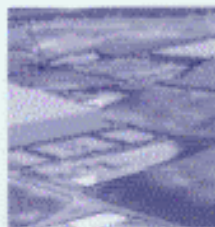


*Second Edition*

# GEOGRAPHICAL INFORMATION SYSTEMS

ABRIDGED

*Principles, Techniques, Management, and Applications*



EDITED BY

Paul A. Longley  
Michael F. Goodchild  
David J. Maguire  
David W. Rhind



INCLUDES  
CD-ROM

# Contents

Preface to abridged edition: New Developments in Geographical Information Systems	ix
List of contributors	xxxiii
Acknowledgements	xlili

1 Introduction · <i>P A Longley, M F Goodchild, D J Maguire, and D W Rhind</i>	1-20
--	------

## Part 1: Principles

### (a) Space and time in GIS

Introduction · <i>The Editors</i>	21-25
2 Space, time, geography · <i>H Couclelis</i>	27-35
3 Geography and GIS · <i>R J Johnston</i>	37-48
4 Arguments, debates and dialogues: the GIS-social theory debate and the concern for alternatives · <i>J Pickles</i>	
5 Spatial representation: the scientist's perspective · <i>J F Raper</i>	
6 Spatial representation: the social scientist's perspective · <i>D J Martin</i>	
7 Spatial representation: a cognitive view · <i>D M Mark</i>	
8 Time in GIS and geographical databases · <i>D J Peuquet</i>	
9 Representation of terrain · <i>M F Hutchinson and J C Gallant</i>	
10 Generalising spatial data and dealing with multiple representations · <i>R Weibel and G Dutton</i>	
11 Visualising spatial distributions · <i>M-J Kraak</i>	49-65

### (b) Data quality

Introduction · <i>The Editors</i>	67-68
12 Data quality parameters · <i>H Verigin</i>	69-83
13 Models of uncertainty in spatial data · <i>P F Fisher</i>	85-95
14 Propagation of error in spatial modelling with GIS · <i>G B M Heuvelink</i>	
15 Detecting and evaluating errors by graphical methods · <i>M K Beard and B P Buttenfield</i>	

### (c) Spatial analysis

Introduction · <i>The Editors</i>	97-99
16 Spatial statistics · <i>A Getis</i>	101-116
17 Interactive techniques and exploratory spatial data analysis · <i>L Anselin</i>	
18 Applying geocomputation to the analysis of spatial distributions · <i>S Openshaw and S Alvanides</i>	
19 Spatial analysis: retrospect and prospect · <i>M M Fischer</i>	
20 Location modelling and GIS · <i>R L Church</i>	

## Part 2: Technical Issues

## (a) GIS architecture issues

Introduction · <i>The Editors</i>	117-118
21 New technology and GIS · <i>M Batty</i>	119-131
22 GIS in networked environments · <i>D J Coleman</i>	133-147
23 Desktop GIS software · <i>S Elshaw Thrall and G I Thrall</i>	149-159
24 GIS interoperability · <i>M Sondheim, K Gardels, and K Buehler</i>	
25 GIS customisation · <i>D J Maguire</i>	

## (b) Spatial databases

Introduction · <i>The Editors</i>	161-162
26 Relational databases and beyond · <i>M F Worboys</i>	163-174
27 Spatial access methods · <i>P van Oosterom</i>	175-190
28 Interacting with GIS · <i>M J Egenhofer and W Kuhn</i>	191-201
29 Principles of spatial database analysis and design · <i>Y Bédard</i>	

## (c) Technical aspects of GIS data collection

Introduction · <i>The Editors</i>	203-204
30 Spatial referencing and coordinate systems · <i>H Seeger</i>	
31 Encoding and validating data from maps and images · <i>I Dowman</i>	
32 Digital remotely-sensed data and their characteristics · <i>M Barnsley</i>	205-220
33 Using GPS for GIS data capture · <i>A Lange and C Gilbert</i>	

## (d) Data transformation and linkage

Introduction · <i>The Editors</i>	221-223
34 Spatial interpolation · <i>L Mitas and H Mitasova</i>	
35 Multi-criteria evaluation and GIS · <i>J R Eastman</i>	225-234
36 Spatial tessellations · <i>B Boots</i>	
37 Spatial hydrography and landforms · <i>L Band</i>	
38 Intervisibility on terrains · <i>L De Floriani and P Magillo</i>	
39 Virtual environments and GIS · <i>J N Neves and A Câmara</i>	
40 The future of GIS and spatial analysis · <i>M F Goodchild and P A Longley</i>	235-248

### Part 3: Management Issues

Introduction · <i>The Editors</i>	249-252
<b>(a) Making the GIS efficient, effective, and safe to use</b>	
Introduction · <i>The Editors</i>	253-254
41 Choosing a GIS · <i>T Bernhardsen</i>	255-264
42 Measuring the benefits and costs of GIS · <i>N J Obermeyer</i>	265-274
43 Managing an operational GIS · <i>L J Sugarbaker</i>	
44 Institutional consequences of the use of GIS · <i>H J Campbell</i>	
45 Managing uncertainty in GIS · <i>G J Hunter</i>	
46 Liability in the use of GIS and geographical datasets · <i>H J Onsrud</i>	
<b>(b) Data as a management issue</b>	
Introduction · <i>The Editors</i>	275
47 Characteristics and sources of framework data · <i>N S Smith and D W Rhind</i>	
48 Characteristics, sources, and management of remotely-sensed data · <i>J E Estes and T R Loveland</i>	
49 Metadata and data catalogues · <i>S C Guptill</i>	
50 National and international data standards · <i>F Salgé</i>	
<b>(c) GIS as a management tool</b>	
Introduction · <i>The Editors</i>	277-278
51 GIS for business and service planning · <i>M Birkin, G P Clarke, and M Clarke</i>	279-292
52 Managing public discourse: towards the augmentation of GIS with multimedia · <i>M J Shiffer</i>	293-302
53 Managing a whole economy: the contribution of GIS · <i>J Smith Patterson and K Siderelis</i>	
<b>(d) The impact of broad societal issues on GIS</b>	
Introduction · <i>The Editors</i>	303-304
54 Enabling progress in GIS and education · <i>P Forer and D Unwin</i>	
55 Rethinking privacy in a geocoded world · <i>M R Curry</i>	305-314
56 National and international geospatial data policies · <i>D W Rhind</i>	315-335

**Part 4: Applications**Introduction · *The Editors*

337-341

**(a) Operational applications**Introduction · *The Editors*

343-345

57 GIS in the utilities · *J Meyers*58 GIS in telecommunications · *C Fry*59 Transportation GIS: GIS-T · *N Waters*60 GIS in emergency management · *T Cova*61 GIS in land administration · *P F Dale and R A McLaren*62 Urban planning and GIS · *A G-O Yeh*63 Military applications of GIS · *D Swann*64 Applying GIS in libraries · *P Adler and M Larsgaard***(b) Social and environmental applications**Introduction · *The Editors*

347-349

65 The rebuilding of a country: the role of GIS in South Africa · *D R MacDevette,  
R J Fincham, and G G Forsyth*66 Health and health care applications · *A Gatrell and M Senior*67 GIS and the geography of politics · *M Horn*68 Monitoring land cover and land-use for urban and regional planning · *P Bibby and J Shepherd*69 GIS and landscape conservation · *R J Aspinall*70 Local, national, and global applications of GIS in agriculture · *J P Wilson*71 GIS in environmental monitoring and assessment · *L Larsen*72 Epilogue · *P A Longley, M F Goodchild, D J Maguire, and D W Rhind*

Consolidated bibliography

Appendix: glossaries and acronyms

Author index

Subject index

351-357

**NOTE:** Chapters marked with a CD-ROM icon in this Table of Contents are only available as full-text PDFs on the CD-ROM included with this book. Color images referred to in some of the chapters (denoted as "Plates" in the text), are only available in a digital image gallery on the included CD-ROM.