

# Lecture Notes in Geoinformation and Cartography

---

Series Editors: William Cartwright, Georg Gartner, Liqiu Meng,  
Michael P. Peterson



S.C.M. Geertman • W.P. Reinhardt  
F.J. Toppen  
Editors

# Advancing Geoinformation Science for a Changing World



Springer

*Editors*

Stan Geertman  
Faculty of Geosciences  
Utrecht University  
Heidelberglaan 2  
3584 CS Utrecht,  
The Netherlands  
[s.geertman@geo.uu.nl](mailto:s.geertman@geo.uu.nl)

Wolfgang Reinhardt  
AGIS / Faculty of Computer Science  
University of the Bundeswehr Munich  
Werner-Heisenberg-Weg 39  
85577 Neubiberg  
Germany  
[Wolfgang.Reinhardt@unibw.de](mailto:Wolfgang.Reinhardt@unibw.de)

Fred Toppen  
Faculty of Geosciences  
Utrecht University  
Heidelberglaan 2  
3584 CS Utrecht,  
The Netherlands  
[f.toppen@geo.uu.nl](mailto:f.toppen@geo.uu.nl)

ISSN 1863-2246                            e-ISSN 1863-2351  
ISBN 978-3-642-19788-8                e-ISBN 978-3-642-19789-5  
DOI 10.1007/978-3-642-19789-5  
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2011925152

© Springer-Verlag Berlin Heidelberg 2011

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilm or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

*Cover design:* SPi Publisher Services

Printed on acid-free paper

Springer is part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

## Preface

The Association of Geographic Information Laboratories for Europe (AGILE) was established in early 1998 to promote academic teaching and research on GIS at the European level. Since then, the annual AGILE conference has gradually become the leading GIScience conference in Europe and provides a multidisciplinary forum for scientific knowledge production and dissemination. In that, it can be regarded a full successor of the preceding EGIS (European Conference on Geographical Information Systems) and JECC (Joint European Conferences and Collaboration) conferences, which dominated the European GI-conference scene during the nineties.

For the fifth consecutive year the AGILE conference promoted the edition of a book with the collection of scientific papers that were submitted as full-papers. Those papers went through a competitive review process. The 14<sup>th</sup> AGILE conference call for full-papers of original and unpublished fundamental scientific research resulted in 70 submissions, of which 26 were accepted for publication in this volume after a thorough selection and review process (acceptance rate of 37%).

The papers submitted to our Program Committee all can be considered to contribute to the ‘Advancing Geoinformation Science for a Changing World’, which is the overall title of this 14<sup>th</sup> AGILE conference. Therein we acknowledge that the pace of developments is increasing all the time and that our field of mutual interest – GIScience – can be considered a valuable player to cope in a proper way with these fast changing circumstances. We think that the papers included in this volume nicely reflect the contribution of GIScience to our ever-changing world.

The scientific papers published in this volume cover a wide diversity of GIScience related themes, including: spatial-temporal modeling and analysis; road network and mobility research; GeoSensor development and application; socio-spatial modeling and analysis; spatial data processing and structuring; and GI-information generation and dissemination.

Organizing the program of an international conference and editing a volume of scientific papers requires time, effort, and support. We would like to thank the authors for their high-quality contributions, which are invaluable for an edited volume. Moreover, we would like to thank the reviewers

for their difficult task to pick out those contributions that are really worthwhile for inclusion in such a book. Although this task always has a subjective part, by fulfilling the review process double-blind and demanding at least 3 reviews per submission we hope and expect to have overcome this subjectivity in sufficient manner. In addition we would like to thank the AGILE Council and Committees for their support.

We would also like to thank our sponsors (ESRI, the faculty of Geosciences, Utrecht University and the Royal Dutch Association of Geographers, KNAG) for their kind contribution to this conference. And last but for sure not least we would like to thank Springer Publishers for their willingness – already for the fifth time – to publish these contributions in their academic series *Springer Lecture Notes in Geoinformation and Cartography*.

*Stan Geertman, Wolfgang Reinhardt, Fred Toppen (editors)*

Utrecht/Munchen  
February, 2011

# **Committees**

## **Programme Committee**

Programme Chair Stan Geertman  
University of Utrecht (The Netherlands)

Programme Co-Chair Wolfgang Reinhardt  
Universität der Bundeswehr München (Germany)

Programme Co-Chair Fred Toppen  
University of Utrecht (The Netherlands)

## **Local Organizing Committee**

Fred Toppen, University of Utrecht (The Netherlands) (chair)  
JanJaap Harts, University of Utrecht (The Netherlands)  
Henk Ottens, Royal Dutch Association of Geographers - KNAG,  
(The Netherlands)

## **Scientific Committee**

Suchith Anand, University of Nottingham (United Kingdom)  
Peter Atkinson, University of Southampton (United Kingdom)  
Fernando Bação, New University of Lisbon (Portugal)  
Itzhak Benenson, Tel Aviv University (Israel)  
Lars Bernard, TU Dresden (Germany)  
Michela Bertolotto, University College Dublin (Ireland)  
Ralf Bill, Universität Rostock (Germany)  
Thomas Bittner, State University of New York at Buffalo (USA)  
Lars Bodum, Aalborg University (Denmark)  
Arnold Bregt, Wageningen University (The Netherlands)

- Thomas Brinkhoff, Institute for Applied Photogrammetry and  
Geoinformation (Germany)
- Christoph Brox, University of Muenster (Germany)
- Gilberto Camara, National Institute for Space Research (Brazil)
- Christophe Claramunt, Naval Academy Research Institute (France)
- Arzu Cöltekin, University of Zürich (Switzerland)
- Max Craglia, Joint Research Center (Italy)
- Arie Croitoru, The University of Alberta (Canada)
- Joep Crompvoets, Katholieke Universiteit Leuven (Belgium)
- Leila De Floriani, University of Genova (Italy)
- Michel Deshayes, Cemagref - UMR TETIS (France)
- Juergen Döllner, HPI-Institute an der Universität Potsdam (Germany)
- Matt Duckham, University of Melbourne (Australia)
- Sara Fabrikant, University of Zürich (Switzerland)
- Peter Fisher, University of Leicester (United Kingdom)
- Anders Friis-Christensen, National Survey and Cadastre (Denmark)
- Michael Gould, ESRI (USA)
- Francis Harvey, University of Minnesota (USA)
- Jan Haunert, University of Würzburg (Germany)
- Gerard Heuvelink, Wageningen University (The Netherlands)
- Stephen Hirtle, University of Pittsburg (USA)
- Hartwig Hochmair, University of Florida (USA)
- Bin Jiang, University of Gävle (Sweden)
- Chris Jones, Cardiff University (United Kingdomr)
- Didier Josselin, Université d'Avignon et des Pays du Vaucluse (France)
- Maarit Kahila, Aalto University (Finland)
- Derek Karssenberg, University of Utrecht (The Netherlands)
- Marinos Kavouras, National Technical University of Athens (Greece)
- Richard Kingston, University of Manchester (United Kingdom)
- Eva Klien, Fraunhofer Institute for Computer Graphics - IGD (Germany)
- Thomas Kolbe, Technical University Berlin (Germany)
- Menno-Jan Kraak, Technical University Enschede – ITC  
(The Netherlands)
- Marc van Kreveld, University of Utrecht (The Netherlands)
- Antonio Krüger, University of Münster (Germany)
- Lars Kulik, University of Melbourne (Australia)
- Roger Longhorn, Geo:Connexion (United Kingdom)
- Michael Lutz, Joint Research Centre (Italy)
- Hans-Gerd Maas, Dresden University of Technology (Germany)
- Stephan Maes, Universität der Bundeswehr München (Germany)
- Bela Markus, University of West Hungary (Hungary)
- Filipe Meneses, University of Minho (Portugal)

Adriano Moreira, University of Minho (Portugal)  
Pedro Muro Medrano, Universidad de Zaragoza (Spain)  
Javier Nogueras Iso, Universidad de Zaragoza (Spain)  
Atsuyuki Okabe, University of Tokyo (Japan)  
Peter van Oosterom, Technical University Delft (The Netherlands)  
Volker Paelke, Leibniz Universität Hannover (Germany)  
Marco Painho, New University of Lisbon (Portugal)  
Dieter Pfoser, Research Academy Computer Technology Institute (Greece)  
Lutz Pluemer, Universität Bonn (Germany)  
Poulicos Prastacos, Foundation for Research and Technology, Heraklion (Greece)  
Florian Probst, SAP Research CEC Darmstadt (Germany)  
Hardy Pundt, University of Applied Sciences Harz (Germany)  
Ross Purves, University of Zürich (Switzerland)  
Martin Raubal, University of California at Santa Barbara (USA)  
Tumash Reichenbacher, University of Zürich (Switzerland)  
Femke Reitsma, University of Canterbury (New Zealand)  
Claus Rinner, Ryerson University (Canada)  
Jorge Rocha, University of Minho (Portugal)  
Maribel Yasmina Santos, University of Minho (Portugal)  
Tapani Sarjakoski, Finnish Geodetic Institute (Finland)  
Tiina Sarjakoski, Finnish Geodetic Institute (Finland)  
Johannes Schöning, University of Muenster (Germany)  
Monika Sester, Leibniz Universität Hannover (Germany)  
Takeshi Shirabe, Technical University Vienna (Austria)  
Elisabete Silva University of Cambridge (United Kingdom)  
Spiros Skiadopoulos, University of Peloponnese (Greece)  
Hans Skov-Petersen, University of Copenhagen (Denmark)  
John Stell, University of Leeds (United Kingdom)  
Kathleen Stewart Hornsby, The University of Iowa (USA)  
Juan Suárez, Forestry Commission (United Kingdom)  
Danny Vandenbroucke, Katholieke Universiteit Leuven (Belgium)  
Agnès Voisard, Fraunhofer ISST (Germany)  
Monica Wachowicz, University of New Brunswick (Canada)  
Robert Weibel, University of Zürich (Zwitserland)  
Stephan Winter, The University of Melbourne (Australia)  
Mike Worboys, University of Maine (USA)  
Bisheng Yang, Wuhan University (China)  
May Yuan, University of Oklahoma (USA)  
Francisco Javier Zarazaga-Soria, University of Zaragoza (Spain)



# Contributing Authors

## **Nathalie Abadie**

Université Paris-Est – Institut Géographique National (IGN)  
Saint-Mandé, France

## **Rafael Odon de Alencar**

Database Laboratory,  
Departamento de Ciência da  
Computação, Universidade  
Federal de Minas Gerais, Belo  
Horizonte, Brazil & SERPRO,  
Brazil

## **AliAsghar Alesheikh**

Department of Geospatial Information Systems, K.N.Toosi University of Technology, Tehran, Iran.

## **Fadi Badra**

Cemagref & UMR TETIS Montpellier, France

## **Felix Bache**

Institute for Geoinformatics,  
University of Muenster,  
Germany & 52°North Initiative  
for Geospatial Open Source  
Software, Germany

## **Thomas Bartoschek**

Institute for Geoinformatics,  
University of Muenster,  
Germany

## **Agnès Bégué**

CIRAD & UMR TETIS Montpellier, France

## **Carmen Brando**

Université Paris-Est – Institut Géographique National (IGN)-COGIT Laboratory, Saint-Mandé, France

## **Juliane Brink**

Institute for Geoinformatics,  
University of Muenster,  
Germany

## **Arne Broering**

Faculty ITC, University of Twente, The Netherlands & Institute for Geoinformatics, University of Muenster, Germany & 52°North Initiative for Geospatial Open Source Software, Germany

## **Bregje Brugman**

Delft University of Technology (OTB – Department of GIS Technology), The Netherlands

## **Bénédicte Bucher**

Université Paris-Est – Institut Géographique National (IGN)-COGIT Laboratory, Saint-Mandé, France

**Françoise Chaillou**

CERMA laboratory UMR CNRS  
Nantes, France

**Padraig Corcoran**

Department of Computer  
Science, National University of  
Ireland Maynooth. Ireland

**Rodrigo Costa Mateus**

Informatics Center, Federal  
University of Pernambuco,  
Recife, Brazil

**Ron Dalumpines**

TransLAB: Transportation Re-  
search Lab, School of Geography  
& Earth Sciences, McMaster  
University, Hamilton, Canada

**Clodoveu Augusto Davis Jr.**

Database Laboratory,  
Departamento de Ciência da  
Computação, Universidade  
Federal de Minas Gerais, Belo  
Horizonte, Brazil

**Demetris Demetriou**

School of Geography, University  
of Leeds, United Kingdom

**Laura Díaz**

Institute of New Imaging  
Technologies, University Jaume  
I, Castellón, Spain

**Patrice Dumas**

Centre International de Recher-  
che sur l'Environnement et le  
Développement (CIRED) No-  
gent-sur-Marne, France &  
CIRAD France

**Cristina Dutra de Aguiar**

Ciferri  
Computer Science Department,  
University of São Paulo at São  
Carlos, Brazil

**Corné P.J.M. van Elzakker**

Faculty ITC, University of  
Twente, The Netherlands

**Manuel Fabritius**

Fraunhofer IAIS, St. Augustin,  
Germany

**Elisabetta Genovese**

Centre International de Recher-  
che sur l'Environnement et le  
Développement (CIRED) No-  
gent-sur-Marne, France

**Carlos Granell**

Institute of New Imaging Tech-  
nologies, Universitat Jaume I,  
Castellón, Spain

**Elias Grinias**

Department of Geoinformatics  
and Surveying, TEI of Serres,  
Greece

**Stéphane Hallegatte**

Centre International de Recher-  
che sur l'Environnement et le  
Développement (CIRED) No-  
gent-sur-Marne, France & Ecole  
Nationale de la Météorologie,  
Meteo, France

**Mahdi Hashemi**

Department of Geospatial Information Systems, K.N. Toosi University of Technology, Tehran, Iran.

**Jan-Henrik Haunert**

Chair of Computer Science I,  
University of Würzburg,  
Germany

**Dirk Hecker**

Fraunhofer IAIS, Sankt Augustin, Germany

**Joaquín Huerta**

Institute of New Imaging Technologies, Universitat Jaume I, Castellón, Spain

**Christine Körner**

Fraunhofer IAIS, Sankt Augustin, Germany

**Dimitris Kotzinos**

Department of Geoinformatics and Surveying, TEI of Serres, Greece & Institute of Computer Science, Foundation for Research and Technology – Hellas, Heraklion, Greece

**Thomas Leduc**

CERMA laboratory UMR CNRS Nantes, France -

**Udo Lipeck**

Institute of Practical Computer Science, Leibniz Universität Hannover, Germany

**Ina Ludwig**

Fraunhofer Institut für Intelligente Analyse- und Informationssysteme (IAIS), Sankt Augustin, Germany

**Thiago Luís Lopes Siqueira**

São Paulo Federal Institute of Education, Science and Technology, IFSP, Brazil & Computer Science Department, Federal University of São Carlos, Brazil

**Michael May**

Fraunhofer IAIS, Sankt Augustin, Germany

**Martijn Meijers**

Delft University of Technology , OTB – Department of GIS Technology, The Netherlands

**Henry Michels**

Institute for Geoinformatics, University of Muenster, Germany

**Michael Mock**

Fraunhofer IAIS, St. Augustin, Germany

**Peter Mooney**

Department of Computer Science, National University of Ireland Maynooth. Ireland

**Roland Müller**

Fraunhofer IAIS, St. Augustin, Germany

**Christoph Mülligann**

Institute for Geoinformatics,  
University of Muenster,  
Germany

**Tomoyuki Naito**

Department of Mechanical and  
Environmental Informatics, To-  
kyo Institute of Technology, Ja-  
pan

**Daniel Nüst**

Institute for Geoinformatics,  
University of Muenster,  
Germany

**Peter van Oosterom**

Delft University of Technology,  
OTB – Department of GIS Tech-  
nology, The Netherlands

**Jens Ortmann**

Institute for Geoinformatics,  
University of Muenster,  
Germany

**Toshihiro Osaragi**

Department of Mechanical and  
Environmental Informatics,  
Tokyo Institute of Technology,  
Japan

**Thomas Ouard**

CERMA laboratory UMR CNRS  
Nantes, France

**Edzer Pebesma**

Institute for Geoinformatics,  
University of Muenster,  
Germany

**Yoann Pitarch**

LIRMM - CNRS - UM2,  
Montpellier, France

**Frans Rip**

Centre for Geo-Information,  
Wageningen University,  
The Netherlands

**Ricardo Rodrigues Ciferri**

Computer Science Department,  
Federal University of São Carlos,  
Brazil

**Sven Schade**

Institute for Environment and  
Sustainability, European Com-  
mission, Joint Research Centre,  
Ispra, Italy

**Daniel Schulz**

Fraunhofer IAIS, Sankt  
Augustin, Germany

**Angela Schwering**

Institute for Geoinformatics,  
University of Muenster,  
Germany

**Darren M. Scott**

TransLAB: Transportation Re-  
search Lab, School of Geography  
& Earth Sciences, McMaster  
University, Hamilton, Canada

**Linda See**

School of Geography, University  
of Leeds, United Kingdom &  
Institute for Applied Systems  
Analysis (IIASA), Laxenburg,  
Austria

**Monika Sester**

Institute of Cartography and  
Geoinformatics, Leibniz Universität Hannover, Germany

**Hendrik Stange**

Fraunhofer IAIS, Sankt Augustin, Germany

**Christoph Stasch**

Institute for Geoinformatics,  
University of Muenster,  
Germany

**John Stillwell**

School of Geography, University of Leeds, United Kingdom

**Alain Tamayo**

Institute of New Imaging Technologies, Universitat Jaume I, Castellón, Spain

**Maguelonne Teisseire**

Cemagref & UMR TETIS Montpellier, France

**Frank Thiemann**

Institute of Cartography and Geoinformatics, Leibniz Universität Hannover, Germany

**Theo Tijssen**

Delft University of Technology,  
OTB – Department of GIS Technology, The Netherlands

**Valéria Cesário Times**

Informatics Center, Federal University of Pernambuco, Recife, Brazil

**Maike Krause-Traudes**

Fraunhofer Institut für Intelligente Analyse- und Informationssysteme (IAIS), Sankt Augustin, Germany

**Pablo Viciano**

Institute of New Imaging Technologies, Universitat Jaume I, Castellón, Spain

**Elodie Vintrou**

CIRAD & UMR TETIS Montpellier, France

**Angi Voss**

Fraunhofer Institut für Intelligente Analyse- und Informationssysteme (IAIS), Sankt Augustin, Germany

**Jia Wang**

Institute for Geoinformatics, University of Muenster, Germany

**Hendrik Warneke**

Institute of Practical Computer Science, Leibniz Universität Hannover, Germany



# **Table of Contents**

Preface ..... **v**

List with Committees..... **vii**

List with Contributors..... **xi**

## **Spatial-Temporal Modeling and Analysis**

Spatio-Temporal Analysis of Tehran's Historical Earthquakes Trends ..... 3  
Mahdi Hashemi, AliAsghar Alesheikh

Damage Assessment from Storm Surge to Coastal Cities: Lessons  
from the Miami Area ..... 21  
Elisabetta Genovese, Stéphane Hallegatte, Patrice Dumas

Mining Sequential Patterns from MODIS Time Series for Cultivated  
Area Mapping ..... 45  
Yoann Pitarch, Elodie Vintrou, Fadi Badra, Agnès Bégué ,  
Maguelonne Teisseire

## **Road Network and Mobility Research**

A Comparison of the Street Networks of Navteq and OSM  
in Germany ..... 65  
Ina Ludwig, Angi Voss, Maike Krause-Traudes

Extension of Spatial Correlation Analysis to Road Network Spaces ..... 85  
Toshihiro Osaragi, Tomoyuki Naito

GIS-based Map-matching: Development and Demonstration  
of a Postprocessing Map-matching Algorithm for Transportation  
Research ..... 101  
Ron Dalumpines, Darren M. Scott

Modeling Micro-Movement Variability in Mobility Studies .....	121
Dirk Hecker, Christine Körner, Hendrik Stange, Daniel Schulz, Michael May	

## **GeoSensor Development and Application**

The SID Creator: A Visual Approach for Integrating Sensors with the Sensor Web .....	143
Arne Bröring, Felix Bache, Thomas Bartoschek, Corné P.J.M. van Elzakker	
An OGC compliant Sensor Observation Service for mobile sensors.....	163
Roland Müller, Manuel Fabritius, Michael Mock	
Empirical Study of Sensor Observation Services Server Instances .....	185
Alain Tamayo, Pablo Viciana, Carlos Granell, Joaquín Huerta	
Qualitative Spatio-temporal Reasoning from Mobile Sensor Data using Qualitative Trigonometry .....	211
Juliane Brink	
Connecting R to the Sensor Web.....	227
Daniel Nüst, Christoph Stasch, Edzer Pebesma	

## **Socio-Spatial Modeling and Analysis**

LandSpaCES: A Spatial Expert System for Land Consolidation .....	249
Demetris Demetriou, John Stillwell, Linda See1	
Towards a “typification” of the Pedestrian Surrounding Space: Analysis of the Isovist Using Digital Processing Method .....	275
Thomas Leduc, Francoise Chaillou, Thomas Ouard	

Modelling Umwelten .....	293
Jens Ortmann, Henry Michels	

## **Spatial Data Processing and Structuring**

Detecting Symmetries in Building Footprints by String Matching .....	319
Jan-Henrik Haunert	

Simultaneous & topologically-safe line Simplification for a variable-scale planar partition.....	337
Martijn Meijers	
Validating a 3D topological structure of a 3D space partition.....	359
Bregje Brugman, Theo Tijssen, Peter van Oosterom	
Querying Vague Spatial Information in Geographic Data Warehouses.....	379
Thiago Luís Lopes Siqueira, Rodrigo Costa Mateus, Ricardo Rodrigues Ciferri, Valéria Cesário Times, Cristina Dutra de Aguiar Ciferri	
A Scalable Approach for Generalization of Land Cover Data .....	399
Frank Thiemann, Hendrik Warneke, Monika Sester, Udo Lipeck	
<b>GI-Information Generation and Dissemination</b>	
GEOSS Service Factory: Assisted Publication of Geospatial Content....	423
Laura Díaz, Sven Schade	
Analysis of Quantitative Profiles of GI Education: towards an Analytical Basis for EduMapping.....	443
Frans Rip, Elias Grinias, Dimitris Kotzinos	
Geotagging Aided by Topic Detection with Wikipedia.....	461
Rafael Odon de Alencar, Clodoveu Augusto Davis Jr.	
Specifications for User Generated Spatial Content .....	479
Carmen Brando, Bénédicte Bucher, Nathalie Abadie	
An Empirical Study on Relevant Aspects for Sketch Map Alignment....	497
Jia Wang, Christoph Mülligann, Angela Schwering	
Topologically Consistent Selective Progressive Transmission .....	519
Padraig Corcoran, Peter Mooney	
Erratum.....	E1

