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THE STRATEGIC PERSPECTIVES OF USING GIS-TECHNOLOGIES FOR CREATION OF INTEGRATIVE ANTARCTIC GEO-BASE OF SCIENTIFIC DATA

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Abstract. Strategic prospects use GIS technologies are presented in report for making integrated geodatabase of scientific data, designed on base of the lifelengths operating in the field of automations of the information handling in National antarctic scientific centre MES of Ukraine (NASC). It is shown, that given decision effectively, in good time, corresponds to the world standard of the collection, processing and presentation of scientific data.
Key words: GIS, Geodatabase, ArcGIS, Server technology.

Реферат. У доповіді подано стратегічні перспективи використання ГІС технології для створення інтегрованої геобази наукових даних, яка проектується на основі багаторічних напрацювань в галузі автоматизації обробки інформації в Національному антарктичному науковому центрі МОН України (НАНЦ). Показано, що дане рішення є ефективним та своєчасним, відповідає світовим стандартам збирання, обробки та презентації наукових даних.
Ключові слова: ГІС-технологія, Геобаза, ArcGIS, Серверні технології.

Реферат. В докладе представлены стратегические перспективы использования ГИС технологии для создания интегрированной геобазы научных данных, проектируемой на основе многолетних наработок в области автоматизации обработки информации в Национальном антарктическом научном центре МОН Украины (НАНЦ). Показано, что данное решение эффективно, своевременно, соответствует мировым стандартам сбора, обработки и презентации научных данных.
Ключевые слова: ГІС-технология, Геобаза, ArcGIS, Серверные технологии.

The Advantage of the Geographic information system (GIS)

The Influence of the information technology on the life of the modern society increases every year. In spite of crisis phenomenas, which have certainly touched and research side to activity of the person, growing of this influence will increase in future, firstly in connection with growing following parameter information systems:

- velocities of data processing;
- reception capacity;
- broad possibilities on using of the mobile decisions;
- possibilities for use web-technology and technology of the making the virtual surrounding.

Obviously that in such condition, use of geospatial forming vastly raises working efficiency with information and removes technology GIS on higher level.

Nowadays geographical approach is the best for decision of the different problems of the human activity. It allows to spare money, time, due to following characteristic:

- possibility to integrate separated data;
- presence of the modern methods of the spatial analysis;
- possibility to prototype the different processes and unite the models in united database;

- possibility to automate the working process of gaining of the new date (the new knowledge) from available information.

The most popular in the world GIS is presented by straightedge of the programme products from company ESRI, under trademark ArcGIS. This GIS allows to execute the broad spectrum of the problems to which pertain:

- cartography;
- visualization of information;
- animation;
- quantitative data processing;
- building of the diagrams;
- execution of modeling, spatial analysis, network interaction;
- management data;
- use of web-service;
- making the server architecture.

Software ArcGIS is used on Ukrainian antarctic station by Academician Vernadsky (UAS), as well as in other organizations of Academies of the Sciences in Ukraine which work on antarctic themes. These are the following organizations:

- National antarctic scientific centre MES of Ukraine (NASC);
- Institute of the geological sciences NAS of Ukraine (IGS NAS Ukraine);
- Institute of the geophysics by S. I. Subbotina NAS Ukraine (Institute of the geophysics NAS Ukraine);
- Institute of the microbiology by D.K. Zabolotnogo NAS Ukraine (IMB NAS Ukraine).

The Specialists of company ECOMM conduct education and give the consultations in using of ESRI software to employees of afore-mentioned organizations.

Creation of Geodatabase "GIS-Antarctic"

Due to using of the united platform (ArcGIS) in collection, keeping and information handling, GIS-projects are easily integrated. Using general maps, different sets of date (geodetic, topographical, biological, geological, microbiological, geophisical...) wich can be kept autonomously, as well as in united database.

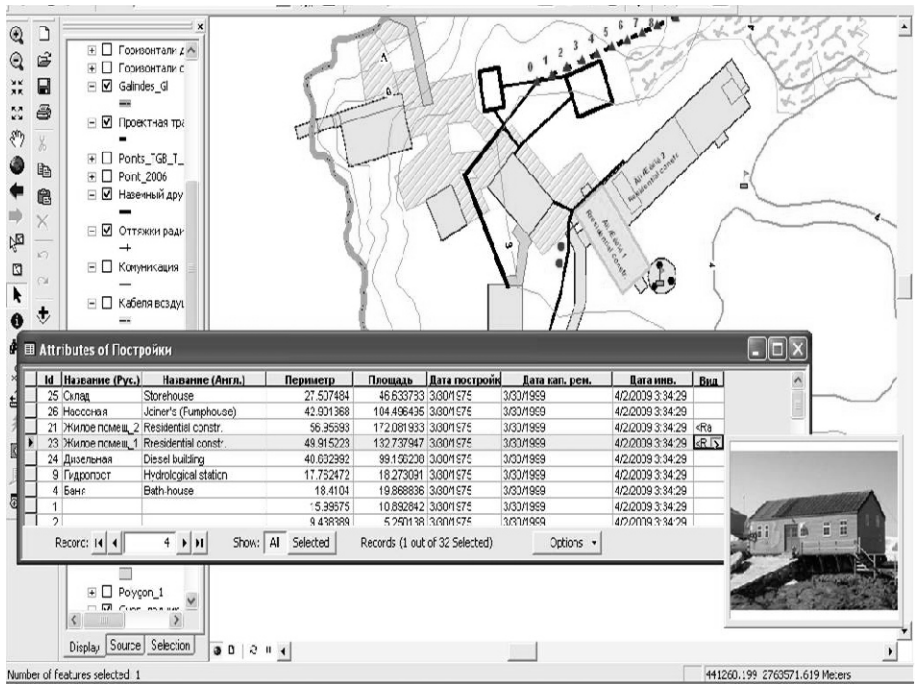
Creation of digital maps of i. Galindez and the nearest islands was a first stage in development of Geodatabase "GIS-Antarctic". On this stage space images of the different precision were broadly used that have allowed to get base of digital maps for places difficult of access, such as i. Galindez (the glaciers, gorges, breakaways etc.), as well as other islands.

On following stage of the development Geodatabase, the module of the infrastructure of Antarctic station by Vernadsky was created that has allowed by using ArcGIS, to examine quantitative and spatial features of the constructions and engineering buildings. The Interface ArcMap allows to systematize all these data and use in various projects (Pict. 1).

In Pict.1. attributive (descriptive) data unit infrastructures (the dwelling premises 1) and its image are shown on the digital maps, as well as its photographic image, which is considered as attributive sign. Geodatabase in such type was used in different projects, for instance "Designing the scheme of the route of petrol pipe line", "Designing the new tank for fuel and pipe line".

In the first project was said about elevated laying of the pipe line from node of the leading-in, in region of fuel tanks to the place of the ship quay (the north-eastern part of island). When making the scheme of the route, which has extent about kilometer, the following problems were solved:

- Aligned of the route of the pipe line with provision for glacier
- Minimization of the material for pylon of the pipe line with provision for:
  - relief to terrain;
  - concrete platforms of the available engineering buildings;
  - more exact location when making the project;
  - revision of the raw data for project.



Pict.1. Geodatabase "GIS-Antarctic" in interface ArcMap.

Creation of Geodatabase "Biogeographical testing area"

The Big spectrum of the problems was solved in the making of Geodatabase "Biogeographical testing area", which is a component part of Geodatabase "GIS-Antarctic". It's the building of geodetic network "Biogeographical testing area" and georeferencing of the bucky places of the selection microbiological sample, and different biotypes (ecotope) – an moss, lichen, silt (make of lake digital maps).

The most interesting problem was the building of 3D-topological model of the testing area, that allowed to lead the calculation spatial factor influencing upon biocoenosis – gradients, aspects, water balance, solar radiation.

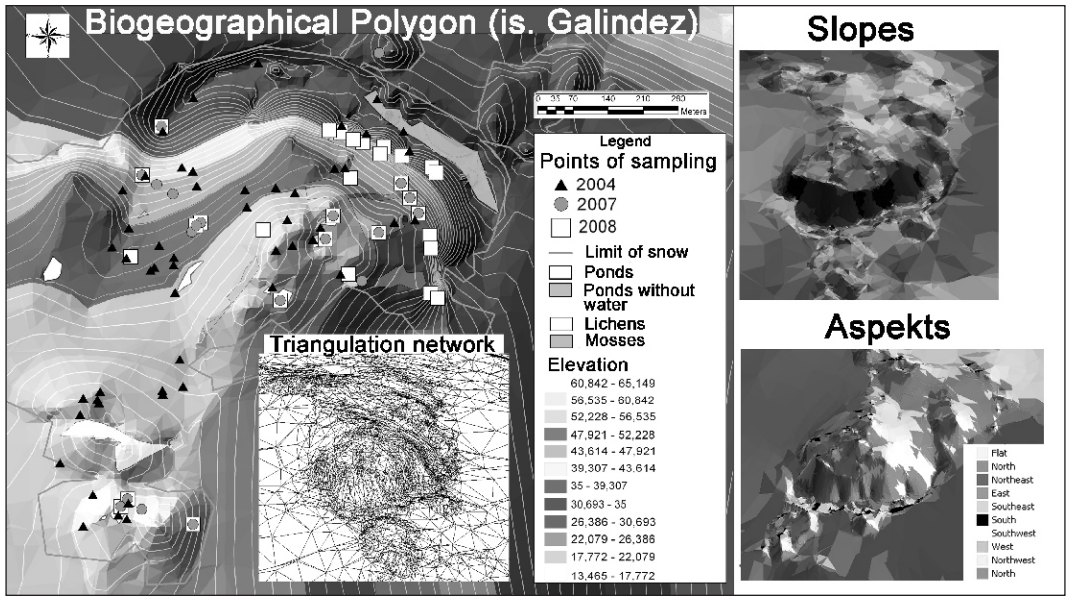
The Visualization of Microbiological date given in ambience ArcGIS with use the 3D models of the testing area allows more graphically display the spatial regularities in change under study parameter (stability microorganism to toxic metal, concentration of the metal in ambience and etc.) (Pict.2).

Work with raster of images

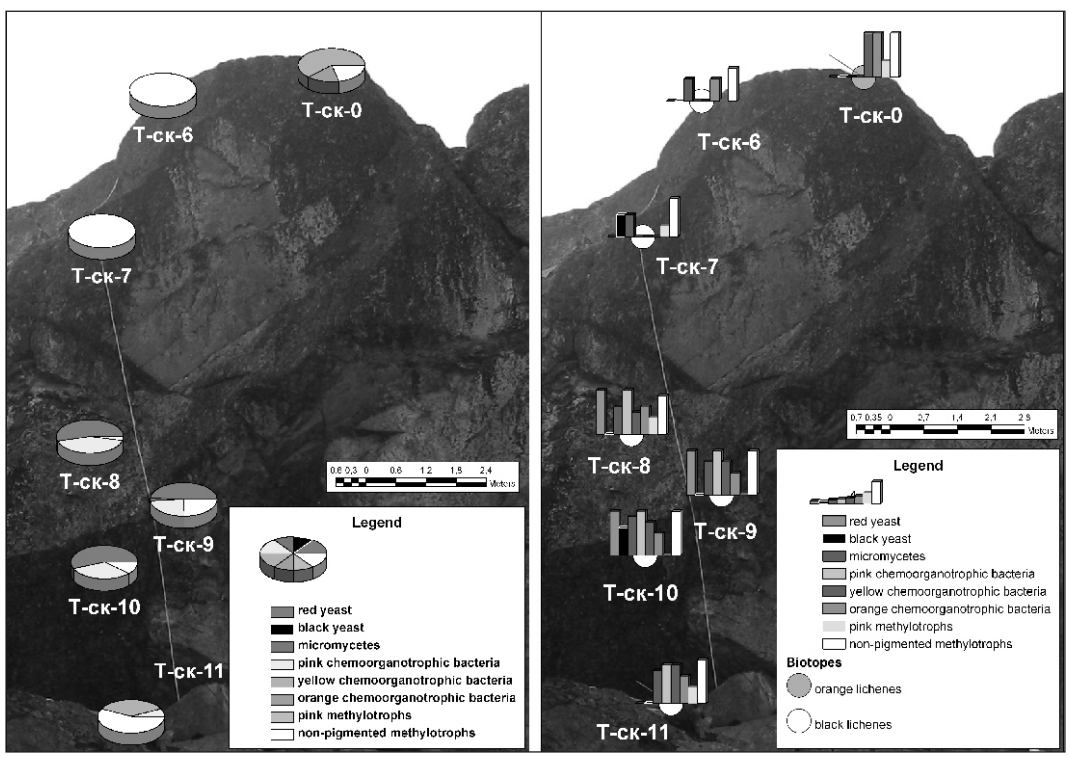
The Possibilities ArcGIS allow to create the relational photographic database with geospatial location, where photo is presented in the manner of attributive characteristic in cell of the table.

Considering the big volume of photographic material such approach allows to get structured photo catalogue with geospatial relation.

The original way of using GIS technologies was demonstrated during the work with microbiologists data. The Photographies of the vertically located testing area (model ecosystem "Skalodrom-2") were topologically clinging to the points of the selection of the tests that has allowed to count the area and amounts of the different types of biocoenosis on the investigated territory, using the whole power of the mathematical device GIS. The Columns and pie charts show the correlations in amount of pigmental and unpigmental forms of microorganisms (Pict. 3).



Pict. 2. Building 3D topological model Biogeographical testing area.

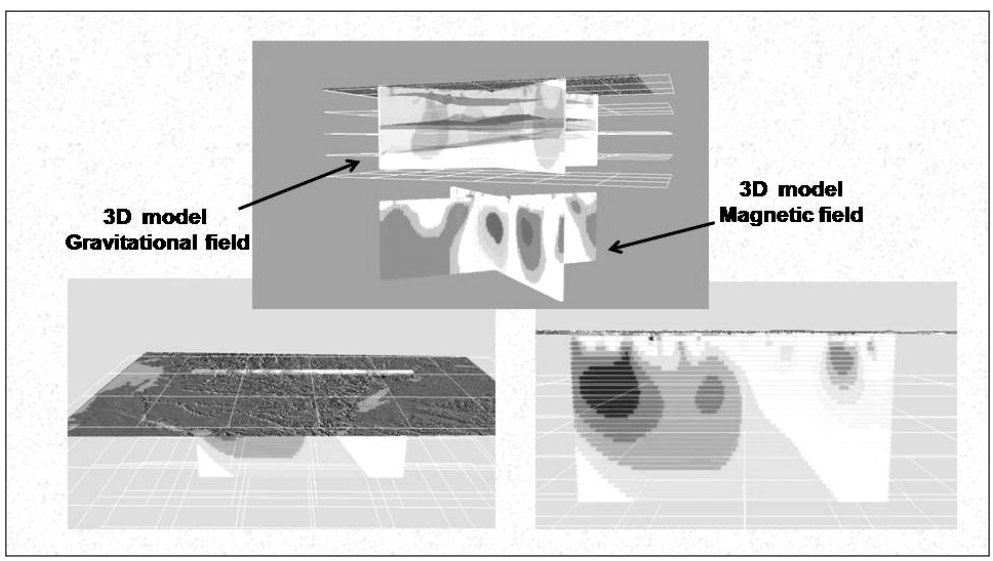


Pict. 3. Topological alignment of vertically located Microbiological testing area (model of ecosystem "Skalodrom-2").

Application of GIS possibilities when making the cards electro- and gravel-magnetic anomaly of the Argentinean Archipelago

Use of ArcGIS allows successfully to execute the problems on building interpolational surfaces i.e. surfaces received on point experimental data. Such building is executed with the using of the specific mathematical methods (the splines, cricking, back-weighted distances and others). These possibilities were successfully used in geophisical and geological themes of NASC when making the maps of magnetic anomaly of Argentinean archipelago, in the mapping bathymetrical data in Galindez region and on the nearest islands.

The more perspective three-dimensional presentation gravitational and magnetic data, shown in Pict. 4. The vertical cut of the gravitation field is shown in higher part of the picture, a little below is the same cut, but of the magnetic field. The Particularity of this method there is that cuts are executed on beforehand built cube data. As a result we have a possibility to build the sections in any direction and any forms.



Pict. 4. 3D-dimensional presentation of gravitational and magnetic data.

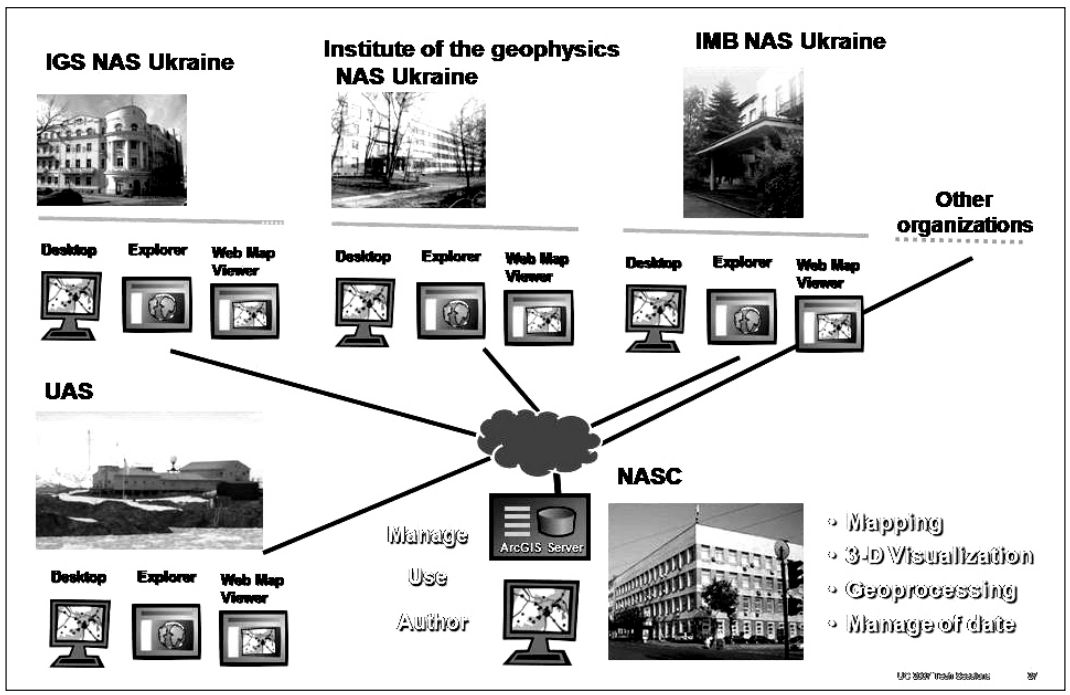
Server GIS technologies are the basis of the future information decisions

Nowadays it's possible to create the integrated Antarctic of Geodatabasa. This is necessary to do it on the basis of experience of using GIS technology in NASC, institute AS of Ukraine, UAS by Vernadsky, and with obligatory use of server GIS technology, allowing to raise the collection, keeping, processing geodata on the modern international level. Below there is the description and main particularities of the base modules of such information system.

ArcGIS Server is a programme complex, allowing to work with cartographic and other geospatial information in the composition of intranet\internet networks (Pict. 5.). At present it allows to realize the most modern decisions.

Use of ArcGIS Server provides the wholeness and urgency of data at any moment of time. Besides, there is possibility to save in available format all database, which are already used in NASC and in the research instituts. And the main idea is that data will be available to all, to whom they are intended. Integration is provided due to use of server technology with any other exhibits, for instance Internet Explorer or with the other browsing, applications MS Office etc. Collection, keeping, creation of data request and analysis of geodata are realized on the server that raises reliability of the operation of the whole system (Pict.5.).

On the one hand GIS users can fill the cartographic server with new information, placing the data, layers of the digital maps, the bases of geodata, created by them, in the general vault. On the other hand, possessing necessary rights of the access, they can use cartographic information of the general access placed on the server. Besides, several specialists can simultaneously work on different parts of the same project, creating the general maps or set of the maps, supporting or filling general Geodatabase. And finally, users can use the possibility of the server on data processing.

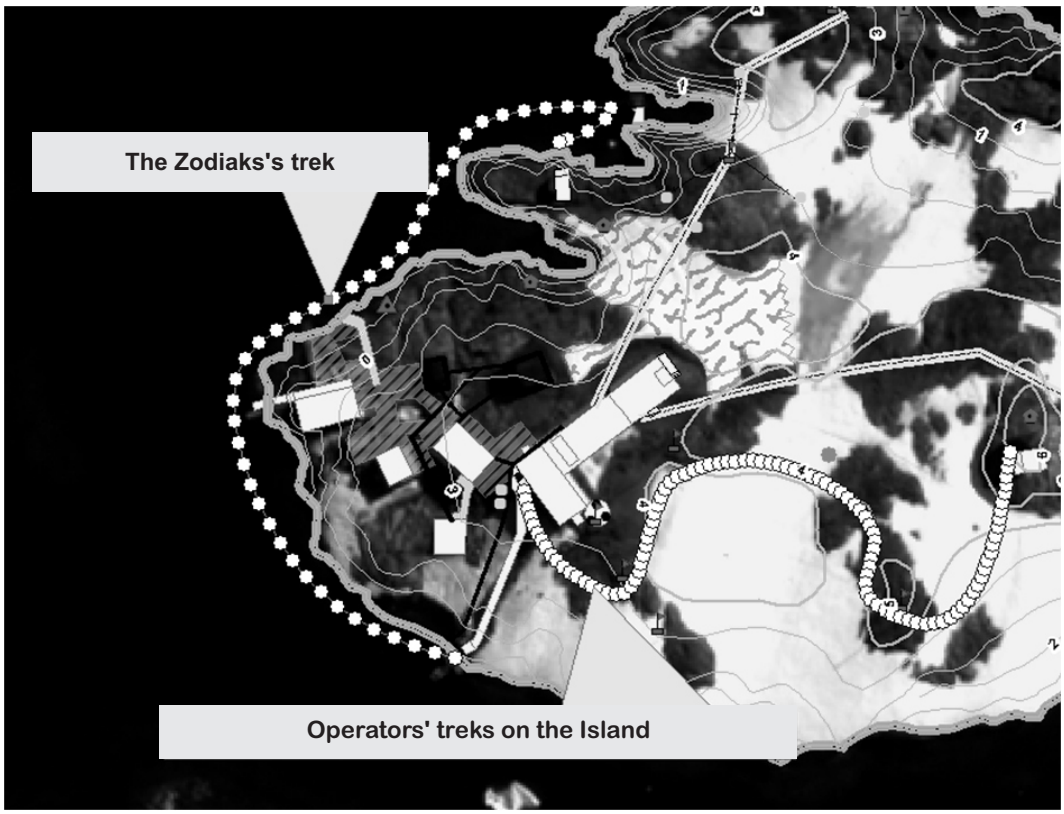


Pict. 5. Realization of the decision on base ArcGIS Server on collection, processing and keeping data

The key idea, realized in server GIS is all that possible to do in "desk" GIS (ArcGIS DeskTop) possible to do and in server ambience (ArcGIS Server). It is realized by creation services, which are found directly on the server. So the user, having certain rights access to GIS-server and the using of the Internet by means of own GIS-applications or simply browsing has a possibility of fullfunctional GIS. This is one more way on spare facilities and resource. The Services can be used also by any applications, capable to integrate them in information ambience of the enterprise.

One of the example of the service was presented in Pict. 6. This is trekking decision in server performance, allowing execute monitoring the displacement polar explorer working outside of stations. On dispatching point, on stations or in any point of the globe, at presence of the internet-channel of sufficient reception capacity, in real-time, the tracks of moving objects are displayed.

The Tempestuous development of mobile exhibits finds its reflection and in realization of this subject in different types of services and in ArcGIS products themselves. The researchers have the big choice either in hardware part – palmtop, smart phone, subnote, or in programme decisions (on-line or off-line modes, use of the server decisions or autonomous work). But complex approach is provided in all events in preparation and realization of the project.



Pict. 6. Treking decision in server performance

GIS portal is an united window in the world spatial data

And in conclusion several words about the most perspective direction server GIS technology – a creation GIS portal.

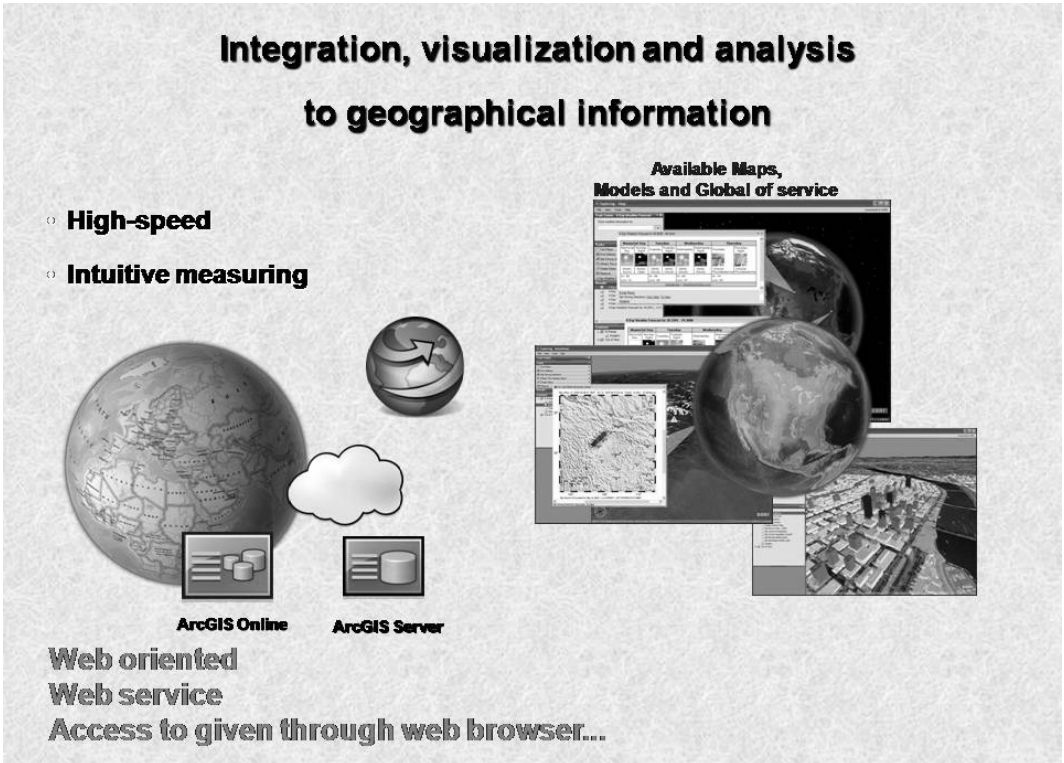
Several years ago idea of the making Spatial Data Infrastructure (SDI) appeared by associations of information resources themselves and metadata ("information about information") in the form GIS-portal.

Notion of the portal itself is taken from architecture (Latin. Porta - an entry, gates), where this term is used for indication "main of the entry" buildings or complex. With standpoint of the users, GIS - a portal is "united window of" access first of all to metadata, it provides searching of necessary spatial information its description, as well as direct reception geodata and work with digital maps (Pict. 7).

The structure of GIS-portal is technology and software one gateway of Web-access for searching for, issues and use geodata and service in any point of the global network Internet, as well as accomodation of information about the data which someone has. The Portal presents itself united node of the access to spatial data, in independence from them locations, format and structures.

Portal decision will allow to solve three scale problems GIS-community:

- association of information resource of many producers and users of spatial data on all level of the integrations - from global to territorial or local;
- provision of searching for/access to necessary information by simple facility, not requiring specialized software and preparation;
- sequencing of spatial information in available for all directories, suitable to automated searching for on miscellaneous criterion (temporary, spatial, semantic etc.).



Pict. 7. Organization GIS-portal.

When making GIS-a portal in National antarctic scientific centre, data will be available (on determined condition) for scientists of the whole world, referring to Antarctic studies.

Obviously that systematic introduction GIS-technology on Ukrainian antarctic station by Academician Vernadsky, in National antarctic scientific centre, and the other organizations, participants in undertaking of the antarctic research, provides, and will provide high efficiency in technologies of the collection, keeping and use to scientific information.