



Palacký University  
Olomouc



# Geoinformatics in Olomouc



DEPARTMENT OF GEOINFORMATICS  
PALACKÝ UNIVERSITY OLMOUC







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## Olomouc: A university city

Olomouc has always placed among the most prominent medieval cities of the Czech lands. For centuries, its good geographical location, its university with long tradition, its culture and crafts have made it a natural centre of Moravia for artists, intellectuals and merchants alike.

Nowadays, Olomouc is the main city of the Olomouc Region and has over 100,000 inhabitants, which makes it the fifth biggest city in the Czech Republic. After Prague it is the second biggest historical area in the country, with its old university, Archbishopric, Moravian Philharmony, many interesting museums and theatres, vast parks and a zoo.

Olomouc has been known as a university city for centuries. It is a city full of young people that offers cultural and sports events and life in an attractive region with a low cost of living.

The Palacký University draws on long tradition. It was founded in the 16th century and is the second oldest university in the Czech Republic. It has become a modern educational institution that offers a wide range of study programmes and engages in a variety of research activities. Its eight faculties are attended by 23 000 students - more than a fifth of the city's number of inhabitants.





## Department of Geoinformatics

The Department of Geoinformatics was founded in 2001. The roots of geoinformatics at the Palacký University can be traced back to 1989, to the Department of Geography. Nowadays, the Department of Geoinformatics is a distinctive academic department that offers high quality education and research. It is renowned both nationally and internationally. The main fields are geoinformatics and geoinformation technologies in education and research, and their publicity, both in the Czech Republic and abroad. Its activities encompass teaching in the field of geoinformatics with special emphasis on geographical aspects, research projects that follow worldwide trends and promotion of modern geoinformation technologies in all spheres of the Czech society.

The Department owns two specialised laboratories for GIS and Earth remote sensing and one research laboratory for the eye-tracking technique in cartography. It uses state-of-the-art equipment and software. Its teaching activities are accompanied by cooperation with prominent national commercial companies in the field as well as respected foreign universities. The teachers do their best to react to the individual needs of students of bachelor, master and doctoral courses enabling them to take part in research projects, work and gain experience in commercial companies and excel in national specialised student contests.



### ■ Head of the department:

**prof. dr. Vít Voženílek** ([vit.vozenilek@upol.cz](mailto:vit.vozenilek@upol.cz))

Thematic cartography, atlas cartography, modelling in GIS

### ■ Academic and research staff:

**dr. Jaroslav Burian** ([jaroslav.burian@upol.cz](mailto:jaroslav.burian@upol.cz))

Spatial planning, urban modelling, GIS in human geography

**dr. Jan Brus** ([jan.brus@upol.cz](mailto:jan.brus@upol.cz))

Environmental GIS, uncertainty in cartography, decision-making processes

**dr. Zdena Dobešová** ([zdena.dobesova@upol.cz](mailto:zdena.dobesova@upol.cz))

Spatial database, programming in GIS, digital cartography

**assoc. prof. Jiří Dvorský** ([jiri.dvorsky@upol.cz](mailto:jiri.dvorsky@upol.cz))

Neural networks, computer science

**dr. Blažena Kratochvílová** ([blazena.kratochvilova@upol.cz](mailto:blazena.kratochvilova@upol.cz))

Point processes, theory of probability statistics

**dr. Jakub Miřijovský** ([jakub.mirijovsky@upol.cz](mailto:jakub.mirijovsky@upol.cz))

Earth Remote Sensing, GNSS, geodesy, UAV

**dr. Rostislav Nėtek** ([rostislav.netek@upol.cz](mailto:rostislav.netek@upol.cz))

Web cartography, geoinformation technologies, open source

**dr. Vít Pászto** ([vit.paszto@upol.cz](mailto:vit.paszto@upol.cz))

Spatial information, geocomputational methods (shape metrics, fractal dimension measurements, fuzzy sets and logic, information entropy)

**dr. Stanislav Popelka** ([stanislav.popelka@upol.cz](mailto:stanislav.popelka@upol.cz))

Eye-tracking in cartography, 3D modelling

**assoc. prof. Vilém Pechanec** ([vilem.pechanec@upol.cz](mailto:vilem.pechanec@upol.cz))

Geoinformatics in environmental protection, GIS and Internet technologies, decision support systems

**dr. Miroslav Rypka** ([miroslav.rypka@upol.cz](mailto:miroslav.rypka@upol.cz))

Fractals, chaos, compositional data

**dr. Jana Svobodová** ([j.svobodova@upol.cz](mailto:j.svobodova@upol.cz))

Digital elevation models, geoinformatics in geomorphology and environmental applications

**assoc. prof. Pavel Tuček** ([pavel.tucek@upol.cz](mailto:pavel.tucek@upol.cz))

Statistical inferences, nonlinear models, geostatistics, dataprocessing in R

**dr. Alena Vondráková** ([alena.vondrakova@upol.cz](mailto:alena.vondrakova@upol.cz))

Thematic cartography, user issues in cartography

### ■ Project staff:

**Tomáš Burian** ([tomas.burian@upol.cz](mailto:tomas.burian@upol.cz))

3D printing, 3D modelling

**Vendula Hejlová** ([vendula.hejlava@upol.cz](mailto:vendula.hejlava@upol.cz))

Wireless sensor networks, monitoring of air pollution, air pollutants related to city traffic, distribution of nodes in urban environment

**dr. Helena Kilianová** ([helena.kilianova@upol.cz](mailto:helena.kilianova@upol.cz))

Environment, landscape ecology, land use

**Tomáš Králík** ([tomas.kralik@upol.cz](mailto:tomas.kralik@upol.cz))

Visualization, 3D modelling, Cartography

**Karel Macků** ([karel.macku01@upol.cz](mailto:karel.macku01@upol.cz))

Quality of life, socioeconomic geography, data processing

**Chukwudi Nwaogu** ([chukwudi.nwaogu01@upol.cz](mailto:chukwudi.nwaogu01@upol.cz))

Geoinformatics, land use, land cover

**Jan Piňos** ([jan.pinos01@upol.cz](mailto:jan.pinos01@upol.cz))

Smallworld, databases, geodata pre-processing, etl, programming

**Tomáš Pohanka** ([tomas.pohanka@upol.cz](mailto:tomas.pohanka@upol.cz))

Distributed databases, fuzzy logic, informatics

**Tomáš Pour** ([tomas.pour02@upol.cz](mailto:tomas.pour02@upol.cz))

Remote sensing, thermal imaging, image processing

**Zbyněk Janoška** ([zbynek.janoska@upol.cz](mailto:zbynek.janoska@upol.cz))

P-systems in transportation

**Pavel Samec** ([pavel.samec@upol.cz](mailto:pavel.samec@upol.cz))

Forestry, analysis modelling prediction

**Lenka Zajičková** ([lenka.zajickova@upol.cz](mailto:lenka.zajickova@upol.cz))

GIS in transportation, spatial analyses and modelling, geostatistics

### ■ Administration staff:

**Jaroslava Mrázová** ([jaroslava.mrazova@upol.cz](mailto:jaroslava.mrazova@upol.cz))

Students and staff matters

**Jitka Doležalová** ([jitka.dolezalova@upol.cz](mailto:jitka.dolezalova@upol.cz))

Public relations

**Bohumil Ptáček** ([bohumil.ptacek@upol.cz](mailto:bohumil.ptacek@upol.cz))

Technician





## There is always something going on

### Cartographical Days in Olomouc

A yearly event consisting of lectures by top experts in thematic cartography and selected fields of application:

- thematic cartography in climatology and hydrology
- thematic cartography in demography
- thematic cartography in spatial planning
- thematic cartography and geography in schools
- thematic cartography in transport and statistics
- thematic cartography and landscape
- cartography and 3D print technology
- cartography and economy

### Olomouc Geoinformatics Colloquiums (OGiC)

Invited lectures given by prominent experts:

- **Prof. László Zentai** (Budapest, Hungary)  
Application of the web 2.0 in cartographic education – is it time for cartography 2.0?
- **Dr. Ranka Stanković** (Belgrade, Serbia)  
Integrating semantic knowledge with GIS application
- **Dr. Tamas Jancsó** (Székesfehérvár, Hungary)  
Automatic DTM checking based on aerial photos
- **Prof. Carsten Jürgens** (Bochum, Germany)  
Urban Remote Sensing – An Overview of its possibilities
- **Dr. Maik Netzband** (Bochum, Germany)  
Global Urban Dynamics research with geoinformation data and methods
- **Dr. Waldemar Kociuba** (Lublin, Poland)  
Use of Laser Scanning Technology in the Cold Climate Environment

- **Prof. Richard Legates** (San Francisco, USA)  
Spatial Planning in GIS
- **Dr. Monika Micháľková** (Bratislava, Slovak Republic)  
Fluvial systems – new challenge for geoinformatics
- **Prof. Sara Irina Fabrikant** (Zurich, Switzerland)  
Geographical Information Visualization and Analysis
- **Prof. Terje Midtbø** (Trondheim, Norway)  
Cartographic Visualization of Indoor Environment
- **Prof. Ferjan Ormeling** (Utrecht, Netherlands)  
Atlas Cartography, Toponymy, Data Quality
- **Prof. Itzhak Benenson** (Tel Aviv, Izrael)  
Applications of Geosimulation in Transportation
- **Prof. Menno-Jan Kraak** (Twente, Netherlands)  
Geovisual Analytics
- **Prof. Jonathan Raper** (London, Great Britain)  
Location Based Services
- **Prof. Corné van Elzakker** (Enschede, Netherlands)  
Use and User Issues in Geoinformatics
- **Dr. Arzu Coltekin** (Zurich, Switzerland)  
Human Vision of Geovisualization
- **Prof. Francis Harvey** (Minneapolis, USA)  
GIS, Spatial data infrastructures
- **Prof. Manfred Buchroithner** (Dresden, Germany)  
True 3D visualization, High-mountain cartography
- **Prof. Harmut Asche** (Potsdam, Germany)  
Geographic visualization, adaptive GIS
- **Prof. Wolfgang Reinhardt** (München, Germany)  
GI and disaster management

### Cartographical conferences by the Cartographic Societies of the Czech and Slovak Republic (1997, 2009)

A high-level meeting of Czech and Slovak experts in cartography, geoinformatics and geodesy.

### GIS day

A global educational event held on the third Wednesday of November each year that enables geographic information systems users and vendors to open doors of the Department to schools, businesses and the general public to showcase real-world applications of GIS

### Map of the Year

The Department of Geoinformatics is an eminent partner of the Cartographic Society of the Czech Republic. Since 1998 Department of Geoinformatics has been considered its secretariat and Vít Voženílek has become the chairman of the expert committee. Both students and employees of the Department have won several prestigious awards in various categories of this contest. The Department plays an equally important role when organising an international competition Barbara Petchenik Children's Drawings Award, where it acts as an organiser of national rounds.



### INDOG doctoral Conference

The INDOG doctoral Conference is a part of the project led by Department of Geoinformatics. Doctoral students who are in the process of completing their thesis are invited to submit papers for presentation to a group of academic discussants with special expertise in the topics they are assigned. The conference aims to provide the students with an assessment of their presentational skills and a constructive critique of their research by a group of peers and senior academics. It

is also an opportunity to access a wider academic network and the postgraduate job market. The conference is made possible each year by the support of Dept. of Geoinformatics and the public and business sector.

### StatGIS Conference

StatGIS conference is a part of the project led by Department. It aims to present to the students and teachers of Faculty of Science, Palacký University, the results of scientific researchers reached by their research. The topics are not a common part of the teaching courses, but they extend actual knowledge in studied areas by significant way. The conference is attended by several of leading international experts.

### CARTOCON

Between 25-28 February 2014 department organised CARTOCON 2014 Conference, at which Commission on Cognitive Visualisation, Commission on Use and User Issues, Commission on Atlases and Commission on Maps and the Internet organized their meetings. The main objective was to join European, world and Czech experts in cartography together. More than 350 participants, including many young colleagues, presented and discussed current topics in cartography and GIScience. The ICA Executive Committee used this event to hold their regular meeting.





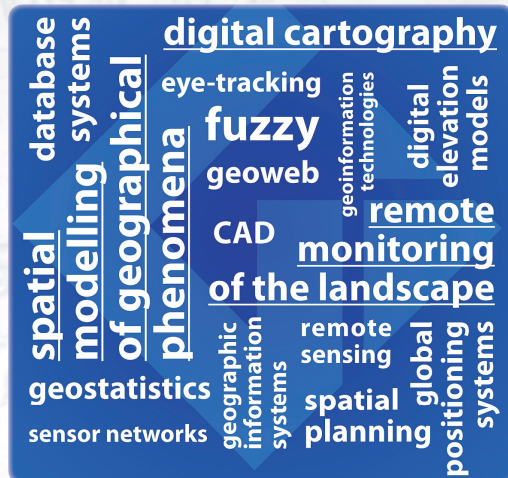


## Geoinformatics

In Olomouc, we consider geoinformatics as a modern information-based concept that works with top technologies and is applied in many fields. It appeals to those interested in geography and information technologies.

*„Geoinformatics deals with information about spatial phenomena and their relationships. Geoinformatics is about data, maps, programmes, satellite and aerial photos, navigation systems, computer models and simulations. And it is always related to landscape, territory, states, cities, mountains, rivers and other geographical objects.“*

The graduates of Geoinformatics in Olomouc easily find jobs in public administration, private companies and academic institutions. They are reliable GIS administrators, map makers, spatial analysts, database administrators, project managers, programmers or developers.

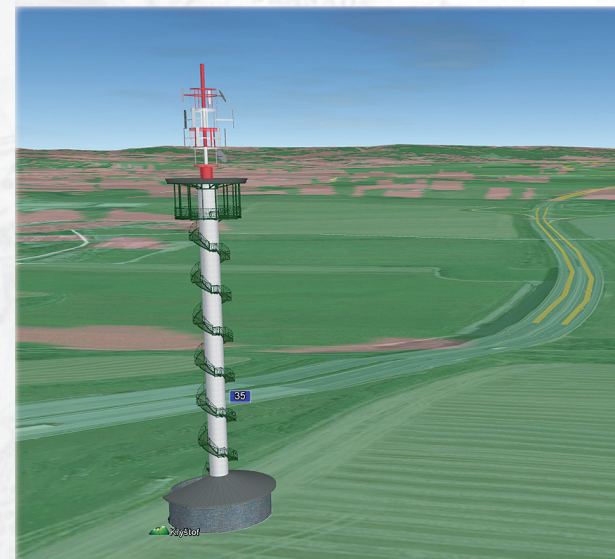
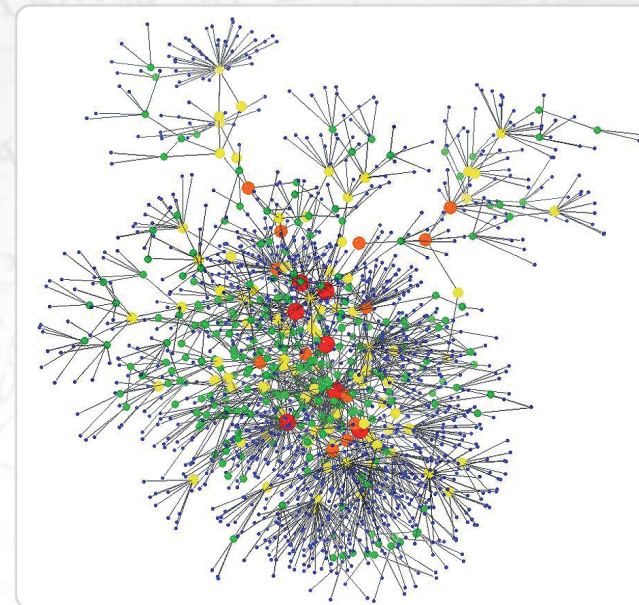


## Fields of research

In research, our staff boasts their activity on general geoinformatics topics, development and application of geographical information systems, remote sensing data processing, thematic and digital cartography, landscape spatial modelling, spatial planning in GIS, etc.

Currently, the Department's activities follow primarily three research streams:

- Spatial modelling of geographical phenomena in GIS
- Digital cartography
- Remote monitoring of the landscape



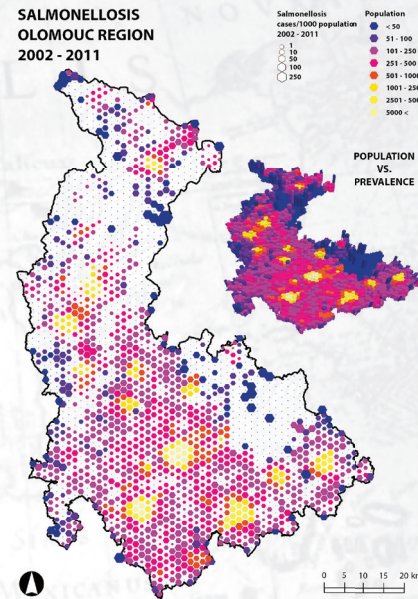


## Spatial Modelling of Geographical Phenomena in GIS

The scientific and research stream of the Department uses the latest theoretical knowledge from geoinformatics and state-of-the-art approaches to Geographic Information Systems. In addition to basic geoinformatic research, applied research in geosciences is based on spatial analyzes, syntheses, modeling and simulations.

### Projects:

- Research on the movement of people in the intercourse of the urban and suburban space of the Olomouc region
- Artificial intelligence methods in GIS
- Analysis and modeling of ecotone dynamics in GIS environment
- Predictions of shallow landslides using the dynamic DYLAN model
- Spatial simulation modeling of accessibility
- Urban Planner



### Selected theses:

- The influence of the position of regional bus stops in the town of the link with public transport
- Fuzzy arithmetics application in multicriterial evaluation of landscape potential
- Dependency analysis with the use of correlation and logistic regression in R
- Traffic accessibility of public institutions in Moravian regions
- Periodic data analysis and visualization for the Fire rescue service of the Zlín region
- Implementation of basic functions of fuzzy arithmetic in C# with application in ArcGIS

## Digital Cartography

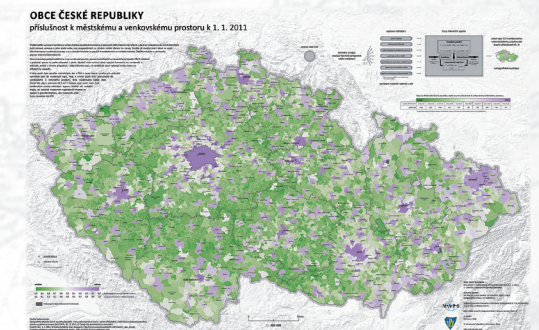
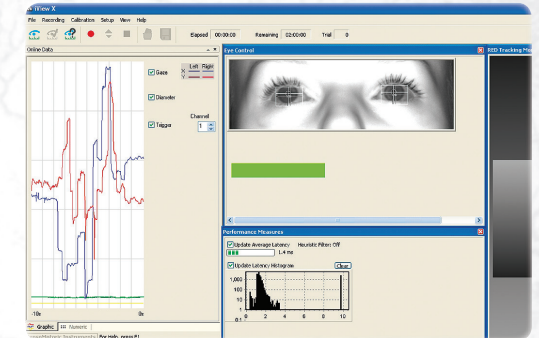
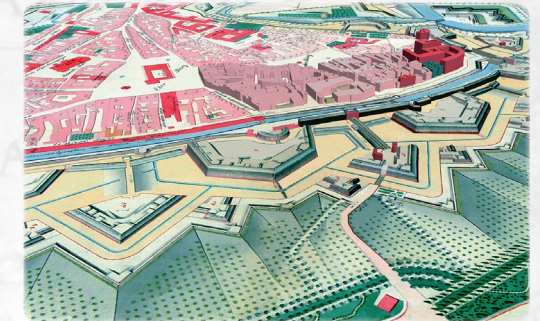
Research in digital cartography in Olomouc is focused on the development of new visualization techniques and complex cartographic works, especially thematic atlases and web cartoproducts. In addition to fundamental research in cartographic semiology, researchers and students focus on various aspects of the creation and use of different map types. As one of the few European departments, Department of Geoinformatics carries out research of map perception and cognition using eye-tracking device.

### Projects:

- Intelligent system for interactive support of thematic map production
- Perception of geospace by modern types of tactile maps
- Evaluation of cartographic functionality in GIS software
- Visualization, interpretation and perception of spatial information in thematic maps
- Climate atlas of Czechia
- Atlas of phenological conditions in Czechia
- Increasing the effectiveness of copyright protection in cartography and geoinformatics

### Selected theses:

- 3D guide of Litovelské Pomoraví
- Thematic maps in autostereoscopy
- 3D guide of Litovelské Pomoraví
- User testing and optimization of spatial data quality visualisations
- Creating color map scales by cartographic style
- Cartographical representation of the climate of the Czech Republic since 1990
- Anaglyph renderings of the building of Šantovka complex
- Influence of cartographic style on the perception of roadmaps
- Anaglyph renderings of the building of Šantovka complex
- Implementation of 3D printing for producing physical terrain and surface models





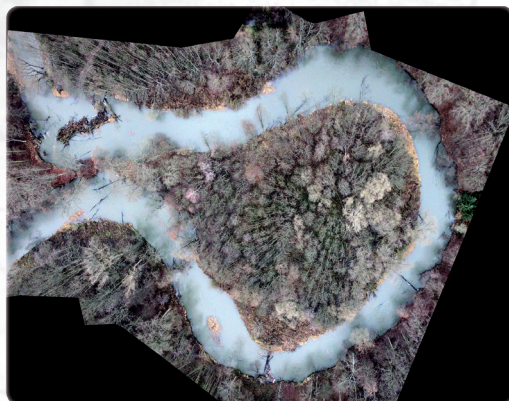


## Landscape Monitoring

The scientific and research stream of the department is focused on the collection, processing and evaluation of information on individual landscape components by means of contactless methods, especially remote sensing of the Earth and wireless sensor networks. Research explores and develops methods of contactless collection of spatial data about the landscape. The department has two drones, three special cameras for taking digital pictures and video recordings in visible and infrared spectral resolution and a series of contact and non-contact sensors.

### Projects:

- Contactless monitoring and spatio-temporally modelling variability of selected differing soil characteristics
- Wireless continuous monitoring
- Advanced integration of sensor networks and non-contact landscape monitoring in precision agriculture
- Methods for creating scenarios of impacts of global change on land use and modelling the functional relationship between in land use changes and the provision of ecosystem services



### Selected theses:

- Implementation of methods Structure from motion to UAV photogrammetry
- Modeling development of land use modeling using tools Marxan and CLUE
- Monitoring and modelling of surface runoff using GIS
- Creating 3D models of geomorphological objects from stereo-photographs
- The use of small format photography in archaeology
- Sensor networks in environmental studies
- Condition and future development of the meander in PLA Litovelské Pomoraví
- Comparison of selected per-pixel classifiers to identify built-up areas

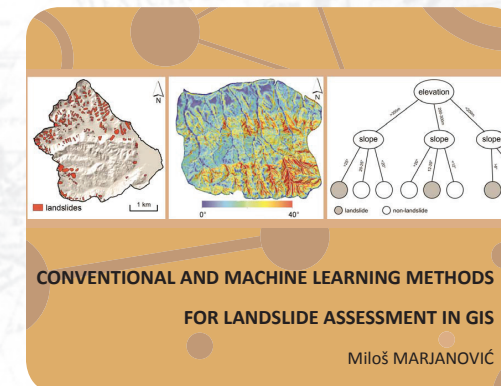
## Publications

The Department of Geoinformatics is the most active geoinformatics department in the Czech Republic in terms of number of published publications. The quantity and quality of published publications do not have a domestic comparison. Authors of learning texts, scientific monographs, maps and atlases are not only members of the department and external collaborators, but also geoinformatics students.

M.A.P.S. (Map and Atlas Product Series) is designed to publish maps, map series, and atlases. All these titles are published by the Palacký University Publishing House. Manuscripts are reviewed by two independent opponents.

The TERRA NOTITIA series is intended to publish results of postgraduate students after successful defense of their dissertations.

- Color distance in cartography - Brychtová, A. (2016)
- Conventional and Machine Learning Methods for Landslide Assessment in GIS - Marjanović, M. (2014)
- Sensor systems and their integration with GIS in environmental studies - Pechanec, V. (2014) [in Czech]
- Unmanned Aerial Systems - Data collection and using in photogrammetry - Miřijovský, J. (2014) [in Czech]
- Geoinformatics in spatial planning - Burian, J. (2014) [in Czech]
- Fuzzy Surface Analyses: First experiments - Caha, J. (2014)
- Geoinformatics in analyzes of rural and urban space - Burian, J., Pászto, V., Tuček, P. (2014) [in Czech]
- Orthophotomap - Bělka, L., Voženílek, V. (2013) [in Czech]
- Atlas of phenological conditions in Czechia - Hájková, L., Voženílek, V., Tolasz, R., et al. (2012)
- Transport accessibility of Prague : time accessibility in road and rail network in 2012 - Hudeček, T., Žáková, Z., Blahník, P., Kufner, J., Vondráková, A. (2012) [in Czech]
- Modeling of forest growth conditions in the Czech Republic - Samec, P., Tuček, P. et al. (2012) [in Czech]
- Climatic regions of Czechia: Quitt's classification during years 1961-2000 - Květoň, V., Voženílek, V. (2011)
- Methods of thematic cartography – spatial data visualization - Voženílek, V., Kaňok, J., a kol. (2011) [in Czech]
- Tactile maps by 3D printing technology - Voženílek, V. et al. (2009) [in Czech]
- Ecotones in the contemporary landscape - Kilianová, H., Pechanec, V., Lacina, J., Halas, P. et al. (2009) [in Czech]
- Evaluation of cartographic functionality in geographic information systems - Dobešová, Z. (2009) [in Czech]
- Climate atlas of Czechia - Tolasz, R., Valeriánová, A., Míková, T., Voženílek, V. et al. (2007) [in Czech]
- Cartography for GIS: geovisualization and map communication - Voženílek, V. (2005)
- Czech Geography at the Dawn of the Millenium - Drbohlav, D., Kalvoda, J., Voženílek, V. (eds.) (2004)











## Bachelor degree in Geoinformatics and Geography

The bachelor degree in Geoinformatics and Geography consists of 6 terms (three years of study) and the graduates acquire skills in the fields of geoinformatics, geoinformation technology and geography.

In geoinformatics students are taught the basics of digital representation of reality, geoinformation technologies of geographic information systems (GIS), remote sensing, global positioning system (GNSS), spatial statistics, computer cartography and its applications in geography. The geographical part of the programme focuses on various branches of geography (climatology, hydrology, etc.) and methods of study of landscape environment. Cartography and its use in geoinformatics as well as geography form an integral part of the programme.

The main aim of the study is to prepare university-educated GI experts with introduction to geoinformation technology. The graduates are able to use potential of geoinformation technologies in various geographical disciplines. This university education develops independence and individual creativeness in students. The study plan is aimed at improving practical skills. During the semester of practice students make use of both their theoretical knowledge from lectures and their practical skills.

The graduates are able to work with GIS software packages, write documentation and partly participate on research and development activities in common



geographical issues using geospatial technology. During the programme students acquire theoretical knowledge and skills in geoinformatics and geographical disciplines. Students become familiar with modern software products and receive basic knowledge of computer science and mathematics, programming and information systems. Students also gain experience in implementation of software projects.

The programme is completed by a diploma thesis. Students demonstrate their ability to work independently and professionally to apply the knowledge and skills gained during their studies.



## Master degree in Geoinformatics

The master degree in Geoinformatics enables students to continue improving the knowledge and skills of their bachelor studies in geoinformatics and geography in the areas of geoinformatics, geoinformation technology and its application in geosciences.

In follow-up study, students learn about theoretical approach in geoinformation technology (GIT trends in modelling of GIS, the state information policy) and about theoretical aspects of cartographic disciplines (stylistic of cartographic works, atlas and web cartography). Moreover, they use the theoretical information for practical application in the fields of applied geoinformatics (geoinformatics in physical and socio-economic geography, geology, environment and other fields such as agriculture and forestry, as well as modelling of natural hazards and landscape planning). In geography, emphasis is put on further study of geographical sub-disciplines and their methods related to landscape.

After the studies the university educated geoinformatics know the basics of geoinformation technology and can use it in the sub-disciplines of geography. The theoretical knowledge is related to practical skills developed during work on end-of-term projects. The programme enhances



individual thinking and creative approach to solution of projects. Special emphasis is put on issues that are the most popular in practice.

The programme completed by a master thesis. The student demonstrates the ability to work independently and professionally and to apply theoretical and practical knowledge and skills gained during the studies.

After this programme students are able to realize operational, documentation, as well as research and development activities, including solving problems with the use of geographic geoinformation technology.





## PhD in Geoinformatics and Cartography

The doctoral study programme in Geoinformatics and Cartography focuses on the main theoretical and practical aspects of GIS, Earth remote sensing, GPS, computer cartography, geostatistics, theoretical aspects of cartographic semiotics in analogue and digital maps, aspects of atlas production, etc. The main aim of the programme is to prepare highly qualified scientists for expert and scientific work in several specializations in geoinformatics and cartography.

### Requirements:

- four years full-time study (daily job)
- lecturing (26 hours per academic year)
- examinations – four modules, English language, state doctoral exam
- publications in scientific journals
- presentations at scientific conferences
- three-month research internship at foreign universities
- PhD thesis
- participation in the Department's activities



### Advantages:

- scholarship
- accommodation in an international students dormitory
- longer student life
- access to worldwide libraries, Internet, new technologies
- improving knowledge and skills in demand
- networking in high technologies
- living in a beautiful historical city

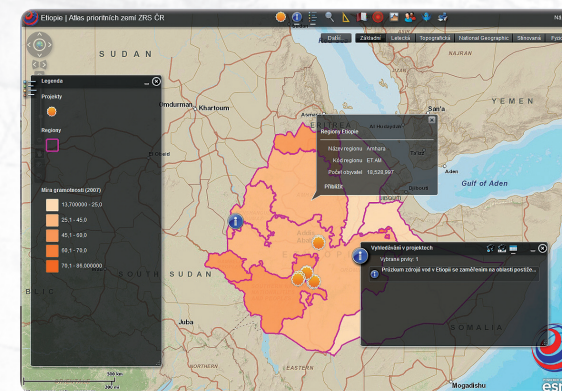


## PhD theses

- Photogrammetric approach to geodata collection with the use of unmanned aerial vehicles
- Visualization of uncertainty in environmental studies
- Application of GIS analyses when dealing with logistics issues in public transport
- Advanced methods for landslide assessment using GIS
- Non-technical aspects of map creation in atlas cartography
- Phenological landscape analysis with the support of GIT
- Fractals and fuzzy sets in GIS modelling
- RIA for crisis management
- Assessment of 3D visualization in GIS using Eye-tracking technology
- Color Distance in Cartography
- Experimental wireless sensor network for air pollution monitoring in the centre of Olomouc city
- Neutral Networks in GIS Modeling
- Spatial and multivariate statistical analyses of epidemiological data



- Experimental wireless sensor network for air pollution monitoring in the centre of Olomouc city
- Graph theory in analyses of spatio-temporal data
- Geodatabases distribution with spatial analysis potential
- Analysis, synthesis and modelling in urban remote sensing
- Predictive modelling of land-use in Central Europe
- Analysis of the geography of forest soils in the Czech Republic
- Geoinformation access of spatial data management of public transport in the Czech Republic





## Unmanned Aerial Systems

Since 2009, the Department of Geoinformatics has owned a unique equipment for non-contact collection of landscape data. Drone PIXY is a slow moving model of a motorized paraglider primarily used for close-up remote sensing, providing classic and digital aerial images and video recordings at ultra-low heights (10 - 300 m).



The second model, which is owned by the Department of Geoinformatics is Hexacopter XL. It is a multirotor system with six propellers. Both models allow acquisition of traditional and digital images, including video recording. Its maximum loading capacity allows having several sensors on the board at the same time. Unmanned Aerial Systems offer simple piloting, easy transportation, high resistance and wide use. Research group makes use of the equipment especially in the following fields:

- fluvial geomorphology
- archaeology
- landscape heterogeneity

### Recent results:

- Miřijovský, J., & Langhammer, J. (2015). Multitemporal monitoring of the morphodynamics of a mid-mountain stream using UAS photogrammetry. *Remote Sensing*, 7(7), 8586-8609.
- Miřijovský, J., Brus, J., Pechanec, V. (2011): Utilization of a small format aerial photography from drone PIXY concept in the evaluation of the landscape changes
- Miřijovský, J., Martinek J., Brus, J. (2011): Reconstruction of historical paths with using of small-format aerial photography.

[www.rs.upol.cz](http://www.rs.upol.cz)

## Eye-tracking Research in Cartography

Feeling the absence of objective evaluation of cartographical products, since June 2011 we have started the research on cognitive visualization of maps using eye-tracking.

The eye-tracking technology and method consist in measuring and recording eye movement of the observer in relation to the observed object. The most important part is played by a device that monitors the eye position and movement ("what we are looking at"). The observed object can be represented by paper maps as well as web pages, digital maps or any computer files on the screen.

Department of Geoinformatics is equipped with SMI RED 250 eye tracker and three pieces of Eye Tribe Tracker. Both types of devices work on the basis of non-invasive Pupil and Corneal Reflexion method. It is based on measuring the centre of pupil and corneal reflection of a direct infrared light beam.

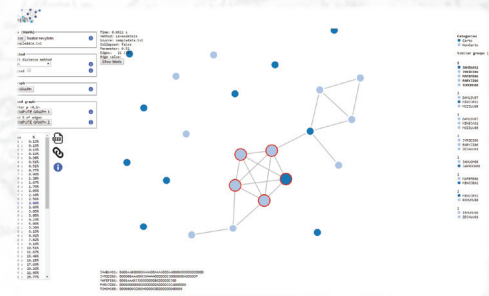
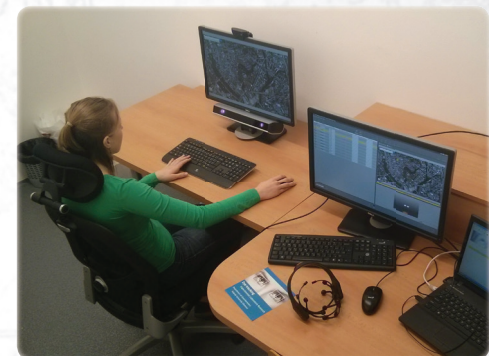
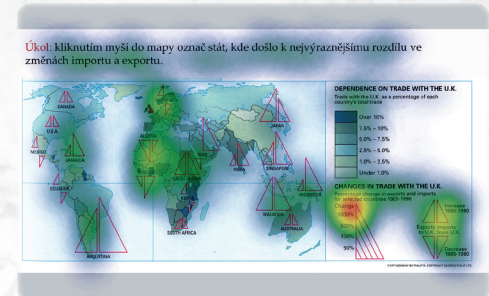
The group investigates the application of the eye-tracking technology and cognitive sciences in the field of evaluation and optimization of maps:

- Eye-tracking in cartography
- Eye-tracking in 3D visualization
- Eye-tracking in Visual Programming Languages
- Development of new analysis tools
- eye-tracking in uncertainty visualization
- eye-tracking in non-technological aspects in cartography

### Recent results:

- Dolezalova, J. & Popelka, S. (2016). ScanGraph: A novel scanpath comparison method using graph cliques visualization. *Journal of Eye Movement Research*, 9(4), 13 p.
- Popelka, S., Brychtová A. (2013): Eye-tracking Study on Different Perception of 2D and 3D Terrain Visualization *Cartographical Journal*
- Mirijovsky, J., & Popelka, S. (2016). Evaluation of color settings in aerial images with the use of eye-tracking user study. *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLI-B3, pp. 763-767.

[www.eyetracking.upol.cz](http://www.eyetracking.upol.cz)

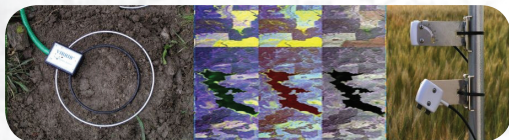




The Department of Geoinformatics cooperates with a number of public institutions and private companies. The cooperation can have the form of a project, commissioned job or student work. Our longterm partners are primarily the Czech Hydrometeorological Institute, the Czech Statistical Office, the Regional Authority of the Olomouc Region, the Olomouc Municipal Authority, the SmartGIS company, the Forest Management Institute and the Transport Research Centre. These are our most important projects:

### MOSESO (2015–2017)

The project is focused on research of heterogeneity of differing soil characteristics and their dynamics. The unique properties of soil give us a chance to study the relation between the vegetation component of landscape units and soil, with orientation on ecotones and their modelling in the environment of GIS. The so far uninvestigated possibility to qualify and quantify the heterogeneity of differing soil characteristics in landscape structures with the use of geoinformation technologies opens the space for totally new approaches and results.

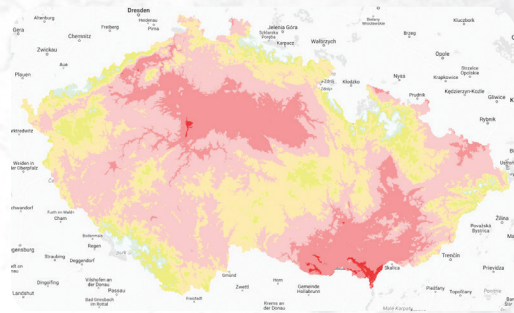


### GeoSpatial Summer School 2017 (2016–2017)

Main aim of the project is to organize GeoSpatial Summer School (G3S), which will provide the latest theoretical knowledge and practical skills in geospatial activities by lectures, practices and projecting; bring researchers, scholars, teachers and students together to share experiences at all levels of higher educational process; and discuss diverse approaches, experiences and points of view on geospatial issues. The summer school motto is – bring your geospatial thinking.

### LaPlaNt (2015–2016)

Project LaPlaNt aims at improving public as well as expert stakeholders' awareness of DSC\_0142-2 hydrological and environmental aspects of farmland as well as the potential for increasing its ecosystem services in diverse modes of its use in relation to the dynamics of natural factors. By means of educational and popularising tools, roles of different landscape components will be explained based on their impact on hydrologic cycle, water quality and quantity, soil erosion, floods, droughts, and related ecosystem reactions from the perspective of water and nutrient exchange as well as biodiversity.



### CzechAdapt (2015–2016)

The aim of this broad and interdisciplinary project was to create an open and continuously updated online database summarizing information about climate change impacts, risks, vulnerabilities and adaptation measures. Outcomes were prepared for the whole area of the Czech Republic on the basis of best available techniques and cooperation of specialist teams. Other goals of the project was to create an information system that provides integrated monitoring and early warning system; and also design the user-friendly system with an emphasis on a high degree of resolution (from the area in front of the Czech regions to individual stations).



### GeoS4S (2015–2017)

Ensuring social, economic and environmental sustainability is one major aim of all the countries but priorities are not the same world over. The partner countries, China and Thailand, are fast growing economies attracting a significant share of Foreign Direct Investment but facing a number of social and environmental challenges. Growing cities, expanding industry and increasing pollution of air, water and soil are big problems in both the countries which have several adverse effects on the society, environment and sustainable development.

### OLINA – Multimedia city guide (2009–2011)

The project consisted of creating a tourist multimedia navigation called OLINA to promote the city and improve the quality of touristic information services in Olomouc. OLINA contains hours of recordings, thousands of photographs and tens of thousands of words in a single device that can be borrowed from information centres in Olomouc. The navigation has been available since June 2011.

### Landscape Atlas of the Czech Republic

The Department of Geoinformatics is an author of this cartographical project and originally also served as a guarantor of the unique Landscape Atlas of the Czech

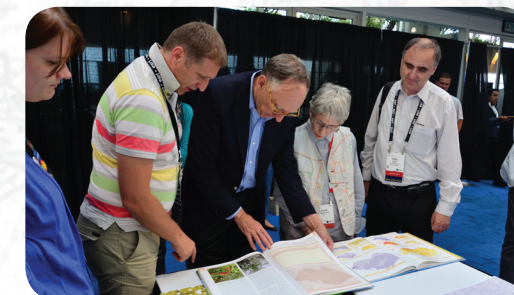
Republic. Tens of institutions cooperated in the project. The atlas contains 791 types of maps, 396 sections and many diagrams and pictures. Its height is 0.5m and its weight around 10kg. Its design and production cost 55 million CZK.

### Traffic census

In the field of GIS and transport, the Department of Geoinformatics cooperated with KPM CONSULT to provide traffic census (public urban and line transport) in the cities of Olomouc, Třebíč, Přerov and Prostějov. Apart from our staff, pre- and post-gradual students participated in the project. The students' role was to carry out the census in the field, conduct a survey, as well as complete the tasks of planning, monitoring and optimisation.

### Evaluation of cartographic functionality in GIS software

The project of International Visegrad Fund dealt with methodology for evaluating geospatial software projects. The main evaluated functionality was cartographic functionalities and the concept of creating thematic map output. The project developed proposals for a new approach to the evaluation of GIS programmes in terms of cartographic functions. The aim of this evaluation is to help future users to select the most suitable and appropriate programme focusing on cartographic outputs from GIS programmes.

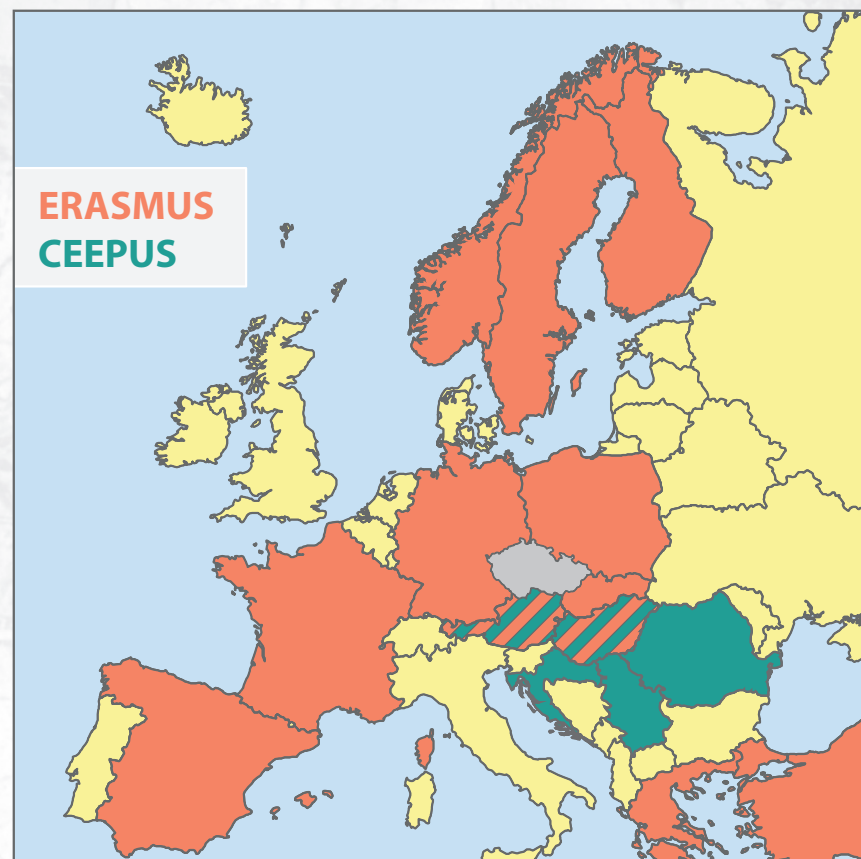






## Foreign partners

Students are offered yearly attractive study stays at foreign universities. In addition to the programs offered by the department or faculty itself, students can take advantage of project, non-university opportunities and individually negotiated foreign study stays. The department has concluded contracts for the exchange of students and teachers with 29 european universities.



## Foreign Study Visits And Research Internships

Many bachelor, master and doctoral students go abroad to study and attend research internships at major european and world universities during their studies in Olomouc. The knowledge, skills and experience gained are used when writing diploma theses and gaining lucrative jobs after graduation. Students from the Department of Geoinformatics in Olomouc have visited countries in recent years:

**Belgium** – Ghent University

**Finland** – Aalto University in Helsinki, University of Turku

**France** – National School of Geographic Sciences Paris

**Iceland** – Iceland Forest Service, University of Iceland Reykjavik

**Italy** – University of Florence, Università di Trieste Polo di Gorizia, Politecnico di Torino

**Israel** – Tel-Aviv University

**Canada** – University of Saskatchewan, University of British Columbia

**Kosovo** – University of Prishtina

**Hungary** – Eötvös Loránd University Budapest, University of Szeged, University of West Hungary Sopron

**Germany** – Ruhr-Universität Bochum, Dresden University of Technology, University of Munster, University of Potsdam, Max Planck Institute for Demographic Research Rostock

**Netherlands** – Delft University of Technology

**Norway** – University of Bergen, Norwegian University of Science and Technology Trondheim

**New Zealand** – University of Canterbury

**Poland** – Jagiellonian University in Cracow, Maria Curie-Skłodowska University in Lublin

**Portugal** – University of Lisbon

**Austria** – University of Salzburg, Vienna University of Technology

**Greece** – Aristotele University of Thessaloniki

**Slovakia** – Univerzita Komenského v Bratislave, Technická univerzita v Zvolenu

**Slovenia** – University of Ljubljana

**Serbia** – Belgrade University

**Spain** – University of Catalunya in Barcelona, Universidad de la Laguna, Universidad Politécnica de Valencia

**Sweden** – University of Gävle, Lund University

**Switzerland** – University of Zurich

**Turkey** – Yıldız Technical University Istanbul

**Great Britain** – University of Brighton, University of Cambridge, University of Leicester, University College London, University of St Andrews



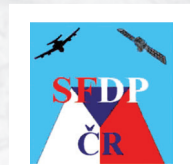


## Social life



## Partnerships & Memberships

- Department of Geoinformatics is a collective member of the Czech Association for Geoinformation (<http://www.cagi.cz>), co-organises its events and participates in its development.
- The Department of Geoinformatics is one of the most important bodies in the Czech Republic. Major cartographic activities in the Czech Republic (<http://www.czechmaps.cz>), the competition provides an organizational map of Children's Drawing Contest and Barbara Petchenik. It holds its annual Day of Cartography and in 2009 hosted the 18th cartographic conference.
- The Department of Geoinformatics works closely with the Czech Geographic Society (<http://www.geography.cz>) and is the seat of the Section of Cartography and GIS.
- The Department of Geoinformatics works closely with the Society for Photogrammetry and Remote Sensing (<http://www.sfdp.upol.cz>).
- The Department of Geoinformatics is actively involved in a number of international cartographic associations (<http://cartography.tuwien.ac.at/ica/>) and is represented in the Commission for National and Regional Atlases.
- The Department of Geoinformatics supports activities of the International Geographical Union (<http://www.igu-net.org>) and is represented in the Commission for Geographical Information Systems.
- The Department of Geoinformatics is in close contact with the Slovak Association for Geoinformatics (<http://www.sagi.sk>).







## Why don't you cooperate with us on

- joint research projects
- joint study programmes, exchange of students and researchers, fellowships
- organising conferences and workshops
- writing publications

## Join our doctoral programme in

- spatial modelling of geographical phenomena in GIS
- digital cartography
- remote monitoring of landscape

## Get in touch with us to

- consult your work
- discuss academic plans
- inspire us and get inspired



DEPARTMENT  
OF GEOINFORMATICS

Contact:

<http://www.geoinformatics.upol.cz>

<http://www.prf.upol.cz>

<http://www.upol.cz>

