Map-based surface and subsurface flow simulation models: An object-oriented and GIS approach

by

Zichuan YE, B.S., M.S., MPA., M.S.

David R. Maidment, PhD.

And

Daene C. McKinney, PhD.

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CENTER FOR RESEARCH IN WATER RESOURCES

Bureau of Engineering Research • The University of Texas at Austin
J.J. Pickle Research Campus • Austin, TX 78712-4497

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Zichuan Ye

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ABSTRACT

MAP-BASED SURFACE AND SUBSURFACE FLOW SIMULATION MODELS: AN OBJECT-ORIENTED AND GIS APPROACH

Zichuan Ye, Ph.D.
The University of Texas at Austin, 1996
Supervisors: Daene C. McKinney, David R. Maidment

A hydrology simulation model is composed of three elements, which are (1) equations that govern the hydrologic processes, (2) maps that define the study area and (3) database tables that numerically describe the study area and model parameters. When a model is constructed with its three elements separated, its portability and user-friendliness are usually limited because any modification of one component will not be reflected in the others. The purpose of this research is to develop a map-based flow simulation model with all three model-components integrated. The model is constructed under a geographic information system (GIS) and based on the concepts of object-oriented programming. As its name suggests, a map-based model is map-centric and it allows all the regular model procedures such as construction, simulations, modifications, and result-processing to be activated directly from the model maps. Based on this ‘map-centric’ and object-oriented concept, a map-based surface/subsurface water flow simulation model is developed and successfully applied to simulate surface and subsurface flow on the Niger River Basin in West Africa. In the process of constructing this map-based model, techniques are also developed to address and solve some GIS
related problems such as treatment of spatially-referenced time-series data, feature-oriented map operations, dynamic segmentation of an arc, and integration of flows along a line.
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