Paweł Ćwiąkała, Edyta Puniach, Monika Jarosz, Kamil Kmak: **The Surveying Inventory of Kraków-Częstochowa Upland's Rocks Illustrated with the Example of the Hercules' Club (Maczuga Herkulesa) in Pieskowa Skała** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

This article discusses the process of creating a three-dimensional model of a rock as an inventory method of inanimate nature monuments.

The subject of the research was one of the best-known monuments of inanimate nature in Poland, namely the Maczuga Herkulesa situated in the Ojcowski National Park. The 3D model of the rock was created on the basis of geometric data which was acquired with the usage of Terrestrial Laser Scanning. This technology has been successfully applied, among others things, to document monuments, both of anthropogenic (buildings, works of arts) and natural origin.

In order to create a model of the Maczuga Herkulesa rock, the measurements by means of Leica ScanStation C10 laser scanner was planned and conducted. Additionally, a control network was created and measured during field works by means of tacheometric and satellite methods. It was aimed at the precise localisation of the object in the National Spatial Reference System, as well as at marking the points of the model with coordinates in the current reference systems. The analysis included the creation of a 3D model of the rock on the basis of the obtained point cloud representing the whole object. In the future, the point cloud and the created 3D model can serve as initial data, which are necessary in order to define periodic changes in monadnock geometry. It was proved in the article that the applied method of acquiring spatial data by means of terrestrial laser scanning enables both fast and accurate transfer of the real object's geometry to a three-dimensional numeric model.

Keywords: terrestrial laser scanning, inventory of monuments of inanimate nature, monadnocks

Teresa Front-Dąbrowska: **The Principles of Changing Land Use Classification under Special Provisions in the Areas of Poland where Landslide Movements and the Risk of Landslide Movements Occur** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

The occurrence of the landslide phenomenon poses a real threat to human life and health. It causes degradation of areas affected by it both in terms of damage to structures as well as the possibility of further using the land for the same purposes. The areas in which land mass movements occurred are usually threatened by the occurrence of similar phenomena in the future, thus the reconstruction of destroyed structures will most probably result in their destruction again and further material losses. Moreover, preventing the destructive phenomena by using building protection is possible in the case of small area landslides and in a small number of cases, its costs are huge and the stabilisation of a part of a large landslide may not produce expected results. In the majority of cases other solutions are applied. They are usually connected with the change of land use classification, limitation or total abandonment of current usufruct in order to minimise the risk in the future.

This article is aimed at examining if communes from the areas of Poland affected by landslide-related disasters take advantage of the possibility of changing land use classification pursuant to the amended Act of 2010 on special principles of the reconstruction, renovation and demolition of structures destroyed or damaged as a result of the destructive influence of the element. The research encompassed communes from Małopolskie, Podkarpackie, Śląskie and Świętokrzyskie voivodeships. They may be used for further analyses in respect of referred to provisions of law, they may also constitute a starting point for a discussion on the further changes of these provisions or on actions which may influence the minimisation of risk in landslide areas. The provisions of the Act on special principles of the reconstruction, renovation and demolition of structures destroyed or damaged as a result of the destructive influence of the elements have not been the object of scientific research so far. The article was conceived by the author as a step towards disseminating knowledge of legal regulations concerning landslide areas.

Keywords: landslides, land use classification

Sylwia Gaj: **Methods for Estimating Relative Accuracy of ALS Data** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

In view of the continuous development of ALS (Airborne Laser Scanning), it has become necessary to develop an effective method of controlling the quality of data obtained with the use of this technology. The author presents three main approaches used in literature for assessing the relative accuracy of the ALS data: the method of comparing DEM models (Digital Terrain Model), the method of comparing points and TIN surfaces (Triangulated Irregular Network) and the method of comparing linear elements. Each of these methods is based on a selection of various types of control objects located in overlapping areas between strips of ALS. In addition, a new approach is presented, based on a comparison of roof ridge lines and elevation grids, developed in Poland in order to assess the relative accuracy of the LiDAR data (Light Detection and Ranging) within the ISOK project (IT System of the Country's Protection against extreme hazards).

Keywords: ALS, accuracy assessment, relative georeference, absolute georeference.

Jakub Kolecki: **Combined Bundle Adjustment with Distances and GPS Observations** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

Today photogrammetric measurements are often supported by observations provided by such devices like inertial measurement units and GNSS receivers. Therefore the functional model of bundle adjustment often needs to be extended to handle various kinds of observations. In this paper the approach to supporting direct geo-referenced images with distance observations is proposed. The behavior of final accuracy of adjustment is examined depending on the number of distances involved. Besides the influence of inaccurate weighting of GPS observations is addressed. Tests were carried out using a closed-loop image network with good controllability and a large number of tie points. The results show that using distances as supplementary information may help to fix the scale of the photogrammetric network and prevent check point errors from increasing even if a low accuracy GPS solution is available. However one should always keep in mind that the role of distances depends on the

accuracy of their measurements and finally on the geometry of the network.

Keywords: integrated bundle adjustment, direct geo-referencing, mobile mapping, GPS

Kamil Maciuk: **The Influence of Adding GLONASS Signals on Quality of RTK Measurements** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

Introducing the GPS+GLONASS module in 2011 greatly expanded the extent and potential of the capabilities of the ASG-EUPOS system launched in 2008. Precision solutions that use the real-time service NAWGEO, depending on field conditions, allow for obtaining accuracy of several centimetres. In this paper measurements were performed with the use of ASG-EUPOS's RTK corrections at points located in the urban area. For each of the measurements, the percentage of the obtained solutions types was determined. This article analyses the effect of adding the Russian navigation system signals on the number and quality of RTK solutions.

Keywords: satellite measurements, GLONASS, RTK, ASG-EUPOS

Monika Mika: **The Use of Hand-held GPS Receivers for the Identification of Objects in a Wooded Area** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

This paper presents the results of a comparative analysis of objects (trees) coordinates survey using hand-held type receivers GPSMAP 76, and the Nautiz X7 GPSmap 62st. The works were performed in the palace and park complex in Osiek, in the autumn and winter, to minimize the influence of terrain curtains in the form of leaves, which prevent or significantly restrict the applicability of GPS measurements.

The results of field measurements with the use of three types of receivers showed wide disparity in the obtained coordinates. Despite these differences, the identification of objects turned out to be unambiguous. A satisfactory effect was achieved through the choice of research methodology, involving the simultaneous use of the navigation functions of Garmin receivers and the ArcGIS software of the Nautiz X7 receiver. This receiver can in fact perform the functions of a laptop with the creation of GIS databases for the positioned objects. If the position of the identified tree was not certain the database and maps from the GEOPORTAL

were applied. This database is developed for the inventory of monuments of nature and is located in the local resources. In the database of natural monuments, for each of the trees one can find basic descriptive attributes concerning its species, diameter or age, as well as photographic documentation.

The aim of this study was the determination of the differences in data acquisition using hand-held type receivers GPSMAP 76, and the Nautiz X7 GPSmap 62st and the determination of the degree of their suitability in the wooded area to identify individual objects (trees).

Keywords: determination of a point coordinates, GPS receivers

Korneliy Tretyak, Serhiy Periy, Ihor Sidorov, Lubov Babiy: **Complex High Accuracy Satellite and Field Measurements of Horizontal and Vertical Displacements of Control Geodetic Network on Dniester Hydroelectric Pumped Power Station (HPPS)** • Geomatics and Environmental Engineering 2015, Vol. 9, No. 1

Technique of complex GNNS and ground measurements on the control geodetic network of Dniester HPPS for monitoring deformations of the earth surface is proposed and implemented. It allows increase the accuracy of determining the coordinates of points by replacing GNSS measurements in areas of poor reception of satellite signals with precision ground linear-angular measurements.

Keywords: GNSS measurements, network adjustment, horizon openness