Distributed Hydrologic Modeling Using GIS

Second Edition

by

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This monograph sets forth a unified approach and principles for modeling hydrologic processes distributed in space and time using geographic information systems (GIS). The focus of this Second Edition is on the principles of how to implement a distributed model using geospatial data to simulate hydrologic processes. Once we embark on fully distributed representations of hydrologic processes, conservation laws form the basis for modeling, and spatial data management becomes necessary. A physics-based approach involves the laws that govern the complexities of all the paths that water travels, from precipitation falling over a river basin to the flow in the river. Advances in computational power and spatial data management systems now support our ability to create detailed mathematical representations of a watershed. Technology has enabled the transformation of hydrologic modeling from lumped to distributed representations with the advent of new sensor systems such as radar and satellite, high performance computing, and orders-of-magnitude increases in data storage. Global digital datasets of elevation at thirty meters (or smaller) or soil moisture estimates from satellite and through data assimilation offer tantalizing detail that could be used in distributed hydrologic models to better manage water resources and to improve hydrologic prediction.

Worldwide geospatial data has become readily available in GIS format. A modeling approach that can utilize this data for hydrology offers many possibilities. GIS data formats, spatial interpolation, and resolution have important effects on hydrologic simulation of the major hydrologic components of a watershed. Examples are provided that illustrate how to represent a watershed with spatially distributed data along with the many pitfalls inherent in such an undertaking. Since the First Edition, software development and applications have created a richer set of examples, and a deeper understanding of how to perform distributed hydrologic analysis and prediction. This Second Edition is oriented towards a commercially available distributed model called Vflo™. The basic edition of this model, with a 30 day license, is included on the enclosed CD-ROM.

Audience

This volume will be valuable for researchers, faculty, upper division undergraduate and graduate students, hydrologists, physical geographers, hydrometeorologists, and practitioners in civil, agricultural, and water resources engineering.

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