



POLISH EXPERIENCE IN SHARING THE GEOINFORMATION RESOURCES (OGNIWO)

Йдеться про концепцію та основні цілі проекту "Розвиток цифрових геопросторових ресурсів та їх доступність в національній геоінформаційній науковій системі, що інтегрує геодезичні знання (OGNIWO)". Фінансування проекту здійснювалося в рамках програми оперативної діяльності "Інноваційна економіка" за другим пріоритетним напрямком. Головне завдання проекту – забезпечення постійного і надійного доступу польських наукових кіл та підприємців до розвинутої інформаційної інфраструктури. Система дає можливість користуватися геоінформаційними ресурсами Інституту геодезії та картографії для наукових, дослідницьких, господарських та навчальних цілей.

Інститут геодезії та картографії має унікальні геоінформаційні ресурси з таких дисциплін, як фотограмметрія і дистанційне зондування, геодезія, геодинаміка та картографія, а також інформацію про наукові публікації і результати науково-дослідних робіт у цих сферах. Результатом проекту є геопортал "OGNIWO", який дає можливість широким колам потенційних споживачів отримати доступ до ресурсів за допомогою типового веб-браузера. Просторові геодані надаються через Інтернет і вони доступні для всіх зареєстрованих користувачів. Домашня сторінка: <http://geozasob.igik.edu.pl/> or www.igik.edu.pl.

Представлена концепция и основные цели проекта "Развитие цифровых геопространственных ресурсов и их доступность в национальной геоинформационной научной системе, интегрирующей геодезические знания (OGNIWO)". Финансирование проекта осуществлялось в рамках программы оперативной деятельности "Инновационная экономика" по второму приоритетному направлению. Главная задача проекта – это обеспечение постоянного и надежного доступа для польских научных кругов и предпринимателей к развитой информационной инфраструктуре. Система дает возможность пользоваться геоинформационными ресурсами Института геодезии и картографии для научных, исследовательских, хозяйственных и учебных целей.

Институт геодезии и картографии имеет уникальные геоинформационные ресурсы по фотограмметрии и дистанционному зондированию, геодезии, геодинамике и картографии, а также информацию о научных публикациях и результатах научно-исследовательских работ в этих сферах. Результатом проекта является геопортал "OGNIWO", который дает возможность широкому кругу потенциальных пользователей получить доступ к ресурсам с помощью типового веб-браузера. Пространственные геоданные предоставляются через Интернет и они доступны для всех зарегистрированных пользователей. Домашняя страница: <http://geozasob.igik.edu.pl/> or www.igik.edu.pl.

Many surveying and cartographic institutions hold in their archives unique collections of spatial data. Some of these institutions endeavor to make the resources accumulated over the years ready for dissemination and use in research. A collection of maps, aerial and satellite imageries, and various measurement records taken in the field are unique documents describing the environment at a specific time in the past. For this reason, the circle of researchers interested in spatial data archives significantly extends, inter alia, to those who are engaged in research in the broad sense of historical geography, economic history, urban planning, etc.

The Institute of Geodesy and Cartography in Warsaw is a unique resource for researchers interested in using historical spatial data. The data have been collected for nearly seventy years, i.e. since the foundation of the Institute in 1945. They are the result of research conducted at the Institute in the field of geodesy, geodynamics, photogrammetry, cartography, topography, remote sensing and spatial information systems, and knowledge about the environment.

The need to share this resource comprising scientific publications and research results appeared in relation to their suitability for research and development conducted in the framework of the National Programme for Research and Development, which should contribute to faster economic development of Poland and the con-

struction of the knowledge-based economy.

The basic premise of sharing the collected archival materials is the ability to easily find the needed geoinformation, then getting access to it and its use in research or decision-making process, which underlies, among others, building the information society, e-government, the European INSPIRE spatial information infrastructure and the realization of many other programmes offered by the European Union.

The National System of Scientific Geoinformation Integrating Geodetic Knowledge – OGNIWO, which was created under the project "Investment in the development of the computer infrastructure of science," and implemented in 2011-2013 meets such a goal. The OGNIWO provides the scientific community and other potential users with a permanent and safe access to advanced IT infrastructure, which allows the use of resources of the Institute of Geodesy and Cartography in scientific works, among other things to conduct research using the technologies of the information society, as well as economic, educational like.

The OGNIWO system connects the user of digital geoinformation resources to the resource data via web services, and also connects the geospatial resources to geoinformation infrastructures on regional, national and international levels. Spatial data services are available to all authorized users meaning scientific institutes, research and development institutes, educational institutions, entrepreneurs including domestic and foreign investors, public administration and citi-



zens. Spatial data services are provided around the clock via the Internet as the main medium of communication. Potential users of spatial data provided by the system are researchers involved in such areas of knowledge as agriculture, forestry, geology, mining, environment, planning, transport, telecommunications, navigation, tourism, as well as defense and crisis management. Access to the data does not require the user to have a specialized GIS software, as it is obtained using a typical web browser.

Information resources made available by the Institute of Geodesy and Cartography cover the whole country or its selected areas and they are, as mentioned above, in a form of maps, aerial photographs, including photographs made in special techniques and satellite images obtained by environmental satellite, as well as their processed products in a form of thematic collections characterizing the state of the Earth's surface. To facilitate the use the resources are divided into several groups:

- resources of scientific publications in the field of photogrammetry, remote sensing, geographic information systems and computer cartography, which included library collections, patents and publications, and the results of research of the staff of the Institute;

- resources in the field of geodesy and geodynamics, which included the results of research in GNSS observation stations, multi-functional observation station "Borowa Góra", as well as the results of observations and the characteristics of the state of potential geophysical fields for the area of Poland;

- photogrammetric resources, which included ground photographs, aeriels and satellite images and photogrammetric products manufactured on their basis, such as aerial triangulation results, numerical terrain models, orthophotomaps and maps showing situation and elevation;

- remote sensing resources, which primarily included satellite images performed by environmental satellites operating in the optical spectrum and microwave, as well as the results of ground-based measurements and observations used to verify the satellite data;

- vector and matrix resources created from databases with very different content, different geographical scope, format and method of sharing;

- cartographic resources included both analog and digital items.

Resources have been characterized in accordance to a specification which included among others, information such as the management model of the resource, the thematic scope, spatial coverage, timeliness, data model used, spatial resolution, data format and spatial reference system, the conditions of using the resource and the history of its creation. This was the basis for development of methods integrating and harmonizing different spatial data sets and converting these sets into an agreed form described using metadata.

The methodology for the integration and harmonization of data sets collected at the Institute took into account a standardized approach to modelling geographic information described in international stan-

dards in the field of geographic information¹, documents of European spatial information infrastructure INSPIRE and OGC specifications. This approach is based on the development of domain-specific application schemas, object catalogs, data characteristics by metadata description, unified description of the location, topology, spatial and temporal reference and coherent dictionaries and thesauri. Advantages of such approach consist in the versatility and independence of tools used to collect, manage and share resources².

Consequently, the adoption of such a methodology ensured interoperability of sets included in the geoinformation resource and enabled to connect spatial data sets and to interact spatial data services, without repetitive manual intervention, in such a way that the result is coherent and the added value of the data sets and services is enhanced³. For all potential users of the resources of the Institute of Geodesy and Cartography this means an easy and automated matching of data sets to various subjects and from different sources, based on different sets of rules of interpretation in the course of a single analysis.

OGNIWO is a network system formed by two nodes cooperating with each other: the central and the Internet. Both nodes make use of their resources through communicating by means of standardized services and they are functioning autonomously, i.e. in such a way that the exclusion of one of them would not immobilize the rest of the system. For cooperation of individual nodes in the OGNIWO system and cooperation of the Internet node with external systems of a geportal, a service-oriented architecture was used (Service Oriented Architecture – SOA)⁴. OGNIWO has been designed as a so-called scalable system, which means that it is possible to increase the size (number of components) according to increasing functionality and number of users.

Central node (shared by employees of the Institute) is a system for collecting, managing and sharing digital resources grouped into seven geospatial repositories:

1. Repository of library collections and unpublished results of research. This repository forms a Digital Library of the Institute of Geodesy and Cartography. The library is created within the OGNIWO project and operates based on dLibra software. All collections are described with metadata in Dublin Core standard, the publications are provided in PDF format enriched with active tables of content and bookmarks. Bibliographic databases are operated by the WebLIS software. Digital Library IGiK belongs to the federation of Digital Libraries and to European, EPNP, BazTechu, Astrophysics Data System and

¹ Polski Komitet Normalizacyjny, PN-EN ISO 19101 – 19119. – Warszawa, 2005-2007.

² Gotlib, D. Budowa Krajowej Infrastruktury Danych Przestrzennych w Polsce – Harmonizacja Baz Danych Referencyjnych / D. Gotlib, A. Iwaniak, R. Olszewski. – Wrocław, 2006. – s. 17-19.

³ Dyrektywa 2007/2/WE Parlamentu Europejskiego, art. 3, pkt. 7.

⁴ Kubik, T. GIS. Rozwiązania sieciowe. – Warszawa: PWN, 2009. – S. 35-38.

EBSCO Publishing. Figure 1 shows the home page of Digital Library IGiK. Starting Page of Digital Library IGiK is <http://bc.igik.edu.pl/> website or through the website IGiK.

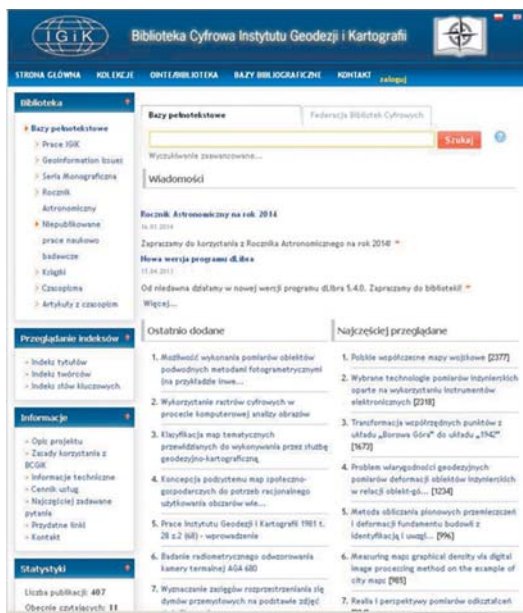


Fig. 1. Homepage of Digital Library IGiK

2. A repository of geodetic and geophysical data.
3. A repository of measurements and field observations.

4. Photogrammetric repository.

5. A repository of remote sensing data including satellite images, aerial photographs, orthophotomaps and products manufactured from the source remote sensing data.

6. A repository of vector files (point, line, surface) and matrix files (grid). A key role in this repository plays a database – the Digital map of Poland designed at a scale of 1:200 000. This database was originally created by the digitization of topographic map of Poland at scale 1:200 000. The next database is the Corine Land Cover with sets of derivatives. The third large collection of vector databases form data resulting from research projects. They are characterized by great diversity in terms of contents, coordinate systems and formats of recording.

7. A cartographic repository.

The central node of the OGNIWO system is characterized by the diversity of used operating systems, systems for database management, specialized application softwares, and also by the diverse functionality, type, format and amount of data collected. The thematic scope, models, types and formats of data collected in the central node reflect the tasks performed by each unit of the Institute, the requirements of research and development projects and used tools.

Resources collected in the central node are integrated, harmonized and standardized in terms of spatial reference system and the data format. From the

side of functionality the central node is equipped with a module for communication with the internet node and the integrated system for management of the IGiK digital geoinformation resources.

Internet node to which for employees of the Institute in contrast to the central node the access is limited is a geportal extended by the library server through which geoinformation resources of the Institute are made available, i.e. spatial data and library databases. Providing is done using advanced informative infrastructure and information society technologies. The architecture of this node includes several modules: for communication between Internet node and the central node, for the management of data and metadata, for spatial analysis and for data sharing via the Internet, for security and authentication, and for monitoring of the node.

The authors of the system wanted to pay particular attention to cartographic repository including both paper and digital maps. Shared maps were created as a result of various scientific and development projects or on demand of custom businesses and public administration. They are mostly digital image maps (satellite or aerial) supplemented by the base map contents and the digitized analog maps mainly of land cover and land use.

Issues of the environment and its protection have a significant position in the set of thematic maps. During the increasing deterioration of the environment in Poland scholars began wondering about restoration of the so-called zero state to which the scope and extent of degradation could be compared. Based on a retrospective analysis of aerial photographs from the years 1956-1983 a research was conducted to check the status and environmental changes in the areas of location of industrial flagship objects in the 70-ies of the 20th century, namely the Ironworks Katowice and Belchatowski Fuel – Energy District.

This is reflected in the sequence of maps showing the impact of large industrial investments on anthropopressures of geographical environment. Zoological Map of Ironworks Katowice region, State and changes in the geographical environment in the years 1956-1972 in the area of future construction of Ironworks Katowice, State and environmental changes in the geographic region of Ironworks Katowice in the years 1972-1982, Changes of the environment in the area of Belchatowski Fuel – Energy District in 1964-1983.

The assessment and documentation of the processes of transformation and land degradation in the Upper Silesian Industrial Region in relation to the 5 towns of the Upper Silesia (Bytom, Chorzow, Jaworzno, Swietochlowice and Zabrze) are, in turn, shown on maps of the state and changes in the geographical environment.

The Institute of Geodesy and Cartography frequently used remote sensing data for mapping of flood waters within, among others, basins of Bobr, Kwisa and Szprotawa in 1977, the Vistula near Plock in 1982, and in Bug and Narew valleys in April 1979.

In July 1997 Satellite ERS-1 series took pictures in the western Poland, depicting a flood in the Oder



valley. Results of the analysis of microwave images were shown on maps of flooding of the Oder catchment. They show the maximum extent of the flood wave on the background of a land use map. The whole Oder valley within the Polish borders is presented on four map sheets. (Maps of flooding in the catchment area of the Oder River in 1997, 1:100 000, smelter, Opole, Slubice, Szczecin.)

The catastrophic flooding that took place in the valley of the Oder River in July 1997, contributed to undertake a number of works aimed to determine the potential flood hazard areas of Sudeten Foothills and the Silesian Valley. Among the data necessary for the efficient operation of simulation models for determining the probability of a flood event there were also included maps showing the status and changes in land use in the Oder catchment during the period 1975-1992. (Oder River Land Use, 1975. 1:500 000, Oder River. Land Use Changes from 1975 to 1992, 1:500 000.)

As examples of the environmental-cartographic documentation relating to the idea of sustainable development of the Vistula River were maps developed on the basis of aerial diachronic photographs showing the state and changes in land use in the area of the middle section of the river. Photointerpretation analysis allowed to capture the specificity of a large river valley landscape, which is characterized by great spontaneity and instability expressed in high variability of a water flow and a course of the trough. The results of the interpretation of aerial photographs of 1959 and 1992 have been documented in a series of 12 maps. (Status and changes in the geographical environment of the middle section of the Vistula valley in the years 1959-1992, 1:10 000.)

There is a large group of thematic works dealing with issues of the application of remote sensing data to produce land use maps both at the scale of a country, province or a region. These maps were made at various scales ranging from small scales till up to 1:10 000.

The land use mapping issues were reflected, inter alia, in developing the concept of a uniform land use map at scale 1:50 000 for the whole Poland. The basis for compilation of the content, thematic range and outlines were land cover and land use items identified in the third level of the CORINE program, and the information about spatial distribution of the land use items was derived from color aerial photographs at a scale of 1:26 000, made for the whole Poland in years 1994-1997.

As an example of works aimed at developing the methods for mapping the land use with intention to assist spatial planning at the Community level is a map of land use for the Community Strzyzewice (district of Lublin. Community Strzyzewice. Land use 1:25 000).

The thematic map of changes in land use in Poland in the years 1930-2000 also matches the area of the land use change problems. This map shows the results of comparison of the land cover database of Poland in 2000 developed within the framework of the European project CORINE Land Cover 2000 with information obtained from the analysis of the Polish Land Use Map at scale 1:1 000 000 developed by F. Uhorczak based on topo-

graphic maps at scale of 1:100 000 made in the 30-ies of the 20th century. Almost seventy-year period between the execution dates of database CLC-2000 and Uhorczak's map allowed the determination and presentation of the size and direction of changes in land use in Poland in 1930-2000. (Changes in land use in Poland in the period 1930-2000.)

In the repository of thematic maps the area of problems associated with forest research is clearly exposed. Of particular note are maps of the sanitary condition and health of forests developed on the basis of visual interpretation of spectrozonal aerial photos that allow the detection of pathological changes in vegetation.

A comprehensive study of environmental degradation in the Polish part of the Sudetes based on remote sensing data became the basis for compilation of the three maps illustrating the state of stamina of spruce stands damaged by biotic and abiotic factors. (Map of the health and sanitary condition of the Izerskie Mountains, 1:25 000. Map of the health and sanitary condition of the forest. Izerskie Mountains and Karkonosze, 1:25 000, Sudety.)

A significant position in the repository of thematic maps is occupied by compilations which are the result of research on the use of multispectral satellite images in assessing the state of forests in the Western Sudetes, and thus the area of ecological disaster. Supervised classification of satellite images taken in 1976, 1984 and 1990 allowed to discern eight categories of the forest condition including the spruce stands slightly weakened, spruce stands strongly weakened, dying and dead stands, also the assessment of the damage dynamics and the estimate of the degraded area size. The result of the analysis is a set of maps showing the assessment of the forest condition in the Sudety. (Map of Forest Quality – Western Sudety, 1:100 000, Sudety test site classification maps, 1:100 000 Western Sudety. Map of the state of forests, 1:100 000.)

The results of the spatio-temporal analysis about changes in land use, deforestation factors and hazard zones of soil erosion of the Polish and Czech part of the Izerskie Mountains in the years 1780-1994 clearly relate to issues of forest changes in the Western Sudetes.

Issues related to delimitation of areas with unfavorable conditions for agriculture in Poland (LFA), show thematic maps that point out the commune in which arable lands are unfavorable for the agricultural economy. (Less-Favored areas for Agriculture, scale 1:1 000 000, Malopolska Region, areas with unfavorable farming conditions, scale 1:300 000.)

The studies on Polish agricultural space were also a subject of the MARS program (Monitoring of Agriculture with Remote Sensing), the aim of which was to work out a method for defining an area and structure of major crops in Poland using information obtained through satellite and airborne remote sensing; also the delimitation of agricultural production space and its stratification in areas with different intensity of production. (Knyszyn test site classification maps, 1:100 000, Koziencice test site classification maps, 1:100 000, Silesia test site classification, 1:100 000.)



Environmental and agricultural issues were studied in a project aimed at determination, inventory and monitoring of the natural areas of high value which were used by agriculture and forestry. Scope of work included inter alia the cartographic delimitation of areas of high natural value in Poland, what is illustrated on another map from the repository which shows the percentage of areas of high conservation value, in the geodetic precincts for communes with extensive farming (Areas of High Natural Values (HNV) in Poland, 1:750 000).

A relatively new element in the cartographic repository are image maps. The basis for image maps was properly processed and integrated image information obtained from satellite or aerial imagery and

descriptive information from traditional cartographic sources. An example of landscape visualization using perspective method is the landscape map of Karkonoski National Park at scale of 1:50 000 based on aerial and satellite images. The imaging studies also include selected regions of the country: Warsaw, Mokotow, Wladyslawowo, Tatra Mountains.

Access to IGiK resources for researchers interested in historical spatial data is implemented via a graphical web browser interface that communicates with spatial data network services. Network services are provided in accordance with the specifications of Web services together with open and legally non-proprietary standards. Access to Internet node will be preceded each time by the authentication and autho-

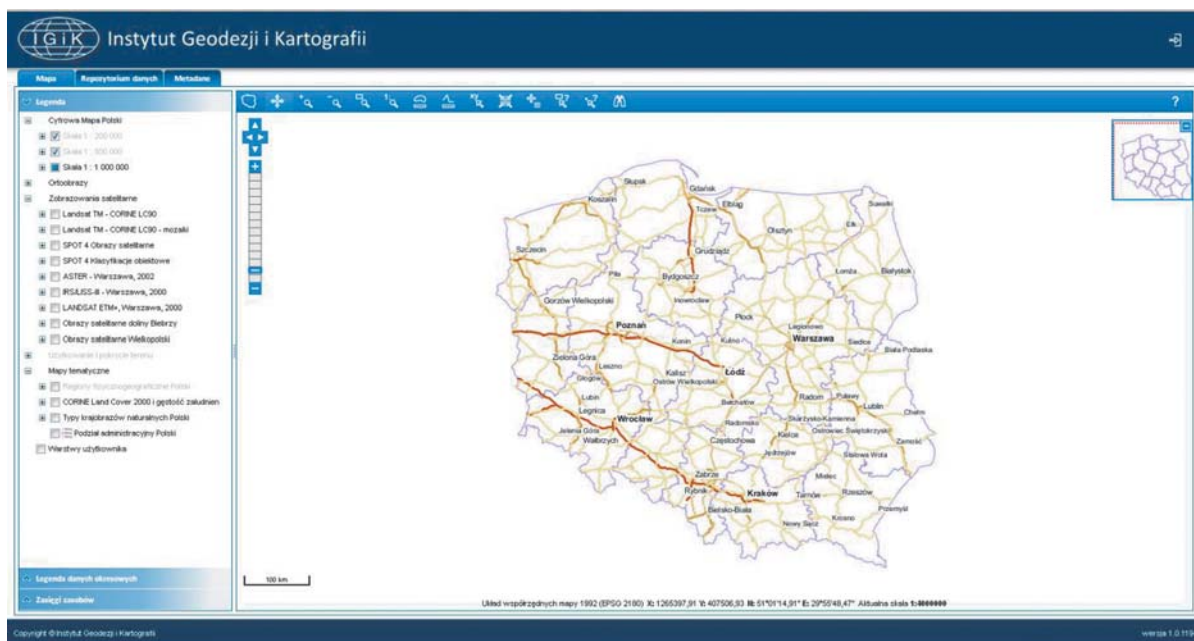


Fig. 2. Homepage of the OGNIWO website

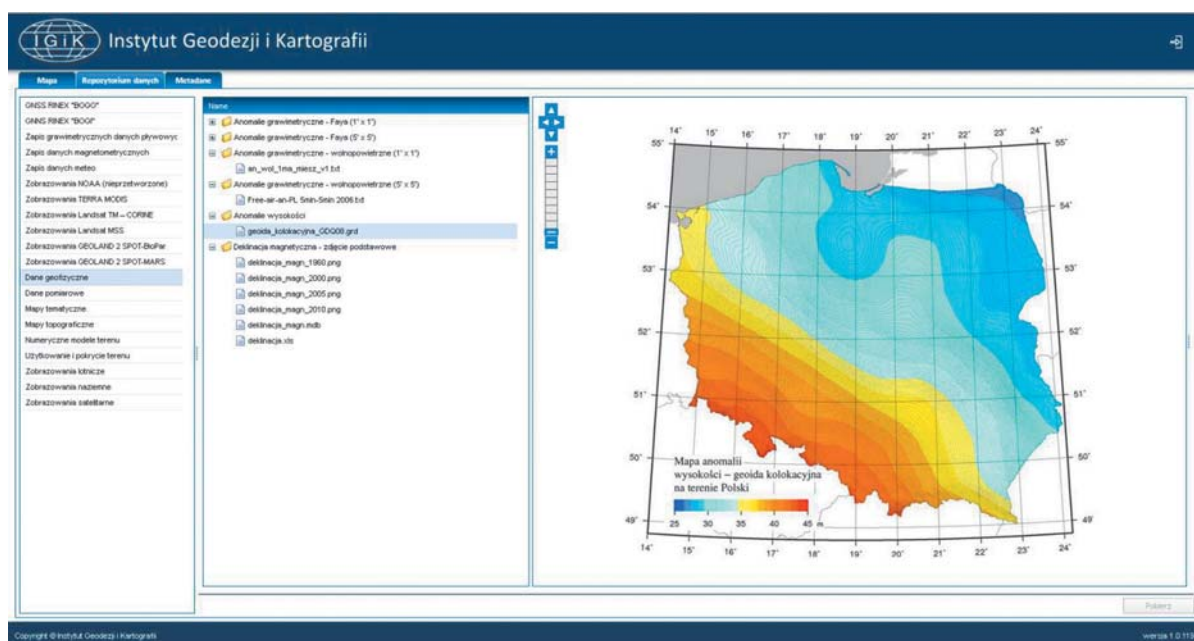


Fig. 3. An example of data from repository



rization of a client. In developing the rules of availability of digital geospatial resources it was prepared the description of the OGNIWO system architecture along with technical specifications of hardware and software necessary for its operation. For selected resources the application schemas in UML were made, in accordance with ISO and INSPIRE documents.

In addition there have been developed technologies, procedures and tools to support the process of digitization of the analog and the integration and harmonization of existing digital resources, and also the principles of collection of library data.

Homepage of the OGNIWO website is <http://geozasob.igik.edu.pl/>, or by the Institute www.igik.edu.pl.

OGNIWO website comprises three tabs: "Map", "Data Repository", "Metadata". The user starts working having the data resources displayed on the "Map", then through the window of attributes in addition to displaying metadata and bibliography he can also see the resources on the map, go to the repository or library and download files. Figure 2 shows the homepage OGNIWO, and Figure 3 an example of data from repository.

The system distinguishes between two types of users: logged in and not logged in. The logged in user can use all the resources available data and is entitled to download these data. This user also sees all resources of "data repository". In contrast, the not logged in user has access only to a part of spatial resources in the "Maps" window and to a part of resour-

ces in the "Repository Data" window but do not has access to the "Get Data".

The OGNIWO, which was developed at the Institute has provided users with constant access to advanced IT infrastructure that enables the use of resources of the Institute of Geodesy and Cartography in scientific works, among other things to conduct research using technologies of the information society for the economic, educational, and other purposes. Resources are widely used as evidenced by the number of users who visit Ogniw website.

Literature

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