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

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A question about how to predict the runoff from a basin where there is no history of flow measurements is probably featured in almost every hydrology graduate student’s oral examination. It has certainly been one of the longest-standing problems for the profession. The International Association of Hydrological Sciences Prediction in Ungauged Basins initiative [Wagener et al., 2004] has focused researchers and meetings on the topic, culminating in this book, which assembles the thoughts gathered over the last decade.

Runoff Prediction in Ungauged Basins: Synthesis Across Processes, Places and Scales was written by about 130 authors led by a group of five editors. The two lead editors are well known for their previous syntheses on scaling of hydrologic processes, and in this book they return to similar themes of fragmented theory bounded by a surfeit of models and process understanding without a consistent or even coordinated scientific approach to solving these problems. Questions central to scaling regarding the relative utility of distributed modeling approaches versus upscaled physical hydrology have reprimed their appearances as bottom-up and top-down, and panning has been added to the scope of the “zooming” problem. The debate, though, has been reframed, noting that regardless of formulation, shortcomings in mathematically describing processes at catchment scales have led to calibration as a principal activity, burying process uncertainty in more parameters. The ungauged basin is offered as an archetype blank slate for which there is no pretense, only performance.

The book is written and edited as a single book with coherent and consistent themes progressing from beginning to end. Although the book is large and gives an initial physical appearance similar to that of many syntheses of the last couple of decades, wherein hard covers bookend a series of quasi-independent papers, the editors and authors have bound a single story here told from several different angles. Most of the chapters are organized around hydrologic outcomes, such as high flows, low flows, or annual runoff, the kinds of metrics one might wish to estimate in an ungauged basin.

Each chapter is organized similarly, beginning with a brief review of work on the topic and a brief description of the hydrologic processes influencing the particular behavior. The reviews are not comprehensive but are thorough enough that readers will be able to effectively find the literature. The meat comes in describing and comparing the several modeling approaches applied in studies of each process. Performance metrics are drawn from the papers discussed in each section and compared based on the nature of the approach (e.g., statistical, geostatistical, physically based, or similarity derived). A summary chapter near the end explores these performance metrics arrayed across the various chapter topics, regions, climates, study scale, and alternative inferential approaches. The final chapters apply the synthesis to shape a path for more coordinated and fruitful science toward understanding hydrologic processes.

In summary, this book represents a step forward in advancing hydrologic theory. In combing through many hydrologic representations and inferential approaches to contrast their performances in several contextual frames, the authors have provided a coherent and solid platform from which to explore hydrologic processes.

Reference


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