## CONTENTS

## PREFACE INTRODUCTION

011 A D TTD			
CHAPTER	1.	The atmosphere-soil-plant system and the water cycle (E. Romijn)	
	1.1.	Introduction	1
	1.2.	The abiotic subsystem	3
	1.2.1.	Evaporation and evapotranspiration	3
	1.2.2.	The climate and the water balance	10
	1.2.3.	The soil	13
	1.3.	The biotic subsystem	17
	1.3.1.	The trophic system	17
	1.3.2.	Limiting factors	19
		List of symbols	26
		References	28
CHAPTER	2.	Movement of agrochemicals in the unsaturated	
		and saturated zones	
	2.1.	(V. Beneš)	
	2.1.	Movement of agrochemicals in the unsaturated zone	29
	2.1.1.	Water in the unsaturated zone	31
	2.1.2.	Water flow in the unsaturated zone	32
		Soil water potential	34
		Hydraulic conductivity	40
	2.1.5.		43
	2.1.6.	Calculation of the water flow	45
	2.1.7.	Movement of solute in the unsaturated zone	46
	2.1.8.		48
	2.1.9.	Schematic diagram of nitrogen movement	50
	2.2.	Movement of agrochemicals in the saturated	,
	2.2.	zone	5 2
	2.2.1.	Water flow in the saturated zone	52
	2.2.2.	Types of aquifers	54
	2.2.3.	Flow in phreatic aquifer	56
	2.2.4.	Flow in confined aquifer	56
	2.2.5.	Radial flow	56
	2.2.6.	Coefficients of specific storage	57
	2.2.7.		59
	2.2.8.		60
	2.2.9.		61
		Coefficient of hydrodynamic dispersion	63
		Mathematical solution of the flow and	
	•	transport equation	68
		List of symbols	76
		References	79

CHAPTER	3.	Impact of fertilizers and pesticides on groundwater quality (V. Houzim, J. Vávra, J. Fuksa, V. Pěkný,	
	3.1.	J. Vrba and J. Stibral)	0.0
	3.2.	Introduction	89
		Organic fertilizers	91
	3.2.1.		91
	3.2.2.		
	2 2	fertilizers in soil	96
	3.3.	Inorganic fertilizers	98
	3.3.1. 3.3.2.	Impact of physical and chemical properties of inorganic fertilizers on groundwater	101
	2 2 2	quality	104
	3.3.3.	Biological adsorption of fertilizers and its	
	2 2 4	impact on groundwater quality	108
	3.3.4.	Circulation of other nutrients	110
	3.4.	Pesticides	112
	3.4.1.	Chemical decomposition of pesticides Biological degradation of pesticides in soil	121 124
		References	129
CHAPTER	4.	Influence of irrigation and drainage (E. Romijn)	
	4.1.	Introduction	133
	4.2.	Objectives of irrigation and drainage	133
	4.2.1.		133
	4.2.2.	Soil water conditions	134
	4.2.3. 4.3.	Importance of irrigation and drainage Criteria for development of irrigation	135
		and drainage systems	136
	4.3.1.	Irrigation	136
	4.3.2.	Drainage	140
	4.4.	Side effects of irrigation and drainage with special reference to groundwater	
		quantity and quality	142
	4.4.1.	Side effects of irrigation	142
	4.4.2.	Side effects of drainage	144
		List of symbols	147
		References	148
CHAPTER	5.	Mathematical models (J. Balek)	
	5.1.	System approach	149
	5.1.1.	Identification of the problem	150
	5.1.2.	Identification of available data	151
	5.1.3.	Identification of simulated system	151
	5.1.4.	Identification of constraints	153
		Selection of the model	153
	5.1.6.	Testing of the model	154
	5.1.7.	Adaption of the model	154
	5.2.		155

## CASE HISTORIES

-	Consequences of irrigated agriculture in arid and semi-arid areas on groundwater	
	(M.C. Agarwal, A.C. Goel, R.K. Malik)	233
-	Impact of agriculture on groundwater in Ireland	
	(C.R. Aldwell, D.J. Burdon, M. Sherwood)	243
-	Elevated levels of nitrate in groundwater	
	beneath intensively grazed pastureland in New	
	Zealand	262
	(R.J. Burden)	263
-	The distribution of agricultural soil leachates	
	in the unsaturated zone of the British chalk	
	(S.S.D. Foster, A.H. Bath)	271
-	Prediction of variations in groundwater quality	
	under the influence of pen sewage irrigation	
	(V.M. Goldberg)	285
-	Numerical simulation of the effect of soil	
	nitrogen transport and transformations on ground-	
	water contamination	
	(M. Mehran, J. Noorishad, K.K. Tanji)	297
-	Factors of bacteria and virus transport in	
	groundwater	
	(A. Pekdeger, G. Matthess)	313
-	Modeling nitrogen behavior in the soil profile	
	(H.M. Selim)	323