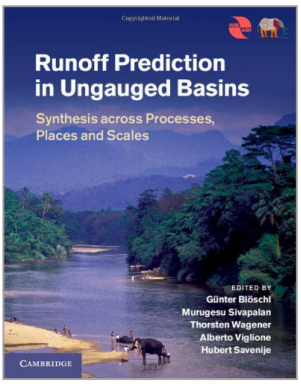
Runoff Prediction in Ungauged Basins: Synthesis across Processes, Places and Scales

A book review



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Floods, crop-threatening droughts, water shortages and water contamination are only some of the global problems that require information on the way water runs in drainage basins. Estimates of the space-time variability of runoff are needed for almost every location where people live, but in most catchments around the world runoff is not monitored. Unrecorded conditions in monitored catchments, such as anticipated changes in climate or land use, pose a similar challenge for hydrologists and water managers.

Runoff Prediction in Ungauged Basins: Synthesis across Processes, Places and Scales is a comprehensive book on runoff prediction. The term prediction stands for the estimation of runoff characteristics – such as the mean annual runoff or the probability of exceeding a certain flood runoff – for unmonitored locations and situations using climate data and catchment properties.

The book is an attempt to overcome the so-called fragmentation problem in hydrology. Hydrology lacks universal theories at the catchment scale, which is the scale of interest for most water problems. Process knowledge has been derived mainly from the point scale, but upscaling from this to the catchment scale is extremely difficult. Today, there is a huge variety of models and approaches for catchment runoff prediction, strongly differing in model concepts, structure and parameters, as well as input used. Many, if not most, runoff predictions follow a pragmatic strand, are not rigorously tested, and aim at local solutions, but do not foster the transfer of knowledge and understanding. As a response to this fragmentation, the International Association of Hydrological Sciences started the global community effort Predictions in Ungauged Basins (PUB) in 2003. Over the last decade, this initiative has successfully worked towards organising knowledge and developing transferable generalisations. This book is a central outcome of the PUB initiative, and attempts to put in order the current practice, experience and range of approaches in this field. It builds, among other things, on a comparative assessment of thousands of studies. The editors have managed to collect more than 130 authors in a coherent book, covering about 25000 catchments from all around the world.

The book is intended for hydrologists and Earth and environmental scientists with an interest in hydrology. The editors put much effort in laying out how runoff is interwoven with landscape characteristics and catchment history. The concept of co-evolution of landscape processes (i.e. reciprocal evolutionary change of soils, vegetation, and topography in response to climate dynamics, geological processes and human interventions) plays an important role. Thanks to such comprehensive and advanced perspectives, this book will also be a good starting point for early stage researchers. It contains a large number of very illustrative, high-quality figures, schematically depicting the functioning of catchments or exemplifying central statements. Many photographs of rivers and landscape features support the editors' concept of 'reading the landscape', with the aim to better understand the processes underlying spatio-temporal variability of runoff. Even though the volume is not a hydrology textbook, the concepts and many figures will be most valuable in university hydrology courses.

The book addresses the fragmentation of modelling approaches through comparative hydrology – comparing prediction methods and their success across regions, scales and processes. Investigating the differences and similarities between a large number of catchments around the world is used as vehicle to understand how catchments function and why and where prediction methods work. A key to diagnosing catchments are runoff signatures, such as annual runoff or low-flow indicators. The idea is that catchments can be seen as organisms that have reached their current state through co-evolution, and that runoff signatures are the result of the catchment functioning. Hence, the collection of runoff signatures may reveal some aspects of the state and internal dynamics of catchments.

The book is organised around six runoff signatures, and each of the chapters 5 to 10 deals with one of these signatures. Chapter 2 introduces the synthesis framework, Chapter 3 discusses the important issue of data, and Chapter 4 gives the basic understanding of the essential catchment processes. The volume also features case studies collected from around the world and includes a summary of the findings and best-practice recommendations for prediction runoff in ungauged basins.

The editors convincingly demonstrate how the comparative hydrology approach helps bring order to the overwhelming variety of prediction methods. Given the large number of authors and the range of concepts and methods, it is amazing that the editors managed to compile such a coherent book. It is truly a unique synthesis of the available knowledge on runoff prediction, and a rich source for scientists and professionals working in ungauged catchments. Its broad perspective and the many attempts to reconcile diverging concepts will certainly stimulate the discussion in areas beyond runoff prediction.

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