasis	256
			28.5 The classification of ecosystems	258
			28.6 Ecosystems in time	260
			28.7 Retrospect	261

Chapt	er 29 Energy flow in ecosystems		Part VI Oceanic systems	
29.1	The process of photosynthesis	262	·	
29.2	Energy and its relationships with the		Chapter 33 Formation and morphology of the	
	laws of thermodynamics	263	ocean floor	
29.3	Gross and net primary productivity	263	33.1 The major oceans: characteristics and	
29.4	Secondary productivity	265		20
29.5	The movement of energy through			21
	ecosystems: food chains and food		33.3 The deep ocean floor	24
	webs	267		26
29.6	Energy transfer networks: the grazing			26
	and detrital pathways	268	·	
29.7	Trophic levels, ecological pyramids		Chapter 34 Sea water movement and marine	
	and models of energy flow	271	deposition	
29.8	Retrospect	273	34.1 Waves 32	28
	•		34.2 Tides and tidal currents 33	<b>3</b> 0
Chap	ter 30 The flow of materials within		34.3 Ocean currents 33	31
	stems: biogeochemical cycles 1		34.4 The thermohaline circulation 33	32
30.1	Model of nutrient flow	276		32
30.2	General characteristics of			33
	biogeochemical cycles	277		33
30.3	The classification of nutrients and			34
	biogeochemical cycles	277	34.9 Processes at coastlines 33	
30.4	Gaseous biogeochemical cycles	278	34.10 Retrospect 33	
30.5	Sedimentary biogeochemical cycles	285		
20.0	,		Chapter 35 Marine ecosystems	
Chap	ter 31 The flow of materials within		35.1 Marine habitats: their global	
	stems: biogeochemical cycles 2			38
31.1	Biogeochemical cycling at the		25.2 3.4 .	41
	ecosystem level	287		44
31.2	Biogeochemical cycling at the biome			45
	level	294	25 5 5 mm 1	46
31.3	Biogeochemical cycling at the plant			50
	community and species levels	296		_
31.4	Biogeochemical cycling of pollutants		Overview and prospect	
	and radionuclides	299	prospect	
31.5	Retrospect	300	Chapter 36 The integration and modification of	f
			physical processes	•
Chapter 32 Vegetation succession and climax		X	36.1 Interrelationships at the global scale 35	51
32.1	The parallels between scientific,		36.2 The interaction of physical processes	J.
	geographical and plant science			53
	philosophies	302	36.3 The interaction of physical processes	5.
32.3		303	. Processes	55
32.3	Characteristics of successions	306	J.	رر
32.4		308	References 35	58
32.5	Secondary successions	312	J.	- (
32.6	Retrospect	314	Index 3 <sub>0</sub>	68
			2.	