

Book Review

Hydrological Applications of GIS

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Reviewed by Alec Walker, Department of Geomatic Engineering, University College London

This volume, although not aiming to be comprehensive, gives a broad view of the current key issues in hydrological applications of Geographical Information Systems (GIS). The collection of 12 papers from the Journal of Hydrological Processes introduces topics as broad ranging as a national framework for hydrological data storage and access to the technical aspects of several local and regional hydrological models right down to the application of a GIS to the geomorphological and ecological modelling of a meander bend.

The first two chapters cover the issues of data quality as a limiting factor both in hydrological modelling and monitoring roles and better data management for the improved acquisition and dissemination of hydrological data between multiple disparate users. The former includes a brief account of the history of GIS in hydrological science and water management and how its role can be in pre-processing, modelling or post-processing depending on the application. The latter details a generic data model and its application to a national database used to help understand the processes of the coastal zone. It clearly shows the difficulties of data management in such a cross disciplinary subject and how the value of data can be increased with careful central management of data formatting and storage.

All of the remaining chapters are much more technical in nature and many give examples of the effects of data quality on the confidence of hydrological modelling predictions. Chapters 3 and 4 both deal with Digital Elevation Model (DEM) accuracy and pre-processing techniques used to make DEMs suitable for use in hydrological models. DEMs are widely used in hydrological model parameterisation and these techniques are at the leading edge of this particular aspect of the discipline.

Interpolation of data used as parameters in a hydrological model can be performed in many ways either inside or outside of a GIS. Chapter 5 shows that a large-scale distributed model can be particularly sensitive to the interpolation method used.

Chapter 6 describes the prediction of peak stream flows in catchments affected by logging activities. The models are used to both identify areas within a catchment which are hydrologically sensitive to changes in land cover and to investigate the potential and actual effects of such changes on peak stream flows.

Chapter 7 deals with erosion hazard and estimation and shows that the increasing complexity of some GIS models does not necessarily produce more accurate results than a simpler coupled model. The reasons for this can include the difficulty in estimating and measuring the large number of input variables at the catchment scale.

Both chapters 8 and 9 look at landslides. The first uses GIS as a means for data storage, transfer and display whilst using coupled process-based models for numerical analysis. The second uses GIS to map existing landslides to critical rainfall values predicted from a theoretical model. Simulations of slide hazards had widely varying performance across a number of different catchments.

Chapter 10 investigates groundwater contamination at the regional scale and the authors state that their initial understanding of the fate and transport of groundwater pollutants in their region of interest could not have been gained without the coupled process based simulation and GIS.

Remotely sensed data (Landsat and AVHRR) is the dominant data source in the next chapter investigating sediment plumes and coastal geography. Data and products from remote sensing are also used in many of the other studies in this volume.

The final chapter uses GIS at the very different scale of a single meander bend. It was found to be particularly useful in its ability to fix locations precisely, to quantify positional error and to visualise results.

Consistent throughout the papers is the idea that GIS plays a very valuable role in facilitating the modelling and prediction of many aspects of hydrological variables. However the reader should not forget that simpler models might be appropriate for their own application.

As is common in this type of special issue the chapters range as much in their level of technical detail as in their particular topic. Whilst this does give a good broad range of applications it is difficult to know who would best benefit from reading this book cover to cover. Anyone either currently using or about to purchase a GIS would already have a specific use for the system and would therefore only appreciate one or two of the chapters most relevant to their subject. It is of most value to undergraduate or postgraduate students in a number of environmental disciplines or students of Geographical Information Systems wishing to gain a broad appreciation of the use of GIS in hydrological applications.
