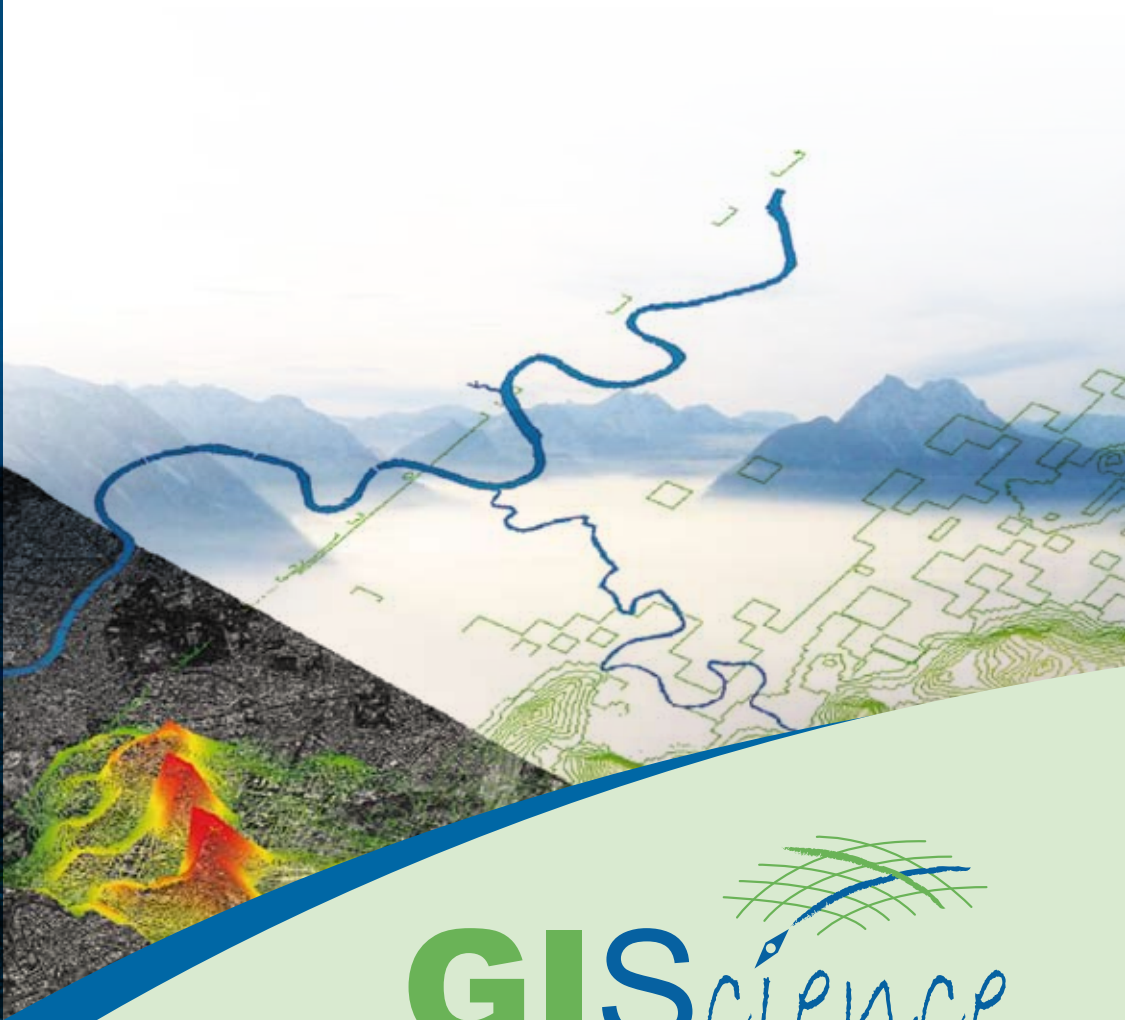**ÖAW**

Austrian Academy
of Sciences

GIScience **research report** 2007 – 2008

GIS*cience*

research unit for
Geographic Information Science

Preface

© Landespresse
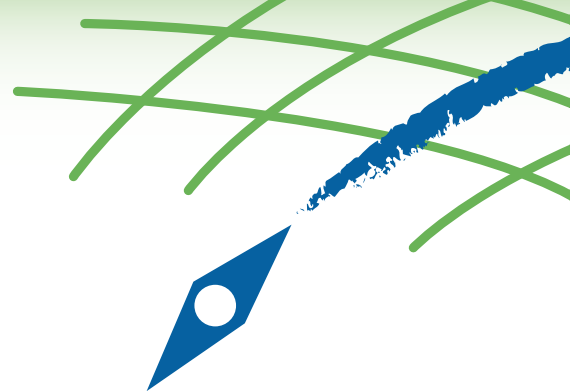
GIScience Facts

01.08.2006 – 31.07.2009
Framework Agreement:
ÖAW – Provincial Government
of Salzburg – University of
Salzburg

01.02.2007
Operational Start

30.05.2007
Official Opening

08.10.2008 - 09.10.2008
First Board Meeting
Scientific Advisory Board

The ÖAW Research Unit for Geographic Information Science was officially opened on May 30, 2007 after several months of preparations and setup at Techno-Z Salzburg which had operationally started on February 1, 2007. Such a significant development requires years of dedicated leadership and vision by many individuals and institutions, moving from an idea to decisions and onwards to implementation!

After the ÖAW had voted to complement and leverage the Salzburg-based cluster around Geoinformatics with a unit dedicated to basic research in GIScience, the Provincial Government of Salzburg, the University of Salzburg and the City of Salzburg were stepping in to provide startup funding and resources for the initial three years of operation. We are deeply grateful to everybody having facilitated and supported the launch of GIScience!

This brochure is aiming at reporting on research projects and results achieved by researchers at ÖAW-GIScience during the startup phase. It has been compiled to offer a first level of access and a broad overview, further detail is available through reports to ÖAW, AkademIS and on www.oeaw.ac.at/GIScience. These results will support the next important milestone for GIScience, a formal evaluation supporting a decision for continuation beyond summer 2009.

The GIScience research unit has achieved impressive results and noticeable impact even during its short period of existence: through numerous well-received publications and presentations, organization of symposia and workshops, public communication of science and successful evaluation and subsequent involvement in various research proposals including EU FP7, GIScience has been fully accepted into the international research community.

All this is primarily a success of the highly motivated team of researchers at GIScience. With their backgrounds in very different disciplines they all have succeeded in 'walking the talk' of trans-disciplinary research! By consolidating views and visions from a range of subjects, and doing this by not only working next to each other but with each other, this team actually has achieved a lot with very little. Congratulations, and keep exploring new ground!

Josef Strobl

ÖAW GIScience supported by:

UNIVERSITY of SALZBURG

STADT : SALZBURG

Land Salzburg
Für unser Land!

Content

***Hofrat Mag. Dr.
Gerfried Brandstetter***

*Head, Department of Science
and Research,
Provincial Government of
Salzburg*

» *Over recent years, Salzburg has
developed into one of the outstanding
R&D centers in Geographic Information
Science globally. A value chain has
been established that comprises
postsecondary education, R&D and
economic implementation within a
cluster of GIS companies. Salzburg thus
has become one of the international hot
spots in GIS. The establishment of the
GIScience Research Unit of the Austrian
Academy of Sciences has added a
basic research component in GIScience
to the regional portfolio. It provides
a fundamental enhancement that
decisively strengthens Salzburg as place
for GIS related education, research and
industry. The trans-disciplinary approach
as well as research into new concepts
of space and time will contribute to the
development of further economically
relevant applications in the field of
Geographic Information Science.*

Scientific Advisory Board

The Scientific Advisory Board (SAB) has the mission to assist the GIScience research unit with defining the strategic orientation of the research programme, identifying suitable research objectives, and providing recommendations and guidance throughout research projects.

o. Univ.-Prof. Dr. Peter Schuster
Austrian Academy of Sciences
President
> www.oeaw.ac.at

Prof. Dr. Doris Dransch (Chair)
Section 1.5: Earth System Modelling
Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences
> www.gfz-potsdam.de

Dr. Alessandro Annoni
Spatial Data Infrastructures Unit
Institute for Environment and Sustainability
Joint Research Centre –
European Commission
> ies.jrc.ec.europa.eu/spatial-
data-infrastructures-unit

Hofrat Mag. Dr. Gerfried Brandstetter
Head, Department of Science and Research,
Provincial Government of Salzburg
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Prof. Dr. Klaus Greve
University of Bonn
Institute of Geography, AG GIS
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MinR Dipl.-Ing. Dr. techn.
Stefan Kolarsky
Austrian Federal Ministry of Science
and Research
Head of Referat II/4b
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Head Office – Section Mathematics
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Prof. Dr. Otti Margraf
Leibniz Institute for Regional Geography
> www.ifl-leipzig.com

Prof. Dr. Anders Östman
University of Gävle
Division of Geomatics
> www.geomatik.se/index_eng.htm

Univ.-Prof. Dr.-Ing. Matthäus Schilcher
Technical University Munich
Institute for Geodesy, GIS and Land Management
> www.gis.bv.tum.de/

MinR Dr. Christian Smoliner
Austrian Federal Ministry of Science
and Research
*Head of Abt. II/4*
> www.bmwf.gv.at

Mission

Geographic Information Science, serving as the common ground for trans-disciplinary basic research at the ÖAW GIScience Research Unit, is understood as the foundation and keystone of the spatial component in today's information and knowledge society.

Based on fundamental concepts from Geography and frameworks from information and communication sciences, GIScience is developing theoretical concepts, methods, algorithms and strategies for modeling the spatial and temporal dimensions of the real world.

Demands for making spatial perspectives explicit arise from numerous application domains, ÖAW GIScience has decided to focus on a research programme led by the search for common ground in concepts and methods, independent from particular application logics.

This common ground of a spatial view is leveraging ubiquitous georeferencing as a key to integrate information from disparate sources, joining natural and social science inputs, combining technical with geographical approaches to achieve innovative outcomes.

Today, we are very obviously in need of crossing borders of scientific disciplines and traditions. The extent of space is one non-extensible resource our globe is offering. Thus we better manage it well to sustain our futures. GIScience is indispensable in this endeavour.
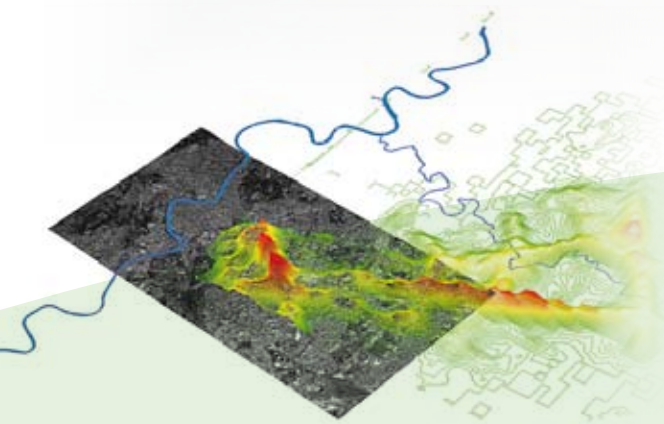
Report on Activities

2007 – 2008
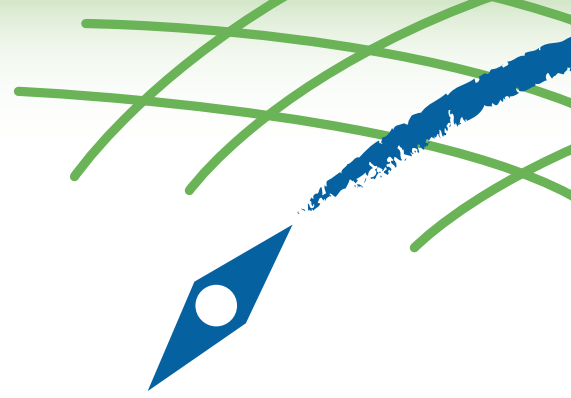
2007

In early 2007 initial work was focussed on building research teams and infrastructure, integration of junior scientists (PhD's) and the establishment of working relationships with peers from various disciplines. Due to the staff's highly motivated and scientifically advanced approaches several projects were quickly established, leading to significant early results in a number of research initiatives which are briefly summarized below.

The implementation of the stated research objectives through specific tasks is coordinated within internal as well as collaborative projects with external partners. The interdisciplinary composition of the GIScience research team is a critically important asset, bringing social and economic scientists together with natural science and technology researchers.

The research group 'analytical methods' started out with rule-based methods for image segmentation and classification. High resolution remote sensing imagery thus yielded land use and vegetation types, which served as the foundation for documenting spatiotemporal change (like urban development), and for simulation scenarios of succession and forest line / land cover changes. Key to these new results from information extraction techniques is the integration of collateral data sets: in addition to multispectral reflectance land ownership, terrain types and topographic entities support the identification of features from imagery.

The real world of course is multi-dimensional, even though traditional cartography might suggest a flat view of the world. 3D and 4D data models are among our core areas of interest, in geological and biological application contexts, but increasingly representing built environments (for engineering and construction). Particularly in the latter area new projects are emerging for large scale urban models.

Another set of interesting results starts to emerge from work related to tracking individual mobility and communication technologies. Hypotheses linking social and behavioural parameters with the use of information and communication technologies lead to research questions which are currently being tackled in two doctoral theses.

Another project with significant potential for innovative science is jointly pursued with researchers at MIT: based on a highly integrated digital city model the concept of a 'Real Time City' opens up new approaches to population and mobility research, as well as for behavioural analysis.

As an Austrian contribution to the International Polar Year (FERMAP-IPY) we accepted responsibility for the 'Schools on Ice' initiative. Here we reach out from Global Change research in Greenland to Austrian high school students doing field work on a glacier on the Dachstein..

Research projects are continuously translated into communication of research results and public relations:

- At the annual AGIT symposium at Salzburg University's Science Faculty an exhibit booth was designed to display research posters from other ÖAW departments, showcasing their GIS-related research outcomes.
- The 'Geoinformatics Forum Salzburg' was co-organised in a leading capacity as a strongly international venue for leading researchers.
- In July 2007 a working group symposium for 'Computer Oriented Geology' (COG)

was dedicated to hydro(geo)logical modelling and GIS-based integration, analysis and modelling of geological data.

- Hundreds of high schools students participated in the 'Global GIS Day' in November 2007, fascinated by contributions from the GIScience unit.
- The ongoing 'Geoinformatics Colloquia' series is co-sponsored by GIScience.
- During the official opening of GIScience highlights from our research programme were presented, receiving a high level of media attention.

2008

2008 was the first full year of operations for the GIScience Research Unit. Most members of the current staff had joined the research team and were developing joint projects guided by the overall research programme. Based on the broad range of expertise and research experience by GIScience staff, several initiatives regarding externally funded co-operative research projects were discussed.

Our potential in this respect was limited by the fact that planning beyond the July 2009 horizon of GIScience' existence required contingency scenarios for all partner commitments. Still, it was possible to not only continue current collaborative projects based on our core research topics, but to enter several new partnerships enhancing the depth and width not only of research themes, but the research team as well.

One particular highlight in 2008 of course was the launch of our participation in a major FP7 project within the eContent+ framework. NatureSDIplus is contributing to the European Commission's INSPIRE initiative; developing, testing and prototyping detailed specifications for a unified data model and services for the documentation of protected areas and species. This project is a cornerstone of the SDI research area in our mid-term programme and therefore was pursued and successfully acquired despite the above mentioned limitations in GIScience's current period of existence.

Another focal theme of research activities emphasized in 2008 is the trans-disciplinary work on 3D models, structures and analyses across several scalar orders of magnitude. These range from geological features to petrographic-lithological objects, and explore the human-biological domain in order to add temporal dynamics as a fourth dimension. While this is not a 'traditional' geospatial domain, analogies across scale ranges facilitate the development of generalized concepts, particularly for multidimensional analyses.

Of particular value is the integration of researchers from very diverse backgrounds, confronting social and natural science, technical and basic science research methods and traditions with common research themes from generic spatial domains. Reaching out across disciplines has proven to be a major creative asset in our research team, offering new ideas and innovative approaches by cross-fertilizing scientific development.

A major new initiative was launched in the area of global change research, leveraging a multi-dimensional time series database of country-level indicators: complex methods of exploratory analysis to identify transitional states in demographics, economies and technologies provide new insights into patterns of development. These observations likely will provide further results by explicit 'spacialisation' of previously non-georeferenced monitoring data sets.

Communicating research results, enabling international exchange of ideas, and initiating new contacts and collaboration again was important for increasing the visibility and recognition of GIScience as a new research entity:
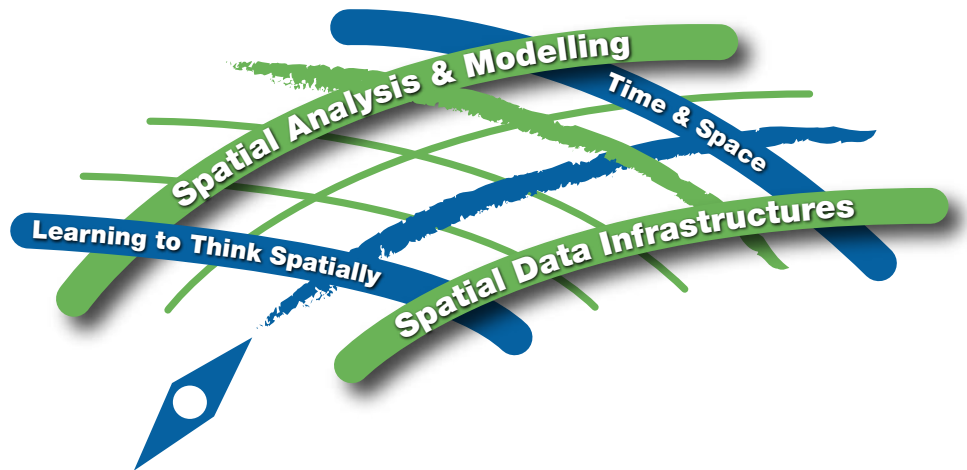
- Leading the programme development of the GeoInformatics Forum, Computer-Oriented Geology and Learning with Geo-Information conferences.
- Contribution in public-access-to-science events like GIS Day, Lange Nacht der Forschung and the 20th anniversary of Techno-Z Salzburg.
- Taking the lead in curriculum development and mobility programs across the CEE region has helped with building a dense network of intensive collaboration in GIScience.
- Welcoming and hosting numerous visitors and delegations from a range of countries and presenting highlights from current research.

» *The GIScience Research Unit is tightly integrated with the 'GIS Research Cluster', made up from research institutions in the industry-led 'GIS Cluster Salzburg'. Between the Centre for Geoinformatics (Salzburg University), the iSPACE Research Studio (ARC), Salzburg Research and GIScience numerous cooperations and joint projects are contributing towards a critical mass of Geographic Information Science researchers at the Salzburg hub for GIScience.*

Josef Strobl
GIScience Director

Research Programme

GIScience has started with a mid-term research programme providing the required focus and direction for a small research unit, particularly with the given trans-disciplinary approach where researchers from diverse backgrounds need to develop a common vision.

This programme has served us well and has already produced excellent results, it will therefore be continued with minor adjustments towards a 5-year horizon. Projects are proposed or identified as operational building blocks with the aim of supporting our overall programme.

Within the wide framework of Geographic Information Science, the following core areas have been chosen based on their critical importance for progress due to application demand, their potential for significant outcomes on an international level, and their suitability for mixed research teams from a range of different disciplines:

Our initial two-year integrated research programme is focussed on the advancement of key topics in Geographical Information Science. In close cooperation with international partners we aim at achieving substantial progress in two major areas critical for current and future developments across GIS application domains:

Spatial Analysis and Modelling

Spatial Data Infrastructures

In addition to these two research areas the ÖAW-GIScience team emphasizes transversal themes:

Time & Space

Learning to Think Spatially

Josef Strobl

AREA 1:
Spatial Analysis and Modelling

Research questions focus on the extraction of new information from spatial observations through application of advanced analysis methods, through the development and implementation of models and the simulation of different scenarios. Particular topics to be addressed in projects are:

- Segmentation-based information extraction from e.g. RS imagery.
- Multidimensional geostatistics and the modelling of dynamic processes.
- Analysis of mobility patterns and spatial behaviour.

AREA 2:
Spatial Data Infrastructures

Building fully spatially enabled ‚information highways‘ is a requirement for better management of our societies and environments. Interoperable, services-oriented distributed architectures consist of numerous components working together as an ‘infrastructure’ supporting multiple uses. Our contributions are aiming at:

- Specification and evaluation of advanced multi-dimensional data models.
- The integration of real-time sensor input.
- Connecting global (change) databases with SDI architectures.

These core research areas are enhanced and complemented by two transversal research themes, designed to facilitate a tighter integration on the level of individual projects which are required to contribute to at least one research area plus one transversal theme:

Time & Space

Traditionally, these meta-dimensions have not been treated from integrated perspectives. Full temporal enabling of data models and analytical strategies is indispensable for spatial monitoring, analysis of mobility and the rapidly changing dynamics in natural and social spaces.

Learning to Think Spatially

Successful communication of spatial knowledge is required across all segments of society. Starting from cognitive aspects, facets of situated learning and interaction with visual stimuli lead to research questions important for a (Geo-) Information Society.

Spatial Analysis and Modelling

Research questions address segmentation-based information extraction from remotely sensed imagery, multidimensional geostatistics and the modelling of dynamic processes. Methods for flexible regionalisation, the analysis of mobility patterns and work with multi-scalar data receive special consideration.

Time and Space

Traditionally, these meta-dimensions have not been treated from integrated perspectives. Full temporal enabling of data models and analytical strategies is indispensable for spatial monitoring, analysis of mobility and the rapidly changing dynamics in natural and social spaces.

Learning to Think Spatially

Successful communication of spatial knowledge is required across all segments of society. Starting from cognitive aspects, facets of situated learning and interaction with visual stimuli lead to research questions important for a (Geo-) Information Society.

Spatial Data Infrastructures

Building spatially enabled 'information highways' is a requirement for better management of our societies and environments. Our contributions aim at the specification of advanced multi-dimensional data models, the integration of real-time sensor input and open interfacing across system architectures.

Prof. Dr. Albert Duschl

Vice Rector of Research, University of Salzburg

» *Geoinformatics has emerged as a major research area within the University of Salzburg. As Vice Rector of Research I congratulate the scientists involved to their impressive contributions towards this discipline. Geoinformatics has a strong translational component which has allowed to establish strategic cooperations with other partners, in particular the ÖAW. We highly appreciate the work of ÖAW-GIScience and look forward to further joint development of this important field.*

Director of ÖAW-GIScience

Josef Strobl

Academic and Professional Functions

- Corresponding Member of the Austrian Academy of Sciences
- Associate Professor at the University of Salzburg, Department of Geography and Geology
- Chair Curricular Commission Geography at the University of Salzburg
- Director of Z_GIS, Centre for Geoinformatics at the University of Salzburg
- Founder and Chair of UNIGIS Salzburg, Co-Chair UNIGIS International
- Programme Chair of the conferences: AGIT, GI_Forum, and Learning with Geoinformation
- President of Austrian Association for Geographical Information
- Vice-president of "Gesellschaft für Geoinformatik"
- Member, GISIG Executive Committee
- Board of Directors, GSDI Association
- Visiting Professor: MSGIS, University of Redlands
- Honorary Professor: Kyrgyz State University of Construction, Transportation and Architecture

Awards

- 2006 Special Achievement in GIS Award
- 2002 Geographic Science Award

Editorial Board

- International Journal for GIS & RS
- Geocarto International
- GIS Science, GIS Business
- International Journal of Geoinformatics
- Journal of Geomatics
- Transactions in GIS
- "Österr. Zeitschrift für Vermessung und Geoinformation" (vgi)
- GIS Development

The initial GIScience team development was focused on building research teams and an effective organisational infrastructure. The integration of junior scientists (PhD's) and the establishment of working relationships with peers from various disciplines received high priorities. Due to our staff's highly motivated and scientifically advanced working style, several research projects were quickly established, leading to significant early results in a number of research initiatives and publications.

The GIScience Team currently includes the GIScience director, 5 senior scientists, 1 junior scientist and 3 PhD students working on basic GIScience research. Their expertise ranges from Geoinformatics, Geodesy, Spatial Economics, Geography, Geography Education, Ecology, Geology, Technical Physics, and Environmental Technology to Global Change. The team is complemented through one organisational manager and one IT expert. Several project staff members hold a temporary contract with the Academy and assist the core scientific team through their specific expertise.

Gilbert Ahamer, Dr.techn.
Technical Physics, Environmental Technology & Global Change. Research focus on analysis of geospatial systems, global change dynamics and regional sustainability.

Barbara Brunner-Maresch, Mag.
Organisation, Controlling, Reporting.

Adrijana Car, Dr.techn.
Research focus on models of space & time, supporting spatial analysis & spatial data infrastructures.

Filippo Dal Fiore
PhD candidate
Spatial Economics & Geoinformatics. Thesis on spatial behaviour analysis and ubiquitous access to information.

Florian Fischer, Dipl. Geogr.
PhD candidate
Geography & Geoinformatics. Thesis on collaborative information sharing and spatial practice in location based social networks.

Sabine Hennig, Dr.
EC project:
Nature-SDIplus – Best Practice
Network for SDI in Nature Conservation.

Matthias Möller, Prof. Dr.
Geography & Geoinformatics.
Research: applied remote sensing,
photogrammetry and image
analysis.

Karin Hörmanseder, Mag.
EC project:
Nature-SDIplus – Best Practice
Network for SDI in Nature Conservation.

Claudia Schmidt, Mag.
Technical infrastructure.

Thomas Jekel, Dr.
Geography & Geography Education.
Research: Geoinformation in education
& inclusion of social space in spatial
decision support systems.

Josef Strobl, Prof. Dr.
Director of ÖAW-GIScience
Geography & Geoinformatics. Research
focus on spatial systems architectures &
spatial analysis, with interests in digital terrain
modelling and planning for sustainable
societies.

Hermann Klug, Dr.
EC project:
Nature-SDIplus – Best Practice
Network for SDI in Nature Conservation.

Gudrun Wallentin, Mag. (MSc)
PhD candidate
Ecology & Geoinformatics. Thesis on an
individual based modelling approach of
landscape change dynamics at the alpine
tree line.
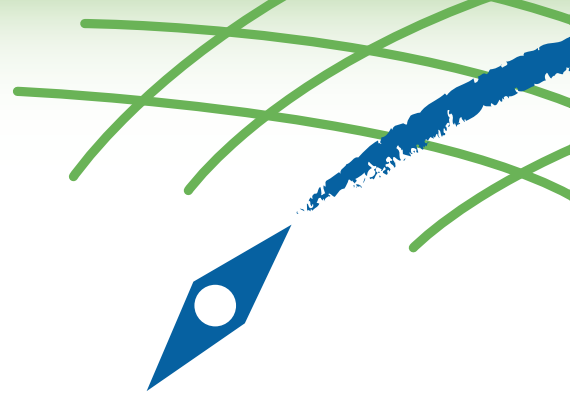
Robert Marschallinger,
Univ.-Doz. Dr.
Geology & Geoinformatics. Emphasis on
geometrical and cell based 3D modelling,
process simulation and visualisation.

Fritz Zobl, Mag. MSc (GISc)
Technical Geology & Geoinformatics. Spatial
Data Infrastructures, 3D modelling: CAD
based geometric Modelling and cell-based
(Voxel) modelling and visualisation.

Project Highlights

GIScience

On the following pages current projects are highlighted. Each of these project highlights emphasises its position within the research programme and offers a brief summary with research focus and selected publications.

Spatial Analysis and Modelling

- GeoMS
- GeoSMT
- GeoNT
- OBIA
- Landscape Change Modelling

Time & Space

- Global Change
- Modelling Mobility
- Real Time City
- Spatial Behaviour
- Time & Space

Spatial Data Infrastructures

- European SDI
- Nature-SDIplus
- GeoICT & Society
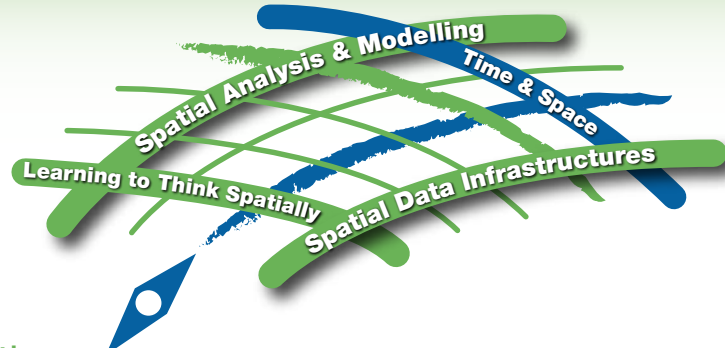- SDI & GeoObjects

Learning to Think Spatially

- CEEPUS
- GI_EDU
- GIST-CroHE
- Schools on Ice

GIScience Conferences
GI_Forum
Learning with Geoinformation
COG

Space and Time in GIScience

Exploring the Cognitive, Social and Operational Aspects of Space and Time in GIScience

Position within the Research Programme
A team within the GIScience Research Unit explores the cognitive, social and operational aspects of space and time in GIScience, issues that are at the centre of research debate in the GIScience community. Our work includes models of both social and physical space and their consequences for spatio-temporal analysis and spatial data infrastructures.

Adrijana Car
with contributions from
Filippo Dal Fiore
Florian Fischer
Thomas Jekel
Robert Marschallinger
Josef Strobl
Gudrun Wallentin
Fritz Zobl

**> www.oeaw.ac.at/GIScience/projects**

Research Focus

Space and time are intrinsic properties of geographical phenomena but they have rarely been treated in an integrative manner. However, full temporal enabling of data models and analytical strategies is indispensable for spatial monitoring, analysis of mobility, and the modeling of dynamic processes. Applications of interest include OpenGIS and Spatial Data Infrastructure (SDI), dynamic and mobile GI, public participation GIS and Spatial Decision Support Systems as well as learning environments with GI.

Our focus is on conceptualization and formalization of space and time and thus emphasizes the interdisciplinary approach at the GIScience Research Unit.

Approach

We investigate how space and time are conceptualized in application areas as mentioned above, and how well the existing models of space and time meet their needs. This investigation is expected to identify gaps, and analysis of these gaps will result in improved spatio-temporal concepts, i.e. ontologies.

Ontology of space-time captures the nature of spatial and temporal dimensions and their unique interaction, and is one of the main topics on a research agenda of the GIScience community. Concepts which are both spatial and temporal – such as motion – require greater knowledge of these dimensions in order to develop more effective data structures, and in turn analysis tools.
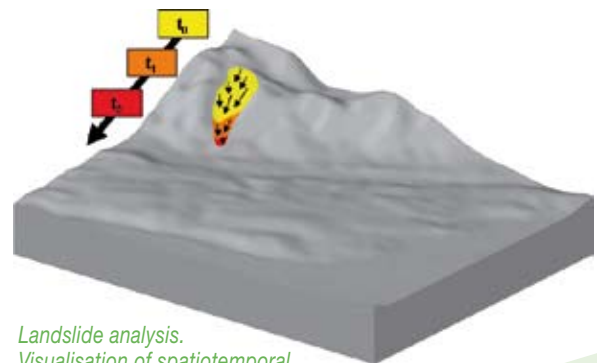
Landslide analysis.
Visualisation of spatiotemporal mass movements and deformations of a landslide in alpine region (Fritz Zobl)
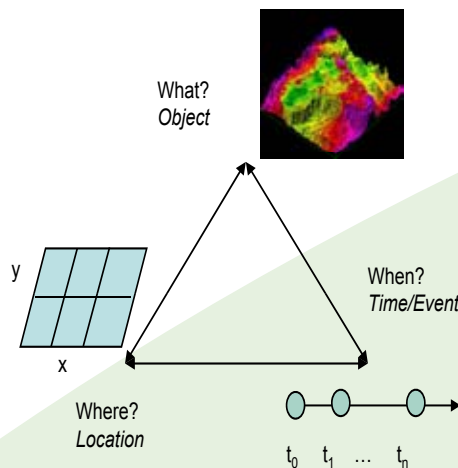
Triangle identifying the What? Where? When? of GI

Ongoing Research

At the GIScience unit there are a number of ongoing projects that are treated as case studies and investigated particularly from a temporal perspective.

One of our projects deals with revealing people's presence based on cell phone data. It is an explicit real time geography project with focus on analysis of mobility and development of ontology for potential mobile and location-aware service applications. A more general question asked here is how well existing (spatio-) temporal concepts such as the ISO Temporal Schema or Time Geography support real time geography.

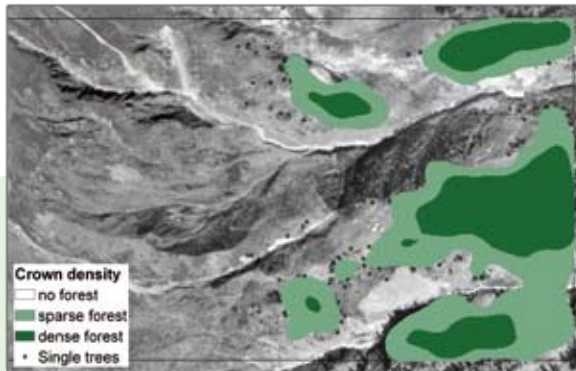*A view of Amsterdam based on cell phone calls (Filippo Dal Fiore)*

Another project focuses on spatio-temporal modeling of natural reforestation. Simulation of the forest crown growth and the analysis of its underlying ontology is expected to offer further insight to temporal uncertainty and discovery of spatio-temporal patterns.

Landslide events are complex geological and geomorphological processes that are one of the major hazards causing loss in lives and property. Deeper understanding of landslides needs complex spatiotemporal analysis involving multitude of factors. Geological, geomechanical and hydrological

Living and Acting in Geo-mediated Spaces (Florian Fischer)

properties as well as spatiotemporal changes of the landslide area require systematic study in order to evaluate the level of hazard and to design a monitoring or warning system.

The last of our projects, 3D modeling and visualization in the field of medicine, indicates strong needs for a true 4D, spatio-temporal modeling and analysis toolbox. Modeling discrete objects as points vs. modeling true 3D objects can be seen as 3D+Time vector approach vs. continuous variation of an attribute value in a voxel model. An underlying model to be developed is expected to allow object's dynamic behavior to be stored as a function of time using appropriate indexes, e.g. development of lesia.

Currently we work on two papers: the first one is related to the study how well existing spatio-temporal concepts support real time geography applications such as emergency services; the other paper focuses on studying spatio-temporal ontology used in simulating forest re-growth attempting to unveil emergence of spatio-temporal patterns.

Forest, 1954

Crown density
- no forest
- sparse forest
- dense forest
- Single trees

Forest, 2006 - "baseline" scenario

Crown density
- no forest
- sparse forest
- dense forest
- Single trees

Spatio-temporal modeling of natural reforestation (Gudrun Wallentin)

Selected Publications

WALLENTIN, G., E. TASSER, U. TAPPEINER & J. STROBL (2007). Reforestation of abandoned alpine pastures in Ötztal, Tirol – spatio-temporal modelling of plant succession. Managing Alpine Future, 2007, 15. - 17. Oktober 2007

MARSCHALLINGER, R. (2008). Geostatistical Space-Time Interpolation Used to Homogenise Hydrological Monitoring Data. In: Car, A., G. Griesebner and J. Strobl, Eds. Geospatial Crossroads @ GI_Forum'08: Proceedings of the Geoinformatics Forum Salzburg. Heidelberg: Wichmann, 190-198.

BRUNNER FK, ZOBL F, GASSNER G. (2003): On the Capability of GPS for Landslide Monitoring, FELSBAU 21/2: 51 - 54

CAR, A., G. GRIESEBNER and J. STROBL, Eds. (2008). Geospatial Crossroads @ GI_Forum'08. Proceedings of the Geoinformatics Forum Salzburg. Heidelberg, Wichmann.

CAR, A., G. GRIESEBNER and J. STROBL, Eds. (2007). Geospatial Crossroads @ GI_Forum. Proceedings of the First Geoinformatics Forum Salzburg. Heidelberg, Wichmann.
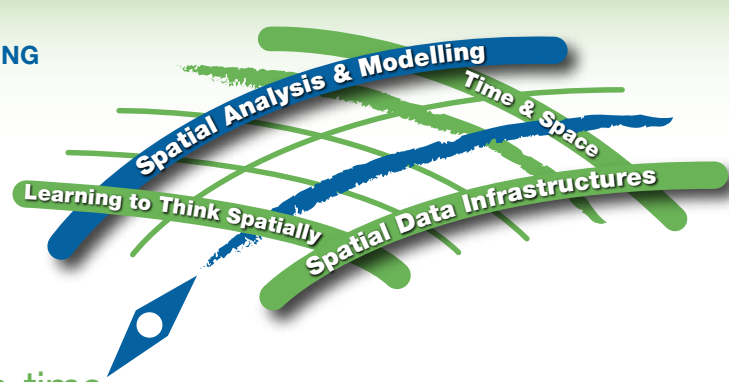
GeoMS

Geostatistical space-time characterisation of Multiples Sclerosis lesion patterns

Position within the Research Programme

Geostatistics is a universal toolbox to analyse, model and simulate natural micro-, macro- and megastructures in space and time. Object based image analysis mimics human visual image interpretation in applying definable, external knowledge to image data. The GeoMS project aims at combining advanced object based imaging and geostatistical methods for the spatio-temporal analysis and simulation of the cerebral damage related to Multiple Sclerosis.

**Robert Marschallinger**

Project Partner

MS centre at the Christian-Doppler-Klinik Salzburg

> www.oeaw.ac.at/GIScience/projects

Research Focus

Multiple sclerosis (MS), the most frequent neurological disease of young adults in Europe and North America, affects the central nervous system (CNS) by attacking the myeline sheaths of nerve tissue. In the brain and spinal chord, MS is typically expressed as mm to cm wide demyelinised lesion volumes, where nervous signals are drastically attenuated and slowed. Many of the dysfunctions of MS patients can be related to the location of MS lesions in the CNS. Magnetic resonance imaging (MRI) is the state-of-art technique for visualising MS related cerebral damage. Despite the vast literature on MS lesions and their extraction from MRI scans, there is only little knowledge about the 3D topological arrangements of MS lesion patterns, their evolution and disease context.

Approach

The GeoMS project pools the heterogeneous knowledge of GIScience geoinformatics and image processing capacity as well as radiologists and neurologists from the Salzburg based Christian Doppler Klink (CDK). The CDK patient database provides MRI scans of selected MS patients as input data for the study. A work flow and methods are being developed for fully automatic segmentation, by object based image analysis ("OBIA"), of MS lesions from multispectral, 3D+t MRI data. The derived 3D+t lesion pattern models are cycled among the project team, thereby assuring interdisciplinary, geoinformatical and medical check up of results.
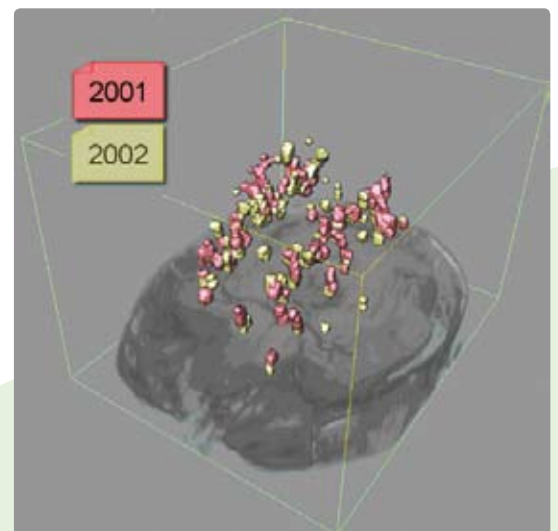
3D+t model of MS lesion development in brain. Patient with heavily progredient MS, lesion development during 1 year (yellow volumes) as compared with pre-existing lesions (red volumes)
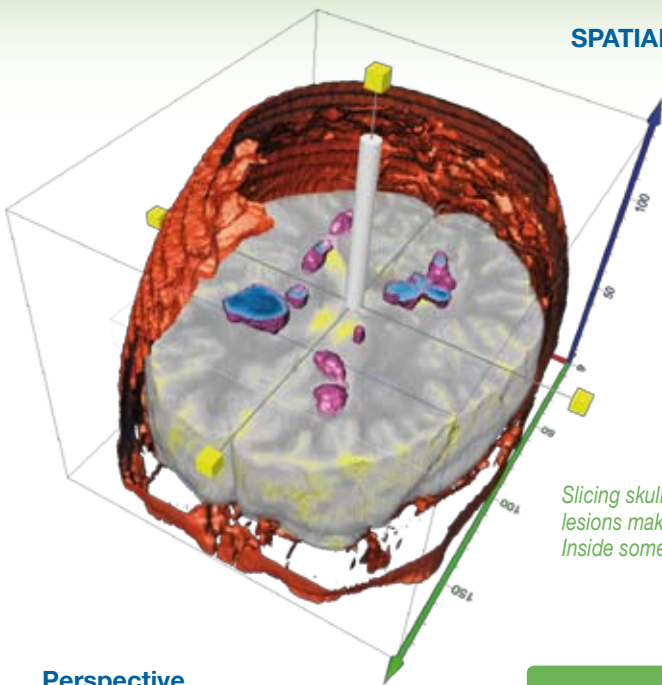
Slicing skull, brain and MS lesions. In this case, just a few but big lesions make up a different 3D pattern as compared with Fig. 1. Inside some lesions, tissue degeneration is visible
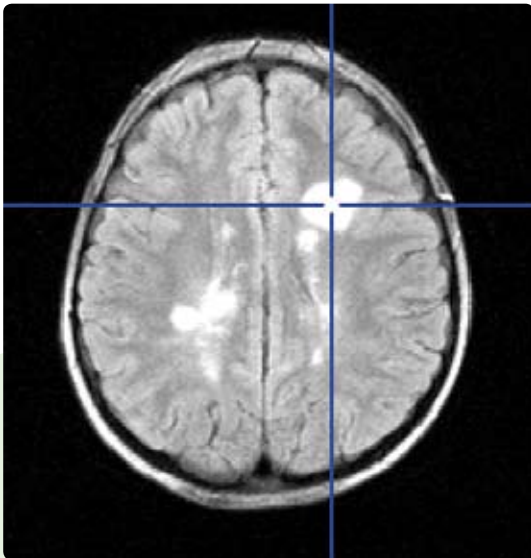
Perspective

The geostatistical analysis and simulation of MS lesion patterns is a quantitative basis for researching possible correlations of different 3D MS lesion patterns with different MS disease progression types as well as changes in the evolvement of MS lesion patterns in the light of recent, high performance MS medication.

One MRI slice (FLAIR sequence)

» *The highly interdisciplinary GeoMS research project links recent advances in two research fields, which, at first sight, lack interference: geosciences and medicine. In geosciences, computer modelling yields detailed representations of the complex surface and subsurface processes of the earth. Medical imaging, with magnetic resonance tomography (MRT) a state-of-art technology, provides a large data pool of disease induced tissue changes; a well-known example are MS lesions. To efficiently support clinical interpretation, besides a high quality 3D visualisation, MS process modelling has to account for the quantitative reporting of lesion changes in the light of MS medication. In the case of MS induced tissue degeneration, merging geoinformatics and medical imaging enables the three dimensional, quantitative documentation and modelling of the course of disease, based on MRT investigations. This is a basis for new awareness of MS progression groups, medication efficiency and, in the long run, the relationship of MS induced morphological changes and psychological patient status. The research project uses the Christian-Doppler-Klinik MS patient data base to establish 3D process models of MS disease progression, adapted from longitudinal and cross-section studies.*

Hofrat Prim. Univ.-Prof. Dr. G. Ladurner
Christian-Doppler-Klinik Salzburg

> www.christian-doppler-klinik.at

Selected Publications and Presentations

MARSCHALLINGER, R., Golaszewski, S., Kraus, J., Kronbichler, M., Kunz, A., Hofmann, P. (2009) Multiple sclerosis: a multi disciplinary approach to the analysis, 4D modelling and spatiotemporal simulation of lesion pattern evolution. Proceedings SEECCM 2009 (Rhodes), accepted.

Presentation at Lange Nacht der Forschung: Einführung MS und MRI, interaktive Darstellung von 4D-Modellen und -Simulationen der pathologischen Veränderungen im Gehirn. 8.11.2008, Christian Doppler Klinik, Salzburg.
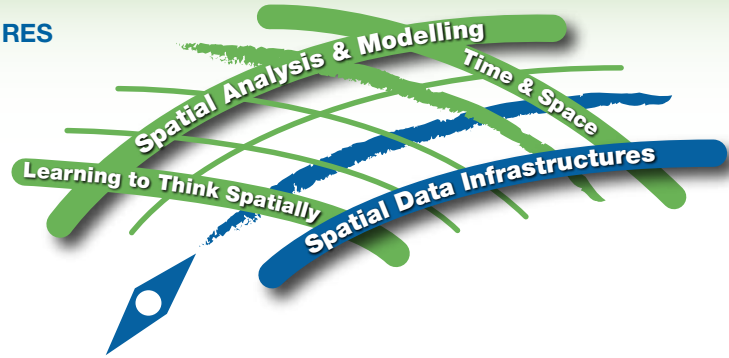
GeoICT & Society

Everyday adoption of geospatial media in urban environments

PhD projects at GIScience

As one partner in the Salzburg multi-institution doctoral programme in GIScience, we are contributing to the advancement of science and the qualification of junior scientists through highly innovative PhD projects integrated with the GIScience research programme.

Florian Fischer

Project Partners
Department for Geography and Geology, University of Salzburg, Heidelberg Mobil International GmbH

Cumulative (paper based) PhD at the University of Salzburg

Supervisors
Prof. J. Strobl (University of Salzburg and GIScience Research Unit), Prof. A. Koch (Department for Geography and Geology, University of Salzburg)
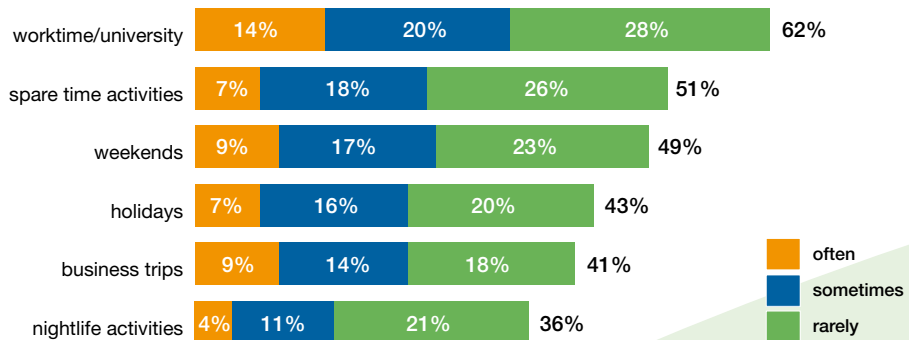
> www.oeaw.ac.at/GIScience/projects

Position within the Research Programme

This PhD-project is focused on urban informatics, the application of location and mapping technologies in urban environments. Within the Research Unit GIScience it links to the primary research field "Spatial Data Infrastructures" (SDI) as well as it touches the transversal research theme "Learning to Think Spatially".

Research Focus

SDIs have been increasingly interwoven with general information systems which lead to a multitude of mapping mash-ups that combine spatial data and other data sources. Together with modern location and communication technology, SDIs are an enabling technology for embedded urban computing and a core technology of the (Geo-)Web 2.0. The integration of geospatial computing and location technologies into everyday urban settings and lifestyles are considered to have an enor-

When do you use Plazes.com? (N=779)

	often	sometimes	rarely	total
worktime/university	14%	20%	28%	62%
spare time activities	7%	18%	26%	51%
weekends	9%	17%	23%	49%
holidays	7%	16%	20%	43%
business trips	9%	14%	18%	41%
nightlife activities	4%	11%	21%	36%

Legend:
- often
- sometimes
- rarely

Usage of geospatial computing, e.g. Plazes.com

*Geo-communication using
Microsoft Virtual Earth*

mous impact on the contemporary urban fabric. However it is less the change of urban form by the implementation of urban information infrastructures but the impact they will have on people in urban environments and their spatial behaviour.

Approach

My research grounds is based on the media-geographical ascertainment of an inextricable interdependency between space and media. Kevin Lynch's "The Image of the City" picks out habitual interactions with the built urban environment to be influential on the perception of the city. Whereas media-geography takes into consideration immaterial cues as well, like in geospatial media through which we form our spatial perceptions and spatial knowledge. According to modern theoretical conceptions in Human Geography the active appropriation and perception of both material and mediated spaces drive subjective entanglements of meaning,

understanding of places and spatial behaviour. Thus reflexive methods are required in order to approach the impact of geo-communication on the urban fabric. Consequently I will examine the individual appropriation of certain types of geospatial media within reception-focused interviews.

Perspective

A survey about spatio-temporal contexts of geo-social media has been conducted in 2008. The results will be published in 2009 as wells as I will conduct several dozens reception-focused interviews with users of geospatial media in Salzburg, Heidelberg and Berlin. This PhD-project will contribute to a theory of usage and effects of geospatial media. It will give detailed insight into the impacts of information and communication technology in urban society and holds practical relevance for the evaluation and utilization of business models for location-based transactions.

Selected Publications

FISCHER F. (2008): Location Based Social Media – Considering the Impact of Sharing Geographic Information on Individual Spatial Experience. In: Car A., Griesebner G. a. J.Strobl (Eds.): Geospatial Crossroads @ GI_Forum '08. Proceedings of the Geoinformatics Forum Salzburg, pp. 90-96.

FISCHER F. (2008): Implications of the usage of mobile collaborative mapping systems for the sense of place. In: Schrenk M. et al. (Eds.): REAL CORP 008: Mobility Nodes as Innovation Hubs. Proceedings of 13th International Conference on Urban Planning, Regional Development and Information Society, pp. 583–587.

Landscape Change Modelling

Individual based modelling of the alpine tree line dynamics
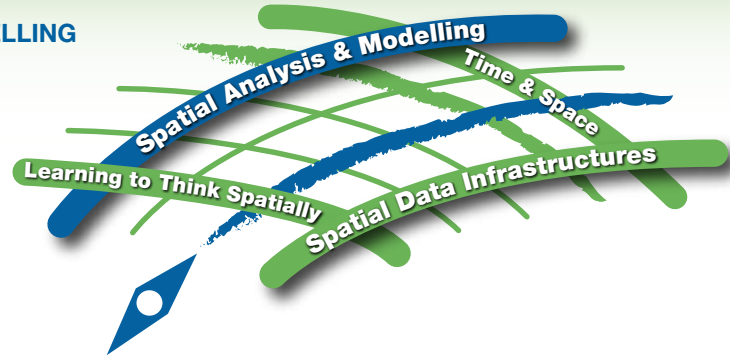
PhD projects at GIScience

As one partner in the Salzburg multi-institution doctoral programme in GIScience, we are contributing to the advancement of science and the qualification of junior scientists through highly innovative PhD projects integrated with the GIScience research programme.

Gudrun Wallentin

Project Partners
University of Innsbruck, Department of Ecology

Cumulative (paper based) PhD, at the University of Innsbruck

Supervisors
Prof. U. Tappeiner (Institute for Ecology, University of Innsbruck),
Prof. J. Strobl (University of Salzburg and GIScience Research Unit)

> www.oeaw.ac.at/GIScience/projects

### Position within the Research Programme

This PhD thesis focuses on questions aiming at process-pattern relationships in Landscape Ecology, using an individual based modelling approach. The project is thus embedded in the primary research field „Spatial Analysis and Modelling" at the OeAW GIScience Research Unit. Methodologically, in this PhD project new ways of analysing spatio-temporal patterns – a major research area in GIScience – are explored. This approach links the thesis to the transversal research theme in „Space and Time".

Research Focus

Tree lines are amongst the most dynamically changing ecosystems in the Alps. In the context of land use and climate change the up-slope shift of the alpine tree line is currently considered as one of the „hot topics" in Alpine Landscape Ecology. Analogous to agent based models applied in the social sciences, individual based models simulate landscape patterns based on local processes and interactions of individual organisms. Unlike descriptive modelling approaches individual based models are tools for the analysis of causal process-pattern relationships in order to explain and predict the genesis of landscape patterns. Geocomputational methods, applied to open research questions in Landscape Ecology, make this work a strongly interdisciplinary one.

Study area in the mountain range above the village of Längenfeld, Ötztal valley in the Austrian Central Alps
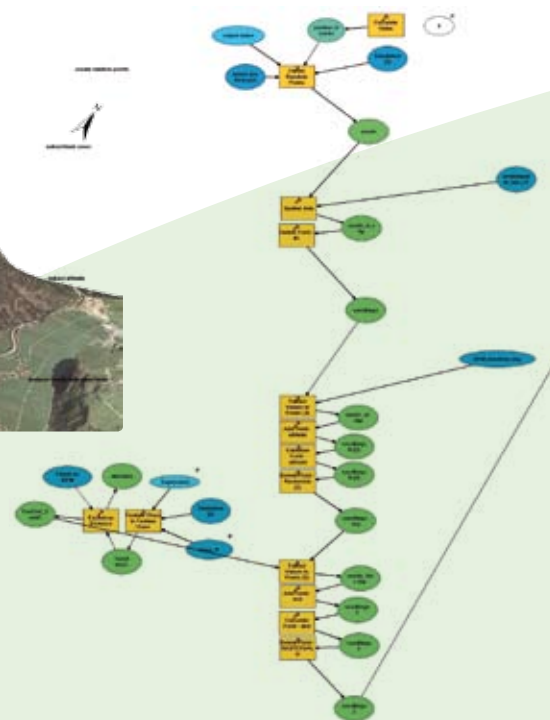
A small larch tree at the current tree line in Ötztal study area

Approach

A new, spatially explicit, and individual based model of the alpine tree line ecotone – called TREELIM – is developed to achieve a better understanding of the spatio-temporal tree line dynamics, to identify the factors driving the dynamics, and to develop a sound basis for future predictions of the tree line location.

Real-world patterns derived from a time series of remotely sensed imagery are used as model input and for model validation. In a pattern oriented modelling approach, a set of multiple patterns observed in the real system at different scales and hierarchical levels are compared to the model output. In model experiments parameters are changed systematically to identify the key factors that are responsible for the emergence of tree line patterns.

The implementation of the conceptual TREELIM model is realised in two ways: using ESRI's ArcGIS Modelbuilder for developing an individual based model is considered a new approach. This implementation method is cross-validated with the help of the well-established modelling framework „NetLogo".

Future outlook

Future research aims at the refinement of the model validation and parameter fitting process. Presently, spatial patterns produced by the model are compared to real world patterns at a certain point in time. In a new approach the evolution of spatial patterns through time will be investigated, taking spatio-temporal rather than just spatial patterns as a benchmark for model testing. This approach links to the „Space and Time" research focus at the GIScience Research Unit.
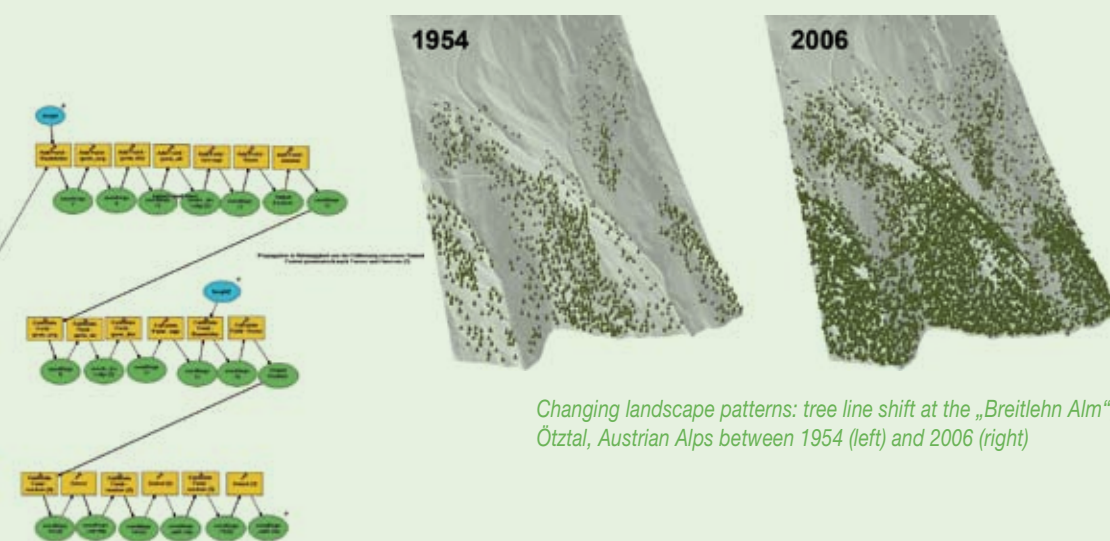
Changing landscape patterns: tree line shift at the „Breitlehn Alm", Ötztal, Austrian Alps between 1954 (left) and 2006 (right)

A flow diagram of the submodel for seed dispersal, constructed with ESRI ModelBuilder

Selected Publications

WALLENTIN, G., U. TAPPEINER, J. STROBL & E. TASSER (2008), Alpine tree line dynamics: an individual based model. Ecological Modelling Nr. 218(3-4), p. 235-246. Impact Factor: 2.077

WALLENTIN, G., E. TASSER, U. TAPPEINER & J. STROBL (2007), Reforestation of abandoned alpine pastures in Ötztal, Tirol – spatio-temporal modelling of plant succession [poster]. Managing Alpine Future, 2007, 15. - 17. Oktober 2007
1st poster prize

Spatial Analysis & Modelling
Time & Space
Learning to Think Spatially
Spatial Data Infrastructures

Spatial Behaviour

Understanding mobility
in an ubiquitously connected society,
based on econometric modelling.
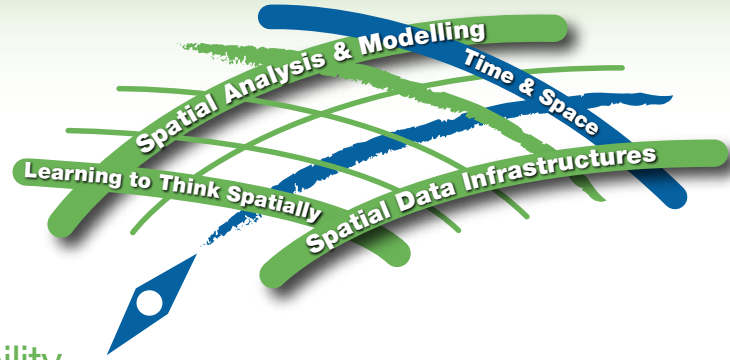
PhD projects at GIScience
As one partner in the Salzburg multi-institution doctoral programme in GIScience, we are contributing to the advancement of science and the qualification of junior scientists through highly innovative PhD projects integrated with the GIScience research programme.

Filippo Dal Fiore

Project Partners
Vrije Universiteit Amsterdam, Department of Spatial Economics
Massachusetts Institute of Technology, SENSEable City Lab

PhD Dissertation at the Free University of Amsterdam (NL)

Supervisors
Prof. E.Beinat (University of Salzburg),
Prof. P. Rietfeld (Free University Amsterdam),
Prof. J. Strobl (GIScience Research Unit),
Prof. C.Ratti (Massachusetts Institute of Technology)

> www.oeaw.ac.at/GIScience/projects

Position within the Research Programme
Provided that it is focussed on the statistical analysis of human travel behaviour, this project is primarily linked to the „Space and Time" and „Spatial Analysis and Modelling" areas of the Research Unit GIScience.

Outline of the PhD project
Mobile technologies such as cell phones, laptop computers and PDAs are more and more diffused all over the world. Once people and professionals are always reachable and ubiquitously connected to information resources, how do they modify their daily spatial behaviour? Do they move differently and, if so, do they move more or less, for which new reasons and to which different places?

Spatial behavior of a field police officer in the city of Groningen, as derived from a GPS-embedded PDA
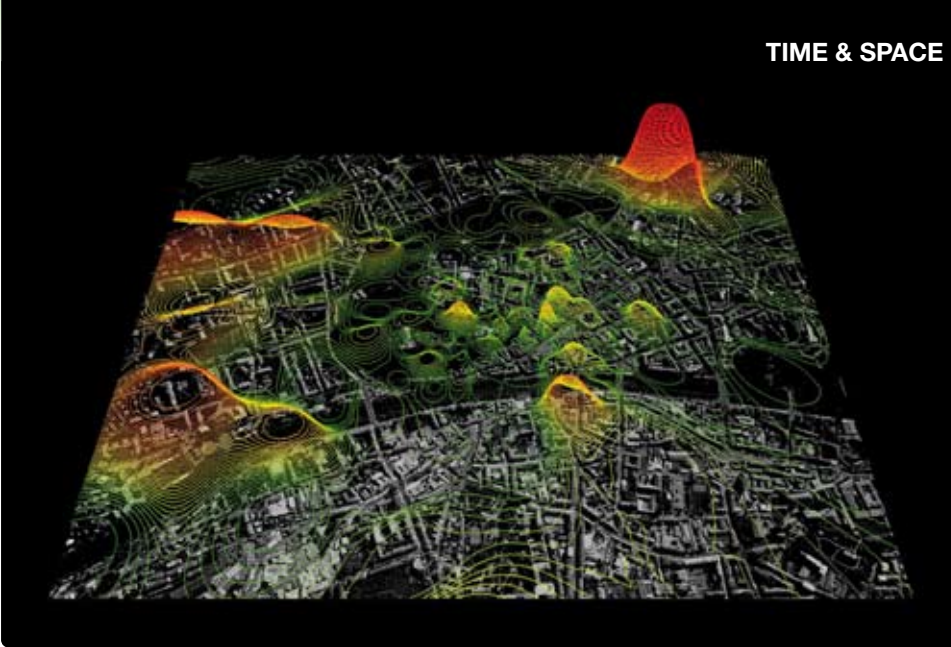
Intensity of cell phone traffic in the city of Graz, recorded in real-time from the A1 Network

This project aims at shading new light on this issue, building on two case studies: the urban campus of the Massachusetts Institute of Technology, where students can count on laptop and ubiquitous Wi-Fi connectivity; the city of Groningen (NL), where policemen are equipped with a portable workstation PDA.

Mobility data are to be collected through mobility diaries and innovative hi-tech solutions (based on triangulation of Wi-Fi signals and GPS tracks), for then being quantitatively analysed in GIS and correlated with socio-demographic data on the same subjects.

Through regression analysis, a mathematical model is devised to predict spatial behaviour from a wide set of independent variables, one of which being the availability of a mobile device. Final results will be relevant for different publics, from transportists to urbanists. Hopefully, an increased awareness of current drivers of human mobility will allow them to plan infrastructures that better adapt to the new needs and are more sustainable in the way they get used.

The project also includes the analysis of cell phone data made available by the telecom operator KPN for the city of Amsterdam. Data include the location of cell phone towers to which phones are connected. After processing such data through algorithms, two types of information can be derived:

- agglomeration of people during the course of the day;
- movements of pedestrians and cars.

Selected Publications

DAL FIORE, F., BEINAT, E., RATTI, C. (2008) Do mobile users move differently? Exploring the spatial implications of ubiquitous connectivity at MIT campus in Car, A., G. Griesebner and J. Strobl, Eds. Geospatial Crossroads @ GI_Forum ,08. Proceedings of the Geoinformatics Forum Salzburg. Heidelberg, Wichmann.

DAL FIORE, F., BEINAT, E. (2008) The Adoption of Mobile Location-Aware Systems for Field Police Work: Evaluation of a Pilot Initiative at the Dutch Police. In Gartner, G., Rehrl, K., Location Based Services and Telecartography II, Berlin: Springer.

DAL FIORE, F., BEINAT, E., RATTI, C., RIETVELD, P. (submitted, 2008) Nomads at last? Understanding travel behaviour and the impact of mobile technologies, year 2008. Transportation Research A.

Mapping Dynamics of Global Change

Spatial Analysis & Modelling
Time & Space
Learning to Think Spatially
Spatial Data Infrastructures
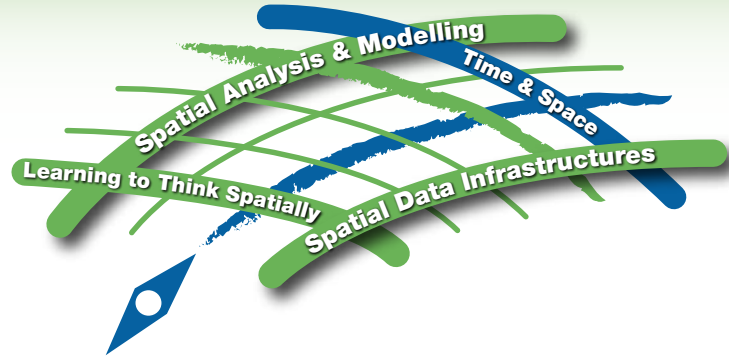
Monitoring Global Change

Position within the Research Programme

Co-operative work within the GIScience Research Unit explores the options to display and analyse the dynamic properties of geo-related procedures. Case studies are global long-term trends derived from history and projected into the future:
(1) land-use change and agriculture,
(2) energy demand and supply,
(3) restructuration of economic patterns.

Gilbert Ahamer
with contributions of
Adrijana Car
Thomas Jekel
Robert Marschallinger
Josef Strobl
Gudrun Wallentin

Research Focus

We develop a geo-referenced methodology for depicting dynamic change processes of the techno-socio-economic systems of all states in the world.

Under the United Nations Framework Convention on Climate Change UNFCCC each country has to deliver convincing projections of its CO_2 emissions. This project strengthens such forward-looking activities and exchanges views within the "Time & Space" project at GIScience.

Our case studies are:
- global system of food demand and supply (agro-economics)
- global system of energy demand & supply (energy economics)
- local systems of soil slide and land cover in Alpine regions.

How will the future evolve?

Drivers for the future development of food production, energy production and ultimately of anthropogenic CO_2 emissions are identified by correlation methods. Spatial patterns in structural trends are analysed by analytic and graphic means.

Research Method

Analysis of the "Global Change Data Base" (GCDB) allows looking into
- the change rates d/dt (equal to a business-as-usual scenario) and
- changes of the change rates d^2/dt^2 (reflects impact of societal "values")

of the "state vector" of the global techno-socio-economic system.

Examples for geo-referenced state variables are energy demand per capita or change of percentage of arable land.
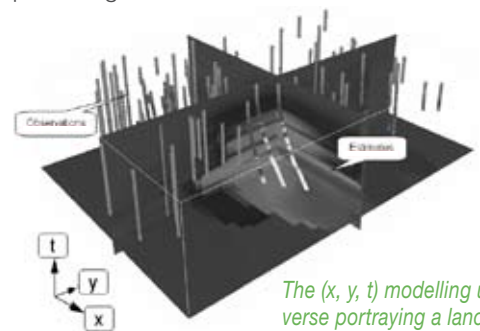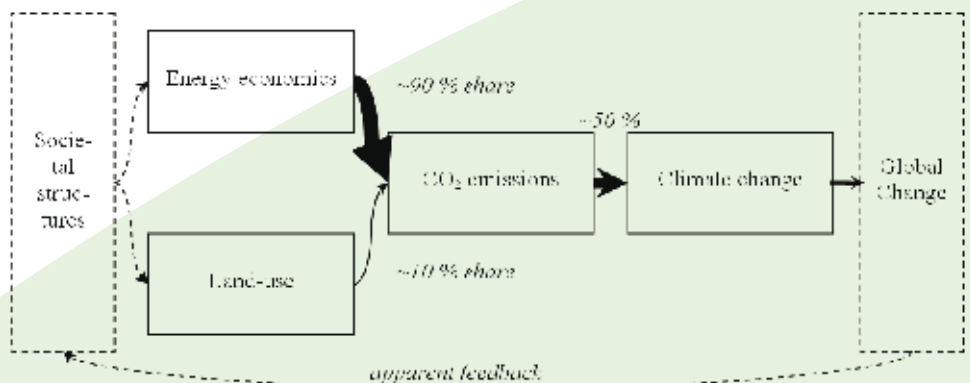

The (x, y, t) modelling universe portraying a landslide process will be used to describe economic shifts
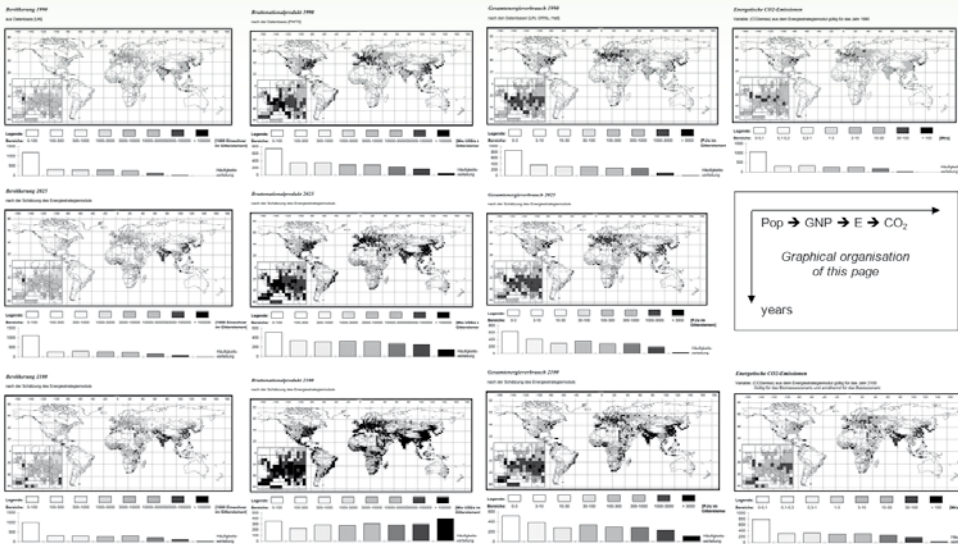
Wider Thematic Context

The two main contexts of drivers for global change are the themes of
- energy and
- land use change.

The thematic context of "Mapping Dynamics of Global Change" encompasses climate change, global change and institutional change

"Maps of global statics" of population, economy, energy, and CO_2 emissions in the classical (x, y; t) style

Screenshot of an individual-based model capable of showing the dynamics of the alpine tree line – with a view to global dynamics

Combination of Methods

The combination of several approaches to generate geo-referenced patterns is promising, such as

- (x, y, t) representation of economic structural shifts as known from geosciences
- agent-based modelling that generates geo-patterns of biospheric variables.
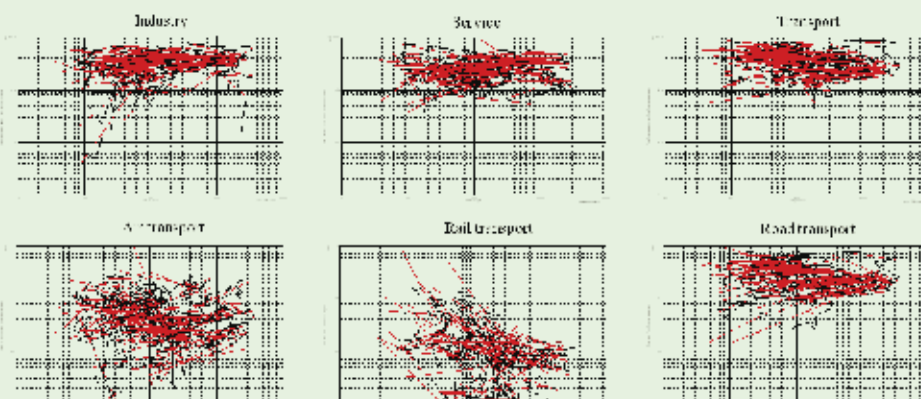
Factual Research Results

1 Geo-patterns:

Driving factors for global change such as population, economic level, energy demand, CO_2 emissions) exhibit geographic patterns that are traditionally mapped for different years, e.g. 1990, 2025 and 2100 (see the "maps of global statics").

2 Enlargement

of the concept of "mapping":

In order to highlight dynamics along time, other spaces than the classical (x, y, t) space are used:

A **transformation of co-ordinates** from time into the economic level GDP/capita renders dynamic structures much more visible and shows paths of development.

Different geometric patterns appear: see the "maps of global dynamics".

3 Trends:

Analysis shows characteristic patterns of global evolution in energy economics. The figures of the GCDB exhibit quantifiable trends for the percentage of various fuels in the countries' energy mix.

Metaphorical Research Results

Generalisation of these findings suggests a sigmoid meta-structure of global techno-socio-economic evolution.

An important feature is the quantitative evaluation of saturation limits in agriculture and energy economics because these limits govern the overall dynamics of future scenarios for global change and specifically of anthropogenic CO_2 emissions and necessary CO_2 abatement measures.

Overall analyses of the global evolutionary structures and sectoral distributions show an evolution from

- matter-oriented to information-oriented activities
- individual to societal activities
- covering basic needs to meeting higher aims of wellbeing.

Such long-term meta dynamics should be made use of for effective climate protection measures.
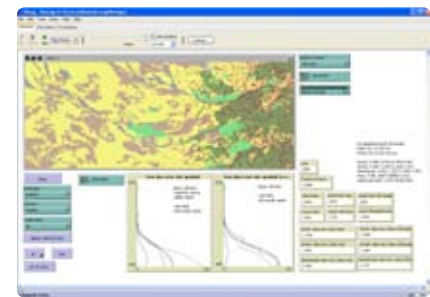
Selected Publications

AHAMER, G.: Im Spiegelkabinett unterschiedlicher Entwicklungsvorstellungen. Journal für Entwicklungspolitik (JEP), 24 (3) pp. 56-76

AHAMER, G., WALLENTIN, G., MARSCHALLINGER, R.: Dynamic processes in space-related modelling. EESD 2008 – Engineering Education in Sustainable Development – International Conference, Graz, 22nd to 24th September, 2008.

AHAMER, G., WAHLISS, W.: Organisationsentwicklung durch Diskurs. Beitrag für ein Buch hsg. von W. C. Kriz Planspiele für die Organisationsentwicklung, Schriftenreihe: "Wandel und Kontinuität in Organisationen" (Bd. 8). S. 225-250, Berlin: Wissenschaftlicher Verlag, 2008, ISBN 978-3-86573-324-5, ISSN1616-5012.

AHAMER, G.; WAHLISS, W.: Guidelines for establishing a baseline scenario. Twinning Project SI06/IB/EN/01 on development of financial instruments according to the Water Framework Directive, Twinning Component 1 & 2, Ljubljana, May 2008.

AHAMER, G.: Learning and analysing through the 'Global Change Data Base'. Second Central Asia GIS Conference - GISCA'08 "GIS for the Future of Central Asia", May 15-17, 2008, KSUCTA, Bishkek, Kyrgyzstan, see http://gis.org.kg/confer/gisca08/.

"Maps of global dynamics": Trends in the "Global Change Data Base" for percentages of energy use in sectors

Object Based Image Analysis
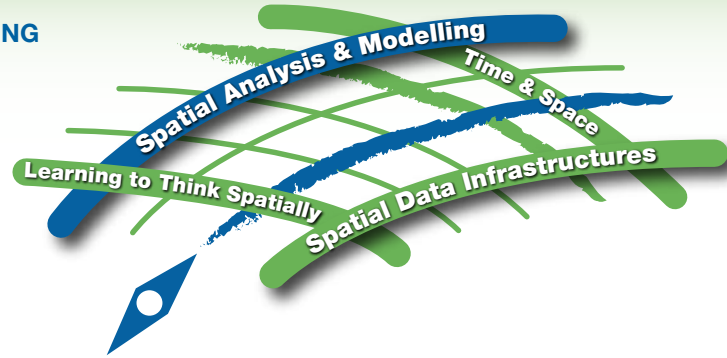
Transferability of OBIA Rules for Urban Mapping

Position within the Research Programme

Urban areas are the centers of our modern industrial life. With object based image analysis (OBIA) algorithm we develop reliable rule sets for the mapping of urban features. Those rules can be transferred from one region to a similar region with a similar patterns. This has been tested successfully for the cities of Phoenix and Las Vegas in the U.S. South West. At GIScience OBIA is one of the main research questions under the research area 'Spatial Analysis and Modelling'.

Matthias S. Möller

Project Partner
Z_GIS, University of Salzburg
Dr. Elisabeth Schöpfer
(currently at the European Space Agency, EO Science & Applications Department)
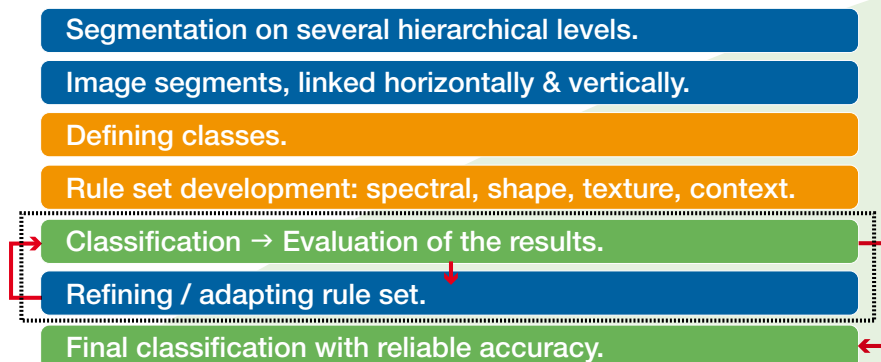
> www.oeaw.ac.at/GIScience/projects

Research Background

Metropolitan areas are the most active regions in terms of economy, human welfare and social networks. Mankind has just passed the meaningful mark of 50% of all people living now in urbanized areas; the trend is still increasing especially in less developed countries.

In this research we are focusing on the development of a method to compare land use land cover (LULC) of different major urban areas all over the world. As basis for the comparison satellite remote sensing images have been tested with reliable results. These images provide a synoptic, standardized and –in any kind- not altered source of information about the real world surface. We make advantage of images acquired from the ASTER satellite, a NASA operated satellite system with a spatial resolution of 15/30/90 m in several spectral bands. Spectral coverage of ASTER ranges from the visible to the thermal infrared within 14 bands. The spectral bands of ASTER, in combination with the comparable high spatial resolution, enable the mapping of urban areas on a moderate scale level of about 1:15.000. For a comparison of urban areas world wide, the developing of unique classification methods is essential. Natural environment and local phenology limits the classification method. Thus classification rules and methods have to be adapted and tuned to the environment of various urban areas.

Instead of pixel spectral value based classification algorithm, we are using object based image analysis (OBIA) tools and sophisticated fuzzy methods. After a segmentation of objects we are developing rule sets to differentiate urban geo objects right out of the image pixels. This approach is similar to the concept of human recognition. It considers object features like spectral color, texture, shape neighborhood and topology. The LULC classes have been slightly modified but follow the American National Land Cover Data (NLCD) schema.

Segmentation on several hierarchical levels.

Image segments, linked horizontally & vertically.

Defining classes.

Rule set development: spectral, shape, texture, context.

Classification → Evaluation of the results.

Refining / adapting rule set.

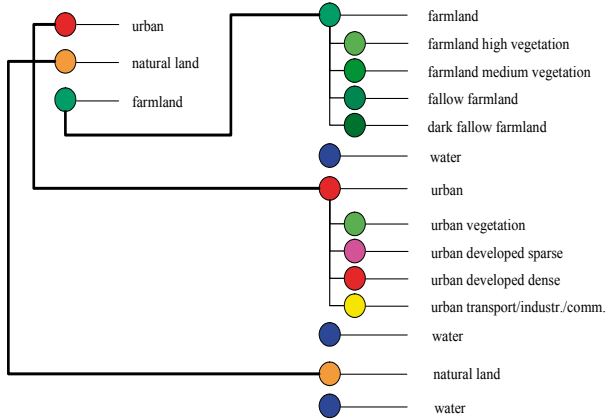Final classification with reliable accuracy.

OBIA - Classification Schema

„New York, New York", Las Vegas

Level I, large segments, manually classification

Level II, small segments, rule-based classification

Classification Rule Set for Desert Cities (Phoenix and Las Vegas)

The OBIA approach leads to reliable classification results when it is applied to two urban areas in the U.S. South West: Phoenix, AZ and Las Vegas, NV. Both metropolitan areas are located in an arid, desert environment (Sonoran desert and Mohave desert) with less than 200 mm annual precipitation, belonging to the Köppen – Geiger climate zone BW. They belong to the most favorite regions of the U.S. located in the center of the so called "Sun Belt" that stretches from Florida in the East to San Diego and Los Angeles in the West. In both regions land is available for low prices, climate is warm and cozy, and the economy is growing with bigger rates compared to the rest of the USA making it attractive to people. However, natural resources are limited and especially clean water will become a problem in the near future.
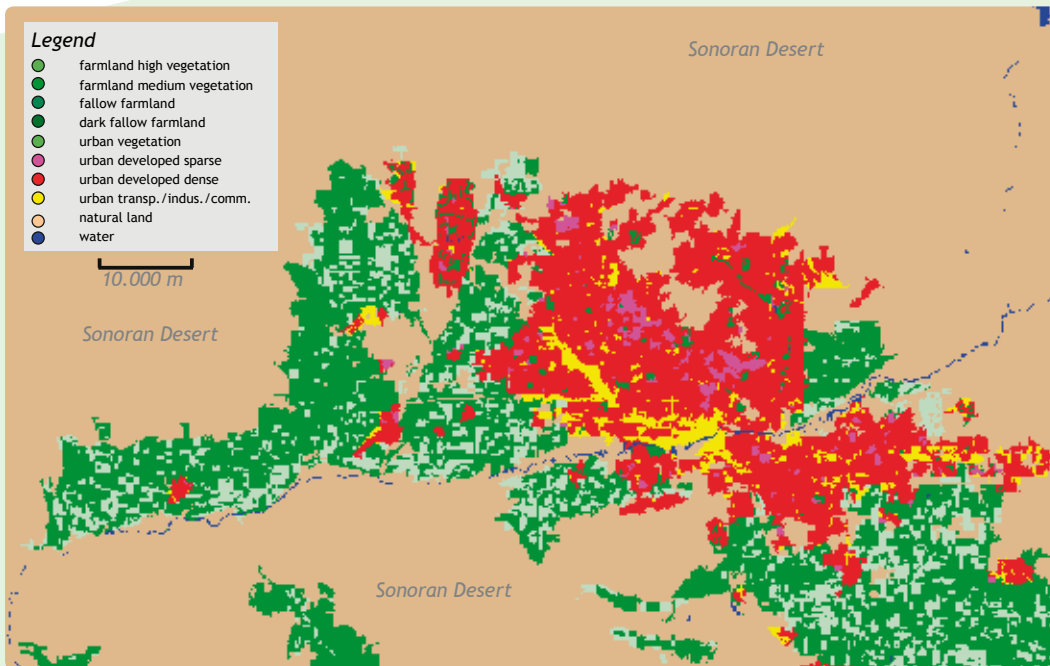
Selected Publications

MOELLER, M. S., SCHÖPFER, E. (2008): Metropolitan Growth Mapped from Space Images, in: Ehlers, M., Behncke, K., Gerstengarbe, F. W., Hillen, F., Koppers, L., Stroink, L., Wächter, J. (edts.): Digital Earth Summit on Geoinformatics 2008: Tools for Global Change Research, p. 274.

BLASCHKE, T., HOFMANN, P., GEORG, I., SCHOEPFER, E., TIEDE, D., LANG, S., MOELLER, M., ARAUJO, E., KUX, H. (2007): Möglichkeiten und Grenzen der Fernerkundung für das Monitoring und Safeguarding informeller Siedlungen: Eine Synthese, in: Beiträge der Jahrestagung der Deutsches Gesellschaft für Photogrammetrie und Fernerkundung 2007, Bd. 16, S. 361-374.

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MÖLLER, M., BLASCHKE, T. (2006): Urban Change Extraction from high Resolution Satellite Image, in: International Archives of Photogrammetry, Remote Sensing and spatial information sciences, Vol. XXXVI, Part 2, S. 151-156.

Legend
- farmland high vegetation
- farmland medium vegetation
- fallow farmland
- dark fallow farmland
- urban vegetation
- urban developed sparse
- urban developed dense
- urban transp./indus./comm.
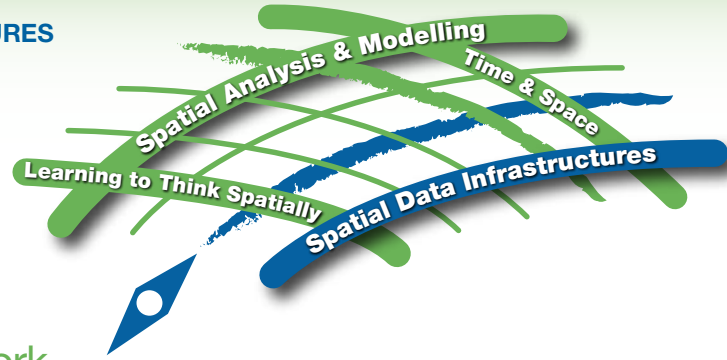- natural land
- water

10.000 m

Sonoran Desert

OBIA - Classified Image of the Phoenix Metropolitan Area (1984)

Nature SDI*plus*

Best Practice Network for SDI in Nature Conservation

SEVENTH FRAMEWORK PROGRAMME

NatureSDI*plus*

Position within the Research Programme

The need for sharing and harmonising spatial data in a national and international context is not least reflected by initiatives such as INSPIRE (Infrastructure for Spatial Information in the European Community). The research within the FP7 project „NatureSDI*plus*" links to spatial data infrastructures (SDI) as one of the primary fields of research at the GIScience Research Unit. In an interdisciplinary team of domain specialists and data modellers we focus on interoperability and exploitability of distributed spatial datasets in nature conservation.

**Barbara Brunner-Maresch,
Florian Fischer,
Sabine Hennig,
Karin Hörmanseder,
Hermann Klug,
Josef Strobl,
Gudrun Wallentin**

> www.nature-sdi.eu

Funded Project
EC-FP7 eContent*plus*

Research Focus

With respect to the INSPIRE initiative, the Best Practice Network for SDI concentrates on the development of a SDI for nature conservation. The SDI will address the needs of integrated nature protection and the various domains for geodata usage in nature conservation nowadays. The responsibility of the GIScience Research Unit within the NatureSDIplus project is on analysis of the state of the art of data accessibility and the assessment of user needs in terms of the re-using and sharing of environmental information. The affordances of target users operating at the local, regional, national and EU scale lay the foundation for the specification of a common data model for nature conservation data as specified by the INSPIRE Annexes.

Approach

Thematically, the NatureSDI*plus* project covers spatial data of protected areas, bio-geographic regions, habitats, biotopes and species distribution. In Europe, a large and heterogeneous user community is working with these geo-data in the context of landscape planning, biodiversity monitoring or protected area management. To spot the main affordances on a harmonised data model, target user needs are surveyed, particularly in respect to scale and resolution, multilingual and semantic aspects.
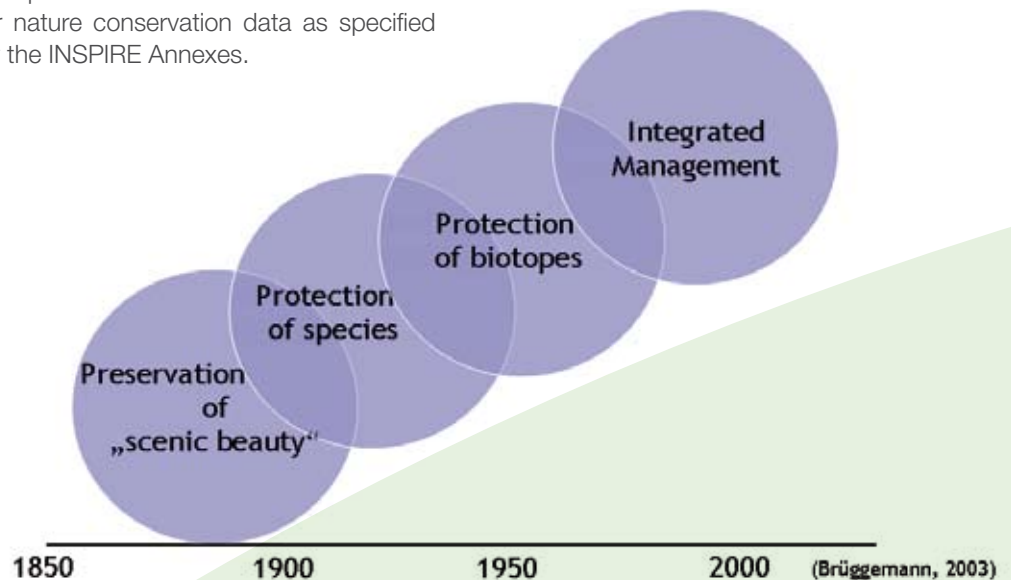
Paradigms of Nature Protection

Adoption of geo-data for education about nature conservation

A gap analysis of the user requirements compared to the state of the art of data accessibility also lies in the responsibility of our team, and provides substantial input to the technological activities in the project. The GIScience Research Unit is involved in all subsequent steps, including data specification, the design of a geoportal, testing and dissemination.

Perspective

As national coordinator for the NatureSDI-plus network in Austria we will build up a network of partners who are involved in nature conservation on all geographical scales. The analysis of users needs and the gap analysis within the first half of 2009 will be a first step in building up the network and is the corner stone of a Spatial Data Infrastructure for nature conservation.

Organigram of the NatureSDIplus Project activities and their interdependencies

>> *INSPIRE is ambitious. The initiative intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services. These services should allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an inter-operable way for a variety of uses.*
> http://inspire.jrc.ec.europa.eu/

>> *We appreciate very much the contribution of the team at the OeAW GIScience Research Unit in Salzburg that brings in expertise in geo-data management and at the same time has working experience in nature conservation.*
Giorgio Saio, NatureSDIplus project leader
> www.gisig.it

GISIG-Geographical Information Systems International Group

>> *The National Park Berchtesgaden is happy to be part in the INSPIRE development process through our collaboration with the GIScience team in the NatureSDIplus project, and to exchange experience with other protected areas developing and using GIS systems.*
Helmut Franz, National Park Berchtesgaden
> www.nationalpark-berchtesgaden.bayern.de

Schools on Ice

Communicating Spatially: Global Change

Schools on Ice

Within this GIScience research agenda, 'Schools on Ice' is closely linked to the idea of enhancing spatial thinking capabilities, with a focus of communicating spatially explicit information on climate change to a wider public.

„Schools on Ice" is a cooperative project of science and education sectors and a contribution to the International Polar Year (IPY). It addresses the problem to communicate complex scientific insights into climate change to foster a broader understanding of the processes of climate change and enhance acceptance of measures to be taken. „Schools on Ice" starts from a pupil's perspective to cover common preconcepts of the public and allows pupils to formulate their own research agendas. The research 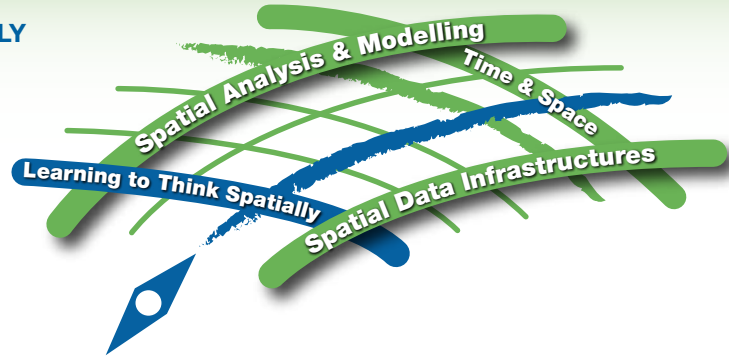in centred on GI-based teaching and learning methodologies for high school pupils (age 14 – 18 years). As major outcomes we expect firstly a deeper insight in the use of collaborative, GI-based methods at school. Secondly, at the end of the project a set of tools will be provided to Austrian geography teachers to disseminate GI-based learning objects to their utilisation at schools.

„Schools on Ice" therefore focuses on an alternative educational approach for
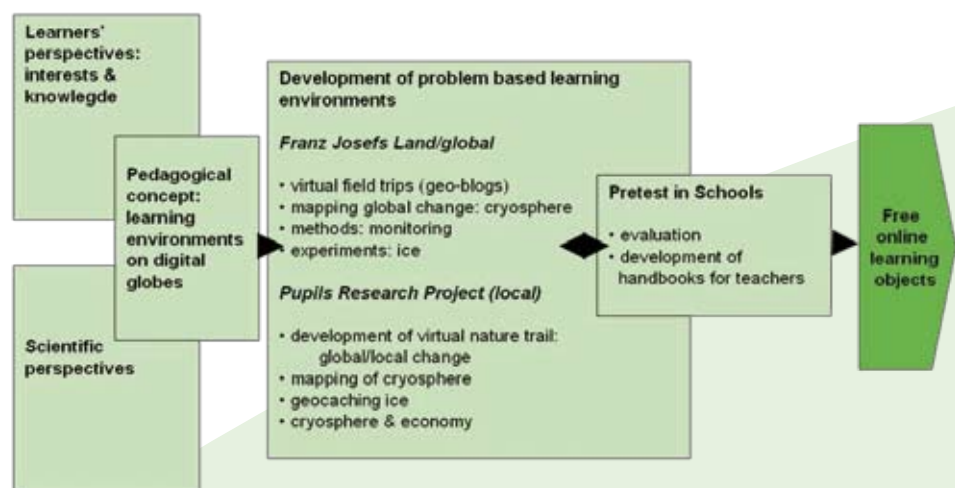
Workflow Diagram: Schools on Ice

Pupils of BG Nonntal conduct measurements on Dachstein Glacier using Georadar, June 2008

communicating global change that includes learners as active participants in the research process. Researchers from the GIScience Research Unit and from University of Technology, Vienna support pupils in finding scientifically defensible answers to their self defined questions. Thus, young researchers act as leaders of learning processes in the understanding of such complex issues as it is global change research and consequently as communicators towards a general public. This includes addressing local and national politicians involved with climate change, and scientific publications done by pupils. Geoinformation (GI) is used both for contextualisation of content as well as a basis for collaborative learning and research.

>> *I'm impressed by the scientific output of pupils at the age of 16. This is professional quality.* Helmut Schrempf, mayor, Ramsau am Dachstein <<

>> *It's a completely different type of learning, out there in the mountains, on the glacier … we got a new insight in scientific research* Florian Sampl, pupil, BG Nonntal <<

Sparkling Science Award for Schools on Ice received from the Austrian Minister for Science and Research, Dr. Johannes Hahn, June 2008

Pupil's map of glacier retreat, BG Traun, Sept. 2008

Sparkling Science Award
More than 30 schools across Austria have been reached by various activities of the project, with four schools acting as explicit research partners in the field. „Schools on Ice" has been awarded national recognition within the Sparkling Science framework as one of the reference projects, with two pupils awarded an educational trip to Baffin Island in summer 2008.

Selected Publications

WALLENTIN, G., JEKEL, T., RATTENS-BERGER, M. & BINDER D. (2008), ‚Schools on Ice' – Einbindung von Lernendenperspektiven in GI-basiertes Lernen. – In: Jekel, T., Koller, A. & Donert, K. (Eds); Learning with Geoinformation III. – Heidelberg: Wichmann, S. 87 – 95.

JEKEL, T. (2008), Children Mapping Global Change. Participatory GI-Based Learning. – In: Proceedings, Map India, Noida (CD-ROM bzw. http://www.gisdevelopment.net/application/miscellaneous/mi08_227.htm).

RATTENSBERGER, M., JEKEL, T., WALLENTIN, G., & MITTERBAUER, U. (2008), Der Klimawandel und was sich unsere Schülerinnen und Schüler darunter so vorstellen: Eine Erhebung von SchülerInnen-Perspektiven. – In: GW Unterricht.

BINDER, D., JEKEL, T., MITTERBAUER, U., HAUSMANN, H., BEHM, M., WALLENTIN, G. & BRÜCKL, E. (2008), Schools on Ice – Bringing the IPY to the classroom. Proceedings EGU.

MITTERBAUER, U. & JEKEL, T. (2008), Schools on Ice – Classroom Experiments on Global Change of the Cryosphere. Proceedings EGU.

Networking Activities

Research Cooperation, International Contacts
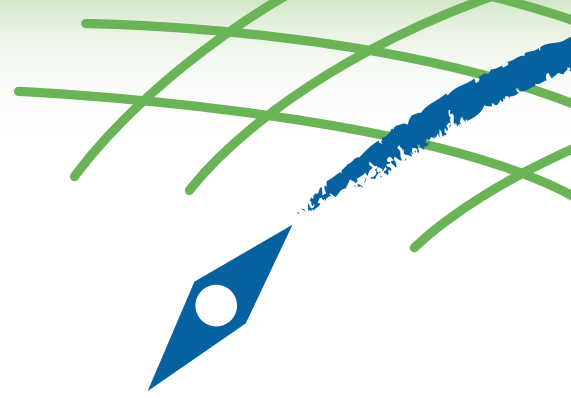
Progress in research today is only achievable when reaching critical mass. Part of this is contributed through exchange within a network of partner institutions sharing common goals and topical orientation. Due to the international orientation and backgrounds of our research team, we could rapidly build up a valuable and strong network of ties to related institutions worldwide.

These partners join GIScience in international projects, through exchange of faculty, offering mutual support in individual projects, or serving as application domain experts for the validation of research outcomes in applied contexts.

International

- Arizona State University, GIOS – Global Institute of Sustainability
  Joint research activities and faculty mobility
- Austria-Central Asia Centre for GIScience (ACA*GIScience), Bishkek, Kyrgyzstan
  *Cooperation within the Eurasia-Pacific Uninet (EPU) as joint conferences and project initiatives PhD dissertation projects. ACA*GIScience is serving as a link to various institutes of the Kyrgyz National Academy of Sciences.*
- Bulgarian Academy of Sciences, Institute of Geography, Bulgaria
  Exchange of faculty members within the wider framework of the CEEPUS mobility programme.
- Chinese Academy of Sciences, Department of Geography and Ecology, Urumqi, Xinjiang, China
 *Cooperation towards a joint event in August / September 2009, support for this CAS department in joining EPU and applying for project support at the Global Spatial Data Infrastructure Organisation (www.gsdi.org) where Josef Strobl currently is a member of the Board of Directors.*
- Eurasia-Pacific Uninet (EPU)
  Contributions to various EPU initiatives through presentations, publications and co-organisation of international conferences and workshops
- GISIG Geographical Information Systems International Group, Genua, Italy
  Membership in this association and joint projects (eg NatureSDI+ within FP7 eContent+)
- Heidelberg Mobil International
  Research cooperation, on-site support
- Herodot Network for Geography in Higher Education, Liverpool, England
  Contributions (conferences, publications, and work towards joint projects) with this European network for Geography teachers continuing education. E.g. 'Learning with Geoinformation' conference.

- International Centre for Integrated Mountain Development (ICIMOD), Kathamandu, Nepal
  Joint workshops and conference with support from EPU
- Jagiellonian University, Institute of Geography and Spatial Management, Krakow, Poland
  Faculty exchange within EPU, and cooperation towards project development, plus a Tempus Higher Education curriculum development program.
- Kyrgyz State Technical University, Institute of Mining and Mining Technologies
  Joint research activities and faculty mobility
- Ludwig-Maximilians University Munich, Department of Geo- and Environmental Sciences, Munich, Germany
  Research cooperation: geostatistical 3D modeling of rock fabrics from neutron tomography investigations.
- Middle East Technical University, Department of Geodetic and Geographic Information Technologies, Istanbul Turkey
  Faculty mobility, hosting of visiting researcher and joint PhD supervision
- MIT Senseable City Lab, Cambridge, USA
  Joint PhD projects and faculty mobility
- National Academy of Sciences of the Kyrgyz Republic, Institute of Rock Physics and Mechanics
  Joint research activities and faculty mobility
- National Academy of Sciences of Kyrgyz Republic, Institute of Biology and Pedology
  Joint research activities and faculty mobility
- National Park Berchtesgaden, Berchtesgaden, Germany
  Cooperation based on joint postdoc faculty and project collaboration
- Research Reactor FRM-II Technical University Munich, Germany
  Research Cooperation: Neutron tomography, a novel method for destruction free material analysis, is applied to rock samples to yield 3D models of the rock fabrics.
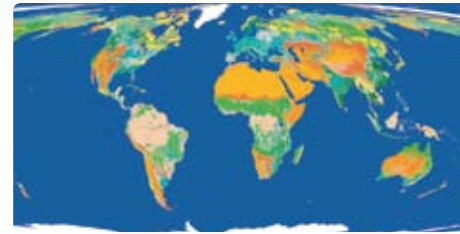
- Twinning Project on Water Framework Directive between Slovenia, Germany and Austria
  Contribution to EU accession project through a twinning approach, formal MoU supporting current and future initiatives.
- University of Bamberg, Institute of Geography
  Joint research activities and faculty mobility
- University of Bonn, Institute of Geography
  Joint research activities and faculty mobility
- University of Osnabrück, Institute of Geography
  Joint research activities and faculty mobility
- University of Texas, Department of Geological Sciences, High-Resolution X-ray Computed Tomography Facility, USA
  Research cooperation: 3D models of fossilised small mammal teeth.
- University of Zagreb, Faculty of Geodesy, Zagreb, Croatia
  Cooperation through the CEEPUS academic mobility network and a Tempus CARDS program on curriculum development in Higher Education.
- Vrije Universiteit Amsterdam, SpinLab, Amsterdam, Netherlands
  Joint PhD supervision and PhD projects with a focus on Location Based Services and 'LB Social Science'.

National
- Christian-Doppler-Klinik
  Research Cooperation 3D-modelling and analysis of multiple sclerosis lesion patterns.
- GIS-Cluster Salzburg
  Membership in this association
- Wildbach und Lawinenverbauung Österreich die.wildbach
  Research Cooperation landslide 2D+t modelling from high precision GPS tracking
- Joanneum Research
  Research cooperation: 3D+t modelling of landslide evolution from seismic tomography
- Natural History Museum Vienna, Department of Geology & Palaeontology
  Research cooperation: Quantifying small mammal teeth morphology for tracking species evolution

- The Private University College of Education of the Diocese of Linz
  Co-organisation of the annual Learning with GI conference
- Research Studios Austria – Studio iSPACE
  Research cooperation
- Salzburg Research
  Research cooperation
- Statistik Austria
  Research cooperation, joint publications
- University of Education, Department of Secondary Schools
  Research cooperation, publications, teacher training
- University of Innsbruck, Department of Ecology
  Joint PhD supervision
- University of Salzburg, Department of Science Education and Teacher Training
  Research cooperation
- University of Salzburg, Z_GIS Centre for Geoinformatics
  Research cooperation
- University of Vienna, Department of Geography & Regional Science
  Research cooperation
- Vienna University of Technology, Institute of Geodesy and Geophysics
  Research cooperation

Journals, Magazines, Publishers
- Geoinformatics – Magazine for Surveying, Mapping and GIS Professionals
- Geocarto International
- GIS Development
- GIS Science
- GIS Business
- Hüthig Fachverlag (Wichmann)
- International Journal of Geoinformatics
- International Journal of Geoinformatics
- Journal of Geomatics
- Österreichische Zeitschrift für Vermessung und Geoinformation
- Transactions in GIS
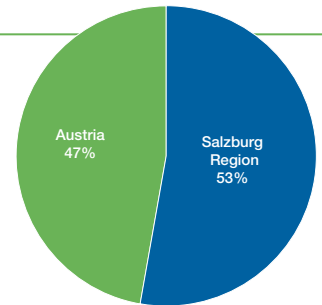
GIScience National Research Network
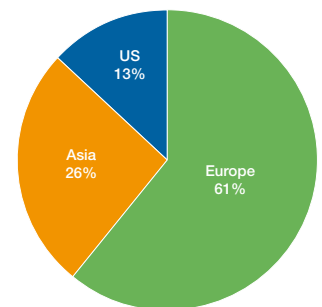
GIScience International Research Network
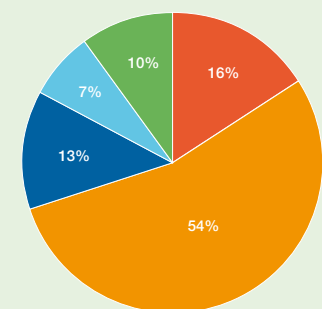
GIScience Outgoing Activities

Research
Presentation
Extension Studies
Research Consulting
Other

Conferences

Developing visions for a spatially enabled future

We at GIScience are convinced that scientific conferences greatly contribute to the dissemination of research findings, to networking and collaboration. Such conferences facilitate links between scientists, professionals, and users, often leading to new project ideas and research directions. We also see conferences as platforms where young scientists can get an international, state of the art feedback on their ongoing research. The GIScience research team contributes to numerous conferences and also chairs and organises GI symposia bringing together an international community of scientists working towards a spatially enabled future.

Geoinformatics Forum Salzburg (GI_Forum)

> *www.gi-forum.org/*
Programme Chair and Organisation:
Adrijana Car (GIScience)

The interdisciplinary symposium GI_Forum focuses on an international GIScience audience, communicating in English, and sharing an interest in translating new methods and techniques into a broad range of application domains in geoinformatics. Young researchers as well as established scientists find a vibrant GI community from academia, industry, and government to analyse progress and to explore new research directions. GI_Forum is organised by the Salzburg University Centre for Geoinformatics together with GIScience and co-located with the highly regarded annual German language conference on Applied Geoinformatics (AGIT, www.agit.at).

Learning with Geoinformation

> *www.agit.at/schule*
Programme Chair and Organisation:
Thomas Jekel (GIScience),
Alfons Koller (PH Linz)

"Learning with Geoinformation" is an annual three day conference within the framework of the AGIT-Symposium, organised in cooperation with the European Herodot-Network and the GI-Forum. It is currently a bilingual conference with German and English-language sessions on Geoinformation in education. It addresses researchers and practitioners in education with a focus on secondary and postsecondary education, including both scientific contributions as well as vocational training through a series of workshops for teachers.

Computer Oriented Geology (COG)

> *www.agit.at/cog*
Programme Chair and Organisation:
Robert Marschallinger (GIScience)

The Working Group „Computer Oriented Geology" (COG) serves as a Forum for discussing the application and development trends of geo-software, specifically for geology, engineering geology and hydrology. The COG brings together practitioners, researchers and students in these fields, as well as producers of dedicated software. The annual, international COG conference takes place during the AGIT at the University of Salzburg, Faculty for Natural Sciences, with proceedings published as a peer-reviewed book.

As from the GIScience space & time focus, the COG is an interface to the practical aspects of geoscience software application – i.e., the challenges met by practitioners when working with current geoscience software in the geostatistical modelling and simulation of landslide hazards, acquifer dynamics or in the optimised handling of non-renewable resources.

Geo-Informatics for Mountain Environment Management (mountainGIS), September 1-11, 2008.

Train-The-Trainer Workshop. Hosted by the International Centre for Integrated Mountain Development (ICIMOD), Kathamandu, Nepal. Jointly organised by Eurasia-Pacific Uninet, Z_GIS University of Salzburg and the GIScience Research Unit of the Austrian Academy of Sciences. (Josef Strobl, GIScience)

Train-the-Trainer Workshop on Geo-Informatics for Mountain Environment Management

The train-the-trainer workshop on "Geo-Informatics for Mountain Environment" was held at the training room of the International Centre for Integrated Mountain Development (ICIMOD) from 1-11 September 2008. This train-the-trainer workshop was organised by Eurasia-Pacific UNINET (E-P Uninet) and its member institutions in collaboration with ICIMOD and coordinated by the Austrian Academy of Sciences-GIScience, Salzburg, Austria.

The aim of this workshop was to generate awareness about the mountain environments as well as to exchange the experience in mountain focused applications of GeoInformatics. Some specific application of GeoInformatics such as environmental specificities of high mountain, natural resource management, protected area management and geohazard and environmental risk management were covered during the training.

The significance of this undertaking was to train teachers and postgraduate students involved in the fields of geo-Informatics and mountain environment management in order to ensure a high multiplier effect. Altogether 21 participants from six different countries including Austria, Nepal, Bangladesh, Bhutan, India and Russia participated in this workshop.

> http://tinyurl.com/b65d8y

GIScience for Salzburg

While the GIScience Research Unit with its research programme is distinctly international in its agenda, GIScience staff is also widely involved with local, regional and national initiatives as well as in consulting for the local government and economy. Highly theoretical and internationally visible research therefore is embedded in explicitly local and regional application domains. GIScience thus helps both the local economy and education community as well the local GIS-cluster to present itself as one of the most active GIS-hubs in Central Europe.

Location Salzburg

- *Cooperation and framework agreement with the Provincial Government of Salzburg*
- *Cooperation and framework agreement with the University of Salzburg*
- *Cooperation and framework agreement with the City of Salzburg*
- *Member of the GIS-Cluster Salzburg*
- *Research Cooperation and joint PhD supervision with Z_GIS (Centre for Geoinformatics of the University of Salzburg), iSPACE (Research Studios Austria) and Salzburg Research*
- *Successful projects: EC and nationally funded projects*
- *Regional scientific support to various institutions*
- *Workplace for Scientists and Students*

Some representative projects

Regional Didactics Center Geoinformatics Salzburg
Josef Strobl, Thomas Jekel
GIScience here contributes to the development, evaluation and dissemination of GI-based learning modules for Austrian Schools.

OeAW Gschliefgraben Workshop
Robert Marschallinger
This workshop will bring together stakeholders and scientists to discuss the state of geological, geophysical and geotechnical modeling, the evaluation of monitoring data and the measures taken in the course of the Gschliefgraben landslide, which is considered one of the best documented natural hazards in Austria.

Karst Water Conference
Gudrun Wallentin
The Karst Water Conference 2008 aimed at contributing to a strategy towards use and conservation of alpine karst water resources. GIScience staff was instrumental in coordination and the editing of the conference proceedings.

Edugov.gv.at
Thomas Jekel
Within this project we develop learning environments that help pupils to put to use the national and regional offerings of e-government with a specific focus on e-participation.

GIScience Lecturing
The GIScience team is contributing a wide range of scientific competence and pedagogical skills within several university teaching programs. Josef Strobl, the GIScience director is teaching a course at the University of Redlands as visiting professor, has served as external examiner at the University of West Hungary, on a curriculum committee at the University of Applied Sciences – Carinthia, and within several instruction-related international projects.

GIScience staff is lecturing at several universities
Salzburg University (AT), University of Vienna (AT), FH Joanneum (AT), Karl-Franzens University Graz (AT), University of Bamberg (DE), Redlands (US), Bulgarian Academy of Sciences (BG), Jagiellonian University of Cracow (PL).

Teaching subjects
3D modelling with GIS, Cartography, Learning with Geoinformation, Geoinformatics for Geologists, Geovisualisation, Globalisation, OpenGIS, Remote Sensing, Spatial Analysis, Spatial Cognition and its relevance to GI, Spatial Implications of ubiquitous connectivity, Technology impact assessment on construction planning and management.

Incoming Visitors

Dr. Li Fayuan

*Nanjing Normal University, China.
Postdoc scholarship through the
Eurasia-Pacific Uninet. Research and
collaboration with Z_GIS and GIScience
staff on digital terrain analysis.
Duration of stay: 07.07.2008 – 29.01.2009*

Dr. Konstantin Krivoruchko

*ESRI Software Development Lead on
Geostatistical Analyst. From 1981 to
1989, Konstantin Krivoruchko served
as a research scientist in the Physics
Department of the Belarussian National
Academy of Sciences, Heat and Mass
Transfer Institute. Research and collabo-
ration with Z_GIS and GIScience staff on
geostatistics.
Co-financed by GIScience.
Self-funded.
Duration of stay: 09.06.2008 – 05.07.2008*

Dr. Mariyana Nikolova

*Bulgarian Academy of Sciences,
Institute of Geography, Sofia, Bulgaria.
Funded by CEEPUS.
Duration of stay: 26.05.2008 - 12.06.2008*

Dr. Rumiana Vatseva

*Bulgarian Academy of Sciences,
Institute of Geography, Sofia, Bulgaria.
Funded by CEEPUS.
Duration of stay: 04.06.2007 - 12.11.2007*

Dr. Ainura Nazarkulova

*Docent at Department „Geodesy and
Geoinformatics", Kyrgyz State University
of Construction, Transportation and
Architecture. Deputy Director of ACA*GISc,
Bishkek, Kyrgyzstan. ACA*GIScience is
serving as a link to various institutes of the
Kyrgyz National Academy of Sciences.
Research and collaboration with Z_GIS and
GIScience staff.
Funded by EPU.
Duration of stay: 13.10.2008 – 30.11.2008*

Deniz Gercek

*(PhD Candidate, Research Assistant):
Middle East Technical University (METU),
Department of Geodetic and Geographic
Information Technologies (GGIT), Turkey.
Research and collaboration with Z_GIS
and GIScience staff on some GIS related
research topics. Funded by METU.
Duration of stay: 11.03.2007 – 15.08.2007*

Dr. Stoyan Nedkov

*Bulgarian Academy of Sciences, Institute
of Geography, Sofia, Bulgaria.
Funded by CEEPUS.
Duration of stay: 02.05.2007 - 23.05.2007*

Dr. Sabine Hennig

*Research and collaboration with Z_GIS and
GIScience staff on her habilitation research.
Self-funded.
Duration of stay: 01.07.2007 – 30.06.2009*

Ainura Nazarkulova, PhD

Kyrgyz State
University of
Construction,
Transportation
and Architecture

Research visit at
ÖAW GIScience
Oct-Dec 2008

» *In the fall of 2008 I had the
opportunity to join the research
team at ÖAW-GIScience with
support from the Eurasia-Pacific
Uninet for several months. My focus
was on postdoctoral work in the
geospatial modelling of hydroenergy
potentials in mountainous regions –
an important topic in my home
country where the energy crisis
is a top priority. I look forward
to continuing this invaluable
cooperation and certainly will stay in
touch while translating the research
outcomes from my stay in Salzburg
into practice. Thanks for a creative,
stimulating and at the same time
challenging work environment!*

Public Access to Science

PR Activities
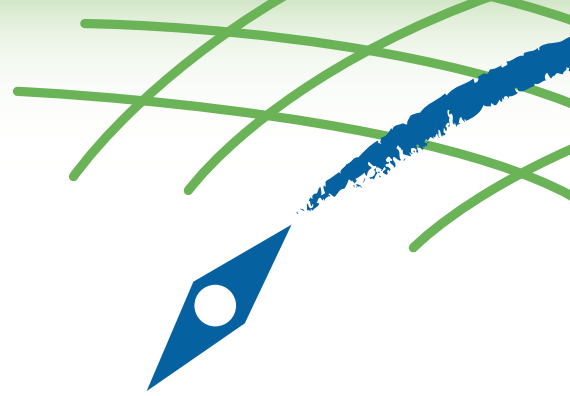
Geoinformatics Colloquia

The Geoinformatics colloquia are jointly organized by Z_GIS, the research studio iSPACE, Salzburg Research, ÖAW GIScience, the GIS-Cluster and further partners from the Salzburg GIS-Location. The events take place at the Techno-Z Salzburg, Tuesdays 4 – 6pm. GIScience scientists occasionally present their research.

Global GIS Day,
annually in November

The Global GIS DAY is an annual event and a major public relations initiative fostering geographic information science and technology by raising public awareness and motivating young people to look into this area for possible further education and careers. At these events in 2007 and 2008 GIScience research projects and activities have been introduced to the main target group – secondary school students and their teachers.
> www.gisday.at

GI_Forum and AGIT,
annually in July

The Salzburg University Centre for Geoinformatics together with GIScience at the Austrian Academy of Sciences is offering an annual forum to the worldwide geoinformatics community, bringing together English-speaking researchers and practitioners across disciplines and industries. Simultaneously, the GI_Forum connects participants into a well established co-located regional symposium – Applied Geoinformatics (AGIT) – sharing the state-of-the art AGIT-EXPO exhibit.

> www.agit.at
> www.gi-forum.org

Since 2007 the GIScience Research Unit invites ÖAW institutions working on GIScience topics to present their research initiatives in the spatial domains at the GIScience booth at the AGIT-EXPO exhibit.

Lange Nacht der Forschung in Salzburg, 2008

The project "Geostatistical space-time characterization of Multiple Sclerosis lesion distributions" has been presented together with the research partner "Christian-Doppler-Klinik" during the event "Lange Nacht der Forschung in Salzburg, 2008!

> www.langenachtderforschung.at

Real Time City Project

24-26 September 2008 –
PicNic 2008 – Amsterdam –
Presentation of The Visible City:
> www.picnic08.com

23-24 September 2008 –
Connected Urban Development
Conference Amsterdam:
> www.connectedurbandevelopment.org

Schools on Ice Project

Sparkling Science Award, 23. 6. 2008: Mr. Hahn, minister for science and research, and Dr. Zeilinger awarded a prize to "Schools on Ice", a project with the school "BG Nonntal" under the lead of the GIScience Research Unit.

Prickelnder Forschungshype, „Sparkling Science" begeistert Jugendliche in: Austria Innovativ, das österreichische Magazin für Forschung und Technologie. Nr. 4 / 2008, p 18-19 o http://www.sparklingscience.at/blog/?cat=7

Video:
Zeilinger presenting awards.
> http://tinyurl.com/cn5qse
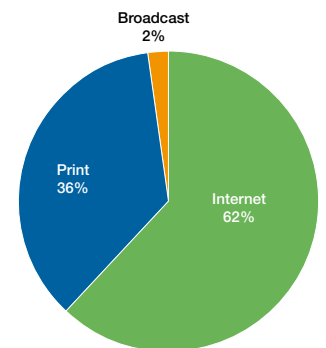
Articles with explicit naming of the GIScience Research Unit
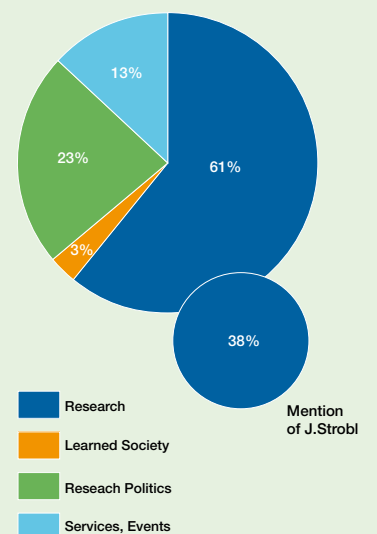
Topics allocation of GIScience media presence 2007 – 2008

Project
Fact
Sheets

Spatial Analysis & Modelling

Time & Space

Learning to Think Spatially

Spatial Data Infrastructures
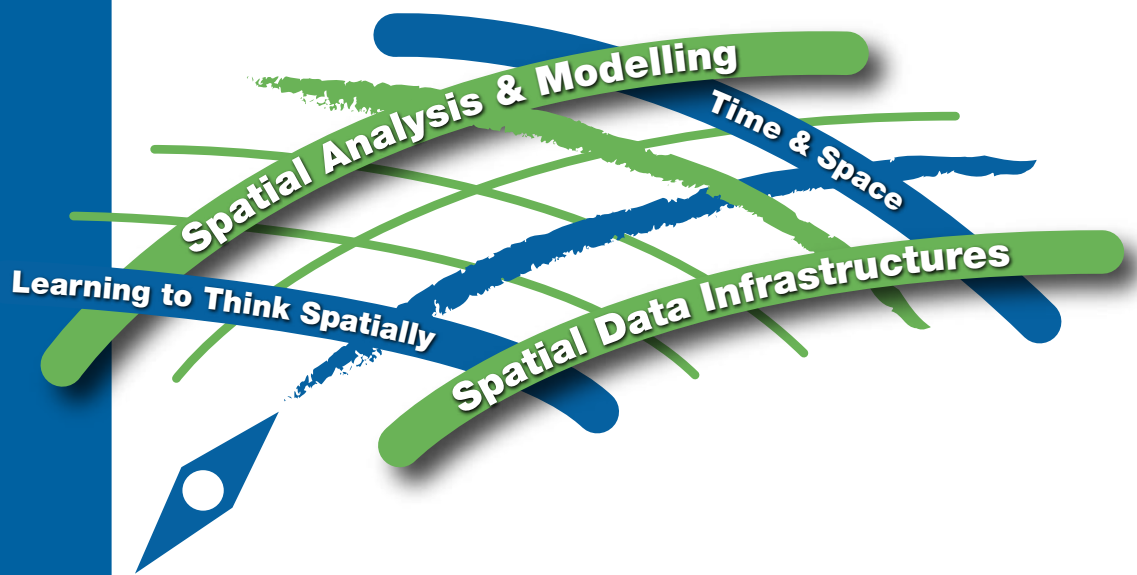
Spatial Analysis and Modelling

OBIA ■

GeoMS ■

GeoSMT ■

GeoNT ■

Landscape ■

Change Modelling ■

Spatial Data Infrastructures

GeoICT & Society ■

SDI & Geo Objects ■

European SDI ■

Nature-SDIplus ■

Time and Space in GIScience

Time & Space ■

Real Time City ■

Global Change ■

Spatial Behaviour ■

Modelling Mobility ■

Learning to Think Spatially

GI_EDU ■

Schools on Ice ■

GIST-CroHE ■

CEE-GIS ■

OBIA

Object-Based Image Analysis

Spatial Analysis

Joint Research Project

Duration
February 1, 2007 – ongoing

Project Group
Matthias Möller
Gudrun Wallentin
Josef Strobl

Project Partner
Centre for Geoinformatics –
Z_GIS, University of Salzburg

30 Year Image Time Series;
Landsat TM, ETM & ASTER

Objects versus pixels

In remote sensing we observe, monitor and characterise our environment by analysing digital images of the earth surface. Just like any other digital imagery, remotely sensed images consist of pixels with different colourvalues. Visually we recognise real world features, because we group the pixels to objects according to our experience of shape and spatial arrangement. In traditional automated pixel based image analysis, meaningful objects are assigned to a sum of pixels with distinct values. However, especially in high resolution images this classification process often leads to a "salt and pepper" effect, resulting in noisy maps. Object based image analysis (OBIA) is a relatively new approach that builds on the human process of object recognition. With this method objects rather than pixels result from the classification process.

How OBIA works

The object based image analysis approach delineates segments of homogeneous image areas. The spatial resolution of the input image, the scale of homogeneity search tolerance and parameters for shape and colour determine the delineation. The segments can be calculated on different scale levels to represent large size objects, medium size objects and small size objects respectively. The segment levels are organised in a hierarchical structure, such that segments are related to their neighbours and the segments of the upper and lower levels they belong to.

In a next step, the delineated segments are classified to real world objects based on spectral, textural, neighbourhood and object specific shape parameters. The set of classification rules represents the expert knowledge of the image interpreter. Depending on the intended classification accuracy, the rule sets for different objects have to be redefined or tuned to enhance classification accuracy in an iterative, self improving classification cycle.

Analysis over time

A research challenge is to include time as a third dimension into the classification process by analysing image time series (Fig.1). The task is to identify, classify and model change to monitor the earth surface over time. This research field links to „space and time" a further focus of the GIScience research unit that deals with the conceptualisation of integrating time into spatial datasets.

ÖAW – GIScience R&D Programme

SPATIAL DATA INFRASTRUCTURES
Building spatially enabled ‚information highways' is a requirement for better management of our societies and environments. Our contributions aim at the specification of advanced multi-dimensional data models, the integration of realtime sensor input and open interfacing across system architectures.

SPATIAL ANALYSIS AND MODELLING
Research questions address segmentation-based information extraction from remotely sensed imagery, multidimensional geostatistics and the modelling of dynamic processes. Methods for flexible regionalisation, the analysis of mobility patterns and work with multi-scalar data receive special consideration.

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Spatial Analysis

GeoMS

Some spatiotemporal aspects of Multiple Sclerosis: Understanding a potentially debilitating disease in 4D
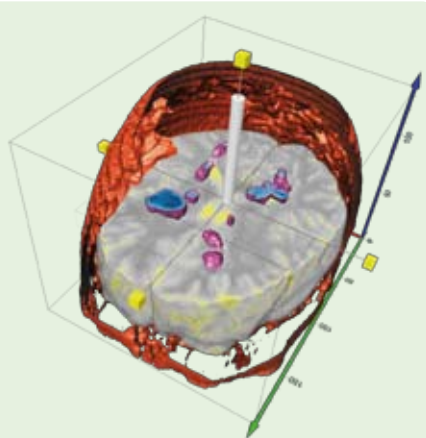
Joint Research Project

Duration
February, 2007 – July, 2009

Project Group
Robert Marschallinger
Peter Hofmann

Project Partner
MS center,
Christian Doppler Klinik
(Salzburg)

Geostatistical space-time characterization of Multiple Sclerosis lesion patterns

Multiple sclerosis (MS), the most frequent neurological disease of young adults in Europe and North America, affects the central nervous system (CNS). While the exact illness triggers still remain obscure, it is generally agreed that MS is an autoimmune disease that attacks the myeline sheaths of nerve tissue. In the brain and spinal chord, MS is typically expressed as mm to cm wide demyelinized lesions, where nervous signals are drastically attenuated and slowed. Many dysfunctions of MS patients can be directly related to the locations of lesions in the CNS.

Advances in medical imaging with magnetic resonance imaging (MRI) at the forefront, provide a steadily improving spatiotemporal data base of MS-related cerebral damage.
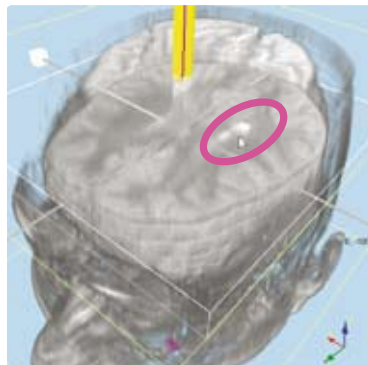
Today, MRI scans are routinely carried out to document the state and course of disease of MS patients. The resulting stacks of MRI images are evaluated to identify the locations of MS lesions, their number and total volume. However, there is only qualitative knowledge relating to the spatial distribution and topological arrangements of MS lesions (lesion patterns), and little is known about the possible correlation of MS lesion patterns with different MS disease types. Nothing is known about the evolvement of MS lesion patterns in the light of recent breakthroughs in MS medication.

Pooling the heterogeneous knowledge of radiologists, neurologists and geoinformatics scientists, the project aims at developing methods for the 3D reconstruction, spatio-temporal analysis and simulation of MS lesion pattern evolution.

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Spatial Analysis

GeoSMT

Small Mammal Teeth as anchors in space-time modelling of species dissemination
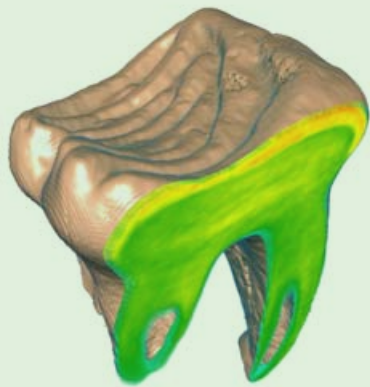
Sliced HECT of an SMT classified by materials

Joint Research Project

Duration
February, 2007 – July, 2009

Project Group
Robert Marschallinger
Peter Hofmann

Project Partner
High Energy Computed
Tomography Facility University
of Texas at Austin,
Natural History Museum
Vienna

Small mammal teeth ("SMT") are widely found in cenozioc sediments the world-wide. Because of the good durability of these microfossils, SMT are used in stratigraphy as well as for researching the rapid eolution and paleogeographic spreading of small mammals.

To date, methods of morphological SMT classification comprise optical microscopy and electron microscope investigation, ending up with images and descriptions of the fossils. Recent advances in high energy x-ray computed tomography ("HECT") have drastically improved the spectral and spatial resolution of this non-destructive analysis method, making it an ideal data source for 3D modelling SMT.

In the GeoSMT project, HECT is used to scan SMT (overall sizes typically 2-4mm, voxel sizes about 2 microns). The resulting raw voxel models are subject to 3D image processing, ending up with 3D models of SMT classified by material properties. Complementing the traditional techniques mentioned above, these 3D models can be qualitatively and quantitatively analyzed in an unprecedented manner: they can be viewed and sliced in any direction and peeled by material properties, volumes and surface areas can be extracted while the involved fossils remain in good order. Providing access not only to the outer surfaces, but also to the interior of teeth, the resulting 3D models serve as a novel basis for SMT classification and communication of research results, because these models can be shared among palaeontologists via internet technology.

In the GeoSMT project, a first goal is to establish a versatile workflow for extracting, from HECT data, the most important morphological features in SMT. Combining the high precision species classification derived from the 3D models and the places/stratigraphy of discovery, another goal of the GeoSMT project is to model, with 2D+t geostatistics, the paleogeographical spreading dynamics of selected SMT species.

The research is conducted in cooperation with the University of Texas High Energy Computer Tomography Lab (UTCT) and with the Natural History Museum, Vienna (NHM). UTCT provides stateof-the-art 3D scanning facilities and the NHM makes available its big pool of samples as well as the paleontological expertise.

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GeoNT

Using High Resolution Neutron Computed Tomography for analyzing the 3D-structures of magmatic rocks
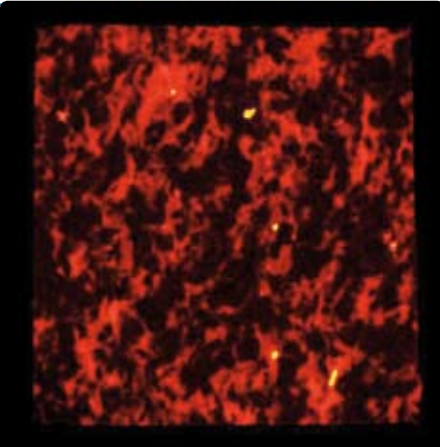
HRNCT derived voxel model of granitic rock

Joint Research Project

Duration
September, 2008 – July, 2009

Project Group
Robert Marschallinger

Project Partner
K.U. Hess (LMU, Earth and Environmental Sciences, Munich, Germany)
J. Kruhl (TU Munich, Fachbereich Tectonic and Material Fabrics, Germany)
B. Schillinger (Research Reactor FRM-II, TU Munich, Germany)

Analyzing 3D-Structures of Syntectonic Magmatic Rocks with Neutron Tomography

High resolution Neutron Computed Tomography (HRNCT) has only recently achieved resolutions comparable to X-ray computed tomography (CT). As compared with CT, HRNCT has the advantages of the higher penetrating power of neutrons. In contrast to X-rays, neutrons interact with the atomic nucleus. Thus, HRNCT is a promising technology for detecting the subtle changes of mean atomic weight of rock-forming minerals found in granitic rocks.

Syntectonic granitoids provide important information about crustal processes, such as formation of large-scale and deep-rooted faults and thrusts, and the compositional and structural re-organization of the continental crust in general. However, emplacement and crystallization of granitoid melts in regional stress fields, though very common processes are not sufficiently understood. Magmatic structures are generally too coarse for thin-section analysis, too diffuse for precise conventional measurements, and often show irregular geometry which does not allow extrapolation from smaller to larger scales and, above all, from 2d to 3d. Neutron tomography offers, to date, the only sufficiently fast and precise method for 3d micrometer resolution of these magmatic structures on the required millimeter- to centimeter-scale. Such data sets form a strong basis for quantification of rock fabrics and, consequently, for comparison of natural, experimentally produced, and simulated fabrics, as well as a deeper understanding of fabric-forming processes.

The prospect of the GeoNT project is to benchmark 3D-models derived from HRNCT with conventional precision serial lapping derived 3D models. 3D referenced, physical slices through the samples, which have been subject to HRNCT before, are related to the HRNCT voxel arrays to study the geometrical and spectral resolution of this novel, destruction free data acquisition method.

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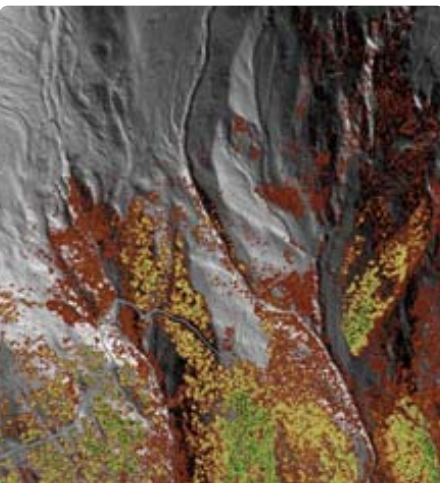*Contact Person: robert.marschallinger@oeaw.ac.at*

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Landscape Change Modelling

Spatiotemporal modelling of natural reforestation

Spatial Analysis

Modelling alpine tree line dynamics – an individual based model

At the intersection of GI-science and landscape ecology this PhD project focuses on the predictive modelling of natural reforestation. The aim is to gain a deeper understanding of the causal relationships of spatial vegetation patterns on abandoned alpine pastures.

Project Description

The Alps currently witness a substantial natural reforestation along the upper tree line due to land abandonment and climate change (Tasser et al. 2007). This research focuses on predictive modelling of plant succession processes on abandoned alpine pastures. A case study in Längenfeld, Ötztal is used (1) to gain a better understanding of regeneration processes at the tree line in the European Alps and (2) to provide a sound basis for decision making.
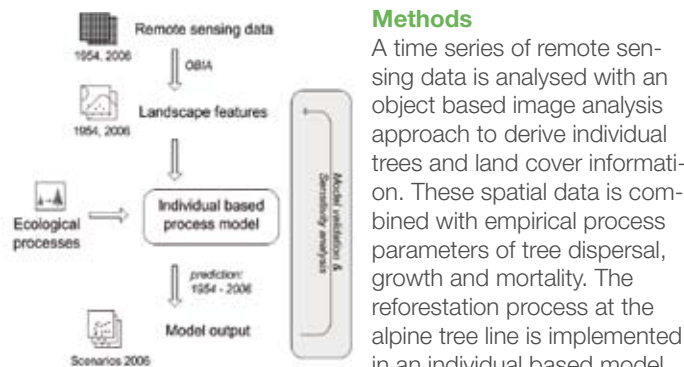
Methods

A time series of remote sensing data is analysed with an object based image analysis approach to derive individual trees and land cover information. These spatial data is combined with empirical process parameters of tree dispersal, growth and mortality. The reforestation process at the alpine tree line is implemented in an individual based model in yearly time steps.

Expected results

The developed reforestation model is expected to provide a better understanding of the processes causing spatial reforestation patterns. Research questions refer to the driving ecological process parameters in the emergence of forest patterns and to the role of land use versus climate change responsible for the current reforestation.

Moreover the reforestation model builds the basis for predictions. Scenarios for different climatic and land use conditions can be simulated. The model output can be visualised to facilitate the communication of the results to the public.

PhD project
Natural reforestation on abandoned alpine pastures – spatio-temporal modeling of plant succession dynamics

Duration
February 1, 2007 – June 30, 2010

Supervision
Dr. U. Tappeiner, Institute for Ecology, University of Innsbruck | Dr. J. Strobl, Centre for Geoinformatics, University of Salzburg & ÖAW GIScience

Project Partner
Institute of Ecology, University of Innsbruck, Austria

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GeoICT & Society

Living and Acting in Geo-Mediated Spaces

SDI

Objectives

The goal of the PhD project is to develop an explorative concept about individual appropriation (including the participatory experience) of geo-enabled media regarding their influence and meaning for everyday urban life. Furthermore insights are anticipated on the individual interpretation and evaluation of geo-contents and the potential for actionable empowerment by geo-enabled media.

This project focuses on fundamental research on the intersection of urban geography and media-science related to the influence of geospatial technology. But the insights also hold practical relevance for the evaluation of mobile content and utilization of mobile marketing concepts. The overall relevance of this topic gains more and more importance as geo-enabled media are widespread and are expected to become a mass-market in the future. Not least by governmental initiatives like SEIS or INSPIRE that explicitly aim on providing useful spatial information to European citizens amongst others.

Project Description

In order to conceptualize urban living I bind it to the term "making of everyday geographies". That is, the processes in which humans interact with their material and social environments that are linked to the notional connection regarding the environments. The subjective entanglements of meaning and material base on the active appropriation and perception of both material and mediated spaces and have been denoted as the "experienced spaces".

The appropriation (reception studies) of certain types of geo-media will be examined to identify different contexts of usage in everyday life. An important aspect is the individual interpretation of geo-media contents as well as the interpretation of urban living on geo-media contents. The theoretical foundation embracing spatial perception, human action and media appropriation accounts for the use of qualitative reception-focused interviews.

PhD project
Effects of Geospatial Media on Urban Space
On the Individual Experience of Geo-Mediated Spaces Using a Media-Geography Approach

Duration
July 1, 2007 –
June 30, 2010

Supervision
Prof. Dr. J. Strobl, Centre for Geoinformatics, University of Salzburg & ÖAW GIScience | Prof. Dr. A. Koch, Department for Geography and Geology, Salzburg University

Project Partner
University of Salzburg, Department for Geography and Geology

ÖAW – GIScience R&D Programme

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SDI & Geo Objects

Spatial Data Infrastructures: Mapping, Modelling & Analysis
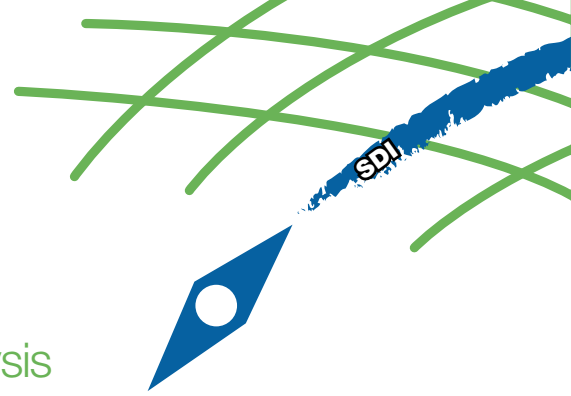
Research Project

Duration
June 1, 2008 –
July 31, 2009

Project Group
Fritz Zobl
Robert Marschallinger

Objectives

This project focuses on the development of advanced multidi-mensional data models in order to provide a better applicability of huge mounds of structured 3D data as well as 3D objects with geometric shapes close to nature (NURBS surfaces). Geospatial information is a requirement for better management of our societies and environments. Geospatial data contains not only above surface (e.g. buildings), or surface data (e.g. remote sensing data) but also subsurface data (e.g. lithological units, and geotechnical objects like tunnels or shafts). In order to have a smart and applicable tool for the design and administration of geospatial and geotechnical projects, the shape of geo objects and associated properties need to be available on a platform conforming to open standards.

Mapping – Modelling – Analysing

Based on mapping and existing geospatial data, (geo-) objects can be represented by 3D geometrical modelling. As a result, solid models of objects are developed and properties of each object are stored in a database. To have the ability to deve-lop and analyse 3D geo objects, the potentiality of creating boundary representation models (B - rep) and Nonuniform Rational B – Splines (NURBS) for geometric shapes as well as a database link of the object properties to the geometrical objects is of high importance.

Spatial and temporal changes and properties of geo objects can be analysed by using voxel models, which are either pro-vided from geostatistics or are derived from three-dimensional geometrical models. Similar to 2D GIS functionality for 2D raster models, properties of objects can be weighted and intersected on the basis of data features and expert knowledge for 3D raster models (voxel models).

Spatial Data Infrastructures

Currently various GI-, CAD- and database software systems are available. Thus, at the beginning of the project, existing GI-, CAD- and database software will be reviewed and evaluated. On the basis of a case study, practicability of these systems for the above defined application of administrating mapping data, 3D modelling and 3D analysis abilities of geo objects will be checked. Based on the results, the focus of the research will be on developing a data model for the process of mapping, modelling and analysing of 3D geo objects.

ÖAW – GIScience R&D Programme

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Dr. Robert Marschallinger
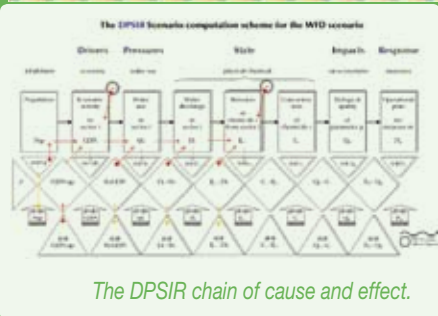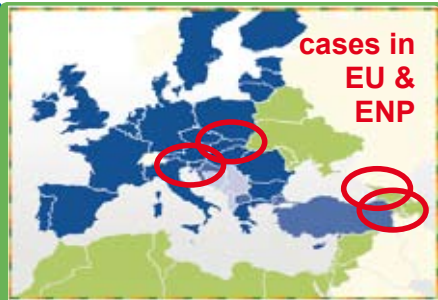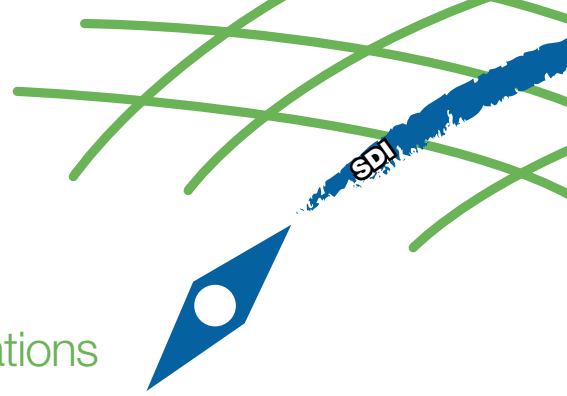
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Austrian

European SDI

Building Blocks and Applications

cases in EU & ENP

The DPSIR chain of cause and effect.

Interdisciplinary Project

Duration
March 2008 – December 2009

Pro...
GI...
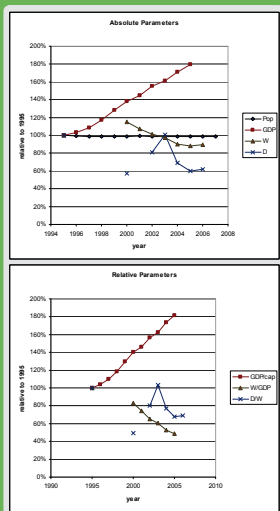
Project Objectives

The new INSPIRE Directive is highly relevant for GIS: it regulates the general situation on spatial information in Europe. This initiative intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services. A Memorandum of Understanding was signed with the "Institute for the Water of Slovenia".

Project Description

This project adds several building blocks to Spatial Data Infrastructures (SDI) from

1. EU member states: Slovenia (building on expertise from Slovakia) on the Water and Air Framework Directives
2. European Neighbourhood Policy (ENP) countries: Armenia and Georgia on aviation and aviation safety

Here, the case of "designing geo-referenced scenarios for the requirements of the Water Framework Directive" is highlighted: Matching of river basins with administrative regions (described by the row of 3 maps below) opens the avenue for geo-referencing the entire chain of cause and effect "DPSIR" in water management down to the municipal level:

Drivers – Pressures – State – Impact – Response,

here (implemented for the Drava river basin, see scenarios at left): population ➔ economic level ➔ specific water demand ➔ specific water discharge ➔ emission of pollutants c in economic sector i:

$$E_{c,i} = Pop \times GDP/cap \times W_i / GDP_i \times D_i / W_i \times E_{c,i} / D_i$$

2 case study areas:
Upper Drava   Lower Drava

from nature → to administration

← and back by measures

ÖAW – GIScience R&D Programme

EUROPEAN SPATIAL DATA INFRASTRUCTURES – BUILDING BLOCKS AND APPLICATIONS

Building spatially enabled information structures is a requirement for better management of our societies and environments. Our contributions aim at the usability for everyday European Union administrative processes while maintaining credibility and scientific excellence. patterns and work with multi-scalar data receive special consideration.

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Nature-SDI*plus*

Best Practice Network for SDI in Nature Conservation

NatureSDI *plus*

Funded Project
Commission of the European Communities Directorate-General Information Society and Media. eContentplus Programme Agreement Number: ECP-2007-GEO-317007

Duration
October 1, 2008 – March 31, 2011

Project Group
Barbara Brunner-Maresch
Florian Fischer
Sabine Hennig
Karin Hörmanseder
Hermann Klug
Josef Strobl
Gudrun Wallentin

Coordinator
Geographical Information Systems International Group (GISIG)

Project Website
> www.nature-sdi.eu

The establishment of Natura 2000 and the new transboundary EU approach for protected sites management has enforced the link between nature conservation and geo-information. This has generated the need for interoperable and accessible EU harmonised datasets. The link is also addressed by the INSPIRE Directive which pursues an EU Spatial Data Infrastructure to support environmental policies. The research within the FP7 project „Nature-SDIplus" links to spatial data infrastructures (SDI) as one of the primary fields of research at the GIScience Research Unit. In an interdisciplinary team of domain specialists and data modellers we focus on interoperability and exploitability of distributed spatial datasets in nature conservation. As national coordinator, and WP2 leader for the Nature-SDIplus network in Austria GIScience will build up a network of partners who are involved in nature conservation on all geographical scales. The analysis of users needs and the gap analysis within the first half of 2009 will be a first step in building up the network and is the corner stone of a Spatial Data Infrastructure for nature conservation. Nature-SDIplus Network aims, through state-of-the-art methodologies and best practice examples, to improve harmonisation of national datasets and make them more accessible and exploitable. Therefore, it contributes to the INSPIRE implementation with specific reference to a cluster of data themes on nature conservation (as per the INSPIRE Annexes):
• Protected sites
• Biogeographical regions, Habitats and biotopes, Species distribution.
The main objective of Nature-SDIplus Network is to: involve new stakeholders; share data and best practices; improve and stimulate exploitation and the re-use of information on nature conservation. The project will analyze the usability and accessibility of data. The results of this analysis will be used to propose a new work item for a standard metadata profile and data model compliant with the INSPIRE Directive and in coordination with CEN/TC 287 Geographic information.

Representative datasets will be provided by the partners from many EU Member States. The project will define a common multilingual and multicultural approach for a simpler, standard access to spatial data. A demonstration geoportal, supported by web services, will provide data accessibility for the different stakeholders. This geoportal will then afford a means to actively engage the stakeholders. Through networking activities a Nature-SDIplus Community will be established. This Community will address the relevant themes on a consensus building approach. This Community will also demonstrate the effectiveness of the Nature-GIS thematic SDIC that is already registered with INSPIRE. The project will, through training and dissemination, ensure that widespread awareness is achieved.

ÖAW – GIScience R&D Programme

SPATIAL DATA INFRASTRUCTURES
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Dipl.-Geogr. Florian Fischer
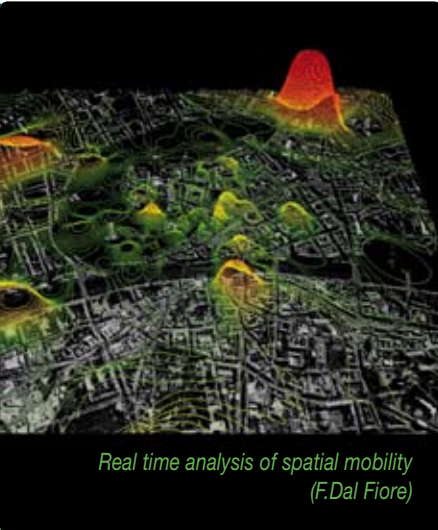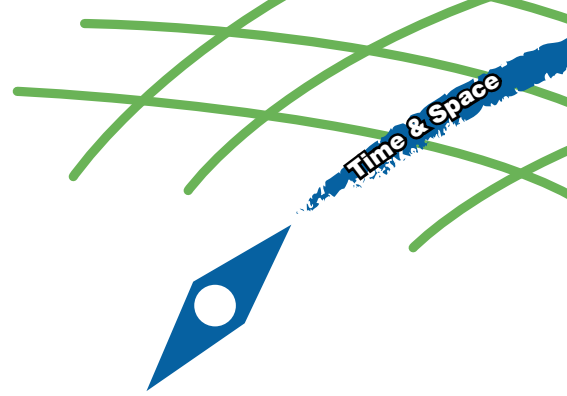
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Time & Space

Time &
Space Space and Time in GIScience

Time & Space

Real time analysis of spatial mobility
(F.Dal Fiore)

Central Idea
The nature and properties of geographic information (GI) are at the very centre of debate in the GIScience community. A part of the GIScience research unit explores the
- cognitive,
- social and
- operational

aspects of space and time in GIScience. This includes models of both social and physical space and consequences thereof for spatial analysis and spatial data infrastructures.

From Spatial and Temporal Concepts to Spatial and Temporal Formalisations
Traditionally, space and time as meta-dimensions are hardly ever treated from integrated perspectives.
Full temporal enabling of data models and analytical strategies is indispensable for spatial monitoring, analysis of mobility, and rapidly changing dynamics in natural and social spaces.

What?
Object

When?
Time/Event

y

x

Where?
Location

t_0 t_1 … t_n
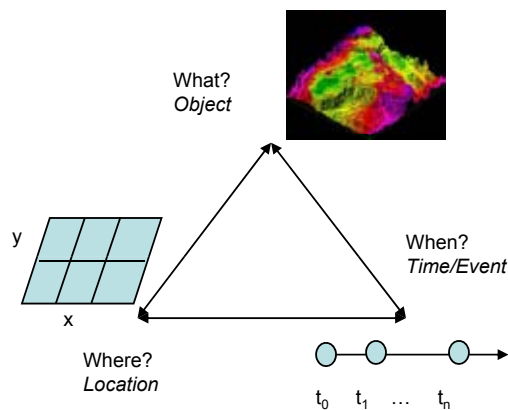
Approach
We investigate how space and time are conceptualized in these application areas, and how well the existing models of space and time meet their needs.
This investigation is expected to identify gaps. Analysis of these gaps will result in improved and/or new spatio-temporal concepts particularly in support of spatial analysis and spatial data infrastructures.

Interdisciplinary Project

Duration
February 1, 2007 –
July 31, 2009

Project Group
Adrijana Car
Gilbert Ahamer
Florian Fischer
Filippo Dal Fiore
Thomas Jekel
Robert Marschallinger
Josef Strobl
Gudrun Wallentin
Fritz Zobl

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Time & Space

Real Time City

Sensing traffic through mobile phone data

Superimposition of cell phone traffic with GPS positions of buses, in real-time: are there enough buses where people cluster?

Joint Research Project

Duration
September 15, 2007 –
Januar 31, 2008

Project Group
Filippo Dal Fiore

Project Partner
Vrije Universiteit Amsterdam,
SpinLAB

The mass diffusion of mobile phones makes them an ideal tool for collecting real-time information on traffic: by knowing where people are calling, you also know where and how they are moving, in an aggregated and anonymous way.
With virtually no investment in any new physical infrastructure, it is possible to detect people presence and mobility, with different degrees of precision.

Available in real-time, these maps can support decision making in multiple contexts, notably in case of emergencies or for evacuations: for the first time it is possible to quantify how many people there are in a given area, at a given time. Mobile phone data could also be analyzed at a weekly or monthly basis to further understand traffic patterns. Traffic-light placement and parking space allocation can benefit.
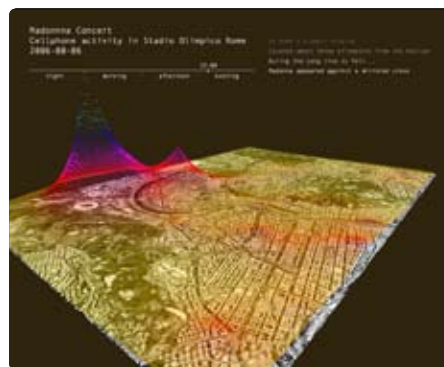
Cell phones data reveal people presence in Rome during a special event.

Eventually, the opportunity to tailor data interpretation for different scopes could open new business opportunities in several sectors. For example, as for dynamic pricing of street advertising and of real and commercial-estate.

The Real Time City project aims at proofing this concept for the metropolitan area of Amsterdam. It leverages on the KPN network and on the data engineering expertise of world reknown research institutions.

Data currently available include the location of cell phone towers to which phones are connected. After processing such data through algorithms, two types of maps can be devised:
• agglomeration of people during the course of the day;
• movements of pedestrians and cars in the Amsterdam metropolitan area.

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Global Change

Mapping Dynamics of Country-level Indicators

Time & Space
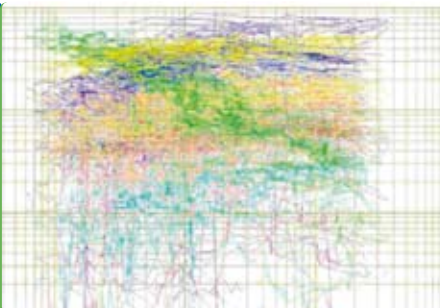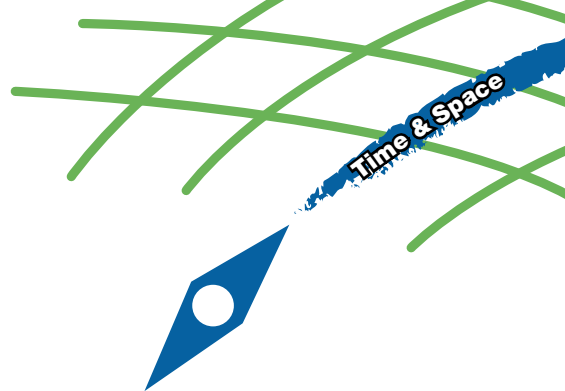
Interdisciplinary Project

Duration
March, 2008 – July, 2009

Project Group
Gilbert Ahamer
Adrijana Car
Robert Marschallinger
Josef Strobl
Gudrun Wallentin

Project Objectives

A suitable geo-referenced methodology for depicting global or local dynamic change processes of the techno-socio-economic system should be found. Case studies are the

• global system of food demand and supply (agro-economics)
• global system of energy demand and supply (energy economics).

Geo-referenced drivers for the future development of anthropogenic CO_2 emissions are identified as well as hypotheses for the intrinsic dynamics of global change processes.

Project Description
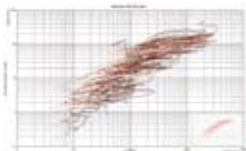
Analysis of the "Global Change Data Base" GCDB allows to look into

• the first derivative
  (slope of the red trend lines at right) and
• the second derivative
  (slope of the red trend lines below)
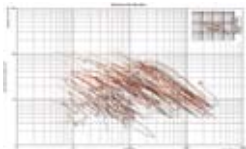
of the state vector of the global techno-socio-economic system. Examples for interesting state variables are energy demand per capita (at right above) or energy demand per economic output (at right centre).

Additional analyses of the economic structures and sectoral distributions (at right below) show an evolution from

• matter-oriented
  to information-oriented activities
• individual to societal activities
• covering basic needs
  to meeting higher aims of wellbeing.

An important feature is the quantitative evaluation of saturation limits in global evolution of agriculture and energy economics because these limits govern the overall dynamics of future scenarios for global change and specifically of anthropogenic CO_2 emissions and necessary CO_2 abatement measures.

Results are presented in international journals, in book chapters and at international conferences.

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Spatial Behaviour

Understanding human spatial behaviour in the ubiquitously connected society
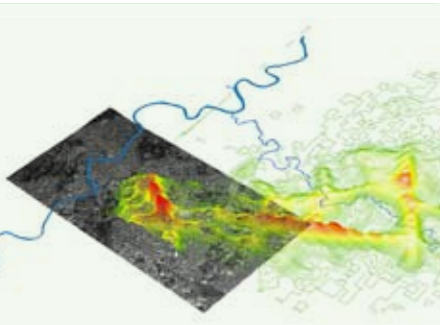
Daily amount of cell phone traffic data exchanged in Rome (Telecom Italia Network, 15.07.2006)

PhD project
Econometric Modelling of Human Mobility

Duration
2007 – 2009

Supervision
Prof. Dr. Josef Strobl, Centre for Geoinformatics, University of Salzburg & ÖAW GIScience | Prof. Dr. Euro Beinat, Vrije Universiteit Amsterdam

Project Partners
Massachusetts Institute of Technology, Senseable City Lab
http://senseable.mit.edu/
Vrije Universiteit Amsterdam, Dept.of Spatial Economics
http://www.ivm.vu.nl/

Research question

Mobile technologies such as cell phones, laptop computers and PDAs are more and more diffused all over the world. Once people and professionals are always reachable and ubiquitously connected to information resources, how do they modify their daily spatial behaviour? Do they move differently and, if so, do they move more or less, for which new reasons and to which different places?

Case Studies

This project aims at shading new light on this issue, building on two case studies: the urban campus of the Massachusetts Institute of Technology, where students can count on laptop and ubiquitous Wi-Fi connectivity; the city of Groningen (NL), where policemen are equipped with a portable workstation PDA.

Methods

Mobility data are to be collected through mobility diaries and innovative hi-tech solutions (based on triangulation of Wi-Fi signals and GPS tracks), for then being quantitatively analyzed in GIS and correlated with socio-demographic data on the same subjects. Through regression analysis, a mathematical model is devised to predict spatial behavior from a wide set of independent variables, one of which being the availability of a mobile device.

Expected results

Final results will be relevant for different publics, from transportists to urbanists. Hopefully, an increased awareness of current drivers of human mobility will allow them to plan infrastructures that better adapt to the new needs and are more sustainable in the way they get used.

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Modelling Mobility in Nature-based Recreation
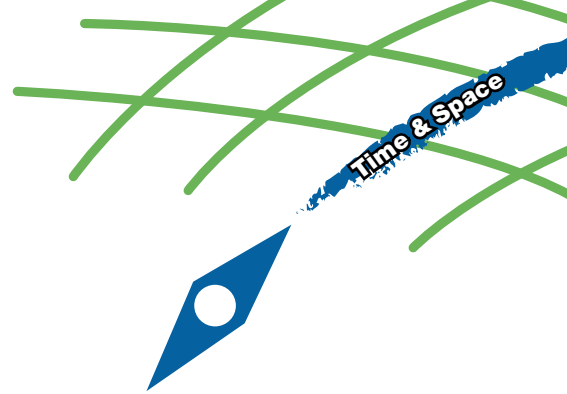
Time & Space

Modelling spatial-temporal behaviour of visitors in recreational and protected areas

This project focuses on the modelling of visitor mobility in recreational and protected areas. It combines knowledge and methods from GIScience and recreational planning and management. The project aims at representing spatial-temporal behaviour of visitors, based on an understanding of nature-based recreation.

Description

Within our modern society recreation is characterised by rising visitor numbers and changing visitor demands. This poses a challenge for recreational planning and visitor management in recreational and protected areas. To meet recreational and ecological demands in a sustainable way, planning and management need a comprehensive database of use vs. resources. Special relevance is given to insights into spatial-temporal behaviour of visitors, particularly their mobility during nature-oriented recreation. The collection of adequate visitor data is not an easy task, given that most recreational and protected areas are remote, have multiple entry and exit points, are crisscrossed by numerous trails and have only few staff present on-site. In this project mobility of nature-oriented recreation is defined using valid and measurable indicators to reflect spatial-temporal visitor patterns. By a case study in Berchtesgaden National Park, methods on how to collect and process data to model recreational mobility are developed.

Methods

The model for recreation mobility consists of two sub-models: The first is a model of recreational infrastructure based on concepts of visitor nodes and recreational routes. The second model is based on a process-oriented approach representing recreational demands and recreational perspectives of visitors. The data is collected by visitor monitoring (e.g. interviews, time-lapse video, acoustic slabs) or made available by stakeholders (e.g. visitor tickets, overnight stays). To use the spatial analysis and animation functionality of ESRI's ArcGIS, the data model is developed in Oracle 10g XE using Oracle Spatial.

Results

The recreational mobility model – not only valid for Berchtesgaden National Park – provides a deeper understanding of the spatial-temporal distribution of visitors and its causal backgrounds. It is the basis for recreational planning, and visitor as well as site management. In addition, results of changing conditions in recreational use can be visualised and discussed.

Postdoc Research Project
Monitoring of the modern land use recreation

Duration
2007 – ongoing

Project Group
Sabine Hennig
Josef Strobl

Project Partner
Berchtesgaden National Park,
Institute of Geography,
FAU Erlangen-Nürnberg

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GI_EDU

Collaborative Learning with GI

Learning to Think

Project Objectives

'Collaborative Learning with GI' aims at providing knowledge on collaborative learning environments with a specific emphasis on value added by spatial representation and collaborative visualisation. The project both develops and evaluates learning environments that support active participation in global change and therefore contribute to spatial citizenship.

Project Description

The project combines game-based learning supported by learning management systems (LMS) with an explicitly spatial approach. The web based negotiation procedure "Surfing Global Change" SGC (Award for Excellence 2005 by Emerald Publishers, MEDIDAPRIX-finalist 2007) describes the interwoven social and learning processes as (I) conveying information, (II) building a team, (III) debating with peers and (IV) integrating with competitors. Devising strategies following these steps is suggested to benefit learning effects.
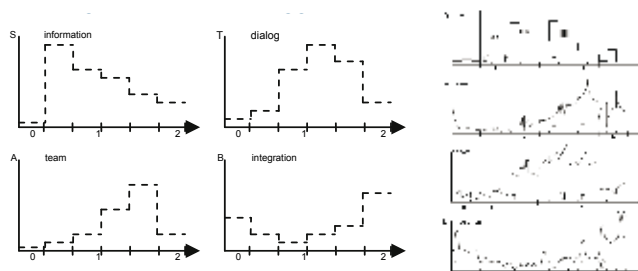
Collaborative Learning with GI explores the added value of geoinformation in the areas of conveying information, debating with peers and integrating strategies with competitors. Integration here is provided by collaborative mapping and visualisation procedures based on digital globes while evaluation is relies on content analyses of contributions and visualisation within the LMS.

Output of the project are guidelines for the construction of GI based collaborative learning environments in both secondary and higher education.

Interdisciplinary Project

Duration
March, 2007 – July, 2009

Project Group
Thomas Jekel
Gilbert Ahamer
Adrijana Car
Josef Strobl

SURFING GLOBAL CHANGE

finalist
medida prix 2007

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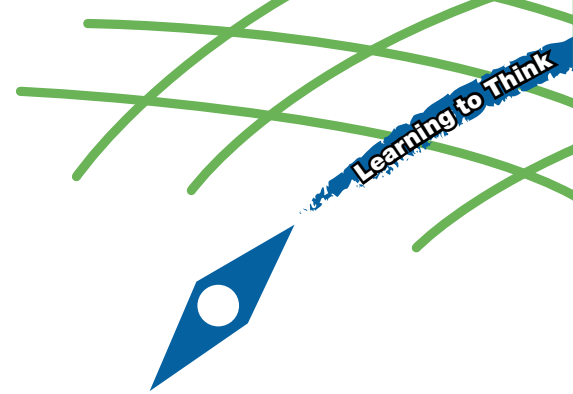
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Learning to Think

Schools on Ice

Globaler Wandel in Polar- und Hochgebirgsregionen

Geoinformation based Learning on Global Change

While Global Change is presented in different forms of media, it may be considered less tangible than other day to day problems. Schools on Ice (FERMAP.eduglobe) coordinated by GIScience offers possibilities for active learning both in virtual learning environments as well as in the field using mobile geoinformation tools for mapping and teaching. Global Change becomes a tangible phenomenon through direct interaction.

Project Description

Schools on Ice:
Online geo-information based Learning on Global Change
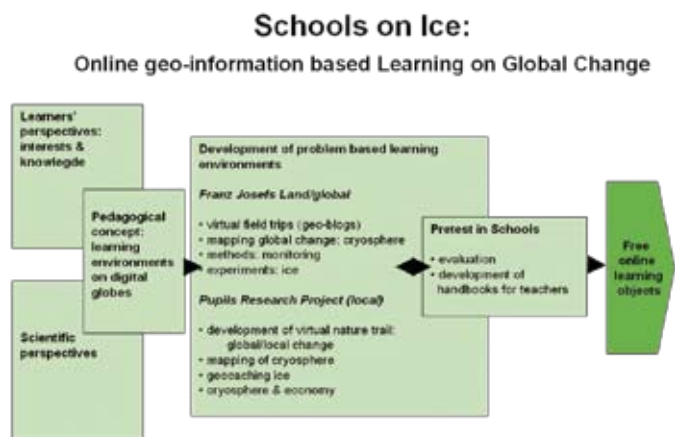
The project strongly advocates the inclusion of learners' perspectives and activity in the conceptualisation of learning materials. Based on these foundations, the project develops and evaluates Geoinformation-based learning objects for free use in schools.

Visualisation and collaboration by learners is based on the use of digital Globes, mapping both global and local change of the cryosphere as well as the economic and ecological consequences thereof. Reference areas are Franz-Josefs-Land on a global and polar scale as well as a section of National Park Hohe Tauern, Austria.

The project is open to further education partners and also serves as a geo-communication base for other FERMAP-IPY projects.

Funded Project
BMWF FERMAP IPY
2007/2008

Duration
July 1, 2007 – June 30, 2009

Coordinator
ÖAW – GIScience
Josef Strobl
Thomas Jekel
Gudrun Wallentin

Science Partner
Technical University Vienna,
Institute of Geodesy and
Geophysics

Education Partners
BG Nonntal, Salzburg
BG Traun
BG XXI, Wien

Project Website
> www.schoolsonice.oeaw.ac.at

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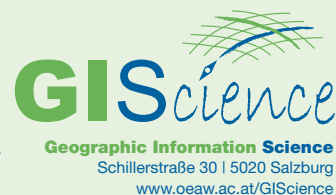
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Learning to Think

GIST-CroHE

Geographic Information Science and Technology in Croatian Higher Education

**European Commission
Directorates-General Education
and Culture
http://ec.europa.eu/dgs/education_culture**

Funded Project
Commission of the
European DG Education and
Culture:Tempus Programme,
Joint European Projects
Agreement Number:
CD_JEP-41174-2006(HR)

Duration
September 1, 2007 –
August 31, 2009

Project Group
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Z_GIS – Centre for
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Project Partner
Jagiellonian University
Krakow |
Faculty of Geodesy,
Univ. of Zagreb |
Prof. Bela Markus,
Univ. of West Hungary |
Prof. Jim Petch,
University of Manchester

Project Website
> www.tempus.geoinfo.geof.hr

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Project summary

The main objective of GIST-CroHE is to revise the existing but not yet implemented MSc programme in Geographic Information Science & Technology (GISc&T) in accordance with the Bologna Declaration for the Faculty of Geodesy at the University of Zagreb. The revision of the MSc curriculum in GISc&T will focus on the contents, teaching methods, and form of delivery. It will lay foundation for life long learning in the respective field as well.

The short term outcome of this project is a revised MSc programme in GISc&T in accordance to the approved European and international model curricula in GISc&T. This curriculum can be seen as a contribution to the convergence of the Croatian Higher Education (HE) system with the European HE Area through further reform of the content and teaching methodologies and in accordance with the Bologna Declaration.

The long term objective of this project is to define elements of a model curriculum in GISc&T at MSc level that is based on respective international model curricula but allows for it interdisciplinary implementation in study programmes such as earth and environmental sciences, forestry and agriculture, or architecture and urban planing, and yet meets the needs of educating professionals needed not only at the Croatian GIS market but also in the West Balkan region.

Faculty of Geodesy at the University of Zagreb is the explicit beneficiary of the project because it will end up with a revised, modern GISc&T curriculum and modern equipment to support its implementation, faculty trained in teaching methodology, and foundation for establishing quality assurance set up. The EU partners will benefit just as well: Collaboration within the framework of the TEMPUS project will increase the international position and visibility of JagiellonianUniversity in the field of GISc&T and e-learning. Looking at the potentials of the global educational market, worldwide applicability of curricular concepts and the building of capacities and competences for a strengthened role in international GIS education, the main benefit for Salzburg University in this project will be the expansion of its international reach.

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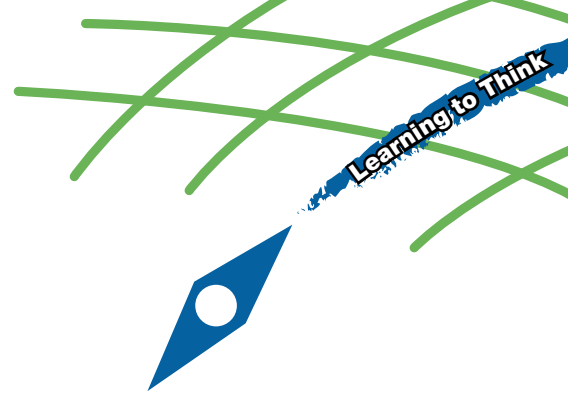Phone: +43(0)662-8044-5278

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Learning to Think

CEE-GIS

Applied Geo-Informatics
CII-AT-0062-04-0809

In 2005 Centre for the Geoinformatics (Z_GIS) at Salzburg University established a network of academic institutions called "Applied Geoinformatics" (CEE-GIS) within the Central European Exchange Program for University Studies (CEEPUS) http://www.ceepus.info. Today this network brings together 10 institutions from Poland, Czech Republic, Hungary, Romania, Bulgaria, Prishtina/Kosovo, Serbia, Croatia and Austria with a common interest in Applied Geoinformatics.

Z_GIS and the Research Unit GIScience have developed intense cooperation. GIScience is interested in expanding networking in the trans-regional scientific community, thus Z_GIS includes the Unit in the CEE-GIS network by sharing hosting activities particularly for PhD and advanced MSc students from the network institutions whose work is in the Unit's field of interest.

The main network activities include:
- full semester undergraduate and graduate exchange focusing on Geoinformatics methodologies, hosting students coming from a transdisciplinary array of institutions
- offering an annual international Summer School
- short intensive courses and research visits by students working on their theses
- teaching visits by faculty, assisting with integrating curricula, working on pedagogical issues and developing eLearning or blended learning strategies for international student bodies
- exploring possibilities for common educational and research projects

In 2008/09 all network partners were awarded a total of 60 months for mobility. This year Z_GIS hosted 10 students for a short and long term stay who conducted their thesis work or attended courses, and 2 teaching staff offering lectures on selected topics in Applied Geoinformatics for students at Salzburg University. In 2007/08 a visiting researcher from the Institute of Geography at the Bulgarian Academy of Sciences (and now Director of the Institute) contributed greatly to signing a framework agreement between the two institutions.

One of the major outcomes of this CEEPUS network cooperation was the submission of a proposal aiming at developing a curriculum for an MSc programme in GIScience under the TEMPUS CARDS program in 2006. The project partners from Salzburg, Cracow and Zagreb were awarded a 2 year grant (http://tempus.geoinfo.geof.hr/). Success in such an initiative has proven a key indicator for advancing the cooperation beyond the networking stage and resulted in establishing institutionalised cooperation on a high level.

Funded Project
CEEPUS II - Network 2008/2009
Central European Exchange
Program For University Studies

Duration
October 1, 2008 – July 31, 2009

Project Group
Adrijana Car & Josef Strobl

Project Partner
University of Salzburg, Z_GIS, Dr. Josef Strobl |
Bulgarian Academy of Science, Institute of Geography |
Mendel University of Agriculture and Forestry Brno, Department of Geoinformation Technologies |
Palacký University, Olomouc, Department of Geoinformatics |
University of Zagreb, Faculty of Geodesy, Chair of Geoinformation Science |
University of West Hungary, College of Geoinformatics |
Jagiellonian University in Cracow, Institute of Geography and Spatial Management, GIS Laboratory |
West University of Timisoara, Department of Geography |
Belgrade University, Remote Sensing Center, Faculty of Mining and Geology |
University of Prishtina, Department of Geodesy

Programme Website
> www.ceepus.info

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Geographic Information Science
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www.oeaw.ac.at/GIScience

Publications
& Presentations

2007 – 2008
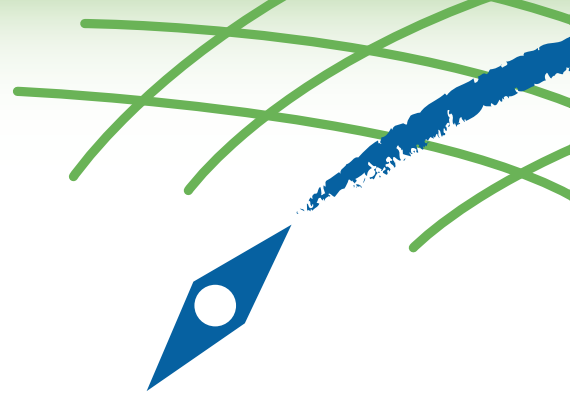
Dissemination of research outcomes is focussed on publications and presentations to scientific audiences – researchers at GIScience have reached an impressive width and depth of different target groups.

Papers	**138**
Presentations	**120**
Total	**258**

For details see following pages

- Other
- Abstract or Poster
- Peer-reviewed Articles
- Edited Books
- ISI Publications

2% · 12% · 44% · 4% · 38%

GIScience Publications
2007 & 2008

- Invited Keynotes
- Invited Talks
- Other

24% · 24% · 52%
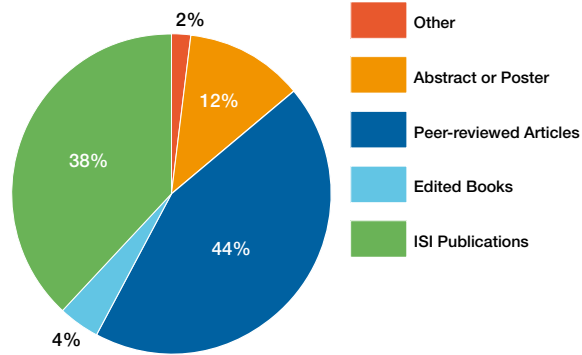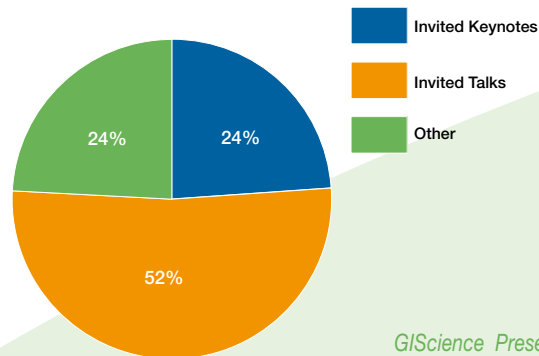
GIScience Presentations
2007 & 2008

GIScience Publications
2007 – 2008

ISI Journal Articles 2007 & 2008

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Blaschke, T., Hofmann, P., Georg, I., Schoepfer, E., Tiede, D., Lang, S.,

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Bohnert, J. & Jekel, T. (2007) Weltkulturerbe und sozialer Raum: wahrgenommen, erdacht und gelebt. Das Beispiel Hampi, Karnataka, Indien. In: Luger, K & Wöhler K.H. (Hrsg.), Welterbe & Tourismus; Innsbruck: Studienverlag.

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Mitterbauer, U. & Jekel, T. (2008) Schools on Ice - Classroom Experiments on Global Change of the cryosphere (Poster). European Geosciences Union (EGU).

Moeller, M.S., Blaschke, T. (2008) Urban LULC and structure extraction for the City of Beijing, China. (EARSeL Annual Conference) In Reihe: EARSeL Remote Sensing - New Challenges of High Resolution, hrsg. v. Laboratories, EARSeL European Association of Remote Sensing; Bochum: Ruhr Universität Bochum, S. 87 - 93.

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Wallentin, Gudrun (2008) Spatial biases in LiDAR based tree delineation., Map India 2008 - Abstract Volume (Map India 2008); New Delhi, S. 43.

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Other Publications 2007

Blaschke, T., Zeil, P., Strobl, J., Lang, S., Tiede, D., Moeller, M., Triebnig, G., Schiller, C., Mittlboeck, M., Resch, B. (2007) GMES: From Research Projects to Operational Environmental Monitoring Services. (XXXVI-1/W51) In Reihe: Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, hrsg. v. (ISPRS), International Society for Photogrammetry and Remote Sensing, S. on CD.

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Jekel, T. & Kloyber, E. (2007) Die Einbindung sozialen Raums in GIS als Grundlage partizipativer Planung. SIR Mitteilungen & Berichte (2007), S. 123-132.

Jekel, T. & Rattensberger, M. (2007) LernerInnenperspektiven zur nachhaltigen Stadtentwicklung. GW-Unterricht (2/2007), S. 23-32.

Marschallinger, R. (2007) Using AutoDesk Design Review for Round Tripping Geotechnical 3D Models in Distributed Work Groups. Geoinformatics, Bd. 10 (8), S. 4.

GIScience Presentations

Invited Keynotes 2008

Poscher, G.; Eder, St.; Marschallinger, R.; Sedlacek, Ch. (28.02.2008) Geologie und Geotechnik des Angerberges, Trassenstudien im Abschnitt Kundl / Radfeld - Brannenburg . Vortrag: BBT-Sympoium - Internationales Symposium Brenner-Basis Tunnel und Zulaufstrecken (Univ. Innsbruck, Fakultät f. Bauingenieurwesen), Innsbruck/AUSTRIA <http://www.uibk.ac.at/i3b/bbt/programm.htm>.

Strobl, J. (01.06.2008) Digital Earth Brainware. A Framework for Education

and Qualification Requirements. Vortrag: Herodot Network-Workshop, Madrid/SPAIN.

Strobl, J. (01.07.2008) Real-time Geographies. Real-time enabling of SDI's. Vortrag: GI-Forum 2008 (Salzburg University, Z_GIS Centre for Geoinformatics), Salzburg/AUSTRIA.

Strobl, J. (03.02.2008) Enterprise GIS for Infrastructures -GIS Infrastructures for Enterprises. Vortrag: MapIndia 2008 (GIS-Development), New Delhi/INDIA.

Strobl, J. (12.05.2008) OpenGIS Architectures for Distributed Spatial Data Infrastructures. Vortrag: Chinese Academy of Sciences, Urumqi/CHINA.

Strobl, J. (13.03.2008) Von Raumwissenschaft zu mehrdimensionaler Analyse. Vortrag: Sitzung Math.-Nat. Klasse der ÖAW (ÖAW), Wien/AUSTRIA.

Strobl, J. (14.01.2008) Location, Tracking and Health Services. Vortrag: Health GIS Conference, Bangkok/THAILAND.

Strobl, J. (19.08.2008) GIS in Public Welfare - Promoting the Spatial View. Vortrag: Map Asia Conference , Kuala Lumpur/MALAYSIA.

Strobl, J. (20.11.2008) Öffentliche Verwaltung ohne GIS?. Vortrag: Fachforum VOGIS 2008 (VOGIS), Feldkirch/AUSTRIA.

Strobl, J. (24.06.2008) Real Time GDI Components for INSPIRE Frameworks. Vortrag: EC INSPIRE Conference (European Commission), Maribor/SLOVENIA.

Strobl, J. (25.08.2008) Real-time Geographies: Monitoring Sustainable Societies and Environments. Vortrag: Map Africa Conference, Cape Town/SOUTH AFRICA.

Invited Keynotes 2007

Möller, M. (29.06.2007) GPS - Tracking and Tracing. Vortrag: International Summer School GIS (Salzburg University, Z_GIS Centre for Geoinformatics), Salzburg/AUSTRIA.

Strobl, J. (01.11.2007) Virtuelle Grenzen in der Realen Welt. Vortrag: Geodätisches Kolloquium (Fachhochschule Frankfurt am Main), Frankfurt/GERMANY.

Strobl, J. (02.02.2007) Geodata to Geoservices: Design Issues for GI Infrastructures. Vortrag: emGIS Conference (Z_GIS - Centre for Geoinformatics, University of Salzburg), Thimphu/BHUTAN.

Strobl, J. (03.05.2007) Dynamisches Raum-Zeit Monitoring mittels Geofencing. Vortrag: Geodätisches Kolloquium (Universität der Bundeswehr), München/GERMANY.

Strobl, J. (09.04.2007) Geographic Information and Technologies: Emerging Perspectives. Vortrag: MapMiddleEast Conference (GIS Development Middle East), Dubai/UNITED ARAB EMIRATES.

Strobl, J. (11.04.2007) Geographic Learning in Social Web Environments. Vortrag: Changing Geographies: Innovative Curricula (IGU - Commission for Geographical Education), London/UNITED KINGDOM.

Strobl, J. (14.06.2007) Geoinformatik: Alltags-Technologie in Markt und Gesellschaft. Vortrag: Festvortrag VIV Bayern (Landesvermessungsamt), München/GERMANY.

Strobl, J. (15.02.2007) Rasterbezugssysteme für hochauflösende Regionalstatistik. Vortrag: Geodätische Woche (Universität Innsbruck), Obergurgl/AUSTRIA.

Strobl, J. (15.05.2007) Regional Models for Renewable Energy Potentials. Vortrag: Conference on „Eco-Energies for Future Generations" (Northwest Agricultural and Forestry University), Yangling/CHINA.

Strobl, J. (18.10.2007) Geoinformatics curricula and eLearning pedagogy. Vortrag: International Conference on Education in Geodesy and Geoinformatics (Kyrgyz State University of Construction, Transportation and Architecture), Bishkek/KYRGYZSTAN.

Strobl, J. (20.10.2007) Professional Education for the GeoInformation Society. Vortrag: Workshop Chair (Map Africa Conference), Cape Town/SOUTH AFRICA.

Strobl, J. (22.11.2007) Räumliche Statistik - Wissensgewinn aus Geodaten. Vortrag: Fachforum VOGIS 2007 (VOGIS), Feldkirch/AUSTRIA.

Strobl, J. (23.01.2007) Geographic Information as a Public Utility. Vortrag: Map World Forum (GIS Development), Hyderabad//INDIA.

Strobl, J. (25.01.2007) Geographic Information Science. Vortrag: Expert Meeting (DFG), Bonn/GERMANY.

Strobl, J. (26.09.2007) Geo-ICT - Connecting Physical and Virtual Geographies. Vortrag: Invited Presentation at Workshop on ‚Geo-ICT and the Role of Location within Science' (Vrije Universiteit Amsterdam), Amsterdam/NETHERLANDS.

Strobl, J. (27.06.2007) LBS - The Big Picture. Vortrag: International Summer School GIS (Salzburg University, Z_GIS Centre for Geoinformatics), Salzburg/AUSTRIA.

Strobl, J. (28.06.2007) Pathways to Realtime Geographies. Vortrag: Summer School on Mobile and Location Based Services (Z_GIS – Centre for Geoinformatics, University of Salzburg), Salzburg/AUSTRIA.

Strobl, J. (29.10.2007) Geospatial Awareness, Skills and Knowledge - Managing Our Future. Vortrag: Plenary Keynote (Map Africa Conference), Cape Town/SOUTH AFRICA.

Invited Talks 2008

Ahamer, G. (02.09.2008) Assessing Biomass Production. Vortrag: mountainGIS - Train-the-Trainer workshop on Geo-Informatics for Mountain Enrionment Management (ICIMOD), Kathmandu/NEPAL <www.icimod.org>.

Ahamer, G. (16.05.2008) Web-Based Collaborative Discourse Using „Surfing Global Change". Vortrag: Second Central Asia GIS Conference - GISCA'08 "GIS for the Future of Central Asia" (Kyrgyz State University of Construction, Transportation and Architecture), Bishkek/KYRGYZSTAN <http://gis.org.kg/confer/gisca08>.

Ahamer, G. (23.09.2008) GIS educates for Integrated Assessment. Vortrag: EESD 2008 - Engineering Education in Sustainable Development - International Conference (TU Graz), Graz/AUSTRIA <http://eesd08.tugraz.at>.

Ahamer, G. (24.09.2008) Dynamic processes in space-related modelling. Vortrag: EESD 2008 - Engineering Education in Sustainable Development - International Conference (TU Graz), Graz/AUSTRIA <http://eesd08.tugraz.at>.

Ahamer, G. (27.06.2008) Renewable Energy Policies. Vortrag: ENERegion Summer School (Z_GIS), Salzburg/AUSTRIA <http://www.edu-zgis.net/index.php?option=com_content&task=view&id=141&Itemid=71>.

Ahamer, Gilbert (15.05.2008) Learning and analysing through the 'Global Change Data Base'. Vortrag: Second Central Asia GIS Conference - GISCA'08 ‚GIS for the Future of Central Asia (Kyrgyz State University of Construction, Transportation and Architecture), Bishkek/KYRGYZSTAN <http://gis.org.kg/confer/gisca08>.

Car, Adrijana (06.11.2008) UNIGIS – A Successful Career Development for Professionals through Online Distance Learning. Vortrag: Kolloquium (Institut für Geographie und Regionalforschung), Klagenfurt/AUSTRIA <http://www.uni-klu.ac.at/uniklu/va/va.jsp?vanr=31504&nav=z>.

Dal Fiore, F. (2008) Cities as real-time control systems. Which role for geo-information? Guest lecture at the dept.of Informatics of the City University of London. London (UK),; , 22.05.2008 (22.05.2008) Cities as real-time control systems. Which role for geo-information?. Vortrag: Guest lecture at the dept. of Informatics of the City University of London/UNITED KINGDOM.;

Dal Fiore, F. (2008) Do mobile users move differently? Exploring the spatial implications of ubiquitous connectivity at MIT campus, lecture at GI Forum 2008, Salzburg, 01.07.08 (01.07.2008) Do mobile users move differently? Exploring the spatial implications of ubiquitous connectivity at MIT campus. Vortrag: GI Forum 2008/AUSTRIA.

Dal Fiore, F. (2008) Does complexity manifests as the power to blackmail? The search for geopolitical equilibrium and the war on terror, International Conference on Conflict and Complexity, English Society for Complexity, Canterbury (UK) 03.09.08 (03.09.2008) Does complexity manifests as the power to blackmail? The search for geopolitical equilibrium and the war on terror. Vortrag: International Conference on Conflict and Complexity/UNITED KINGDOM.

F., Fischer (20.05.2008) Implications of the usage of mobile collaborative mapping systems for the sense of place. Vortrag: Real Corp 08, 13th International Conference on Urban Planning, Regional Development and Information Society, Wien/AUSTRIA.

Fischer F. (01.07.2008) Location Based Social Media Considerations on the Impact of Sharing Geographic Information on Individual Spatial Experience. Vortrag: Geoinformatics Forum (GI_Forum), Salzburg/AUSTRIA.

Fischer F. (16.10.2008) Geomedien erobern den Alltag - Einflüsse der Medienaneignung auf urbane Lebensräume. Vortrag: Arbeitskreissitzung Geographie der Telekommunikation und Kommunikation, Salzburg/AUSTRIA.

Fischer F. (29.08.2008) LBS erobern den Alltag - Medienaneignung und räumliche Bezüge im Kontext der neuen Geomedien. Vortrag: PhD Workshop Heidelberg mobil International GmbH, Heidelberg/GERMANY.

Jekel, T. (03.07.2008) Integrating Learners Perspectives: The School on Ice project. Vortrag: Lernen mit Geoinformation (ÖAW_GIScience), Salzburg/AUSTRIA.

Jekel, T. (04.09.2008) Rethinking Spatial Thinking. Vortrag: Future Prospects in Geography, Liverpool/UNITED KINGDOM.

Jekel, T. (30.06.2008) Lernen mit Geoinformation: postulierte Ziele & empirische Befunde. Vortrag: GIS-Ausbildungstagung, Potsdam/GERMANY.

Jekel, T. (30.06.2008) Lernen mit Geoinformation: Reisen zwischen Forschung und Unterrichtspraxis. Vortrag: Kolloquium PH Heidelberg, Heidelberg/GERMANY.

Jekel, Thomas; Wallentin, Gudrun (01.04.2008) Digitale Globen im Unterricht: Klimawandel. Vortrag: Seminar für OÖ BHS-Geographielehrer (Pädagogischen Hochschule Linz), Unterach a. A./AUSTRIA.

Marschallinger, R. (23.01.2008) Towards More Intelligible Aquifer Dynamics: Cartographic Animations Used to Highlight Hydrological Processes. Vortrag: Int. Conference on Cartography and GIS, Borovets/BULGARIA.

Marschallinger, R. (28.10.2008) 3D-reconstruction and modelling of natural materials. Vortrag: Mineralogisch-Petrologisches-Gefügekundliches Seminar LMU, München/GERMANY.

Möller, Matthias (04.02.2008) Urban LULC and structure extraction for the City of Beijing, China. Vortrag: EARSeL Tagung (Ruhr Universität Bochum), Bochum/GERMANY.

Möller, Matthias (04.07.2008) Geobrowser – Katalysatoren für Geoinformationen im Unterricht. Vortrag: AGIT (Universität Salzburg), Salzburg/AUSTRIA.

Möller, Matthias (04.09.2008) Mount Kilimanjaro Land Use Land Cover Mapping from Satellite Image Time Series. Vortrag: High Mountain Remote Sensing Carography - X (ICIMOD), Kathmandu/NEPAL.

Möller, Matthias (23.04.2008) Wie wir unsere Welt verändern: Beobachtungen eines Fernerkundlers. Vortrag: UNIGIS Express (Institut für Geoinformatik), Universität Osnabrück/GERMANY.

Strobl, J. (03.12.2008) Digital City Salzburg. Vortrag: Autodesk University (Autodesk), Las Vegas/UNITED STATES.

Strobl, J. (04.07.2008) Geospatial Qualifications: Schools, Citizens and Professionals. Vortrag: GI-Forum 2008 (Salzburg University, Z_GIS Centre for Geoinformatics), Salzburg/AUSTRIA.

Strobl, J. (05.02.2008) GIS in Social Sciences. Vortrag: Lecture (Jawaharlal Nehru University), Delhi/INDIA.

Strobl, J. (05.02.2008) GIS in the Social Sciences. Vortrag: CSRD (Jawaharlal Nehru University), Delhi/INDIA.

Strobl, J. (07.11.2008) Geoinformatik Kompetenzen aus dem GW-Unterricht. Vortrag: Fachwissenschaftliches und fachdidaktisches Seminar für GWK (PH Niederösterreich), Zeillern/AUSTRIA.

Strobl, J. (09.02.2008) GI Education and Spatial Data Infrastructure. Vortrag: UN-SPIDER Workshop (UNOOSA - United Nations), Salzburg/AUSTRIA.

Strobl, J. (09.05.2008) GIScience for Water Management and the Implementation of European Water Actions. Vortrag: Conference „Water for Future Generations" (Northwest Agricultural and Forestry University), Yangling/CHINA.

Strobl, J. (10.05.2008) High Resolution DEMs for Agricultural Modelling. Vortrag: Conference „Water for Future Generations" (Northwest Agricultural and Forestry University), Yangling/CHINA.

Strobl, J. (11.05.2008) GIScience in Physical Geography. Vortrag: Northwest University Xi'an (Northwest University Xi'an), Xi'an/CHINA.

Strobl, J. (15.05.2008) Reaching out to Distant Learners: Learner-Centered Design and Management of Online Programmes. Vortrag: Second Central Asia GIS Conference - GISCA'08 ‚GIS for the Future of Central Asia (Kyrgyz State University of Construction, Transportation and Architecture), Bishkek/KYRGYZSTAN <http://gis.org.kg/confer/gisca08>

Strobl, J. (16.04.2008) Erneuerbare Energie: Raum und Ordnung. Vortrag: ÖROK-ExpertInnenworkshop „Energie & Raumentwicklung" (ÖROK), Wien/AUSTRIA.

Strobl, J. (17.04.2008) ICT-Portfolio of the Future: Geo-spatial Technologies. Vortrag: Regional Policies on Technology-driven Innovation and Information Society Technologies for SMEs. ESTIIC International Conference, Brussels/BELGIUM.

Strobl, J. (25.02.2008) Von der Insellösung zur integrierten Infrastruktur. Vortrag: Einsatztaktika 2008 (Z_GIS - Centre for Geoinformatics, University of Salzburg), Salzburg/AUSTRIA.

Strobl, J. (26.03.2008) Postgraduate Online Education for GIS professionals. Vortrag: Simposio sobre GIS Educación en América Latina 2008 (Universidad San Francisco de Quito (USFQ)), Quito/ECUADOR.

Strobl, J. (27.07.2008) Digital Earth Framework for Regional Autonomy in Energy Supply. Vortrag: ENERegion Summer School (Salzburg University, Z_GIS Centre for Geoinformatics), Salzburg/AUSTRIA.

Strobl, J. (27.11.2008) Realtime Geography. Vortrag: 5th International Symposium on LBS and TeleCatography , Salzburg/AUSTRIA.

Strobl, J. (29.02.2008) GIScience als Rahmen für Quantitative Methoden in der Geographie. Vortrag: Arbeitskreis für Quantitative Methoden in der Geographie, Salzburg/AUSTRIA.

Strobl, J. (29.05.2008) Geoinformatik-Qualifikationen für die GI-Gesellschaft. Vortrag: Fachhochschule Rapperswil, Rapperswil/SWITZERLAND.

Wallentin, Gudrun (08.02.2008) Spatial biases in LiDAR based tree delineation. Vortrag: Map India 2008, New Delhi/INDIA.

Invited Talks 2007

Car, Adrijana (01.03.2007) UNIGIS@Salzburg: Successful Career Development for Professionals Through Online Distance Learning. Vortrag: IntergeoEAST 2007, Sofia/GREECE.

Dal Fiore, F. (02.10.2007) Digitally Augmented Cities. Vortrag: Research Seminar Urban Information Systems, Massachusetts Institute of Technology, Cambridge/UNITED STATES.

Dal Fiore, F. (03.07.2007) Mobility and ubiquity: case studies and empirical results from MIT campus and Dutch police. Vortrag: Location Based Services Summer School, Salzburg, Salzburg/AUSTRIA.

Dal Fiore, F. (05.07.2007) Fostering New Real-Time Geo-Information to Understand the Spatial Implications of an Ubiquitously Connected Society. Vortrag: GI-Forum, Salzburg/AUSTRIA.

Dal Fiore, F. (07.12.2007) The real-time city. Sensing traffic through mobile phone data. Vortrag: Geoinformatik-Round Table (ÖAW GIScience), Salzburg/AUSTRIA.

Dal Fiore, F. (22.10.2007) Using location data for mobility research. Vortrag: Geoinformatik-Round Table (ÖAW GIScience), Salzburg/AUSTRIA.

Dal Fiore, F. (24.04.2007) Individual travel behaviour and real-time spatial change. Vortrag: Geoinformatik-Kolloquium (ÖAW GIScience), Salzburg/AUSTRIA.

Fischer, Florian (18.09.2007) GIScience - Connecting Real and Virtual Worlds. From exclusive expert tools towards (geo-)information societies. Vortrag: EGEA Annual Congress 2007, Ustron/POLAND.

Girardin, F., Dal Fiore, F., Blat, J., and Ratti, C. (08.11.2007) Understanding of tourist dynamics from explicitly disclosed location information. Vortrag: The 4th International Symposium on LBS & TeleCartography, Hongkong/HONG KONG.

Jekel, T. (03.07.2007) Kollaborative Lernumgebungen mit digitalen Globen - ein explorative. Vortrag: AGIT - Lernen mit Geoinformation. Salzburg/AUSTRIA.

Jekel, T. (03.07.2007) What you all want is GIS 2.0. Vortrag: GI-Forum, Salzburg/AUSTRIA.

Jekel, T. (18.09.2007) Alternatives in Geography Education. Vortrag: XVIII EGEA Conference, Ustron/POLAND.

Marschallinger, R. (09.02.2007) Mehrdimensionale Modellierung von Geoinformation. Vortrag: Geoinformatik-Kolloquium (ÖAW GIScience), Salzburg/AUSTRIA.

Möller, Matthias (23.04.2007) Die Raum - Zeitliche Modellierung und Analyse urbaner Gebiete - Ein mehrskaliger, GIS-gestützter Ansatz basierend auf Fernerkundungsdaten. Vortrag: Geoinformatik-Kolloquium (ÖAW GIScience), Salzburg/AUSTRIA.

Strobl, J. (17.01.2007) Geographic Learning in a Social Web Environment. Vortrag: Lecture (Delhi University), Delhi/INDIA.

Strobl, J. (18.01.2007) GIScience Education: eLearning for Career Advancement. Vortrag: Pacific User Conference (ESRI Asia), Delhi/INDIA.

Strobl, J. (20.01.2007) Use of GIS in Social Science Research. Vortrag: Lecture (Jawaharlal Nehru University), Delhi/INDIA.

Wallentin, Gudrun (02.03.2007) 3D Visualisation for Environmental Education. Vortrag: Geoinformatik-Kolloquium (ÖAW GIScience), Salzburg/AUSTRIA.

Other Presentations 2008

Ahamer, G. & 5 lecturers & 15 students (22.01.2008) Anwendungen von „Surfing Global Change" in der Verwaltungspraxis. Vortrag: Präsentation für Frau Landesrätin Mag. Kristina Edlinger-Ploder (Steiermärkische Landesregierung), Graz/AUSTRIA.

Ahamer, G. (09.10.2008) Mapping Global Dynamics. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Ahamer, G. (11.04.2008) GIScience matters: Materials and methods for a common future. Vortrag: Z_GIS (Uni Salzburg), Salzburg/AUSTRIA.

Ahamer, G., Steiner, A., Salmhofer, C., Schauer, K., Fischer, A., Schuller, M., Wagner, G. (15.01.2008) Ein Klima, um zu handeln. Vortrag: Bildung bewegt - Zukunft nachhaltig gestalten (KFU Graz), Graz/AUSTRIA <http://www.landespressedienst.steiermark.at/cms/beitrag/10877867/25189835/>.

Car, A. (09.10.2008) Space and Time in GIS. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Car, Adrijana (04.07.2008) Towards a Quality Assurance Concept for Postgraduate Distance Learning Programmes for Professionals. Vortrag: Learning with GI 2008 (Zentrum für Geoinformatik der Universität Salzburg und Forschungseinheit GIScience der Österreichischen Akademie der Wissenschaften), Salzburg/AUSTRIA

Dal Fiore, F. (09.10.2008) Mobile technology data and human spatial behaviour. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Fischer, F. (09.10.2008) Effects of the geospatial web on the experience of urban space. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Fischer F. (23.05.2008) Location Based Social Media - Geomedien und Raumvorstellungen. Vortrag: Geoinformatik-Round Table, Salzburg/AUSTRIA.

Jekel, T. (02.02.2008) Children Mapping Global Change. Participatory GI-based Learning. Vortrag: MapIndia 2008 (GIS-Development), New Delhi/INDIA.

Jekel, T. (04.05.2008) GI-based Learning in secondary education. Vortrag: GIS Central Asia, Bishkek/KYRGYZSTAN.

Jekel, T. (09.10.2008) Collaborative Learning with GI. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Marschallinger, R. (02.07.2008) Erfassung und raum-zeitliche Interpolation von Hangbewegungen - Beispiel Gschliefgraben. Vortrag: Computer Orientierte Geologie 2008 (ÖAW GIScience, COG), Salzburg/AUSTRIA.

Marschallinger, R. (09.10.2008) Geostatistical space-time characterization of Multiple Sclerosis lesion distributions. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Marschallinger, R. (08.11.2008) 3D-Modellierung von MS-Krankheitsherden. Vortrag: Lange Nacht der Forschung , Salzburg/AUSTRIA.

Moeller, M. (04.12.2008) Fernerkundung - Mehr als schöne Bilder aus dem Weltraum. Vortrag: 20 Jahre Techo_Z Salzburg (Techo_Z Salzburg), Salzburg/AUSTRIA.

Strobl, J. (09.10.2008) GIScience. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Strobl, J. (22.08.2008) GI-Science Sustaining Planet Earth. Vortrag: ASEA-Uninet Train-the Trainer Workshop (University of Indonesia), Jakarta/INDONESIA.

Strobl, J. (14.04.2008) Digital City Salzburg. Vortrag: Stadtsenat Salzburg, Salzburg/AUSTRIA.

Wallentin, G. (04.12.2008) Raum-zeitliche Modellierung von Landschaftswandel alpiner Gebiete. Vortrag: 20 Jahre Techo_Z Salzburg (Techo_Z Salzburg), Salzburg/AUSTRIA.

Wallentin, G. (09.10.2008) Individual based modelling. Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Zobl, F. (09.10.2008) Mapping, Modelling & Analysis of Geo Objects . Vortrag: GIScience Advisory Board. First Board Meeting (ÖAW GIScience), Salzburg/AUSTRIA.

Other Presentations 2007

Car, A. (20.05.2007) Spatial Cognition and its Relevance to GIS. Vortrag: Spatial Cognition and its Relevance to GIS (Jagiellonian University, Dept. of Geography), Cracow/POLAND.

Car, A. (26.02.2007) Spatial Cognition and its Relevance to GIS. Vortrag: Spatial Cognition and its Relevance to GIS (Bulgarian Academy of Sciences), Sofia/BULGARIA.

Fischer, F. und Koch, A. (07.07.2007) Anwendungspotenziale eines Geosimulationsmodells für die Wohnungsmarktforschung. Vortrag: AGIT 2007, Salzburg/AUSTRIA.

Jekel, T. (15.09.2007) Lernen mit GIS 2.0. Kreative Lernwege durch die Integration von digitalen Globen und Lernplattformen. Vortrag: GMW 2007, Hamburg/GERMANY.
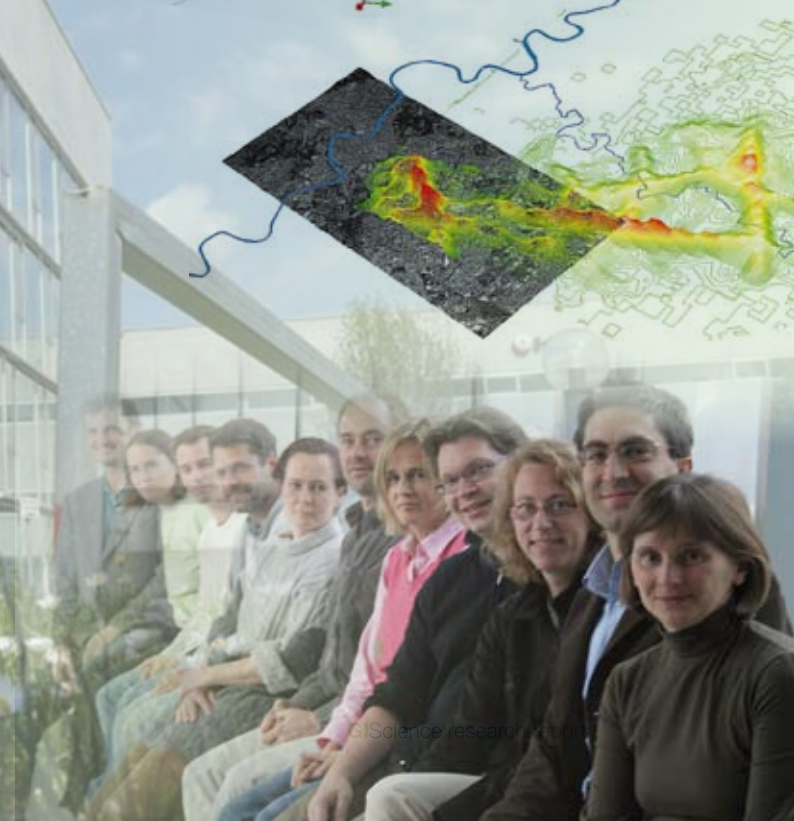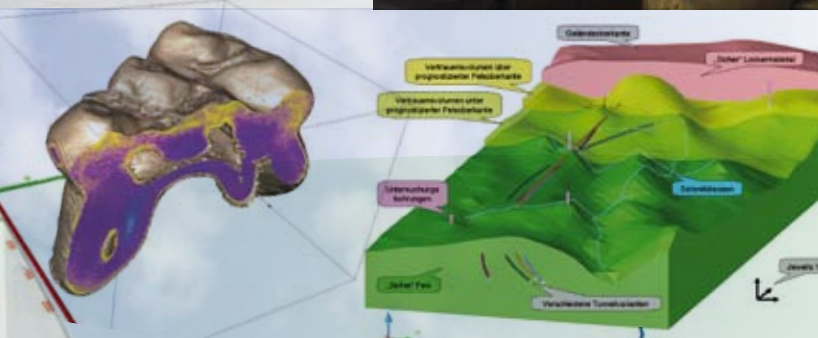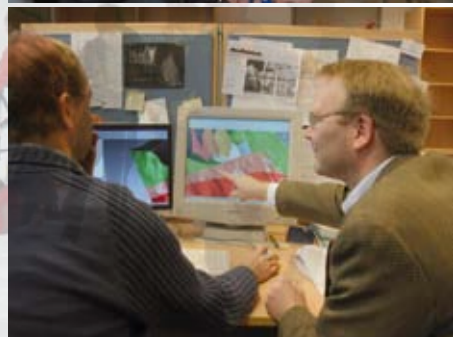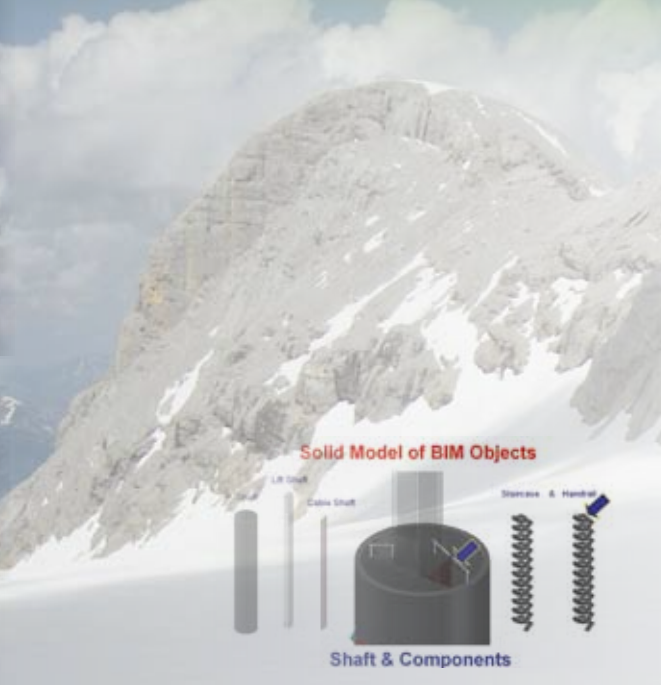
Möller, Matthias (04.10.2007) Fernerkundung und GIS im Krisenmanagement. Vortrag: Deutscher Geographentag, AK Fernerkundung (Deutscher Geographentag), Bayreuth/GERMANY.

Möller, Matthias (26.04.2007) High Resolution Urban Mapping and Biotope Change Analysis. Vortrag: CNES User Group Meeting (CNES - Centre National d'Etudes Spatiales), Toulouse/FRANCE.

Wallentin, G. (04.07.2007) 3D Landschaftsvisualisierung in der Umweltpädagogik. Vortrag: Lernen mit Geoinformation, Salzburg/AUSTRIA.