NATIONAL REPORT

on Activities of the Czech Cartographic Society

Report period

2015–2019

July 2019

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Content

1 Foreword

The national report of the activities of the Czech Cartographic Society in the period 2015 – 2019 represents a short overview of results gained in the Czech cartography. Its purpose is to give a basic information about the stand of cartography in the Czech Republic from the theoretical, productional and educational view as well, The report in its extent cannot give a complex overview about cartographers activities and partly geoinformatics, but the efforts of the authors was to inform the international community with our activities, accesses and main results.

The report is apart from this foreward devided into three basic chapters. The first chapter deals with the structure of the present cartography in the Czech Republic, how it is built and what are the main results of its particulary components. The next chapter is dedicated to the activities of the Czech Cartographic Society and the last chapter presents examples of the outstanding cartographic publications from this period, which have the natio-wide meaning and possibly international enjambement.

2 Czech cartography

Czech cartography is developing in four main areas. The first area focuses on the education, the second on the support of needs of the state administration and defence, the third on the commercial products for the wide public and the last one on the research, development and innovations.

Even though the particular areas have different aims, it comes between them to a wide cooperation and colaboration, especially by the change of information, development of the theory and practice of the cartographic production and last, but not least, by the promotion of cartography in the wide community as in the national standard as well on the international forum.

In the following text the main characteristics of all four areas are introduced.

2.1 Education of cartographers

The education of cartographers in the Czech Republic is provided on several universities and is included into programmes of geodesy, geography and geoinformatics. These programs are provided at the Charles University in Prague (the Faculty of Natural Sciences), at the Masaryk University in Brno (the Faculty of Natural Sciences), at the Palacký University Olomouc (the Faculty of Sciences), at the University of Ostrava (the Faculty of Natural Sciences), at the Czech Technical University in Prague (the Faculty of Civil Engineering), at the Technical University in Brno (the Faculty of Civil Engineering), at the West-Bohemian University in Plzeň (the Faculty of Applied Sciences), VSB–Technical University in Ostrava (Faculty of Geology and Mining), Jan Evangelista Purkyně University in Ústí nad Labem (Faculty of Science, Department of Geography), and at the University of Defence in Brno (the Faculty of Military Technology).

All the universities except the University of Defence provide study programs in three degrees: bachelor (6 terms), master (4 terms) and doctoral (8 terms). The only study at the University of Defence is a full five-year master program. After graduating master study students can continue in the doctoral study at seven Czech universities: Charles University in Prague, Masaryk University in Brno, Czech Technical University in Prague, Technical University in Brno, Palacký University in Olomouc, Technical University in Ostrava and University of Defence in Brno. For more information see the universities web sites.

The bachelor study programs are closed by state exam and by defence of the bachelor thesis. The Bc. graduates can continue in the Master of Science study program, sometimes without any entrance examination.

The Master of Science studying program is closed by state exam and by viva voce of the Master of Science thesis as well. Some of the master graduates can continue in the doctoral studies; its duration is normally 3–4 years. This study is closed by doctoral state exam and a defence of their dissertation theses.

All study programs are deeply supervised by the National Accreditation Bureau for Higher Education, which is an independent authority and provides accreditation of degree programs and institutional accreditation for given university. The bureau gives a state permission to educate students usually for ten years.

Beside of classical forms of education are organized short educational activities as well. A sample is The GeoSpacial Summer School (Geo3S) managed by Department of Geoinformatics at Palacký University Olomouc in 2017, 2018 and 2019. The primary Geo3S focus is to provide and transfer new geosciences skills, techniques and knowledge from scholars/experts to the students. The summer schools offer a unique opportunity for the encounter of students, scholars, and experts in geospatial technologies and data. The summer school is designed to guide students through the entire process of geoinformation project workflow – from data collection, data management, spatial analyses, geovisualisation, to modern presentation of results. Moreover, the Geo3S strives to establish a platform for participants to bring their experiences, ideas, data and projects to share, work, present and discuss it. More at: http://gisummer.upol.cz/.

Fig. 1 Leaflet of Geospacial Summer School 2019

From the year 2019 the ERASMUS MUNDUS COPERNICUS MASTER JOINT DEGREE "DIGITAL EARTH" proceeds by University of Salzburg (Austria), Palacký University Olomouc (Czech Republic) and University of South Brittany (France).

This study is offered to young skilled people from all the world. The applicants can jointly with the application ask for a scholarship. Two-year master's degree program culminates in a diploma from two universities. Students endorse the 1st year in Salzburg and the 2nd year according to the choice of specialization (and diploma thesis) in Olomouc, Czech Republic (Geovizualization) or in Vannes, France (GeoData Science). There are number of excellent partners where students will stay for interships: Esri (USA), Hexagon (USA), University of South California (USA), United Nations University (Germany), University of Bonn (Germany), University of Strasbourg (France), Asian Institute of Technology (Thailand), UNISTRA (France), UNIGIS International, Spatial Services (Austria), GAF AG (Germany), Jawaharlal Nehru University (India). Annually 13-16 scholarships are awarded; anyone can apply as a self-funded student. More at: https://cde.sbg.ac.at/ .

Fig. 2 Leaflet of ERASMUS MUNDUS COPERNICUS MASTER JOINT DEGREE „DIGITAL EARTH"

2.2 Support of needs of the state administration and defence

The state authorities responsible for geoinformation and mapping support of the state administration are represented by civilian and military organisation as well.

The state administration and self-government in the field of cartography provides in the Czech Republic the Czech Office for Surveying, Mapping and Cadastre, whereas the needs of the state defend the Geographic Service of the Czech Armed Forces. Both organizations are established by the law and have exactly defined their responsibilities. The resources for support of their activities form a part of the state budget of the Czech Republic

2.2.1 Czech Office for Surveying, Mapping, and Cadastre

The civilian state administration authority is represented by the Czech Office for Surveying, Mapping and Cadastre (mail address: Pod sídlištěm 9/1800, CZ 182 11 Prague 8 – Kobylisy, Czech Republic, e-mail: cuzk@cuzk.cz, web site: http://www.cuzk.cz).

The subordinary organizations of the Czech Office are the Land Survey Office in Prague, the Research Institute of Geodesy, Topography and Cartography in Zdiby, the Survey and Cadastre Inspectorates (7) and the Cadastre Offices (77).

The state administrative bodies of the real estate cadastre managed by the Czech Office for Surveying, Mapping and Cadastre provide state administration of the real estate cadastre in the Czech Republic and ensure performance of surveying activities in the public interest given by the law.

Operations dealing with cartography and other surveying and mapping activities in the competence of the public administration are the part of the duties of the Land Survey Office as well as the service of the geodetic base of the Czech Republic, the service of the Czech Positioning System GNSS (CZEPOS), geodetic works at the state borders, service of the Fundamental Base of Geographic Data of the Czech Republic (ZABAGED), service of geographic names of the Czech Republic (GEONAMES), service of orthophotographic representation of the Czech Republic, service of the Central Archives of Surveying, Mapping and Cadastre and the service and developing of the Information System of Surveying and Mapping incl. the publication of data on the Geoportal of the Czech Office for Surveying, Mapping and Cadastre.

The next area, closely connected with cartography, is the service of the Fundamental Base of Geographic Data of the Czech Republic (ZABAGED). ZABAGED is a digital vector geographic model of the territory of the Czech Republic with more than 120 types of geographic objects and over 400 sorts of quantitative and descriptive attributes. It is a important part of the Information System of Public Administration of the Czech Republic and its data are using by many authorities of the state adminisdtration and self-government.

The goal of the activity by the service and actualization of ZABAGED consisted in the past in the aerial actualization of the territory on the base of the data gained from the remote sensing (first of all orthophoto and aerial phographs), in investigation of selected infomation at the local authorities and by toporaphic investigation of terrain changes and continuous actualization of selected data in the whole Czech Republic on the base of data administrators. Apart of it will be worked on the analyses of the usability of external data for the ZABAGED actualization and follows the colaboration with the land survey and mapping services of the bordering states in the harmonization of the geographic data in the area of the state borders.

The important task was and in future remains a systematic specifying of data on the base of the new hypsometry from the aerial laser scanning data. The specifying is focused on the communication objects – registered road and motorways, railway tracks, respectively rails, water objects and selected points and lines of the skeleton of terrain relief. In January 2017 were adopted the results of the research project "Innovation of the Fundamental Base of Geographic Data of the Czech Republic" which was solved at the Masaryk University. The goal of the project was the elaboration of a certified methodology, which will propose a way to the future publication of ZABAGED in 3D and also to a better running of information about the ZABAGED data quality. The development will be connected with the confirmation and beginning of realization of the project "Development of ZABAGED 2014" co-financed by EU.

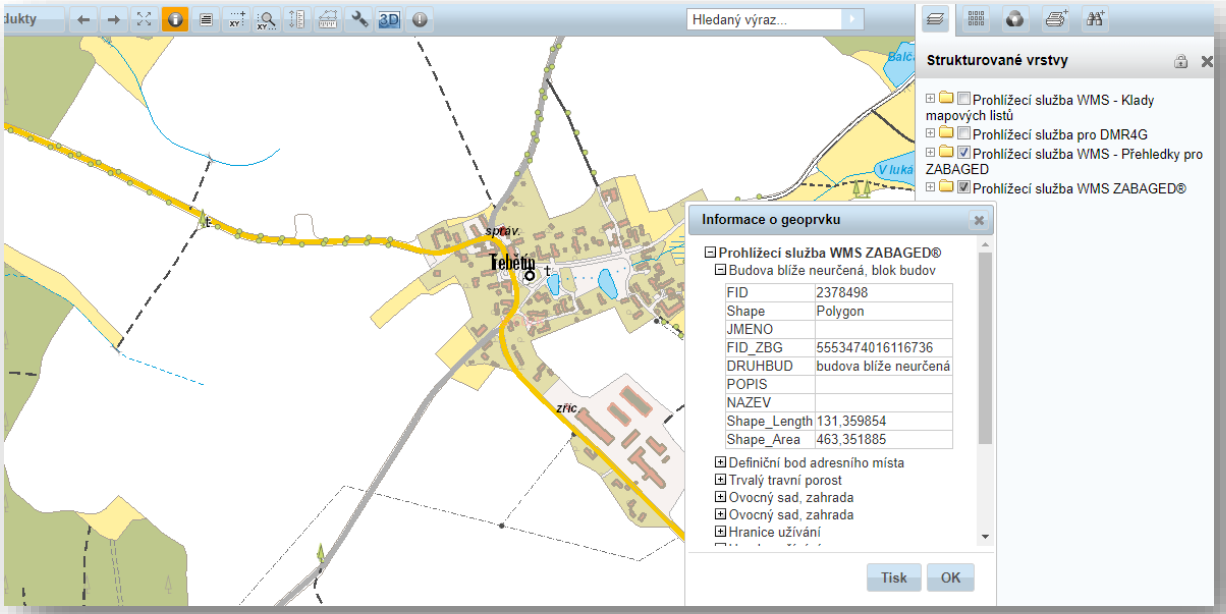

Fig. 3 A sample of the vizualization of the database ZABAGED (source http://geoportal.cuzk.cz/geoprohlizec/)

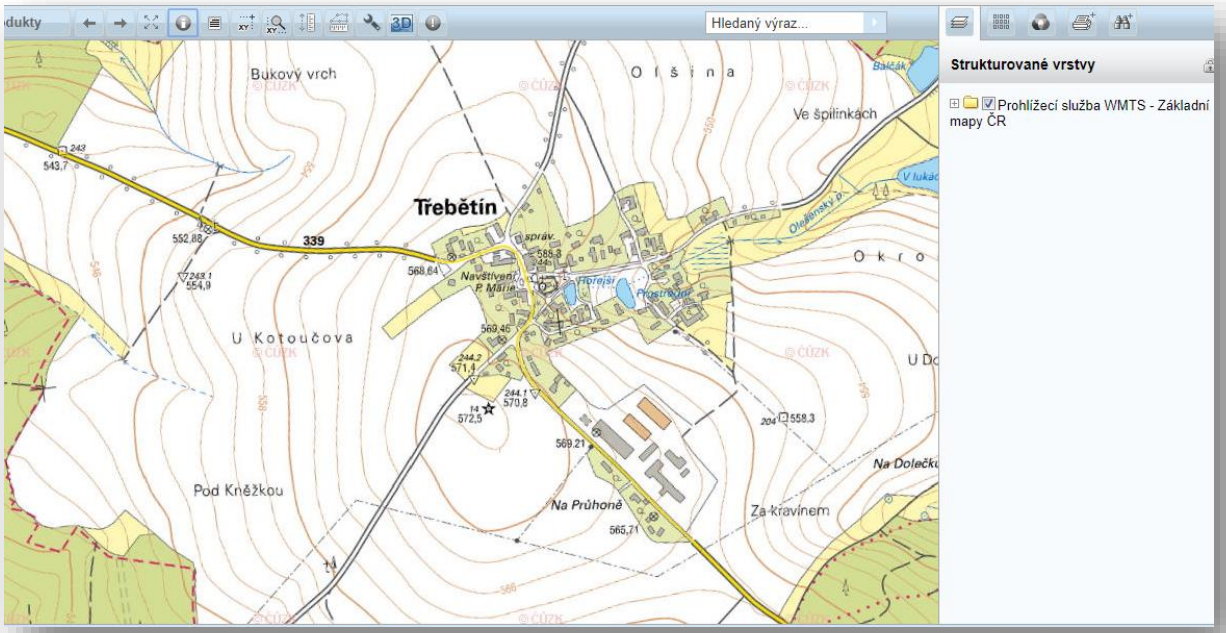

Fig. 4 A sample of the Basic Map 1:10 000 created from the data base ZABAGED (source http://geoportal.cuzk.cz/geoprohlizec/)

The Land Survey Office in collaboration with the Military Geographic and Hydro-Meteorologic Institute and the 24th air-base of the Ministry of Defence guarantee on the base of a conclused agreement between the Czech Office for Surveying, Mapping and Cadastre and the Ministry of Defence the administration of the basic hypsometric data base of the Czech Republic

The digital relief model of the 4th generation (DMR 4G) was for the whole territory of the Czech Republic finished in the year 2014. It is a case of a raster digital relief model represented by a net of geodetic high points with a regular space differentiation 5 x 5 m and a total mean error of high determination 0,30 m in an uncovered terrain and 1,00 m in terrain with vegetation.

The digital relief model of the 5th generation (DMR 5G) was for the whole territory of the Czech Republic finished in the year 2016. It is a case of a digital relief model in the form of nodal points of an unregulary triangular network (TIN) defined by a total mean error of high determination 0,18 m in an uncovered terrain and 0,30 m in terrain with vegetation,

The digital surface model of the 1st generation (DMP 1G) was for the whole territory of the Czech Republic finished as well as DMR 5G in the year 2016; it is a case of a digital surface model in a TIN form, which is defined by a total mean error of the high determination 0,40 m for the exactly defined objects and 0,70 m for the not exactly defined objects.

Fig. 5 Procedural service "Altimetry analysis" accessible on the Geoportal ČÚZK (source https://ags.cuzk.cz/dmr/)

The Land Survey Office in colaboration with the Military Geographic and Hydro-Meteorologic Institute in the long term provides a regulary aerial photo survey and the following creation of the orthophoto of the Czech Republic The whole territory of the Czech Republic is covered by photo surveying in a two years period (i.e. every year a half of the territory). The differenciation of the photos moves from 15 cm until 20 cm in the terrain. To the further distribution and elaboration the 16 bit colour (RGB) photos and photos in the near infrared spectral band will be used. The resulting orthophoto has a space differenciation 20 cm in terrain.

To the land surveying activities in common interest belongs the standardization of non-settlement geographic objects names from the territory of the Czech Republic and the settlement and non-settlement geographic objects names from the territory outside the Czech Republic. The results of these activities are guided in the data base of the geographic names of the Czech Republic managed by the Secretariat of the Commission of Geographic Names of the Czech Office for Surveying, Mapping and Cadastre in the competence of the Land Surveying Office and new from the year 2015 in the data base "Names of the World".

The activities of the Commission of Geographic Names become evident in the international field, while the Commission was entrusted to preparation and organization of the 19t^{h} session of the Working Group on Exonyms (UNGEGN). The session was successfully realized from 6th till 8th April 2017 in Prague.

All the upon mentioned activities preceede to the service of basic and selected state thematic maps dedicated to the common administration of the Czech Republic and the administration of the paneuropean topographic data bases EuroRegionalMap (ERM), EuroGlobalMap (EGM) and EuroBoundaryMap (EBM). The basic maps offer the basic topographic informations at scales 1:10 000 (4533 map sheets), 1:25 000 (773 map sheets), 1:50 000 (211 map sheets), 1:100 000 (59 map sheets) and 1:200 000 (18 map sheets). Beside of basic maps prepares the Land Survey Office using computers from the cadastral data, ZABAGED, data base of fundamental controls and data base GEONAMES a new State Map 1:5000.

In the year 2015, the preparation works on the creation of a new edition of State Maps were iniciated; these maps will be offered to users from the year 2023. A proposal of a new map layout for the variant of maps using S-JTSK coordinate system as well for the variant using ETRS89 coordinate system was elaborated. A separate task was the proposition of a new topographic map at the scale 1:5000 which will be meant especially for detailed territorial planning and for the building projection activities of the local type. In the first half of the year 2018 was finished the preparation of the technology of creation of this map and subsequently was started its pilot verification.

The results of land surveying activities of the Land Surveying Office introduce especially the space data offered various forms covered the various areas of the user's needs.The main part of products has a digital form, which enabled their presentation, offering and distribution by the electronic way. The Land Survey Office is the administrator of the GEOPORTAL of the Czech Office for Surveying, Mapping and Cadastre (http://geoportal.cuzk.cz), which forms a basic instrument for gaining information about the provided products and services, enable the visualization of products and last, but not least, is an intermediary for order of data and services not only from the Information System of Surveying and Mapping but of classical prented maps as well.

2.2.2 The Geographic Service of the Czech Armed Forces

The Geographic Service of the Czech Armed Forces (GS) is the part of Ministry of Defence responsible for the Geographic Support of the Czech Armed Forces and Ministry of Defence (MoD) as well. The most of its tasks are fulfilled by own forces and resources. GS undertakes two major tasks:

- performance of the state administration in the surveying in the area of national defence,
- geographic support of MoD and the coalition forces in the Czech and foreign territory.

The main production part of GS is the Military Geographic and Hydro-Meteorologic Institute (MGHMI).

MGHMI is responsible of permanent data collection from various sources. The effective co-operation with civilian organizations, mainly with the Czech Office for Surveying, Mapping and Cadaster (ČÚZK), enables to manage the data acquisition from the Czech Republic territory.

The collection and processing of geospatial information from abroad is being implemented particularly with involvement in international projects such as Multinational Geospatial Co-production Program (MGCP) a TanDEM-X High Resolution Elevation Data Exchange Program (TREx).

Fundamental military geospatial database is the Digital Model of Territory 25 (DMÚ 25), vector database in resolution of 1 to 10 meters according to feature classes. The key information source for maintenance and update of the database are ortogonalized aerial imagery processed in collaboration with ČÚZK. The equivalent of this database data model is the Digital Model of Territory 100 (DMÚ 100). These models cover the whole Czech territory including a small overlap over the Czech border.

These data models are essential data bases for creation of national military map set - the topographic maps in the scales of 1:25,000, 1:50,000, and 1:100,000. Basic map scale set is supplemented with Military maps of the Czech Republic 250, 500 and 1MIL. GS is also responsible of military thematic maps production. The basic thematic maps are issued for Air Forces and for military training in Military Training Areas. Special map products based on a specific request, beside standard scale maps, are produced as well. MDG 50, a standardized map product based on MGCP geospatial data, is created for the purpose of covering and provision of foreign territory. All principal map products are processed in the digital version, raster equivalents (RE), including their publication in the form of web map services (WMS). The map production has NATO standards implemented and it is due to the necessity of assurance of compatibility and interoperability of geographic products. A proposal of realization of a new military standardized TM 50 of the Czech Republic and near abroad regions was created in the terms of compiled standard.

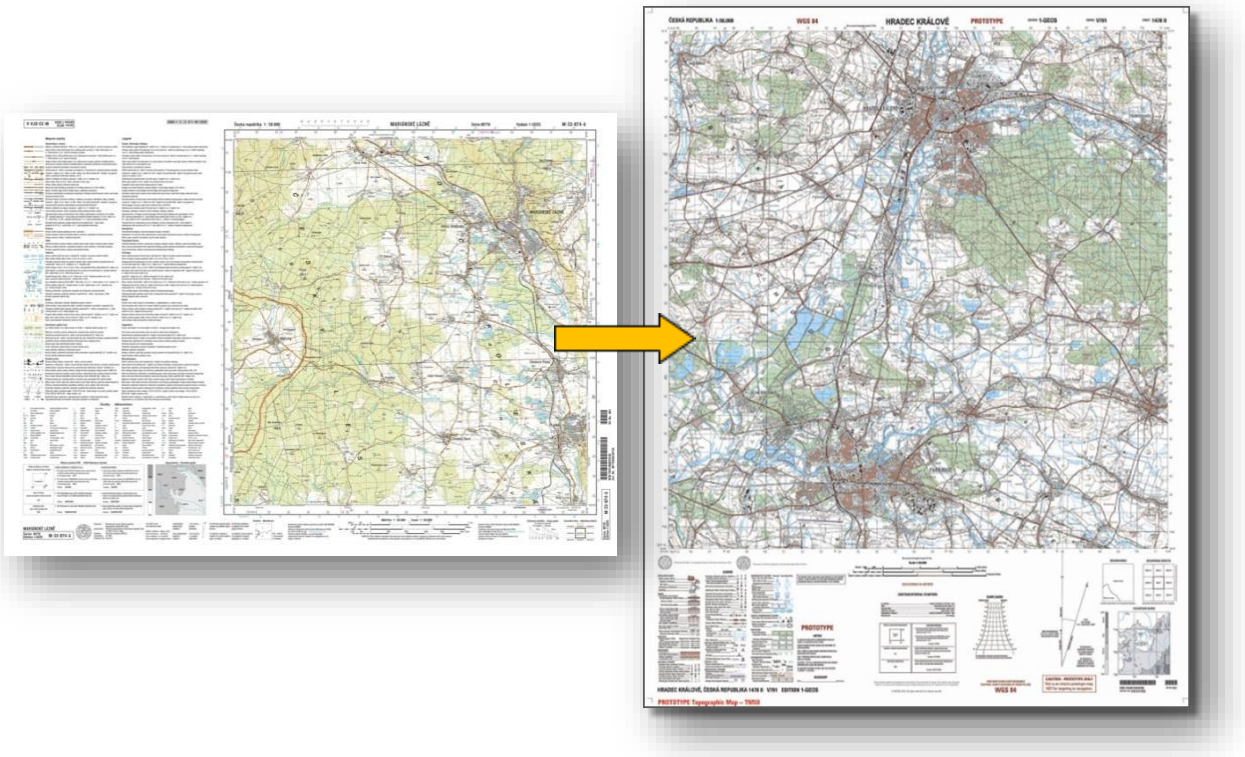

Fig. 6 Current form of military TM 50 and the proposal of a new standard

Digital terrain models with various levels of detail were created for the purpose of a map production and more importantly for spatial analyses. The terrain itself is represented by digital terrain models level one to five (DMR) and surface by digital model of surface level one (DMP). The production of the most detailed models DMP 5 and DMP 1 is secured in cooperation with ČÚZK. High-rise objects/obstacles are being managed within the framework of Register of High-rise Objects (RVO). Significant act of GS is active involvement in the international project TREx with the aim of production of global terrain model.

The area of military geographic information involves thematic map products. These information complement text part describing particular area. National geographic information production also covers Military Geographic Evaluation of the Czech Republic (VGV ČR). The foreign territory is covered by Rapid Geographic Information (RGI).

All map products are in different forms part of various Command and Control Systems, weapons and navigational systems and irreplaceable basic layer in the area of exercise and simulator technologies.

Utilities of web portal (geoportal) is one of the form of data sharing. Not only WMS and geospatial information are available within the scope of the portal, but network applications for solving geospatial tasks are present as well.

GS has acquired a new printing capability. Sublimation printing on resistant materials covers both requirements of unique military usage and preserving of analogue forms of maps

2.3 Commercial cartography

Apart of state organizations deals with the cartographic production for the public a number of commercial subjects. The cartographic publishing houses produce the printed products as well as the electronic ones, focused specially on the map web sites. The list of the mentioned cartographic publishing houses with their web sites and their orientation to the main production follows.

Kartografie Praha, Inc., Prague

web sites: http://www.kartografie.cz

The publishing house issues especially geographic and school maps and atlases, road maps and atlases, tourist maps, city plans and other cartographic products. In the edition for schools the publishing house began with the map and atlases publication in on-line version in a form of the web service.

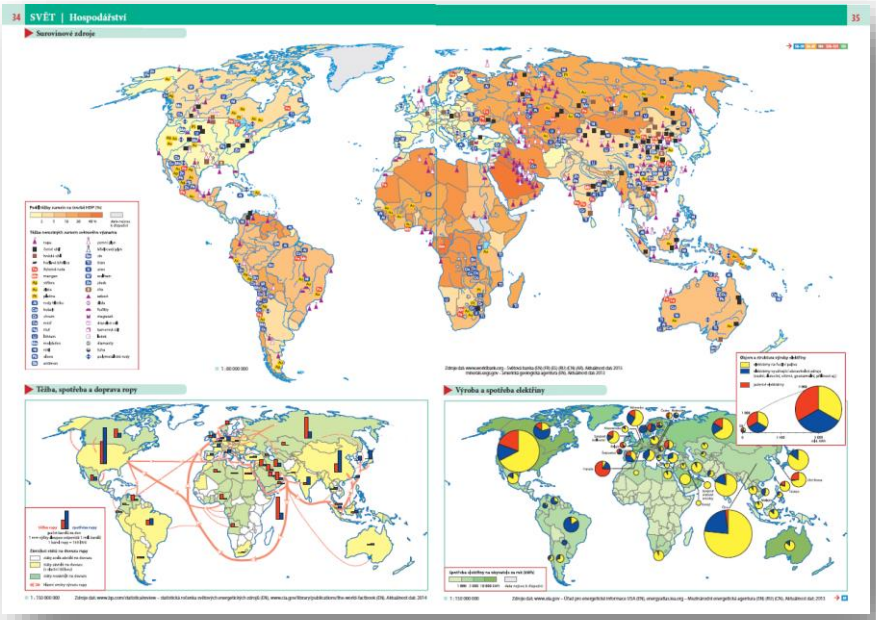

Fig. 7 Example of web map of on-line School World Atlas (http://www.skolniatlassveta.cz/wp-content/uploads/2014/11/Svet_hospodarstvi.png)

Kartografie HP, Ltd., Jičín

web sites: http://www.kartografiehp.cz/

The publishing house deals with the production of plastic relief, picture and panoramic maps, lenticular maps and post cards and as well by the own creation of detailed tourist maps at scales 1:25,000 untill 1:15000

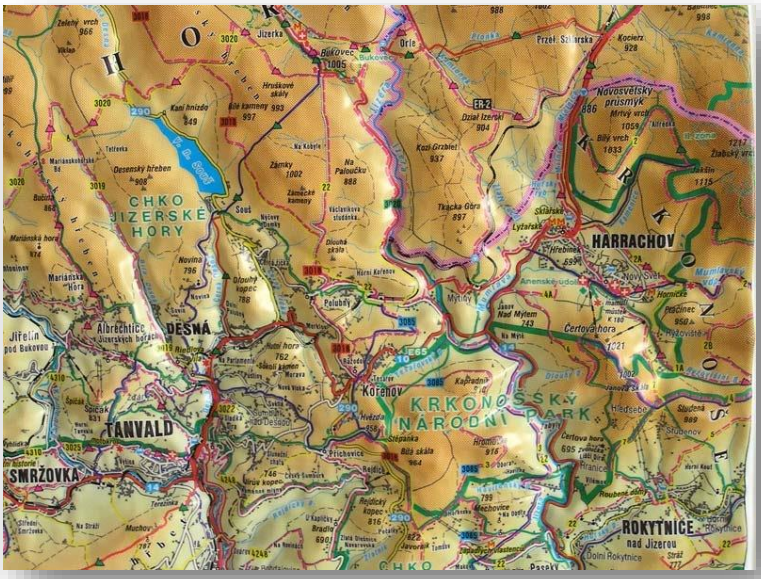

Fig. 8 Example of relief map (http://kartografie.cis.cz/e-shop/jizerske-hory-a-cesky-raj-1-66-666-7.html)

Klub českých turistů (Czech Tourist Club), Prague

web sites: https://kct.cz/

The Czech Tourist Club was established in the year 1888 and join nearly 40 000 tourists from the whole Czech Republic. Through its care originated a thick net of market footpaths. The Club together with the comapny TRASA issues the own tourist and cyclotourist map. The issued titels are edited in repeated editions thus, so as the market will be satisfied by actual maps. The map edition covers the whole territory of the Czech Republic. It has a unique scale 1:50,000, unique content and form. The cartographic base create the maps of the Land Survey Office.

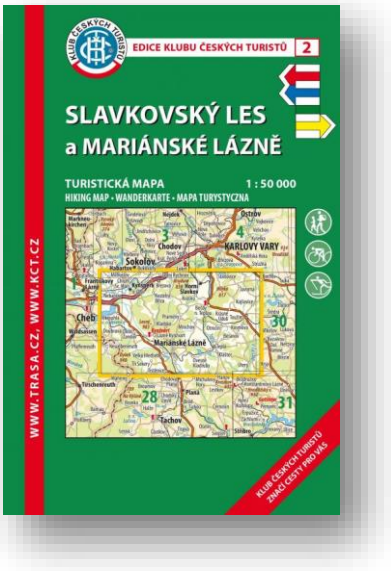

Fig. 9 Exaple of tourist map (https://kct.cz/mapy-kct)

PFArt, Ltd. Brno

web sites: http://www.pfart.cz/

The publishing house deals with production of city plans, school atlases and wall maps.

PLANstudio, Ltd., Prague

web sites: http://www.mapdesign.eu/

The publishing house deals with production of city plans, tourist and regional maps and atlases.

Seznam.cz

web sites: https://mapy.cz/

The publishing house is oriented exclusively on the web cartography. At the present time gives information from the whole world. It is possible to show the map depiction in seven basic variants – the basic, touristic, winter, photographic, aerial, transport and geographic. A part of the service is the possibility to produce maps for the blinds and week-sighted people.

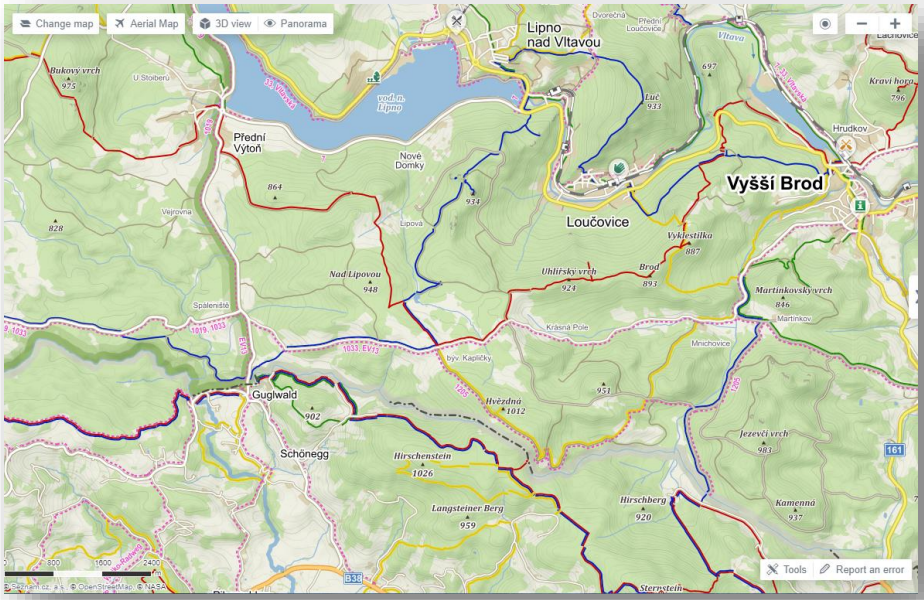

Fig. 10 Example of mapy.cz map – touristic version
https://en.mapy.cz/turisticka?x=14.2235660&y=48.6038078&z=13)

SHOCart, Ltd., Zádveřice

web sites: https://www.shocart.cz/

The publishing house deals with the production of tourist maps, map guides, cyclotourist maps and guides, maps for water sports, road maps and atlases, on-line maps and city plans

Stiefel Eurocart, Ltd., Vyškov

web sites: http://www.stiefel-eurocart.cz/

The publishing house is oriented on production of wall maps, political maps, road maps and satellite images

Topograf, Ltd., Prague

web sites: http://www.topograf.cz/

The publishing house deals with the prodution of various cartographic products and information technologies

ZES Brno, Inc., Brno

web sites: http://www.zesbrno.cz/

The publishing house is oriented on the production of wall maps, relief maps and globes

Žaket, Ltd., Prague,

web sites: http://www.zaket.cz/

The publishing house deals with the production of city plans, road maps and atlases and wall maps.

2.4 Research, development and innovations in the Czech cartography

The research and development is provided above all at the academic area in the introduced universities and in the Reaserch Institute for Geodesy, Topography and Cartography in Zdiby. The founder of the Institute is the Czech Office for Surveying, Mapping and Cadastre, but the Institute is a separate subject, which gains the means for its for the support of the research, development and innovations operations almost from the public and non-public resources. The development and innovation are provided as well in some commercional organizations and are focused on new products and utilization of cartographic products.

Main research activities in cartography are founded from several sources. The Grant Agency of the Czech Republic (GACR) and the Technological Agency of the Czech Republic (TACR) are the main providers for research financing. Only several state departments continue to support research, mainly the Ministry of Interior, Ministry of Defence and Ministry of Environment can be mentioned as examples. The applicants have to follow the rules of the providers and usually it is necessary to prepare the research intention for open competition. This process is general and valid also for research in cartography.

During the years 2015 – 2017 proceeded the rearch project of the Technological Agency of the Czech Republic „Research and development of method for cartographic generalization of the state map work in middle scales“, which was regulated by the Research Institute for Geodesy, Topography and Cartography in Zdiby and where the Land Survey Office in Prague guaranteed the consultation and information activities for support of the solution of this task in the function of the customer representative.

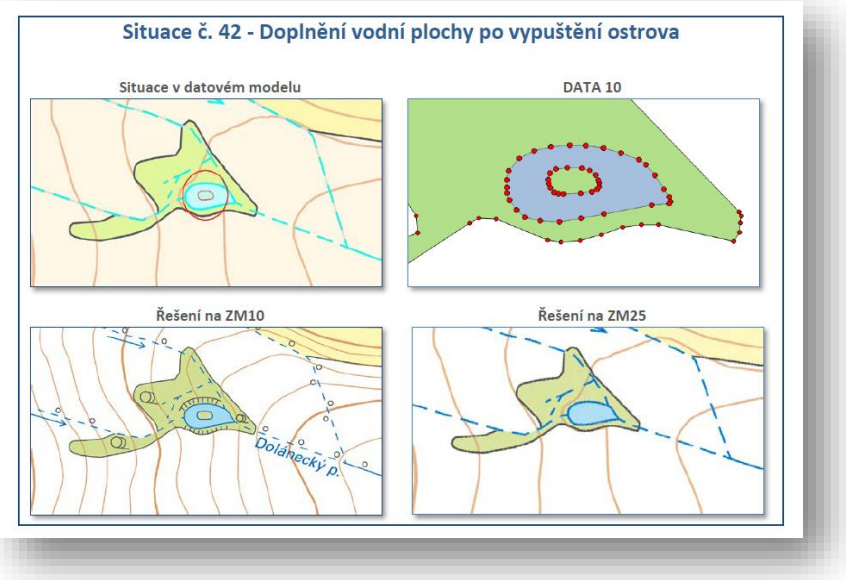

Fig. 11 Example of the cartographic generalisation for state maps – supplemenation of a pond after island deletation (source – VÚGTK)

Multilingual terminological dictionary containing 4,000 technical terms has been continuously updated with foreign-language expressions. The dictionary is available on the Internet. The Research Institute for Geodesy, Topography and Cartography has been the active member of the Council of Public Research Institutions for Applied Research (RAV), the mission of which

is to contribute to solution of existing legislation and operational problems of the public research institutions beyond the scope of the Academy of Sciences of the Czech Republic.

The universities provide a large part of research in cartography and GIS. Almost all doctoral thesis are dealing with present development. Most of universities are focused on different branches and therefore also doctoral thesis have various topics. For example dissertations from the Czech Technical University deals with topics of old maps publication on the Internet, dissertation from the Palacký University with thematic mapping and color systems, dissertations coming from the Masaryk University with issues of cartography and Early Warning and dissertations from the University of Defence with tasks of cartography and GIS application in command and control systems. Many university teachers co-operate on research projects with non-academic teams. In the following text there are several examples of current projects.

At the Faculty of Applied Sciences of the West Bohemian University in Plzeň the methods of treeting geodata and their analysis were researched in order to derive geomentric and physical parametres of the Earth or its parts, rendering data and results to the users through web services, precising of the national base of geographic data, testing of the laser scanning technology and harmonization of data of the space planning with respect to the INSPIRE instruction.

The research team of the Institute of Geography of the Faculty of Natural Sciences of the Masaryk University in Brno researched international projects focused to using cartography in crisis management and by the work with extensive data. During the years 2017 – 2019 was researched the project GIS4DIS - Dynamic mapping methods oriented to risk and disaster management in the era of big data. Project was supported by the Ministry of Education, Youth and Sports of the Czech Republic. The project was focused on collecting and processing data from different sources and their cartographic presentation in real time (i.e. rapid mapping) for crisis management.

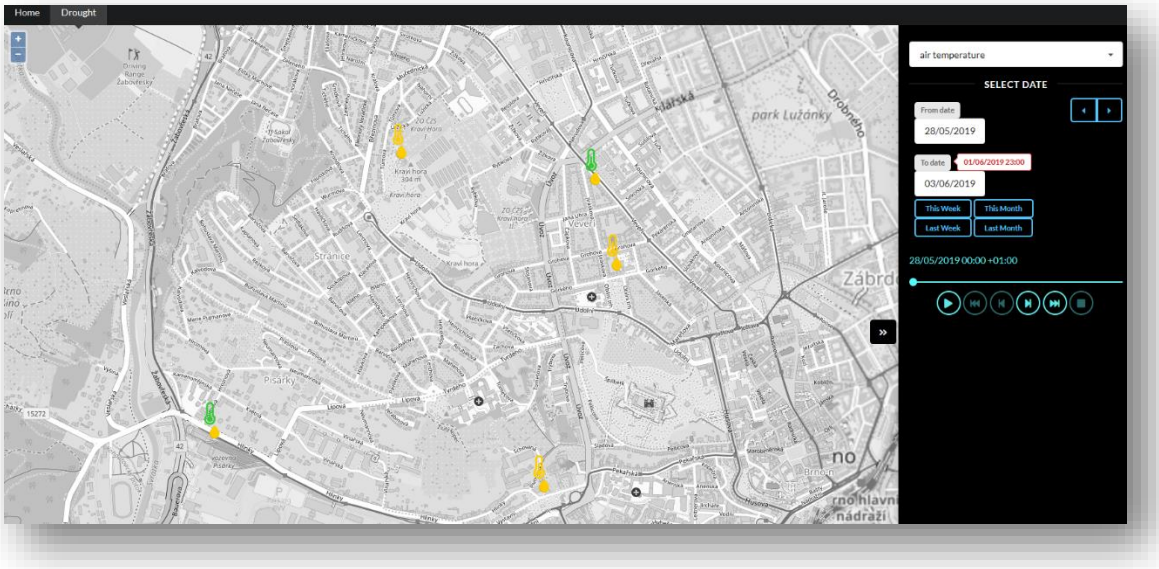

Fig. 12 Example of screenshot of GIS4DIS

Following project called SIEUSOIL will be solved in years 2019 – 2022 in co-operation with China-EU Web Observatory platform that provides Open Linked Data to monitor status and threats of soil and assist in decision making for sustainable support of agroecosystem functions,

in view of the projected climate change. The Observatory platform will through customizable modules support the wise management of soil at field level and will provide showcase of good practices on soil management both for EU and China. The final target will be to support sustainable management of soil, increase land productivity sustainably, reduce crop yield variability across time and space, and support the policy formulation process.

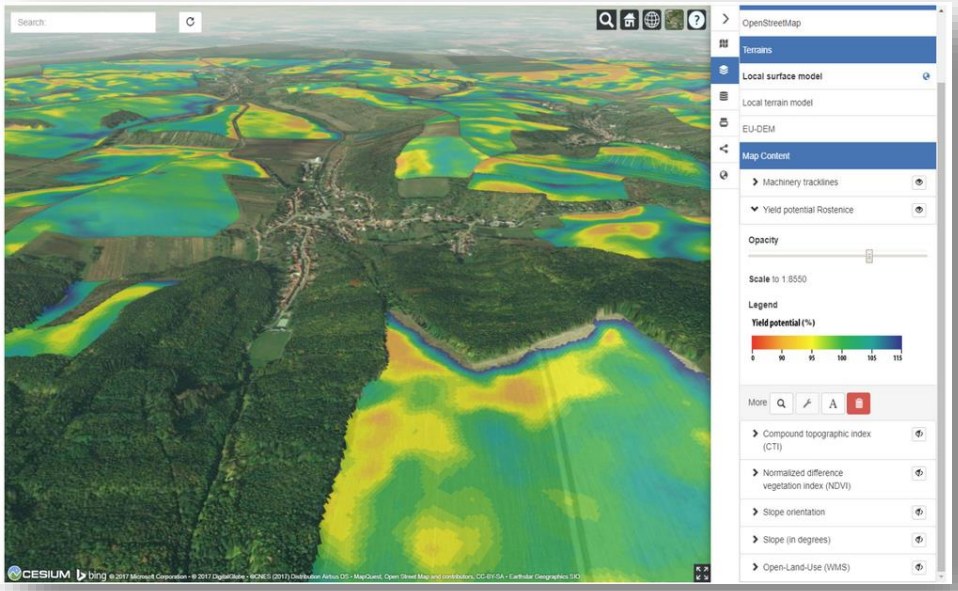

Fig. 13 Example of screenshot of SIEUSOIL

University of Defence in Brno is mainly focused on complex solution of terrain analyses for command and control systems and for support of decision making processes. The complex project of Cross Country Mobility was finalised in the first version on Department of Military Geography and Meteorology which enables to evaluate the potential of landscape for a movement of typical types of transport and armed vehicles used in the Czech Armed Forces.

The complex analyses of terrain are also developed on University of Defence. One example is method of a chosen suitable place for the deployment of decontamination center. This solution is prepared for chemical units of the Czech Armed Forces and for the Integrated Rescue System.

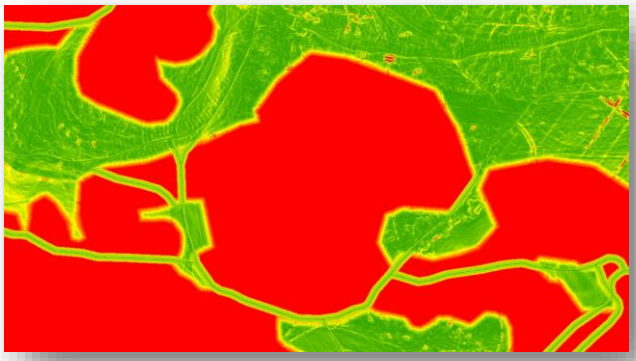

Fig. 14 Cut of a part of map for movement moddelin of armed vehicle PANDUR (red – NO GO, yelow – SLOW GO, green – GO terrain)

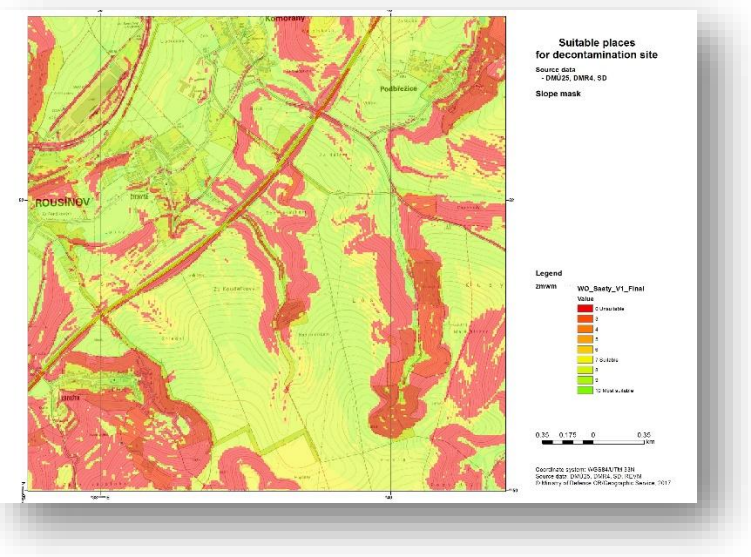

Fig. 15 Example of outputs of terrain analyses for chemical troops of the Czech Armed Forces.

The Department of Geoinformatics of the Palacký University in Olomouc deals with theoretical, technical and user-related aspects of the creation and use of cartographical products. It makes wide use of tools and data models of geoinformation systems, remote sensing materials and geostatistical programs.

The main research topics are thematic atlases, synthetic map-making and map use, usability evaluation of map reading and geovisualization on web.

The Department of Geoinformatics publishes various reviewed maps and atlases as part of Map and Atlas Product Series (M.A.P.S., ISBN 978-80-244-2813-0). Research in cartography is managed and lead by Professor Vít Voženílek. The significant projects are:

- 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
- Multimedia guide for Olomouc City
- Landscape Atlas of the Czech Republic

Fig. 16 Examples of reaserch work at the Palacky University in Olomouc

Increasing the effectiveness of copyright protection in cartography and geoinformatics Jan Evangelista Purkyně Univerzity in Ústí nad Labem, Department of Geography, is focused mainly on usage on cartography and geoinformation products for education on primary and secondary levels. In co-operation with the private sphere (Kartografie Praha publisher) suggested the *design and implementation of the Pupil's Atlas of the World* and other didactic aids for teaching geography. The university also co-operated with the public sphere on the *plan of Emergency medical services (EMS) coverage*. Within the framework of cooperation between the university, regional self-government and EMS, a plan of coverage of EMS has been created, which represents the availability of EMS vehicles in every location of the region. The current methodology has been implemented and its current data improved (tracklogs of EMS vehicles). The cooperation is further developed by work on refining the model.

Through *research centre called CEVRAMOK* (Centre for Virtual Reality and Landscape Modelling) – http://cevramok.ujep.cz, the department also participated in the 3D reconstruction of the defunct settlement of Skoky. In collaboration with the "Pod strechou" organization and the Faculty of Science of Charles University, 3D model of defunct settlement was created. It was printed on 3D printer and exhibited in the Pilgrimage Church in the settlement of Skoky. The virtual 3D model is then used to create image documentation and computer animation.

3 Czech Cartographic Society

The physical and juristic persons working actively in the field of cartography are represented by the Czech Cartographic Society (CCS) as a highest professional authority. The CCS associates the persons interested in the development of cartographic science, techniques and cartographic technologies, of education and professional training of cartographers, of the history of cartography, of the creation, production and using of various types of maps and atlases and of interconnected disciplines. The Society has 106 individual members and is supported by 12 collective members (June 2019). Accordings to their merits by the development of cartography and their work to the benefits of the Society 10 individualities were awarded by honorary membership.

To the activities of CCS belongs the regulary organization of the cartographic coinferences, the competition "Map of the Year", the national competition "Children Cartographic Drawings BARBARA PETCHENIK", organization of professional seminars, exhibitions etc. From the year 2017 is the Czech Cartographic Society a member of the Council of Scientific Societies of the Czech Republic.

The Czech Cartographic Society was established in 1993 after splitting of Czechoslovakia and its Cartographic Society of the Czechoslovak Republic. The Czech Cartographic Society has represented the Czech Republic in the International Cartographic Association (ICA) since 1995, when the Czech Republic was readopted as a regular ICA member country by the ICA General Assembly in Barcelona (Spain).

The official names and contacts:

- in the Czech language: Česká kartografická společnost (ČKS)
- in English: Czech Cartographic Society (CCS)
- Address: Františka Křížka 362/1, 170 00 Praha 7 – Holešovice, Czech Republic
- Web site: http://www.cartography.cz

Executive Committee of CCS for the period 2013-2017:

President:	Václav TALHOFER
Vice-President:	Vít VOŽENÍLEK
General Secretary:	Milada SVOBODOVÁ
Treasurer:	Růžena ZIMOVÁ
Members:	Václav ČADA
	Milan KONEČNÝ
	Miroslav MIKŠOVSKÝ
	Josef RANČÁK

Executive Committee of CCS for period the period 2017-2021:

President:	Václav TALHOFER
Vice-President:	Vít VOŽENÍLEK
General Secretary:	Milada SVOBODOVÁ
Treasurer:	Růžena ZIMOVÁ
Members:	Václav ČADA
	Jiří CAJTHAML

Přemysl JINDRÁK
Zdeněk STACHOŇ
Alena VONDRÁKOVÁ

3.1 Activities of the Czech Cartographic Society in 2015-2019

In the folowing text there are the main activities of the Czech Cartographic Society in 2015-2019. The activities are divided into two main parts – national and international.

- national activities:
  - National Cartographic Conferences,
  - national competitions
  - national seminars and map exhibitions,
  - issue of the newsletter „Zpravodaj KS CR“ (Newsletter of the Cartographic Society of the Czech Republic) – in electronic form only
  - continuous updating of the website of the Society (http://www.cartography.cz)
- international activities:
  - presentation of the Czech cartography on the ICA International Cartographic Conferences in Rio de Janeiro (2015) and Washington, D.C. (2017)
  - ICA commissions, joint workshop ATLASES-COGNISION-USABILITY

3.2 National activities

3.2.1 National cartographic conferences

The national cartographic conferences are regularly organized every two years in different places in Czechia, usually in September.

In the period 2015-2019 two conferences were held – 21st cartographic conference in Lednice (South Moravia) and 22nd cartographic conference in Liberec (Nord Bohemia). About 100 participants took place on these events. Since 2015 CCS has established two grants to support students and young cartographers to participate on all conference programs. These grants ensure conference fees and accommodation.

The program of cartographic conferences has been supplemented by pre-conference workshops focused on topical issues since 2015.

The substantial parts of conference programs are a map exposition, winning works of national round of international competition “Children Cartographic Drawings BARBARA PETCHENIK competition “, and examples of student´s final thesis coming from different universities.

Fig. 17 The 21st cartographic conference in Lednice

Fig. 18 The 22nd cartographic conference in Liberec (2017)

3.2.2 National competitions

CCS organises three regular competitions – Map of Year, The Best Geographic Map, and Children Cartographic Drawings BARBARA PETCHENIK.

3.2.2.1 Map of the Year

The national competition called „Map of the Year“ is the traditional competition in which cartographic products in paper and also in electronic (virtual) form are evaluated. The competition is announced in five categories (Atlases and map collections, Individual cartographic products, School cartographic products, Student works, Electronic cartographic products and web applications). The commission committee consists of respected cartographic experts from universities. The committee members evaluate all logged products according to given and published criteria and they set the order of products.

The results of the competition are yearly presented usually in May every year. In period 2015 – 2019 the results were announced in May at the Book Fair in Prague. Nominated maps and atlases were displayed at the ICA International Map Exhibition in Rio de Janeiro 2015, Washington 2017 and Tokio 2019

Fig. 19 Winners of the competition Map of the Year 2015

Fig. 20 Winners of the competition Map of the Year 2017

3.2.2.2 Geographic Olympics – Additional competition „The Best Geographic Map"

Since the year 2017 the CCS organizes a supplementary competition "The Best Geographic Map" as a part of the Geographic Olympics for the pupils of the primary schools and students

of the secodary schools of the whole Czech Republic, organized by the Czech Geographic Society. The competition will be announced from the level of regional round. Each participant of the regional round of the Geographic Olympics can take part in the competition by the submission of a self-made created map on any geographic topic. The participants are on the costs of the CSS invited to Prague for the central round of the Geographic Olympics, where all showpieces are displayed and evaluated by all competitors and their accompenied persons in the frame of the category MAP POPULI. The professional evaluation make a commission composed from cartographers and geographers. The cartographic part of the commission evaluates the map composition and the visual interpretation, diffficulty and methods of interpretation and the used list of symbols. The geographic part of the commission evaluates the geographic interpretation, the geographic "depth" of elaboration and the innovation of solution. The winner is determined through the sum of the both evaluations.

The Authors of the best maps were rewarded by CSS with interesting prices.

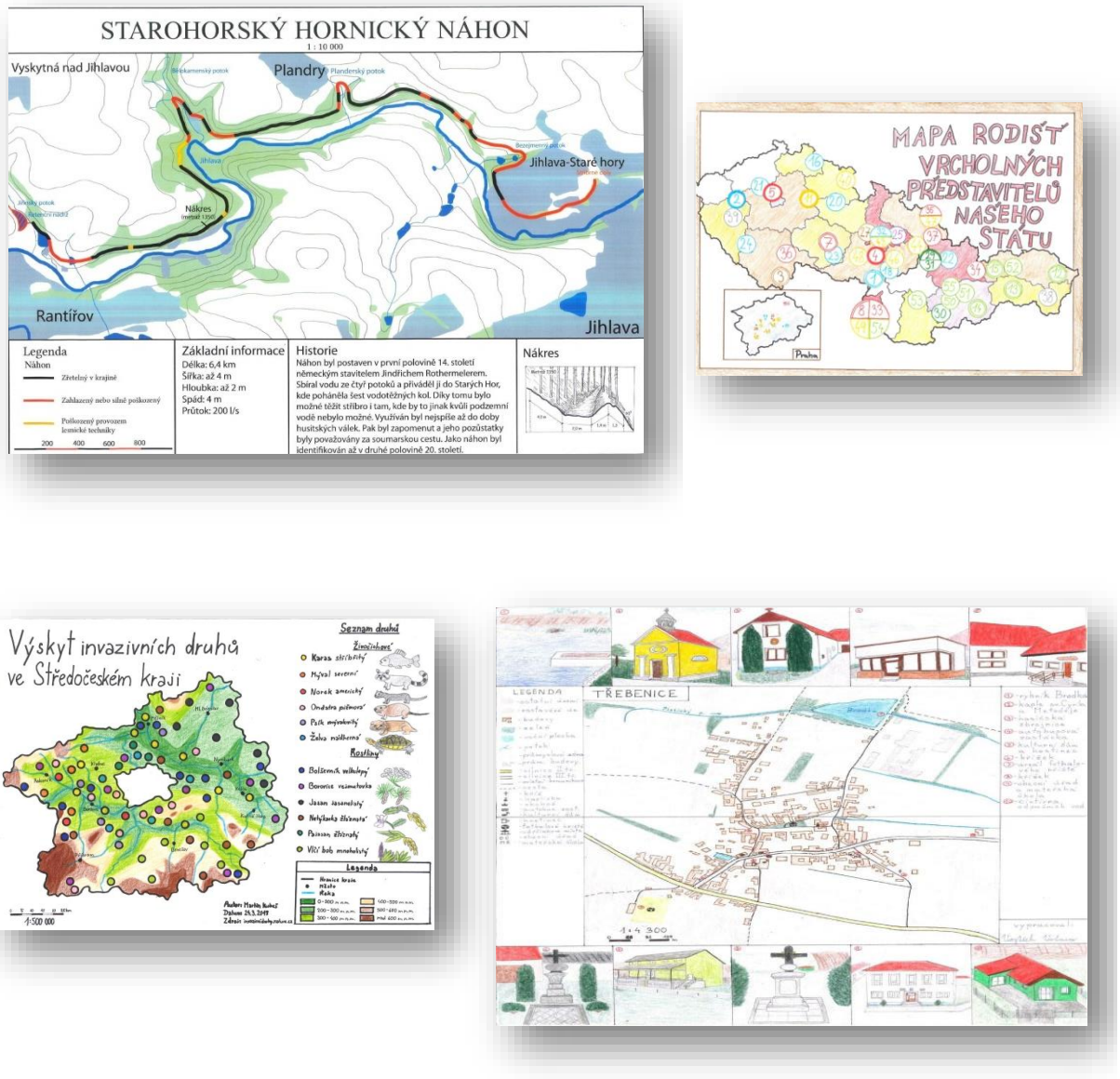

Fig. 21Winning works of Geographic Olympiad – Additional competition „The Best Geographic Map" in 2018

Children Cartographic Drawings BARBARA PETCHENIK competition

The national competition „Children Cartographic Drawings“ is the part of the wide-world competition named after Barbara Petchenik.

During the period 2013-2015 the competition was conducted in April 2015; in the competition more than 600 children works took part. Winning drawings were sent to the organizers of the ICA International Children Cartographic Drawings Exhibition“ on the price of Barbara Petchenik, which took place in Rio de Janeiro, Brazil, during the ICA International Cartographic Conference 2015.

Fig. 22 National competition „Children Cartographic Drawing“, Winner of the year 2015, category of 13-16 years, Jakub Michalička, Klára Rončková: A dream about czech rivers, High School Mírová Karviná–Nové Město

The next national competition „Children Cartographic Drawings“ was in April 2017 - 973 children works The awarded children’s drawings were sent to the organizers of the ICA “International Children Cartographic Drawings Exhibition“ in Washington, D.C.

Fig. 23 National competition „Children Cartographic Drawing“, Winner of 6-8 years category, 2017 year, author: Ema Gregovská – Eye of galaxy, Grammer School Lobodice

The last national competition „Children Cartographic Drawings“ was in April 2019, and 640 authors sent their maps to the organisation board. The awarded children’s drawings were sent to the organizers of the ICA “International Children Cartographic Drawings Exhibition“ in Tokio.

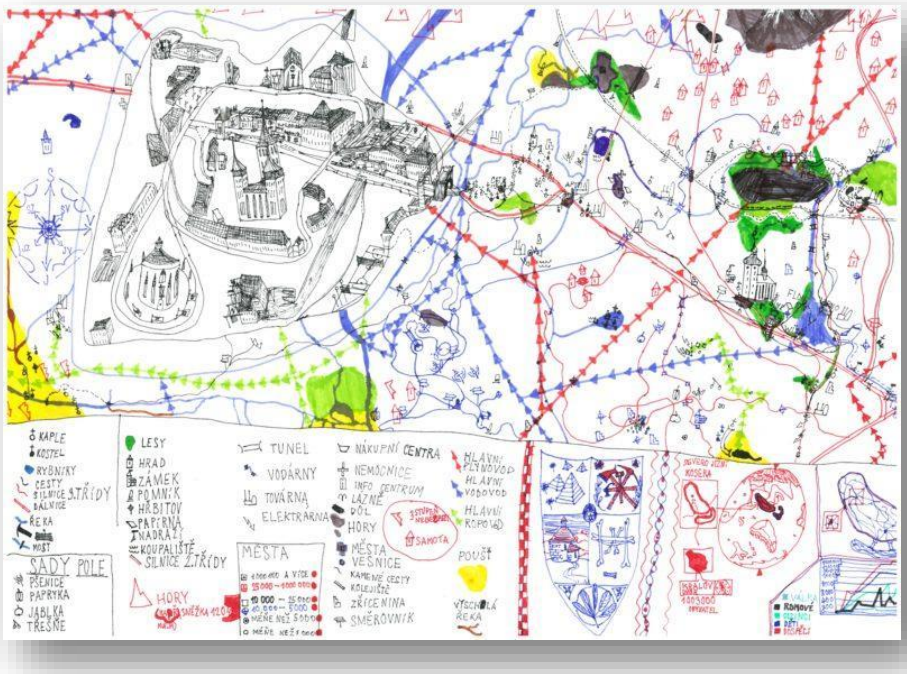

Fig. 24 National competition „Children Cartographic Drawing“, Winner of 6-8 years category, 2019 year, author: Jindřich Šlechta – Město Králův Dvůr, Grammer Artistic School Horažďovice

3.2.3 National seminars and map exhibitions

The CSS organizes or co-organize yearly two main actions – seminars “The Cartographic Day Olomouc” and “Geomatics in Projects”.

3.2.3.1 The Cartographic Day Olomouc

Department of Geoinformatics of Palacký University in Olomouc organizes an anually seminar called „The Cartographic Day Olomouc” (CDO) since 2007. Each Cartographic day was focused on one topic usualy chosen from application of cartographic methods in other areas of general life. The topic in 2015 was “Cartography and 3D print”, 2016 „Cartography and Crises management”, in 2017 „Cartography and Business”, in 2018 “3D visualization”, and 2019 „Cartography and Media”. More than 100 participantes regularly participate on this event every year.

Fig. 25 The Cartographic Day Olomouc 2015 – 3D print (photo KGI UPOL)

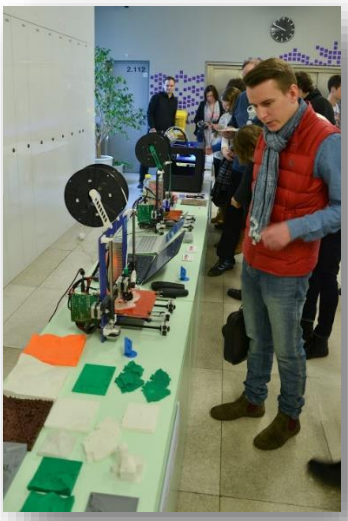

Fig. 26 The Cartographic Day Olomouc – 3D printer (photo KGI UPOL)

3.2.3.2 Geomatics in Projects

Every year in the autumn organizes the Faculty of Applied Sciences of the West Bohemian University in Plzeň in the castle Kozel near Plzeň the conference "Geomatics in Projects", which is combined with other actions – the coneference Information Systems in Agriculture and Forestry and the conference Plan4All under a common designation ISAF & Geomatics in Projects & Plan4All conference. The conference will be usually taken in English. On the action are presented some forth-coming projects as well as some solved problems (vizualization of traffic intensities, SensLog, Open Land Use etc.)

Fig. 27 Participants of the conference Geomatics in Projects

Apart of introduced regular actions are organized single seminars and occasional exhibitions where the Society behaves as a co-organizer

In the years 2015 – 2019 organized the Society working seminars to the problems of author´s Law, took part at the regulary organized sessions focused on the used geomatics (GIS Ostrava, Geomatic in the public administration) or at the student´s competition dealing with problems of the digital cartography.

3.2.3.3 Map exhibitions

In the year 2015 was inaugurated a touring exhibition "Charm of Old Maps", which realized on 8 posters prepared by the Department of Geoinformatics of Palacký University in Olomouc in co-operation with the Geographic Institute of the Masaryk University Brno. The goal of the exhibition was to present by a gripping and vivid art the content of the Claudius map in relation to today´s relations. In this way originated maps inspired by Claudius map, maps with an old design but with up-to-date data, maps with a new design but with old data as well as posters with explanatory and accompanying texts. The exhibition had its premiere at the GIS Esri conference in the Czech Republic, where it was seen by nearly from a thousand participants of

the conference. Nowadays are created four sets of the exhibition posters, which are to disposal for single exhibitions in schools and institutes or are used by single actions of the Society.

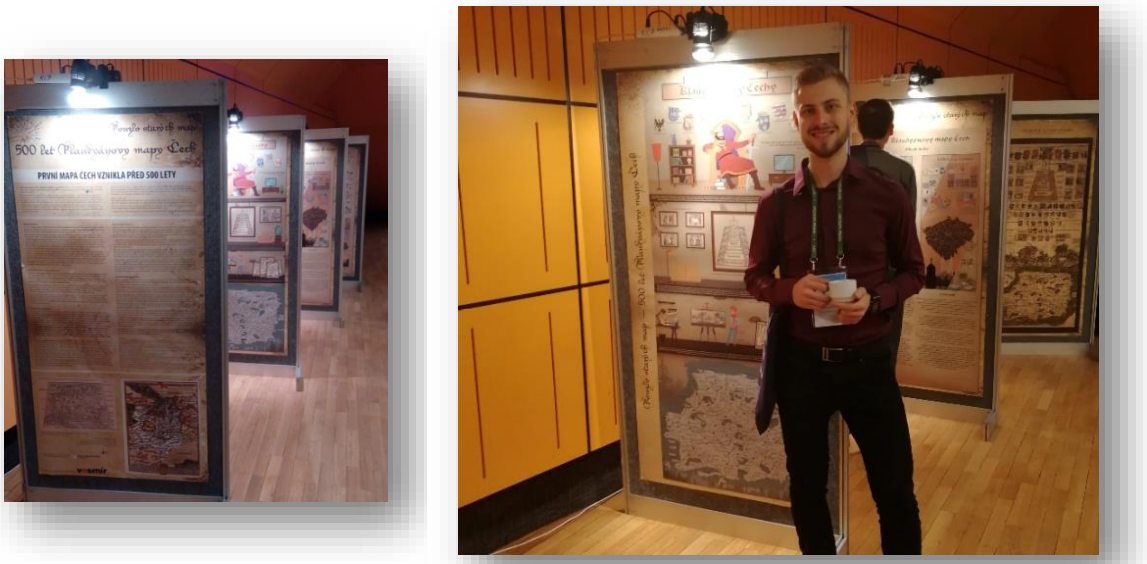

Fig. 28 Posters in the areas of the GIS Esri conference in Prague, the Czech Republic and the author of the exhibition J. Koníček before posters

Fig. 29 Chosen posters in the area of the building of the former Military Geographic Institute in Prague on the occasion of the seminar to the cartographic anniversaries

In the year 2016 was at the occasion of 300 years from the first edition of the Müller´s map of Moravia organized in Brno an exhibition, which besides the presentation of this unique map informed the wide public with further works of that period of cartography in Czech lands.

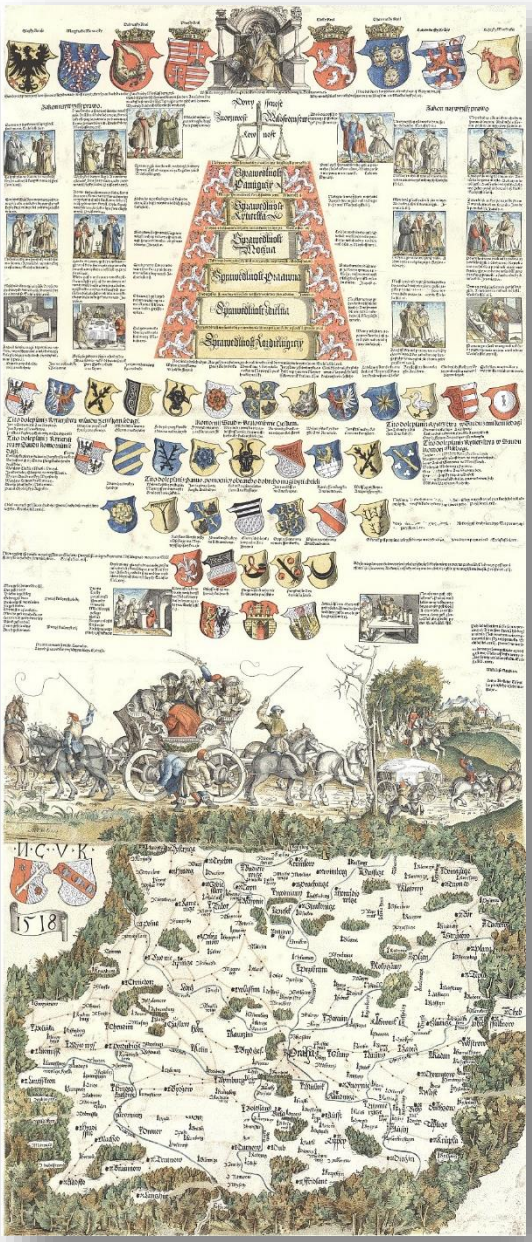

Fig. 30 The oldest separate map of Bohemia – the Claudius map from the year 1518

In the year 2018 passed 500 years from the origins of the oldest known map of territory of the Czech Republic – the Cladius map of Bohemia. It is known only from the one surviving copy, which is saved in the State Regional Archive in Litoměřice. The map was printed in the year 1518 in Nürnberg by the woodcutting technique and is oriented to the south. The map field covers only the lower third part of the map sheet. In the upper part is a picture of the Czech king Ludvík Jagellonský and land shields, which he claimed for him, the scales as a category of impartiality, the mirror of behaviours and further information. To the remainder of this

anniversary was organized in May 2018 a conference and in frame of it was possible to have a look on the introduced original of the map.

Fig. 31 A cut of the Claudius map of Bohemia

On Sunday, October 28th, the Department of Geography (Faculty of Science, Masaryk University), in cooperation with the Czech Cartographic Society, hosted the activity celebrating the 100th anniversary of the establishment of the independent Czechoslovak Republic. During 2 hours, the map of former Czechoslovak Republic in the scale 1:25,000 was composed and thus the largest map of the former Czechoslovakia was created.

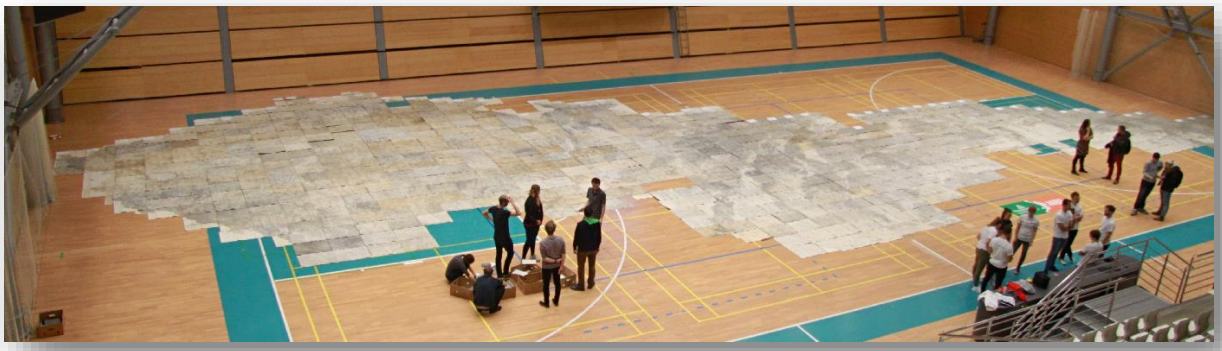

Fig. 32 The largest map of the former Czechoslovakia (Photo: Archive of the Geographic Institute of the Masaryk University, Brno)

3.3 International activities

To the basic international activities of the Czech Cartographic Society belongs the presentation of Czech cartography at the international cartographic conferences and other actions organized by the ICA member organization. The members of the Society are as well active in the executive and professional bodies of the ICA.

3.3.1 International Cartographic Conferences

3.3.1.1 27th ICA ICC Rio de Janeiro

For the 27th ICA International Cartographic Conference being organized in Rio de Janeiro in August 2015 the Czech delegation consisted of 16 participantes, which had 16 oral presentations and 2 presentations in the poster section. 5 sections of the conference were chaired by CCS members. The Society presented 22 maps and 6 children drawings at the international cartographic exhibition.

Successful were the young specialists Mgr. Zbyněk Štěrba, PhD.from the Masaryk University in Brno and Mgr. Jiří Pánek, Ph.D. from the Palacký University in Olomouc, which gained the ICA Research Scholarship.

The most significant success was the election of Prof. RNDr. Vít Voženílek, CSc. to the position of the ICA vice-president. The next great success was the 1st place in the category „Educational Aids“ gained by the Czech company Kartografie HP for the product „Use the map yourself“.

Fig. 33 National delegate of the Czech Republic Vít Voženílek (on the left), the new ICA president Menno Jan Kraak (in the middle) and Cynthia Brewer (on the right)

3.3.1.2 28th ICA ICC Washington, D.C.

In July 2017 took part in Washington, D.C. the 28th international cartographic coonference. On this international meeting of cartographers, geoinformatics and specialists of interconnected professions had the Czech Republic as well its representation.

The Czech delegation was built from 12 participants, which had 11 oral presentations in the plenum and 2 posters. Two young colleagues, Society members Jiří Pánek and Vít Pázsto, both from the Palacký University, gained a grant for their participation on the conference (ICA Research Scholarship). Our delegates chaired two professional sections of the conference. The Czech delegation was chaired by Prof. Václav Talhofer, who was the national delegate at the extraordinary ICA General Assembly. At the international cartographic exhibition 31 Czech products were presented and so the Czech Republic had the second highest number of exhibited products, as well the priority with 44 products belonged to the USA. The Society presented 6 exponates to the competition of Childern Drawings. The showpiece „Relief of Czechia national parks and mountain ranges“ was by the professional commission evaluated as the third best in its category and at the same category by the conference participants as the best one.

Fig. 34 Diplomas for 3D relief of the Czechia – 3rd place in professional commission evaluation and the price of the participants

Fig. 35 Panel exhibition of production of the Czech cartography

3.3.2 ICA commissions joint workshop ATLASES-COGNITION-USABILITY

In April 27-30, 2018, the Joint Workshop ATLASES-COGNITION-USABILITY took part in Olomouc on the Department of Geoinformatics of the Palacký University in Olomouc under

the auspices of ICA. The organization of the meeting was shared by three ICA Commissions, Commission on Atlases, Commission on Cognitive Issues in Geographic Information Visualization and Commission on Use, User and Usability Issues. The goal of the organizers was to join the reached scientific knowledges, opinions and scientific activities of this three cartographic groups and call out a creative discussion on all possible topics, which the commission are going to solve. For development of cartography are such discussions indispensable.

The program of the workshop consisted of one one-day seminar, five discussion themas, 21 oral papers and three seminars. All contributions were listened by 50 participants from 15 countries leaded by ICA president Prof. Kraak, general secretary and treasurer Prof. Zentai and vice-presidents Rodriguez and Prof. Voženílek. The Commission on atlases used the action to a regulary session of its board. For the participants was prepared a social part – a walk through the historical part of Olomouc, a look on the most valuable organ in Czech Republic, an excursion to Macecha and Punkva caverns and a supper in the brewery Černá hora. All participants evaluated the great contribution of the workshop and expressed their desire to continue in organizing of common seminars.

Fig. 36 Participants of the ICA Workshop ATLASES-COGNITION-USABILITY (photo Lukáš Příleský)

3.3.3 Activities in ICA Executive Committee and Commissions

Prof. Vít Voženílek is an ICA vice-president in the term 2015-2019. His liaisons are on Commissions on Atlases, Map Design and International Map Year. He cared about ICA and regional conferences and ICA scholarships.

A significant contribution for the ICA activities was given by Prof. Milan Konečný from the Masaryk University, who is a long-standing Chair of the ICA Commission on Cartography in Early Warning and Crisis Management. During the period 2016 – 2019 were under his chairmanship organized 21 professional actions. More information about this ICA Commission are on the web site https://icaci.org/commissions/.

Mgr. Alena Vondráková, Ph.D. worked as a vice-chair of the ICA Commission on Use, User and Usability Issues. In further ICA Commissions worked a lot of Czech cartographers, especially in ICA Commission on Atlases, Commission on Cognitive Issues in Geographic Information Vizualization, Commission on Education and Training, Commission on Map Projections and on SDI and Standarsd.

3.3.4 Other activities

The Czech Cartographic Society is a collective member of the Czech Association for Geoinformatics. The Society cooperates closely with the Cartographic Society of the Slovak Republic and organizes with it every two years common cartographic conferences. The Society cooperates closely with the Society for Photogrammetry and Remote Sensing of the Czech Republic, with the Czech Union of Surveyors and Cartographers and with the Czech Geographic Society as well.

The Czech Cartographic Society regularly declares grants for support of the development of cartography. From the year 2015 declares two grants for covering the costs of participation at the national cartographic conferences. One of these grants is appointed for students of the bachalor and the magister studying programd and the second for young specialists until 35 years. In the year 2019 was declared a grant for support of participation at the international cartographic conference. The age is here not prescribed, the requirement is the accepted

contribution and its oral presentation in the conference program. The resources of the grant covers the registration fees of the conference.

The Society issues a newsletter „Zpravodaj České kartografické společnosti“ (Newsletter of the Czech Cartographic Society) with information of activities of the Society and of the ICA. The newsletter is regurlary isued every four months. The actually reports are published on the web sites of the Society http://www.cartography.cz.

4 The main cartographic publications in the period 2015-2019

In the period 2015 till 2019 were in the frame of the Society activities and its members issued following publications, which has an international significance:

Masaryk University, Brno published the special Issue of the Geografic Journal. The content of the Special Issue has been prepared together with the International Cartographic Association, namely with the Commission on Cognitive Issues in Geographic Information Visualization, the Commission on Use, User and Usability Issues, and the Commission on Atlases. Selected authors were contacted during the ICA Commissions' joint workshop "Atlases, Cognition, Usability" held in Olomouc (Czechia) at Palacký University in April 2018. Authors from

Athors from the University of Defence in Brno published in Springer the book TALHOFER, Václav; HOŠKOVÁ-MAYEROVÁ, Šárka; HOFMANN, Alois. *Quality of Spatial Data in Command and Control System.* Springer International Publishing, 2019, 192 p. ISBN 978-3-319-94561-3. The book is dealing with the relations between spatial data quality and requirements of decision-making systems. Authors describe system of data quality evaluation and manners of fulfilments of requirements of commenders, present the system of costs evaluation and finaly they present results of Value Cost Analyses on example of vehicles terrain mobility modelling.

Athors team led by Martin SOUKUP issued interesting book Conditions of Fieldwork. Prague: National Museum. ISBN 978-80-7036-511-3. 112 p, in 2016. The objective of the book is the exploration of a diversity of conditions of fieldwork in non-European locations. The chapters of the book demonstrate that the conditions of a fieldwork differ considerably in terms of environmental circumstances, natural risks, dangerous creatures, character of the local communities and the way of life in the countries where the authors conducted their particular researches. The aim of the book is to give a vivid image of real conditions of fieldwork in selected places of our planet.

The Czech cartographers also prepared several textbooks in Czech.

Palacký University Olomouc:

- PÁNEK, J. (2015): Výběr metod participativního mapování (in edition TERRA NOTITIA)
- POPELKA, S. (2015): Hodnocení 3D vizualizací v GIS s využitím sledování pohybu očí (in edition TERRA NOTITIA)
- PÁSZTO, V. (2015): Využití vybraných metod geocomputation pro hodnocení prostorové informace (in edition TERRA NOTITIA)

- BRYCHTOVÁ, A. (2016): Color distance in cartography (in edition TERRA NOTITIA)
- VONDRÁKOVÁ, A. (2018): Vybrané legislativní aspekty v kartografii a geoinformatice
- VONDRÁKOVÁ, A., Voženílek, V. (2017): Politika prostorových dat v České republice
- NÉTEK, R., BURIAN, T. (2018): Free and Open Source v geoinformatice
- POPELKA, S. (2018): Eye-tracking (nejen) v kognitivní kartografii

University Ostrava

- MIKLÍN, Jan – DUŠEK, Radek – KRTIČKA, Luděk – KALÁB, Oto (2018). Map Creation. Ostrava: Ostravská univerzita. ISBN 978-80-7599-017-4, 302 p.
- BLÁHA, Jan D. (2017). Selected Topics in Geographical Cartography. Ústí nad Labem: UJEP. ISBN 978-80-7561-092-8. 159 p. (in Czech)

Since 2015 Palacky University Olomouc has released several maps and atlases:

- BĚLKA, L., VOŽENÍLEK, V. (2016): Prototypy topografických ortofotomap - M-33-069-A-d SOLNICE, topografická ortofotomapa (issue No. 6 in edition M.A.P.S.)
- BĚLKA, L., VOŽENÍLEK, V. (2016): Prototypy topografických ortofotomap – SOLNICE, topografická ortofotomapa 1 : 5 000 (issue No. 7 in edition M.A.P.S.)
- SAMEC, P. a kol. (2016): Zóny ohrožení lesů ČR (issue No. 8 in edition M.A.P.S.) – zóny ohrožení lesů České republiky: fuzzy modelování depozice dusíku a trvalých vlastností ekotopu
- SAMEC, P. a kol. (2016): Zóny ohrožení lesů ČR (issue No. 9 in edition M.A.P.S.) – růstové podmínky lesů České republiky na základě likertova škálování výskytu zón ohrožení lesů v biogeografických regionech
- SAMEC, P. a kol. (2016): Zóny ohrožení lesů ČR (issue No. 10 in editi13 in edition M.A.P.S.)
- MIKLÍN, Jan – DUŠEK, Radek – KRTIČKA, Luděk – KALÁB, Oto (2018). Map Creation. Ostrava: Ostravská univerzita. ISBN 978-80-7599-017-4, 302 p.
- BLÁHA, Jan D. (2017). Selected Topics in Geographical Cartography. Ústí nad Labem: UJEP. ISBN 978-80-7561-092-8. 159 p. (in Czech)