

CRWR Online Report 96-5

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.

August 1996

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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Acknowledgments

I wish to thank Dr. David R. Maidment and Dr. Daene C. McKinney of the Environmental and Water Resources Engineering group of the Department of Civil Engineering, and Dr. David J. Eaton of the LBJ School of Public Affairs for their efforts in allocating funds to financially support me through the graduate school in the University of Texas at Austin. I would like to thank Dr. Maidment and Dr. McKinney for supervising and guiding me through this dissertation research. I would like, also to thank Dr. McKinney, Dr. Maidment, Dr. Edward R. Holley, Dr. Howard M. Liljestrang, and Dr. Eaton for spending time to serve in my dissertation committee and Dr. Holley, Dr. McKinney, Dr. Robert Herman, and Dr. Eaton for administering my qualifying exam in 1993. Finally, I would like to express my gratitude to my classmates and friends: Seann Reed, Francisco Olivera, Pawel Mizgalewicz, David Watkins, Phil DeBlanc, Minder Lin, Cai Ximin, Jessie Li, Ferdinand Hellweger, Jennifer Benaman, and Bill Saunders for their numerous help and encouragement during my dissertation research.

Zichuan Ye

October, 1996

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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