Institute of Geodesy Brno University
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Institute of Geodesy and Geoinformatics
Wrocław University of Environmental
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5th CZECH-POLISH SYMPOSIUM
BRNO - WROCLAW

ACTUAL PROBLEMS OF GEODESY, CARTOGRAPHY AND PHOTOGRAMMETRY

ABSTRACTS

J. Weigel and A. Berková
(Editors)

Sudický Dvůr, Czech Republic
September 14 - 16, 2017

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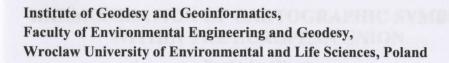(Editors)

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HARMONIZATION OF CARTOGRAPHIC SYMBOLS WITHIN THE EUROPEAN UNION

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ABSTRACT

In the last few years we encounter very often the need to transfer and share data and information not only within one country, but also internationally. With this related efforts for unification of formats, contents and outputs and presentation of these data. Among European Union countries there are these efforts since the establishing the Communities.

These needs of unification also related to map series. Some of the international agreements and standards (e.g. INSPIRE) and also published catalogs of objects (e.g. DIGEST) already deal with international unification of the contents of maps and their formats. However, these don´t solve directly the symbol structure and graphic design of map series.

But it is unified cartographic language that could the most contribute to the uniformity of map series. It would also simplify the possibilities of transfer and sharing of information stored in maps. Map reading would be united due to the same symbols and would be easier erase the borders between foreign map languages.

Currently, each map maker can create and use its own map key. Simultaneously each state publishes state map series with their own cartographic symbols. Therefore, there is a plethora of symbols to sign phenomena in the field.

The only binding symbol sets are just symbols for the state map series. Due to the fact, that in one country is only one set for state map series, it is best to work just with these sets.

To create a unified symbol set for all participating states is not necessary to create completely new symbols, but it is necessary to choose an appropriate criteria for selection from existing symbols.

CONTACTLESS GEODETIC METHODS IN CHECKING THE ROADWAY STRUCTURAL LAYERS

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ABSTRACT

The article deals with the accuracy testing of selected geodetic methods of contactless collection of spatial data on the roadway structural layers. Results from the Trimble S7 total station, the Leica MS60 multi-station, the Trimble SX10 multi-station and the Trimble TX8 laser scanner are presented. The test roadway surface of the highway 500 m length near Lipník nad Bečvou was used. The reference technology was precise levelling, which was used for measurement of the longitudinal profile in the road centre line with a 25 cm resolution and the control points on road-side in 10 m interval. The results of the analyses are put into relation to the requirements for checking the geometrical accuracy of the road construction layers given by the technical regulations of the Ministry of Transport. The geometric parameters considered for the constructional layers of roads include their height, thickness, cross slope and roughness.

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Průkaznost kontroly geometrie konstrukčních vrstev vozovek podle požadavků technických předpisů MD a návrh na jejich úpravu. Souhrnná zpráva projektu SFDI, Sláma, J., Bárta, L., ŘSD ČR, 2017, 52 stran + přílohy (in Czech).

Plošná grafická interpretace nerovností vozovek a analýza kumulace vody na vozovce s predikcí míst vzniku akvaplaningu. Souhrnná zpráva projektu SFDI, Atlas, spol. s r.o., ŘSD ČR, 2017, 41 stran + přílohy (in Czech).

MATHEMATICAL LITERACY OF ENGINEERS IN THE INDUSTRY 4.0

Dalibor Bartoněk[1,2]

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ABSTRACT

The contribution deals with the mathematical literacy of future engineers in the context of Industry 4.0. Even in this advanced stage of automation and robotization, there are situations in the production process where we can not do without a human factor. No machine is and will never be so perfect as to replace human activity completely. But people have to be prepared for this situation both theoretically and practically. There is an example of practice in this contribution, which demonstrates, why knowledge of mathematic is so important especially for the future engineers. This is the reason why mathematics should be put a great emphasis on all technically directed schools.

UNNECESSARY ERRORS OF THE PROCESSOR OF THE RENEWAL OF THE CADASTRAL DOCUMENTATION

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ABSTRACT

A survey sketch was elaborated in the cadastral map in the coordinate system of the stable cadastre (KM-D) to improve the geometric and positional determination of the two plots in 2013. The refined status was correctly entered in the Land Register. In 2016 the cadastral map was changed to the S-JTSK coordinate system and a digitized cadastral map (KMD) was created. As part of this restoration, all of the refined points on the two plots were reduced in quality. Subsequent investigation of the cause of this error revealed other errors caused by the recovery processor when changing the coordinate system. It should be noted that the results of the cadastre renewal are checked after complete restoration stages and there is a written record of the check carried out, but the owners' awareness is not changed when the KM-D coordinate system is changed. According to Section 36 of the Cadastral Law, the cadastral office will correct erroneous cadastre data that was created by a obvious mistake in the renewal of the cadastre at the written proposal of the owner or other legitimate or non-proprietary proposal. Obtaining a bad quality code for a detailed point of landmark mapping can cause a significant problem, but detecting this kind of error in the cadastral documentation is almost impossible for a layman.

The contribution will outline the influence of the human factor on binding data in the Land Register of the Czech Republic.

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Vyhláška č. 357/2013 Sb., o katastru nemovitostí (katastrální vyhláška)

Návod pro obnovu katastrálního operátu a převod, č.j. ČÚZK-01500/2015-22

GNSS AND EDM CALIBRATION BASE BRNO

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ABSTRACT

In 2016 a geodetic base for metrological calibration of geodetic distance meters and GNSS systems was built in Brno, in cooperation of Brno University of Technology and Brno Communications a.s. The calibration base (Figure 1) is in the form of a system of 7 measuring pillars deeply based on a bearing subsoil, meeting the purpose of metrological calibration of GNSS receivers (Figure 2) and EDM instruments (Figure 3).

Fig. 1   Fig. 2   Fig. 3

Today's GNSS measurement systems (receiver, antenna, software) and EDM systems are highly sophisticated, but they are black boxes in terms of users. The need for checking occurs most often in connection with the change of firmware in GNSS receivers or EDM systems due to the need for updating. GNSS accuracy checks are needed in conjunction with the ETRS, the transfer to the national system, and the repeatability and reproducibility of measurements. Calibration of EDM systems consists in determining the constants (addition and frequency) and checking the accuracy of angular and coordinate measurements.

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THE USE OF A LEICA DNA03 FOR PRECISE SPATIAL COORDINATES DETERMINATION OF THE MEASURING POINTS

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ABSTRACT

When performing geodetic measurements very often there is a need for precise situational and height measurements. In this presentation the authors present a prototype prism adapter coupled with precise Leica DNA03 Level. Levelling instrument with the adapter prism allows the measurement of the horizontal distance between the controlled points on the test object.

For functional and accurate evaluation of the levelling instrument with the prism adapter, experimental work was carried out in the laboratory and on the engineering object. On the basis carried out of the experimental-research works was determined the accuracy of the horizontals and vertical distances measurements with the measuring set.

The proposed measurement method with the using precision levelling instrument equipped with a prototype prism adapter and rod code allows to perform measurements of the distance between controlled points in 3D space with an accuracy ±0.02 mm. The proposed measurement method can be used to measure horizontal and vertical distances in precision geodetic measurements of small engineering and industrial objects.

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DIGITALIZATION OF WROCŁAW UNIVERSITY OF ENVIRONMENTAL AND LIFE SCIENCES RESOURCES FOR THE "ATLAS OF OPEN SCIENCE RESOURCES"

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ABSTRACT

The "Atlas of Open Science Resources" (AZON) is an online information platform, created at the Center for Scientific and Technical Information (CWINT) of Wrocław University of Technology within the project "Active Information Platform e-scienceplus.pl". The aim of the project is to gather and integrate the resources of several academic institutions and to create the opportunity to process and share digital science content. The primary purpose of Wrocław University of Environmental and Life Sciences, as a project partner, is to make available the selected resources of the university, including: interactive research and development base, product and technology offer base, and educational platform with e-learning facilities. The work is carried out by the Digitization Center of the Wrocław University of Environmental and Life Sciences, consisting of employees of the Institute of Geodesy and Geoinformatics. Field research includes the implementation of a laser scanner measurements of buildings, landscape architecture and trees in the Arboretum in Wrocław-Pawłowice and realization of photogrammetric inventory of Pawłowice Arboretum and the Research and Didactic Station in Radomierz near Jelenia Góra. The presentation shows the basic assumptions of the project, the measurement procedures, the results of the inventory measurements as well as the examples of their further use.

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IMPACT AND IMPLEMENTATION OF HIGHER-ORDER IONOSPHERIC EFFECTS ON PRECISE GNSS APPLICATIONS

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ABSTRACT

High precision Global Navigation Satellite Systems (GNSS) positioning and time transfer require correcting signal delays, in particular taking into account higher-order ionospheric (I2+) terms. We present a consolidated model to correct second- and third-order terms, as well as geometric bending and differential STEC bending effects in GNSS data. The model was implemented in online service correcting observations in submitted RINEX file for I2+ effects. In order to investigate the impact of I2+ corrections on the results we performed GNSS data processing in two variants, with and without I2+ corrections included. We selected three time periods, one week long each, representing different ionospheric conditions. We used GPS and GLONASS observations from global receivers and two regional networks, in Poland and Brazil. We estimated satellite orbits, satellite clock corrections and Earth rotation parameters, troposphere delay and horizontal gradients, receiver positions with Real-Time Kinematics (RTK) and Precise Point Positioning (PPP) techniques. The satellite-related products (orbits and clocks) were the ones capturing most part of the change after applying I2+ corrections, up to 2 cm for clock corrections, 1 cm for along- and cross-track components, and below 5 mm for radial component. I2+ impact on troposphere products occurred to be insignificant in general. We found I2+ corrections had limited influence on ambiguity resolution performance and reliability of RTK positioning. Finally, we noticed I2+ corrections caused systematic shift in coordinate domain that were time- and region-dependent, and reached up to -11 mm in North component for Brazilian station during active ionospheric conditions.

RELATIVE DISPLACEMENTS IN THE TECTONICAL STRUCTURES OF THE SUDETY MTS. DETERMINED USING CRACK GAUGES TM71

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ABSTRACT

Tectonic creep movements determination have been started since 70-ies of the XX century in the Stołowe Mts. and Bear Cave (Sudety Mts, SW Poland). Relative spatial movements were detected by crack gauges TM71.

These instruments enable measuring relative linear displacements and angular rotations with a very high precision. Presented TM71 were fixed near Sudetic Marginal Fault in the Waliszów-Nowa Morawa tectonic zone, SW Poland. Polish crack gauges network were included in the European Monitoring Network EU TecNet. Project EU TecNet based on 3D monitoring of tectonic creep movements using TM-71. It is managed by IRSM Czech Academy of Sciences, in Prague. This study presents a comparison of the results of tectonic creep investigations using the data series recorded in the Sudety Mts.

CREATION AND PUBLICATION OF OWN MAP SYMBOLS ON ARCGIS ONLINE

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ABSTRACT

The contribution deals with the creation of its own map symbols for the GIS of Moravian wine trails.

Is described the formation of point symbols in vector format. Line symbols can by folding the individual parts of the submitted information on the type of trail, type of communication, surface and difficulty.

Furthermore, symbols were given the property size changes depending on the current zoom and the property of progressive imaging is an expanding the scale of the map.

Subsequently is described the solution of problems in the transfer of GIS with these characters into ArcGIS Online.

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SHIFT DETECTION USING DIGITAL MICROSCOPE

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ABSTRACT

Study of volume changes of building materials provides important information about their behaviour after installation in the building structure. For this purpose we develop an automated non-contact shifts detection method. Special emphasis is focused on the high accuracy of the detection and the low financial cost of the equipment. Proposed method is based on processing a set of images of special target, which are taken with a digital microscope. The method is designed primarily for shift detection of the float for monitoring volume changes of a hydrating mixture on the slab form with flexible constraints. Applicability of this method for monitoring volume changes is verified by the test measurements results.

VALIDATION OF MULTI-GNSS REAL-TIME ORBIT AND CLOCK CORRECTIONS FOR PPP

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ABSTRACT

Ongoing modernization of GPS and GLONASS and development of new systems, such as Galileo, BeiDou or QZSS, allow for making measurements in challenging environment, as well as for improving position accuracy of the points being determined and the time of solution convergence. A continuous growth of the infrastructure requires support from high-quality products, such as precise orbits and clocks for still changing constellation. The most accurate products ensured by International GNSS Service (IGS) are provided with the latency reaching up to 18 days which does not allow users to make measurements in real-time. The primary positioning technique which may be used for real-time solutions and enables obtaining high-quality position is Precise Point Positioning (PPP). PPP is an undifferenced technique which uses a single receiver. Thus, a user must fully rely on the quality of the provided orbits and clocks for determining precise positions in PPP. Real-time IGS (RT-IGS) service and the Centre National d'Études Spatiales (CNES) provide products via internet which satisfy a real-time user's needs. The CNES real-time corrections as opposed to the IGS final products are not screened for outliers, therefore they should be appropriately verified in order to encourage potential users to employ real-time clock and orbit corrections.

This work is focused on the availability and quality validation of Multi-GNSS real-time clock and orbit corrections. The quality assessment was performed in reference to the post-processed final IGS Multi-GNSS Experiment (MGEX) products. Additionally, Satellite Laser Ranging (SLR) observations were employed to validate the obtained orbit accuracy independently. The third orbit validation method was conducted on the basis of the analysis of the residuals from fitting continuous 1-day arc into a series of satellite positions. Satellite clocks were additionally verified using the Modified Allan Variance which allows for checking the long-term and short-term stability of the obtained satellite clocks, as well as for identifying systematic errors affecting the clock

products. At the very end, practical positioning tests using real-time corrections and Multi-GNSS constellation were performed with different system configurations and appropriate weighting scheme using relative weights related to the clock and orbit quality, as well as to the noise of phase and coder residuals. The real-time product availability in the test period was at the level of about 90% for GPS, GLONASS and Galileo and about 80% for BeiDou. The obtained results show that the orbits and clocks quality, which is possible to obtain using streamed data, depends on the system employed, satellite generation, orbital type and the elevation angle of the Sun above the orbital plane. The 3D orbit RMS, when compared to the post-processed MGEX products, is 5, 11, 17, 19 and 42 cm for GPS, GLONASS, Galileo, BeiDou MEO and BeiDou IGSO, respectively.

HISTORICAL AND ACTUAL MAPS OF BÝČÍ SKÁLA CAVE

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ABSTRACT

Býčí skála (Bull rock) cave is part of the second longest cave system in the Czech Republic. The overall length of corridors of whole the system is approximately 17 km. The entrance of the cave is situated at the base of 53 m high Bull rock in the central part of Moravian karst between Adamov town and Křtiny village. Introductory 300 m of main cave corridor was accessible from time of immemorial, so the cave is also very important archaeological finding place.

The very first indication of existence of cave systems in the territory of Moravian karst was depicted on maps at beginning of 18th century. The oldest map of the cave corridor was drawn by Alois Medritzer in the year 1861. The map belongs to the set of maps from age of individual karst investigators. Those maps were created mainly as output of their research activities and are connected with names of investigators Heinrich Wankel, Martin Kříž and Hermann Bock. The second set of maps from age of strong German and Czech amateur speleological groups was created from beginning of 20th century mainly directly after discoveries of new cave passages.

Actually, the whole known cave and eventual new discoveries are newly re-documented by several mapping groups and the map of the cave is occasionally actualized in cooperation between local speleological group and Institute of Geodesy. Classical geodetical and special speleological methods of measurement are complementary used.

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QUASIGEOID IN DOLNI MORAVA NETWORK

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ABSTRACT

The Dolni Morava network is being built since 2014. The last phase (the fourth) so far, of the astrogeodetic measurement was carried out in 2017. The network has got 30 points with the astronomical coordinates, astrogeodetic deflections of the vertical. The quasigeoid was calculated from this data set. The calculation was done in two variants. The first variant was the astrogeodetic levelling according to Molodensky. The astronomical-topographic levelling was used in the second variant. Both variants of the calculation were compared with a model calculated from the geopotential model EIGEN-6C4.

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THE APPLICATION OF GNSS TECHNIQUE IN SEISMOLOGY

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ABSTRACT

Modern geodetic techniques may be applied in investigation the potential causes and results of geodynamic events. In connection with geophysical data (from seismological and geological measurements) they may be used to study natural and anthropogenic earthquakes as well as internal earth structure. Integration of seismogeodetic data leads to the concept of seismogeodesy, especially GNSS seismology.

GNSS observations are widely used to analyse large scale natural earthquakes. In smaller events it is more efficient to combine the GNSS and seismic observations, as these two methods are complementary. Among the differences between them, the integration of seismogeodetic data allows to observe dynamic and static coseismic displacements.

Within the "EPOS – European Plate Observing System" project, it is expected to apply the GNSS technique in analysis of displacements caused by natural and anthropogenic earthquakes, especially mining-induced seismicity.

There was presented the current state of knowledge about the application of GNSS technique in seismology with particular emphasis on anthropogenic tremors. Moreover there were discussed first results of GNSS time series analysis in comparison to seismic observations.

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ECONOMIC ACTIVITY OF INSTITUTE OF GEODESY

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ABSTRACT

Institute of Geodesy participate in range of especial geodetic contracts a few years ago. There are expert opinions which was making at the request of law court particularly. Especial geodetic measurement for nuclear power plant Dukovany for example, mapping survey of rooms at Motol University Hospital for placing modern medical devices, development of survey methodology for Správa železniční dopravní cesty or real estate mapping survey related with part of motorway D1 for Ředitelství silnic a dálnic.

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TEACHING GEODESY IN FACULTY OF CIVIL ENGINEERING, BRNO UNIVERSITY OF TECHNOLOGY

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ABSTRACT

Faculty of Civil Engineering in Brno University of Technology has a long tradition of teaching geodesy and related subjects. Currently, the continuity is maintained by three consecutive study programs – 3-year bachelor, 2-year master and 3-year doctoral. Applicants are constantly interested in the programs and current decrease in counts of students corresponds to demographic development not only in Czech Republic but also in the whole Central European Region. Academic staff keeps the good quality of teaching and uses up-to-date equipment. The graduates are demanded both by surveying and civil engineering authorities and commercial companies. Demands of the employers exceed the numbers of successful graduates. Many of our graduates are successful not only in European but also in world context.

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UAS IN CROP PHENOTYPING

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ABSTRACT

Crop phenotyping aims on collecting characteristics like height, water stress, vegetation index, vegetation stage etc. Manual sampling on houndreds or even thousands experimantal plots could be very time and work consuming. Unamanned Aerial Systems equipped with sensors like RGB, NIR and thermal cameras are high throughput phenotyping tools which can solve this problem. Author describes his experience on working with wheat experiments in the UK during last two years.

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DIRECT GEOREFERENCING OF TERRESTRIAL LASER SCANNING DATA USING VERTICAL DEFLECTION FROM EGM2008 MODEL

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ABSTRACT

An important step in data processing from terrestrial laser scanning (TLS) is georeferencing of the point cloud, i.e. transformation of the point cloud data from the scanner's to an external coordinate system, such as the global Geodetic Reference System 1980. The coordinate transformation can be solved using a minimum of three scanned GNSS (Global Navigation Satellite System) referencing points, effectively estimating the set of seven transformation parameters. In some cases, in urban area, on the streets with high buildings, where the accuracy of some of the GNSS reference point positions is deteriorated by a poor satellite visibility, the number of georeferencing GNSS points is insufficient. The proposed method for direct point cloud georeferencing employs the vertical deflection from the Earth gravity field model and thus demands a minimum number of GNSS measurements. The number of necessary georeferencing points is limited to two. The results of the field experiments have shown, that the differences between the classical georefencing and the proposed method amount at maximum to 7 mm with the standard deviation of 8 mm for all of three coordinate components. The proposed method provides thus the accurate results and may serve as an alternative for the laser scanning data georeferencing.

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LANDSLIDE MAPPING USING THE MOST RELEVANT TOPOGRAPHIC INDICATORS AND AN AUTOMATIC PIXEL-BASED APPROACHE

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ABSTRACT

The availability of airborne laser scanning (ALS) data allows for an automatic landslide mapping using ALS-derived digital terrain model (DTM) only. To achieve it in the automatic manner using machine learning classification algorithms, generation of several DTM derivatives is needed.

The objective of this study is to assess the relevance of diverse landslide morphological indicator (DTM-derivatives) for the automatic mapping using pixel based approached in Polish Flysch Carpathians. Among DTM-derivatives, three initial principal components of hillshades, linear aspect, flow direction, side exposure index, roughness index, curvature (minimum, maximum, mean and Bolstadt variant), mean slope, standard deviation of mean slope, aspect, standard deviation of aspect, topographic position index and openness were tested. Empirical tests were carried out on a study area located in the central part of the Carpathians in Poland and that covers an area of ca 27 km^2. The study area has been affected by more than 250 landslides. The DTM was generated based on ALS point cloud with the average point density of 4 pts/m^2 and the nominal height accuracy of 15 cm.

In order to assess the relevance of topographic features, an extended set of numerical tests was accomplished using double-layer Maximum Likelihood classification. Afterwards, the final automatic landslide mapping was performed by applying the most relevant features and Support Vector Machine classification. The achieved results were compared with the existing landslide inventory map and accuracy parameters such as overall accuracy (OA) producer's accuracy of landslide detection (PA), and kappa coefficient were calculated. Using proposed approach, we received 88% 65%, and 0.55 for OA, PA and Kappa, respectively.

OVERVIEW OF GNSS GEODYNAMIC MONITORING DATA AND RESULTS WITHIN THE MORAVIA TERRITORY

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ABSTRACT

Among the first GNSS geodynamics projects in Czech Republic, the MORAVA geodynamic network was established in 1994 for the purpose of monitoring the movement tendencies in the area between the Bohemian Massif and Western Carpathians. Several other geodynamic GNSS networks have been established within the Moravia territory in last three decades for the purpose of recent crustal movements monitoring. These networks were established by various institutions that are using them for their own particular investigation. New measurements on selected points of the geodynamic epoch GNSS networks together with geophysical and geological knowledge confirm the recent activity in some parts of the Moravia territory.

In the paper we describe the available observing data acquired in MORAVA network and other geodynamic GNSS epoch networks within the Moravia area, their processing and evaluation with subsequent preliminary geo-kinematic analysis and interpretation of the estimated baseline change velocities in relation to the position of main active tectonic zones in the Moravia territory. Evaluation of recent surface deformation tendencies at areas of civil engineering interest could serve to better assessment of the associated geodynamic risk.

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SPATIAL ANALYSIS FOR POST-INDUSTRIAL LANDSCAPE ZONATION

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ABSTRACT

The aim of the paper is to illustrate suitable methods and procedures for post-industrial landscape (PIL) regionalization with the example of the Kamenicko area. The representation of the legacy of post-industrial society was standardized into six types of cultural landscape (91.1 % and more – significant core of PIL; 36.1 – 91 % – undistinguished core of; 19.1 – 36 % – peripheral PIL; 11.1 – 19.0 % – peripheral multifunction PIL; 0.1 – 11.0 % – landscape with featureless industrial heritage; 0 % – landscape without industrial heritage. Following methods helped to propose landscape zonation into the above presented standardized zones at the local level: binary modeling including conversion of the initial polygon layer to raster the format and smoothing by the Focal Statistic tool, IDW interpolation of the proportion averages of post-industrial objects and areas in a given reference unit related to the centroid of reference units, quadrate analysis including smoothing by the Focal Statistic tool, Kernel density estimation applied to a regular 100 m square grid with centroids representing the proportion of post-industrial objects and areas in the given square, Kernel density estimation applied to irregular point layers indicating the extent of post-industrial appearance of objects and areas. The most credible results of data processing on the topical level were achieved by binary modelling including application of a 15 x15 m moving window applied to a raster data format with a 30 m resolution and followed by graphical generalization of zone contours.

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ANALYSIS OF MEASURED DATA FROM STRUCTURAL GEODETIC MONITORING SYSTEM

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ABSTRACT

Geodetic monitoring of engineering objects is one of the basic tasks of the surveyors. Structural geodetic monitoring is a solution which allows uninterrupted monitoring of object state (Di Mauro, Van Cranenbroeck, 2012). Information obtained from the measurement allows real-time response to the phenomena occurring on the object, which can endanger the object itself, its surroundings, and in some cases, human life.

The author presents the use of geodetic, geotechnical and meteorological sensors in a geodetic monitoring system installed on one of the buildings of the Wrocław University of Environmental and Life Sciences. The use of geotechnical and meteorological sensors in the monitoring system allows the examining of the condition of the building, possible deformation and displacement as well as the correlation of the obtained results with the atmospheric conditions prevailing during the measurement. The analysis of measurement data will be presented along with a discussion of their potential use. Moreover, the method of the filtration and statistic analyses of results as well as their interpretation will be presented.

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LOCAL MODELING OF THE DENSITY CHANGES IN THE EARTH'S CRUSTAL MASSES ON THE BASIS OF GNSS/LEVELLING AND GRAVITY DATA - CASE STUDY AT THE AREA OF POLAND

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ABSTRACT

The paper presents the preliminary results of the study related to the modeling of changes in the density of the earth's crustal masses located between the geoid and the Moho surface. Designated density models are simplified models and are an additional result of the local quasigeoid modelling by the GGI method. Hence, for the calculations were used typical data used in quasigeoid modelling by this method (GNSS/leveling height anomalies and gravity data). The results of the modelling were compared with available data on geological-tectonic structures in the area of Poland.

KRONSTADT HEIGHT DATUM CONNECTION TO GLOBAL VERTICAL SYSTEM - TERRITORIES OF THE CZECH AND SLOVAK REPUBLICS EXAMPLE

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ABSTRACT

The development of Global Vertical Reference Frame is an actual topic to be solved by the IAG. In the past was developed methodology for determining the vertical shift of Local Vertical Datums over areas covered by GNSS/levelling sites. This methodology was applied to the Kronstadt Height Datum (KHD) on the territory of the Czech and Slovak Republics. Using the gravity field models EGM2008 and EIGEN-6C4 and the four primary constants (GM, ω, J_2, W_0), the vertical shift of KHD to actual geopotential value W_0 =62 636 856.0 m^2s^{-2} and 62 636 854.0 m^2s^{-2} has been determined. For solution above there is necessary to define the mean Earth's level ellipsoid parameters.

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SUMMARY OF 3D INFORMATION MODELLING

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ABSTRACT

This paper summarize long term activities in development of advanced methods of delivering 3D products such as 3D city models, 3D point clouds and other applications of the 3D datasets. A development of mobile device for interior mapping will be presented as well as results of laser scanning in different location types.

Furthermore, the paper is focused on delivering a detailed 3D model of a city at the level of detail 1 or more. In previous work authors used 3D datasets from airborne lidar and mobile mapping technology for development of an advanced model of the City of Brno (Czech republic). The process includes point cloud classification, automated building vectorization and detection of trees. The aim of the paper is to discuss advanced handling of the model. Author focused on publishing the model to the web application, implement it to the web GIS portal and enrich the model with information from different fields. Possibilities of 3D spatial analyses based on information model will be pointed out.

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COMPARATIVE ACCURACY ASSESSMENT OF DIGITAL SURFACE MODELS CREATED USING UNMANNED AERIAL SYSTEMS

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ABSTRACT

Digital Surface Models (DSMs) are the most commonly used tool to describe the terrain topography. Increasing popularity of drones has led to frequent use of small and light sensors, such as customer-grade RGB cameras or Velodyne laser scanners to create DSMs. However, there is still little information about these sensors and its products accuracy.

The aim of this work is evaluation of the quality of DSMs created using different sensors: Nikon D800 RGB camera, Optris PI Lightweight 450 thermal camera, and Velodyne HDL-32E laser scanner. All data was processed using standard algorithms but varying georeferencing methods. The imagery was processed using bundle block adjustment and dense image matching to create the point cloud which was georeferenced using three strategies: ground control points (GCPs) acquired with RTK technique, air control points (ACPs) obtained with RTK technique, and air control points acquired with GNSS/IMU navigational solution. In the case of laser scanner, the point cloud was georeferenced based on GNSS/IMU reconstructed trajectory. The accuracy assessment covered four aspects: trajectory reconstruction quality (in the case of laser scanner), internal and absolute point cloud accuracy, and DSM and ortophoto comparison between the techniques.

Executed experiments have showed that the choice of sensor and georeferencing strategy has a significant impact on DSM accuracy. The highest accuracy of all the products was obtained using Nikon camera and GCPs georeferencing. The accuracy of DSM obtained by Velodyne HDL-32E was a little worse but it allowed for better visualization of land cover – especially trees. DSM created by means of thermal camera was of the poorest quality.

MULTIROTOR UAS USED FOR GEODETIC, ARCHITECTURAL DOCUMENTATION AND LANDFORM ANALYSIS OF SET OF ARCHAEOLOGICAL OBJECTS IN PERU

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ABSTRACT

Work in high mountains, especially in The Andes, is problematic due to reduce level of oxygen. It is very hard to carry out classic land survey and even harder when the objects from one site are located on few hectares. For that reason authors used a UAS to create documentation of few archaeological sites. Such a documentation apart of architectonic meaning is used to find relations between other sites located nearby.

The research area is a network of archaeological sites, localized in region of Arequipa, at the base of the volcanos Coropuna and Solimana. To determinate the function of each site the high precision documentation of places and surrounding areas is needed. Then it is possible to find the relations and its function in regional network, where the core were administration and ceremonial sites.

The multirotor used in research was a hexacopter. The flight controller was equipped with GPS receiver allowing to process signals from GPS, GLONAS systems and SBAS correction. Its allow to positioning the UAS with accuracy better than 1m. The sensors equipped in hexacopter was camera Sony NEX 7, and multispectral camera Parrot Sequoia.

During this season of work some of the sets of archaeological sites were investigated. The work was divided in few phases: acquire a photos from UAS, and performing land survey using total station and GPS-RTK set to measure some details on ground. The data later processed were analysed to check their accuracy. After that geodetic, architectural documentation were prepared.

ESTIMATION OF THE GEOID AND QUASIGEOID DIFFERENCES AT THE AREA OF POLAND

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ABSTRACT

The paper presents the results of the study on the estimation of differences of geoid heights and height anomalies at the area of Poland. The height differences of both surfaces were determined in more than 30,000 gravity points covering the study area, using Bouguer anomaly with the complete and incomplete Bouguer corrections and the mean values of actual and normal gravity.

MORAVIAN KARST

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ABSTRACT

Karst territories belong to specific natural phenomena. No subsurface spaces provide such a wide range of possibilities for their use as a karst region. The largest karst area in the Czech Republic is the Moravian Karst, which is located north of Brno - the metropolis of Moravia. Since 1956, due to its extraordinary karst phenomena and precious fauna and flora, the Moravian Karst became the Protected Landscape Area.

The Institute of Geodesy, Brno University of Technology, offers voluntary subject Speleological Surveying. The theoretical part of the seminar is focused on karstological theory and methods of underground surveying, in practical part students spare one or two days on field training in Býčí skála (Bull rock) cave in the central part of Moravian Karst. The area of the Moravian Karst is also focused on bachelor and master's theses.

This paper wants to show the results of the mapping of the Výpustek cave and Drátenická cave surroundings. Both caves were used as underground factories during the Second World War. Výpustek cave was later adapted as a military anti-atomic bunker. Currently five caves are open for public tours and exploration in Moravian Karst, Výpustek cave is one of them.

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ABSTRACTS
Contens

5th CZECH-POLISH SYMPOSIUM
BRNO - WROCLAW

ACTUAL PROBLEMS OF GEODESY, CARTOGRAPHY AND PHOTOGRAMMETRY

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(Editors)