
Preface

This book is the result of an initiative by the *Biospheric Aspects of the Hydrological Cycle* (BAHC), a Core Project of the *International Geosphere-Biosphere Programme* (IGBP). It reports on the more than a decade-long research and findings of a large number of scientists studying the Earth system in terms of the connection between the terrestrial biosphere, the hydrologic cycle and the potential anthropogenic influences. The authors contributing to the five parts of the book have highlighted the research and findings of hundreds of scientists who have worked over the past 15 years on the interface between the hydrological cycle, the terrestrial biosphere and the atmosphere. As you read through the book, it becomes clear that the scientific progress goes well beyond any single international programme: it is interdisciplinary and reflects contributions made towards addressing many of the objectives set forth by a number of projects of IGBP, WCRP (*World Climate Research Programme*), and IHDP (*International Human Dimensions Programme on Global Environmental Change*).

At the programmatic level we often compartmentalise and label research as belonging to a specific named programme, but in reality and at the researchers' level, it is all a seamless process that tackles specific and challenging questions related to the highly interactive processes of vegetation, water and humans within the climate system. In their earliest years, BAHC and GEWEX (the *Global Energy and Water Cycle Experiment* of WCRP) recognised the need for thematic synergies and collaboration between the two research programmes. Both programmes have successfully collaborated in a large number of joint research, observational and modelling activities since their inception (BAHC in 1990 and GEWEX in 1988). The *International Satellite Land Surface Climatology Project* (ISLSCP), a GEWEX project, is perhaps one of the best examples of an excellent collaboration between the two programmes. BAHC and ISLSCP have operated "back to back" since the Tucson aggregation workshop in 1994 (Kabat and Sellers 1997)¹. ISLSCP is a leading project in producing and consolidating global datasets for global change studies. BAHC and ISLSCP jointly initiated and coordinated an array of land-surface/atmosphere experiments, known as HAPEX and FIFE (for example *Hydrological and Atmospheric Pilot Experiment* in the Sahel and *First ISLSCP Field Experiment*, respectively). Both programmes jointly took the first steps to initiate the largest and most integrative Earth system experiment so far: the *Large Scale Biosphere Atmosphere Experiment in Amazonia* (LBA). It is gratifying to see some of the research and findings resulting from these joint activities presented in this book.

While we are both extremely pleased with the research progress reported in this volume, we are even more excited about the future results of the planned joint activities associated with the recently launched GEWEX Phase II and the new project in IGBP on the land-atmosphere interface, ILEAPS (*Integrated Land Ecosystem – Atmosphere Processes Study*)², to which the BAHC community will be a major contributor. For example, both the *Coordinated Enhanced Observing Period* (CEOP) of GEWEX,

¹ Kabat P, Sellers PJ (1997) Special issue: Aggregate description of land-atmosphere interactions, foreword. *J Hydrol* 190/3–4:173–175.

² <http://www.atm.helsinki.fi/ILEAPS/>

and the FLUXNET project of world-wide CO₂ flux measurement initiated by BAHC are positioned at the forefront of the Earth system measurement and monitoring approaches. By focusing on a series of reference field sites distributed over all continents (CEOP), on “transect studies” (FLUXNET), and on simultaneous use of satellite and ground observation, these experiments will provide a data set of unprecedented completeness and quality for our scientists to work with.

The *Global Land-Atmosphere System Study* (GLASS) and the *Global Soil Wetness Project* (GSWP) are other examples of successful collaborative activity between the two programmes in modelling land-surface/atmosphere processes and interactions within the climate system (e.g. Feddes et al. 2001)³. These projects are promising a new generation of land-surface schemes for Earth system models. The new schemes will evolve into interactive schemes that increasingly incorporate more hydrological, atmospheric, biogeochemical and ecological information.

Finally, while BAHC and GEWEX place much of their emphasis on the physical and biospheric aspects of water, they have also been very much interested in the potential impact of the alteration of the global hydrological cycle on regional water resources and ecosystems. However, despite the reported scenario and case studies (see Part D and E) and the proposed new approach for vulnerability assessments (Part E), at present, specific regional effects continue to be uncertain. This remaining uncertainty is one of the factors that has thus far hindered the effective application of GEWEX and BAHC research results to operational hydrology and water management strategies. Better links to applications in water resources is therefore one of the main priorities of Phase II of GEWEX and of the new joint project GWSP (*Global Water Systems Project*), co-sponsored by IGBP, WCRP, IHDP and DIVERSITAS (*International Programme of Biodiversity Science*). We remain optimistic that within this decade much progress in this area will be made and it will be the subject of a future publication.

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³ Feddes R A, Hoff H, Bruen M, Dawson TE, de Rosnay P, Dirmeyer P, Jackson RB, Kabat P, Kleidon A, Lilly A, Pitman AJ (2001) Modelling root water uptake in hydrological and climate models. *Bull Amer Meteor Soc* 82:2797–2809.

Vegetation, Water, Humans and the Climate

A New Perspective on an Interactive System

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