

Content

1 Cycles, Feedbacks, and Main Issues

- 1.0 Global Cycles: Overview and Introduction
- 1.1 The Nature of Land-Biosphere-Atmospheric Feedbacks in the Hydrological Cycle
- 1.2 Scale Issues
- 1.3 Multiple Equilibria

2 Systems Approach: the Nature of Coupled Models

- 2.0 Introduction
- 2.1 Fluxes, Compartments and Ordering of Feedbacks
 - 2.1.1 Introduction and Definitions
 - 2.1.2 Inter-compartmental Coupling
 - 2.1.3 Intra-compartmental Coupling
 - 2.1.4 Final Remarks
- 2.2 Non-linearities
 - 2.2.1 Definition and Scope
 - 2.2.2 Types and Effects of Non-linearity
- 2.3 Parameterisation of Complex Hydrological Systems
 - 2.3.1 Mechanistic Modelling
 - 2.3.2 Uncertainty and Probabilistic Models
 - 2.3.3 Validation and Model Performance Evaluation

3 Systematisation of the Interactions between Hydrological and Related Cycles

- 3.0 Introduction
- 3.1 Coupled Processes and Interaction Matrix
 - 3.1.1 Box-and-arrow-diagram of the Hydrological and Related Cycles
 - 3.1.2 Interaction matrix of the Hydrological and Related Cycles
 - 3.1.3 Discussion of the Matrix
- 3.2. Coupling Aspects of Heat and Mass Transfer
 - 3.2.1 Inner-compartmental
 - 3.2.2 Inter-compartmental
 - 3.2.3 Analytical Solutions
 - 3.2.4 Numerical Aspects
- 3.3 Feedbacks at the Hydro-meteorological Interface
 - 3.3.1 Introduction
 - 3.3.2 Different Levels of Coupling
 - 3.3.3 Specific Requirements for Modelling Water and Energy Fluxes at the Hydrometeorological Interface
 - 3.3.4 Conclusions

4 Case Studies

- 4.0 Introduction
- 4.1 Groundwater Modelling in the Urban Area of Barcelona
- 4.2 The Lake Dagow Coupled Model for Groundwater and Surface Water
- 4.3 Modelling the Hydrology of the Nile Delta
- 4.4 Modelling the Changes in Hydrological Cycle Processes for Small and Middle River Basins in Conditions of Permafrost under Climate Change
- 4.5 Modelling Atmospheric and Hydrological Processes in the Boreal Region
- 4.6 A Distributed Model of Runoff Generation in the Permafrost Regions
- 4.7 Investigations on the impact of land-use changes using an integrated hydrometeorological model
- 4.8 The Influence of Anthropogenic Landscape Changes on Weather in South Florida
- 4.9 CLIMBER-2: an Earth System Model of Intermediate Complexity
- 4.10 Feedbacks and Coupling between Water, Carbon and Nutrient Cycling at the Hillslope Scale
- 4.11 The Boreal Ecosystem-Atmosphere Experiment (BOREAS)
- 4.12 Integrated Modelling of Water Availability and Vulnerability of Ecosystems and Society in NE Brazil
- 4.13 Integrated Global-change Modelling with IMAGE-2
- 4.14 The Virtual Watershed Laboratory

5 Summary and Outlook

- 5.1 When and Why is it Appropriate to Use Coupled Models?
- 5.2 Progress in Coupled Models
- 5.3 How much Coupling is Needed ?
- 5.4 Emphasising the Vulnerability and Assessing the Risks of Coupled Systems
- 5.5 Future Research

6 Index