

Preface

Soil–vegetation–atmosphere interactions determine, to a large extent, the global climate and the behaviour of the hydrological cycle. Model predictions thus depend critically on adequate parameterization of this interaction. At the Earth's surface, water falling as precipitation is partitioned into runoff, soil moisture storage, or deep percolation, and is lost through evaporation from wet canopies (interception), through the stomata from single leaves (transpiration) or from the soil surface and from lakes and rivers. In the last twenty years or so, considerable attention has been focused on adequate modelling of soil–vegetation–atmosphere interaction processes by using Soil–Vegetation–Atmosphere Transfer (SVAT) models. Various IAHS commissions (the International Commission on Atmosphere–Soil–Vegetation Relations—ICASVR; the International Surface Water Commission—ISWC; the International Commission on Snow and Ice—ICSI and the IAHS Working Group on Experimental and Theoretical Hydrology at All Scales) and other international organizations (the International Geosphere–Biosphere Program—IGBP-BAHC—core project Biospheric Aspects of the Hydrological Cycle and the Global Water and Energy Cycle Experiment—GEWEX) have organized symposia or workshops on this theme, that have greatly contributed to our current level of understanding.

However, there are still several key issues in SVAT models that are poorly parameterized or that are simply not well enough understood. It was therefore deemed timely for a symposium on SVAT models to be organized by IAHS. Current SVAT schemes include increasingly complex descriptions of the physical mechanisms governing land surface processes. These schemes require large numbers of soil and land surface parameters controlling the vertical fluxes. The underlying rationale is that improved process representation will result in parameters which are easier to measure or estimate, and in improved model performance and robustness. However, this is not necessarily so, mainly because SVAT models require effective values for the various parameters at patch, regional or larger scales, which are not easily estimated and because redistribution of water and energy at sub-grid scales can alter surface properties. Surface energy fluxes can also vary significantly in space and time due to the variability in land surface properties and to local scale advection. Recent studies have shown that characterizing such properties is fraught with difficulties, as determining representative parameterizations is non-trivial due to our inability to accurately measure land surface properties. Hence, data assimilation, whereby measurements are integrated with models, is becoming increasingly used to keep hydrological models on track. Remotely sensed information on the state of the land surface plays an important role in current efforts to improve data assimilation. These issues are particularly difficult to address for snow-covered areas, where vegetation communities are strongly coupled with patterns of snow accumulation and snowmelt. The snow and vegetation interactions influences mass, chemical and energy exchanges. Furthermore, the vegetation is affected by the sensitivity of the vegetation to snow thermal insulation and springtime inputs of melting water, nutrients and latent heat. Current snow models and parameterizations presume stationary plant communities as part of their regional calibrations.

This book contains the 48 papers presented at Symposium S5 during the Sixth IAHS Scientific Assembly held at Maastricht in July 2001. The book is organized into five sections:

- General SVAT Modelling
- SVAT and Precipitation Processes at Large Scales
- Parameter Estimation of Large-Scale Hydrological Models
- Data Assimilation in Large-Scale Hydrological Models
- Snow–Vegetation Interactions

We hope the volume presents a “state of the art” in SVAT modelling in the hydrological community.

This book would not have been possible without the organizing and monitoring skills of Annelies Brekelmans and Ellen Janssen who dealt painstakingly with all the administrative matters and organized the review process. Frances Watkins of IAHS press is thanked for her efforts in preparing the final version of this book.

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