Cambridge University Press & Assessment 978-1-107-13527-7 — Hydrology Wilfried Brutsaert Table of Contents <u>More Information</u>

Contents

Preface to Second Edition		<i>page</i> ix	
Pr	eface	to First Edition	xi
		1.4	
1	Intro	auction	1
	1.1	Definition and Scope	1
	1.2	The Hydrologic Cycle	2
	1.3	Some Estimates of the Global Water Balance	3
	1.4	Methodologies and Procedures	7
	1.5	Conservation Laws: The Equations of Motion	11
		Problems	17
		References	17
Pa	art I	Water in the Atmosphere	
2	Wate	er Aloft: Fluid Mechanics of the Lower Atmosphere	23
	2.1	Water Vapor in Air	23
	2.2	Hydrostatics and Atmospheric Stability	28
	2.3	Turbulent Transport of Water Vapor	33
	2.4	The Atmospheric Boundary Layer	34
	2.5	Turbulence Similarity	39
	2.6	Surface Boundary Condition: The Energy-Budget Constraint	51
	2.7	Surface Variability and Statistical Homogeneity with	
		Disturbed Boundary Layers	67
		Problems	77
		References	80
3	Preci	ipitation	87
	3.1	Formation of Precipitation	87
	3.2	Major Precipitation Weather Systems	90
	3.3	Precipitation Distribution on the Ground	99
	3.4	Interception	106
	3.5	Snow Melt	112
	3.6	Reliability of Operational Precipitation Measurements	117
		Problems	120
		References	122

v

Cambridge University Press & Assessment 978-1-107-13527-7 — Hydrology Wilfried Brutsaert Table of Contents <u>More Information</u>

vi Contents

4 E	Evaporation		130
	4.1	Evaporation Mechanisms	130
	4.2	Mass-Transfer Formulations	131
	4.3	Energy Budget and Related Formulations	136
	4.4	Water-Budget Methods	156
	4.5	Evaporation Climatology	166
		Problems	170
		References	173

Part II Water on the Surface

5	Wate	er on the Land Surface: Fluid Mechanics of Free Surface Flow	183
	5.1	Free Surface Flow	183
	5.2	Hydraulic Theory: Shallow-Water Equations	184
	5.3	Friction Slope	188
	5.4	General Considerations and Some Features of Free Surface Flow	194
		Problems	211
		References	213
6	Over	land Flow	216
	6.1	The Standard Formulation	216
	6.2	Kinematic-Wave Approach	219
	6.3	Lumped Kinematic Approach	227
		Problems	230
		References	231
7	Streamflow Routing		233
	7.1	Two Extreme Cases of Large Flood-Wave Propagation	233
	7.2	A Lumped Kinematic Approach: The Muskingum Method	240
	7.3	Estimation of the Muskingum Parameters	248
		Problems	256
		References	259

Part III Water Below the Surface

8 Water Beneath the Ground: Fluid Mechanics of Flow in Porous Materials		r Beneath the Ground: Fluid Mechanics of Flow rous Materials	263	
	8.1	Porous Materials	263	
	8.2	Hydrostatics of Pore-Filling Water in the Presence of Air	265	

CAMBRIDGE

Cambridge University Press & Assessment 978-1-107-13527-7 — Hydrology Wilfried Brutsaert Table of Contents <u>More Information</u>

	8.3	Water Transport in a Porous Material	281
	8.4	Field Equations of Mass and Momentum Conservation	299
		Problems	309
		References	312
9	Infiltr	ration and Related Unsaturated Flows	318
	9.1	General Features of the Infiltration Phenomenon	318
	9.2	Infiltration Capacity in the Absence of Gravity: Sorption	321
	9.3	Infiltration Capacity	336
	9.4	Rain Infiltration	341
	9.5	Catchment-Scale Infiltration and Other "Losses"	350
	9.6	Capillary Rise and Evaporative Flux at the Soil Surface	353
		Problems	363
		References	366
10	Grou	ndwater Outflow and Base Flow	373
	10.1	Flow in an Unconfined Riparian Aquifer	373
	10.2	Free-Surface Flow: A First Approximation	384
	10.3	Hydraulic Groundwater Theory: A Second Approximation	389
	10.4	Linearized Hydraulic Groundwater Theory: A Third Approximation	404
	10.5	Kinematic Wave in Sloping Aquifers: A Fourth Approximation	419
	10.6	Catchment-Scale Base-Flow Parameterizations	421
		Problems	439
		References	443
Pa	rt IV	Flows at the Catchment Scale in Response to Precipitation	
11	Strea	mflow Generation: Mechanisms and Parameterization	451
	11.1	Riparian Areas and Headwater Basins	451
	11.2	Storm Runoff Mechanisms in Riparian Areas	453
	11.3	Summary of Mechanisms and Parameterization Options	468
		Problems	471
		References	471
12	Strea	mflow Response at the Catchment Scale	475
	12.1	Stationary Linear Response: The Unit Hydrograph	475
	12.2	Identification of Linear Response Functions	482
	12.3	Stationary Nonlinear Lumped Response	502

Contents

vii

viii

Cambridge University Press & Assessment 978-1-107-13527-7 — Hydrology Wilfried Brutsaert Table of Contents <u>More Information</u>

Contents

12.4	Nonstationary Linear Response	506
12.5	Annual Catchment Runoff from Mean Annual Precipitation	508
	Problems	509
	References	514
3 Elem	ents of Frequency Analysis in Hydrology	518
13.1	Random Variables and Probability	518
13.2	Summary Descriptors of a Probability Distribution Function	520
13.3	Some Probability Distributions for Discrete Variables	527
13.4	Some Probability Distributions for Continuous Variables	531
13.5	Extension of Available Records	550
	Problems	556
	References	558
4 After	word: A Short Historical Sketch of Theories About the Water Circulation on Earth	562
14.1	Earliest Concepts: The Atmospheric Water Cycle	562
14.2	Greek Antiquity	564
14.3	The Latin Era	571
14.4	From Philosophy to Science by Experimentation	577
14.5	Closing Comments	589
	References	590
Appendi	c: Some Useful Mathematical Concepts	595
A.1	Differentiation of an Integral	595
A.2	The General Response of a Linear Stationary System	595
A.3	The General Response of a Nonlinear System	602
		001
	References	603