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Abstracts

TECHNOLOGIES AND STANDARDS ON SPATIAL DATA SHARING

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ABSTRACT:

Spatial data sharing and interoperability is an important research orientation in the field of geographic information system (GIS). It is a principal technical sector to realize the objective that anybody may conveniently acquire spatial information service at any time in any place. Thus, scholars in GIS and international standardization organizations as OGC and ISO/TC211 have done a great deal of work on spatial data sharing and interoperability and have issued a series of standards. This paper comprehensively introduces technologies and standards related to geo-spatial data sharing and interoperability.

The federated database technology has established a framework for the collaboration and interoperability between distributed heterogeneous databases. However, the interoperability based on federated databases is comparatively complex. Thus, the interoperability of spatial database is not popularly applied so far.

The Component technology has established a technical base for the identical operations of software modules from different software manufacturers with different programming languages. At present, almost all the predominant GIS software packages worldwide adopt the Component technology, so that the spatial data interoperability between different GIS software can be realized. OGC and ISO/TC211 have constituted access specifications for simple features based on COM and CORBA, which has advanced the development of spatial data sharing and interoperability.

The Web Service technology provides technical support to spatial data sharing and interoperability in a much higher level. Being different from the currently used technologies, the Web Service technology adopts XML language as the supporting platform. In such a condition, the relationship between the databases in the federation is more incompact, while the autonomy of each host database becomes stronger. The occurrence of Web Service technology is warmly welcomed by the experts in the field of geographic information. OGC and ISO/TC211 rapidly

constitute three major specifications as Web Map Service Specification, Web Feature Service Specification and Web Coverage Service Specification. The three specifications based on XML may be used not only to realize the interoperability between heterogeneous spatial databases, but also for Web services of spatial data.

WebGIS-ILA: The GIS for Italian Logistics in Antarctica on the WEB.

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Summary:

A geographic information system (GIS) is an effective HW/SW tool for storing, managing and visualizing geospatial data together with their descriptive attributes. The World Wide Web, on the other hand, is the most recent medium for presenting and spreading the geospatial data embodied in the GIS.

The Italian Agency ENEA has received from Consorzio PNRA the task of implementing a GIS in order to increase the efficiency in the logistic management of the Italian expeditions in Antarctica by making the best of the huge amount of metadata collected during the expeditions. Accordingly, the GIS for the Italian Logistics in Antarctica (GIS-ILA) collects all the information obtained from the yearly expedition reports. Initially the GIS-ILA was operated only locally. That was the version presented at the First International GIS Workshop (Wuhan, 2000). Now the GIS-ILA has been upgraded and a web-version has been implemented. The web site, for the time being, is in Italian, but the English translation is due before long. Cartography, logistic and campaign data and expedition reports are continuously added and therefore are available on the web.

Inventory of On-line Atlases and Geodatabases

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The number of on-line applications available describing Antarctic data and research is growing at an increasing rate.   The Atlas applications range from downloadable pictures of maps displayed as unreferenced image files, to interactive data viewers with download functions, to web map and feature servers providing data for display on remote systems.

As part of the Scientific Committee on Antarctic Research (SCAR) Expert Group on Geographic Information, an inventory of on-line resources is being taken.   The activity is a joint project of U.S. Geological Survey and Gateway Antarctica.   The inventory will provide information describing the types of data and access at each site included, and will be accessible through the SCAR website with active links to all sites listed.

To inventory the Atlases, four classes of sites were developed based on content and capabilities:

1. Unreferenced map files
2. Georeferenced data files available for download
3. Interactive map displays
4. Web map and/or feature services

Additional information itemizing data types and resolutions will also be provided in the inventory table.   All participants in the inventory will be asked to provide one page descriptions of their site to be displayed through a link on the inventory page. The descriptions will provide active links to their home sites which will also be displayed in the one page inventory.

This inventory will be used as the organizing mechanism for an on-line applications group within the Geographic Information Expert Group.

Title: the establishment of the Chinese Polar Science Database System

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Keyword: Metadata, Dataset , Antarctic

Abstract:

In 2002, the Chinese Polar Science Database System (CPSDS) has been established, funded by Ministry of Science and Technology, China, in which some datasets is available online (http://www.chinare.org.cn/WebForm6.aspx) . This work aims to meet the important initiative, as Article III.1.c of the Antarctic Treaty states that Antarctic science data "should be fully and freely exchanged".
Based on the analysis of the current status of polar data management, the characteristic of polar science data, we conclude that to index is the primary step in data management. As metadata is the powerful and useful tool for managing and disseminating scientific data, metadata is used as "search engine" of CPSDS.

ABOUT GIS CARTOGRAPHIC BASEMENT CREATION

FOR EAST ANTARCTICA

FSUE "Aerogeodezia" has created the cartographic basement for the future GIS of East Antarctica.

During the SCAR session of Working group of Geodesy and Geographic Information (Japan, 2000) "Aerogeodezia" Enterprize was committed to prepare a GIS creation draft of topographic and cartographic researches on the territory of East Antarctica.

Considering the project globalness we were proposed and began to create the cartographic part of GIS on the Lasermann Hills area (trapezium R-43-57, 58). Because of the definite causes we could begin our work only in 2003.   Today we can certify that we have done a big work for the cartographic basement creation on the territory of East Antarctica.

In preliminary part of our work we proceeded from the international requirements regarding geodetic control networks which order to use the ellipsoid WGS-84.

As the original cartographic material we used the topographic maps of 1: 100 000 and 1: 200 000 scale which were created by our Enterprize and in cooperation with the other enterprises of Geodesy and Cartography department of URSS and Russia in different years. Before the work beginnings all the geographic names were verified and specified according to the Antarctic Geographic Name Dictionary issued. The work was fulfilled considering the special conventional signs to be applied on Antarctic maps.   As the original cartographic material of the base stations we used topographic maps of 1: 500 and 1: 2 000 scale created by our Enterprize during 1984-2000.

While the cartographic basement creation for the future GIS of East Antarctica we chose ArcMap as the most modern product which will allow us to use in future the most modern formats as ArcView or ArcInfo or ArcEditor.

One of the difficult problems of our work was classification combination. We vectorized maps which have been created with the conventional signs of URSS and Russia.   The set and the content of these conventions differ from the conventions of the Antarctic vectorized maps of the other countries.

Work on the original cartographic material vectorization fulfilled by the group of 7 specialist of "Aerogeodezia" during up to 5 months. The technology consisted of the preliminary editing work, the original material scanning, vectorization and

conversion to the ArcMap appendix, the creation of the cartographic information layers.

Generally the following number of the topographic maps were processed:
- 81 map sheets of 1: 100 000 and 1: 200 000 scale, area 364 000 km2
- 33 plan map sheets of 1:2 000 and 1: 500 scale, area 29 km2

Hereby, we have got now in Russia the cartographic component for GIS of East Antarctica, created on the territory of the Soviet and Russian Antarctic expedition activity.

We suppose that the future development will depend on our joint work coordination. We propose to plan our work by phases.

Phase 1 – to create the unified catalogue of the geodetic network points located on East Antarctica;

Phase 2 – to create the unified cartographic GIS - basement on the territory of East Antarctica using all the earlier created cartographic production of countries participated;

Phase 3 – to create GIS on base of the joint cartographic basement, and to exchange the results between our countries.

Before the result exchange we have to discuss some questions about the juridic side, language, organization, finance support.   From our side we are ready for cooperation and exchange of our work results.

Filatov M.N.
Chief Cartographer

The Cybercartographic Atlas of Antarctica:
Visualization for Antarctic Science

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Presentation Abstract

Cybercartography is a new theoretical construct proposed by D.R. Fraser Taylor (2003): "The organization, presentation, analysis and communication of spatially referenced information on a wide variety of topic of interest and use to society in an interactive, dynamic, multimedia, multi-sensory and multidisciplinary format". The Cybercartographic Atlas of Antarctica Project (CAAP) is a Canadian-led international project that has been endorsed by the Scientific Committee for Antarctic Research (SCAR) and is currently being carried out at Carleton University (Canada) to further develop the concept of cybercartography. Central to the concept of cybercartography, cartographic visualization is a graphical process concerned with exploring data and information, which involves new forms of analysis and cognition. The presentation discusses the use of cartographic visualization in the representation of Antarctic scientific data and information and the relationship between visualization and emerging data infrastructures.

A Web GIS Platform Software based on J2EE- GeoSurf and its Application in Chinese Antarctic GIS Portal Node Construction

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ABSTRACT:

With the rigorous development of information technology, geographic information, as fundamental spatial information, has been in wide use in different domains as social industrial departments, government institution and etc, which assists the sustainable development of the whole society and national economy. However, the inherent malpractices of traditional GIS, such as unable to share data or sources, have impeded further applications of GIS in society and economy. At the same time, the appearance of Internet/Intranet, Communication, Open Technique breaks a new path for the above problems. Therefore, Internet GIS comes into being and shortly after becomes the central domain in GIS. Accordingly, With the development of Java technology, Internet GIS based on Java GeoSurf is experienced with the following three stages: Internet GIS based on Java Applet, Internet GIS based on JavaBeans, Internet GIS based on J2EE.

In order to meet the need of GIS, Business Support System (BBS) and Location Based Mobile Service(LBMS), GeoSurf is in the stage of Web GIS to GIS Web Service. The architecture of GIS Web service is presented based on SOAP & J2EE, the solution of migration from Web GIS to GIS Web Service is introduced and some experiments on WMS and WFS based on J2EE and spatial database are studied. It is a feasible way to provide GIS web service constructed by the combination SOAP and J2EE with spatial database. At the same time, The construction of Chinese cyber cartographic GIS node based on GeoSurf4.0 and portal is presented in this paper.

Keywords: Web GIS, GIS Web Services, Simple Object Access Protocol (SOAP), Java 2 Enterprise Edition (J2EE), GIS Web Service Register, Portal, Antarctica.

The Fundamental Frame and Key Technology of Chinese Polar Scientific Expedition Management Information System Based on Web GIS

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Abstract: Combining the web GIS and MIS (Management Information System), the Chinese polar scientific expedition management will acquire higher efficiency, come into being standardization and information mode step by step. This paper introduces the fundamental frame and sub-systems of the Chinese polar scientific expedition management information system based on web GIS, discourse on the software and hardware structure of the system, data share, backup, and recovery by XML schema, and discusses the problems to push it into polar scientific e-government system.

Keywords: Polar, Expedition, Web, GIS, MIS, E-Government

An on-line map viewer interface to the King George Island GIS data base

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Abstract:

The SCAR King George Island GIS project provides a spatial data base for King George Island, South Shetland Islands, Antarctica. Geographic data sets have been collected and integrated from a variety of institutions and disciplines over the past years. Framework data is provided at medium scale for the entire island and at large scales for selected ice-free areas. Application domains for KGIS data range from ice-sheet modeling to monitoring human impacts. The data base implements the draft SCAR Feature Catalogue. Data sets are provided on the internet as downloadable GIS data. A map viewer interface has been established that allows to create customized maps in a web browser without the need for dedicated GIS software or browser plug-ins. Metadata describing data quality can readily be retrieved through the map viewer interface. The map server also provides a WMS interface enabling on-the-fly integration of KGIS data into WMS compatible clients.

Study on Fragile Ecological Environment in Fildes Peninsula, King George Island Based on GIS

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Adopting optimum control and scientific management of eco-environment in Antarctica is very important to protecting eco-environment against disruption, especially in Fildes Peninsula of King George Island. The study based on RS and GIS technology, establishes the index system of fragile eco- environment in Antarctica, evaluation model of fragile eco- environment in Antarctica This paper puts forward a quantitative study method based on GIS technology and an evaluation result.

Geographical Information System for Arctowski Station.

Samples of spatial analysis.

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Abstract

Geographical Information System for the Site of Scientific Interest (SSSI No. 8) located close to Arctowski Station is described in this paper. Various researches coordinated by the Department of Antarctic Biology of the Polish Academy of Sciences have been conducted there since the Arctowski Station was founded in 1977. GIS allows integrate and archive the results of researches. GIS analysis are the best way for preparing spatial data. The base of this GIS project is the multi-layers structure of geo-referenced objects connected with the relational database. The main thematic layers are: digital elevation model, range of glaciers, hydrography, location of characteristic objects and animals colonies or rookeries. Geomorphologic changes, distribution of the vegetation and colonies which took place during last 20 years are documented.

The system has been designed for ArcView – the most popular desktop of GIS. Vector type of data are stored in Shp (ESRI) format, raster data in GeoTiff and database in DBF. These formats guarantee easy export/import with different GIS applications.

Samples of spatial analysis presented in this paper show GIS capabilities for conducting different researches.

The web pages www.geostat.iung.pulawy.pl/arctowski.htm has been created with Arctowski GIS data for free data exchange. Some of them are still under construction and will be completed.

GIS Interoperability Method Based on Web Service Technology

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Abstract:

With the development of Internet, GIS application not restrict to a single unit and organizations, different applications in different organizations or enterprises need to be accessed by each other though Internet. Traditional GIS interoperability methods include direct geospatial data access method and common Interface access method. The first method asks GIS software has the ability to read all kinds of GIS data format directly, but it is not practical for many of the GIS data formats are private. The second method includes COM or CORBA API Interfaces and SQL access Interface. Distribute Object technique such as DCOM, CORBA and EJB, they all use their private transport protocols to invoke remote object, and the protocols can not understands each others, so these techniques can not fulfill the GIS interoperability in the heterogeneous Internet environment. The emergence of Web Service technique provide cross-platform capability to integrate different kinds of applications, it provide an effective means to implement GIS interoperability.

OpenGIS Web Services (OWS) are individual components of dynamic geospatial computing applications; The OpenGIS Services Framework provides the common set of interfaces that spans these functional parts of the enterprise and provides enterprise-wide interoperability. This paper mainly discusses the detail of three most useful OGC web service: WMS, WFS, WCS and the Implement method of these OGC web services using web service technique. The method include following three steps:
  1. Create GIS application implement OGC web service Interface;
  2. Deploy the application, and enable it to provide service; and
  3. Publish the OGC web service to registration center for service user to search.

We will discuss the technique detail of the three steps in the paper.

OGC WMS is mature and there are lots of applications in the world. But WFS is not so mature and still some problem to be worth to research. In this paper we will discuss the GML application schema define manner and GML compression method, they all can promote the capability of WFS service.

With the development of GIS web service, more and more GIS web service available in the Internet. Users can choice different service to implement their special demand. We will discuss how to composite GIS web service workflow and give out the system design model.

The Handling and Organization of Spatial Data in Chinese Polar Scientific Expedition Management Information System (CPSEMIS)

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Abstract: All activities have been based on spatial positions .It is an important base of Chinese Polar Scientific Expedition Management Information System (CPSEMIS) that how to organize, classify and deal with the polar spatial data. The paper introduced the principle and ways of classification and organization of the polar spatial database according to the demand of CPSEMIS for spatial data and the classified and coded standard of Chinese relief map. All polar spatial data has been divided into three classes: point, line and area. The different Data structure has been created according to attribute of different geographic elements. At the same time, a feasible technical route has been showed that is one route transformed from the format of .cdr to .dxf to coverage to .shp into .map of Geosurf and based on the GIS software, such as CorelDraw, ArcGIS, GeoStar, and so on.

Keys: Chinese Polar Scientific Expedition Management Information System (CPSEMIS) spatial data, data structure, CorelDraw, AcrGis, GeoStar

On-line Antarctic GIS Service: A New Zealand Antarctic GISfor the Ross Sea Region

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The Antarctic GIS developed and hosted by Gateway Antarctica, University of Canterbury is an internet-based tool for managing, accessing and querying Antarctic data in a geographically referenced framework. It also has the capacity to collect data via the web (a feature that may be added in the future). It is an easy to use system that can support logistics, science, and education.

A common platform with multiple uses, including:
- State of the Environment reporting
- Preparation of Environmental Impact Assessments
- Preparation of applications for logistics or funding support
- Querying of multidisciplinary science sources
- Access to Antarctic data, including bibliographic references, aerial photos, map references, protected area data and more.

The system is flexible, so that data can be easily collected, added and analyzed. A distributed data network can be created by linking to and hosting data in collaboration with other organisations so as to maximise efficiency and ease of use.

The system is hosted by Gateway Antarctica via the www and requires no special software on the users' machine. The computer server at Gateway Antarctica does all the work and will respond to the users' queries.   The GIS was developed in consultation with *"The Ross Sea Region GPS, GIS and Mapping Group"*.

The system is running as a free service and currently includes the following data layers:
- Antarctica New Zealand Layers
  - Bibliographic Database 2003
  - Environmental Database
- Gateway Antarctica Layers
  - Aerial photograph locations and flight lines
    - Both hyperlinked to flightline information and images
  - ASPA Map Locations
    - Polygons of map extents linked to images
- Gazetteer Layers
  - Antarctic Place Names
- ADD Layers
  - Contours 200m   Lakes
  - Icefree Areas   Ross Sea Map Sheets
  - Outline of Antarctica

The New Zealand Antarctic GIS for the Ross Sea Region can be accessed from: http://www.anta.canterbury.ac.nz/ under "Aerial Photos and Online Mapping".

ISSUANCE POLAR GEOGRAPHY INFORMATION USING GEOSURF ON INTERNET

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ABSTRACT
The solution of issuancing polar geography information using Geosurf is presented in this paper, logic construction of the system and its function are also introduced briefly.

It is a distributed Browser/Server system, it has three servers, the application server, the map server and the science data server, they are separately disposed in Beijing, Wuhan and Shanghai. The system not only has some functions of common GIS system, such as zoom in, zoom out, etc. but also, it has some particular functions to help polar undertaking - such as route query and analysis, station query and member query, etc. these particular functions help decision-maker make good decision and help polar member work well. This system runs on the internet - the contradiction between the huge special data and the transmittability of network should be taken into account, so the data organization is emphasized in this paper.

Firstly, manage Vector data by two ways. Vector data is main portion of the system, part of it are stored by file, which includes water system maps, island maps, contour maps and elevation data, geodesy control points and others are stored by RDBMS, such as station data, route data, member data, etc. which provides the convenient method to refresh and modify.

Secondly, dynamic load Vector data, initialization main map layers to start the system, load corresponding map layers by the users' requirement. By this way, reduce initialization time to avoid the users' waiting too long time.

Thirdly, cut down the data before send the data to client. In conclusion, all of these means are viable and effective.

KEY WORDS   WebGIS; polar; station; route; research on the spot; specific observation

The Elementary Research on Construct Digital Antarctic Great Wall station with Close-range Photogrammetry and GPS Method

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Abstract: With the high accuracy coordinates got by GPS and the large scope area spatial data got by close-range photogrammetry, using 3D model software, we can reconstruct the Antarctic Great Wall Station, which is useful at training new Antarctica expedition team members and to other subjects' scientific research. This paper describes the method to acquire spatial data and introduces the flow to rebuild the digital Antarctic Great Wall Station using CCGIS, at the end, discusses the further application problems.

Keywords: Photogrammetry, GPS, Digital Antarctica, Great Wall Station

Technologies and methods study of DEM generation in Antarctic inland ice sheet

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Abstract: Digital Elevation Model (DEM) provides us three-dimensional information directly; meanwhile, it is an important platform for other related research. The methods for DEM generation can be simply classified as field surveying and remote sensing. And the later has obvious advantages for Antarctic inland area, where the weather is atrocious and even some places are inaccessible. With the satellite data -- Synthetic Aperture Radar image data and Advanced Spaceborne Thermal Emission and Reflection Radiometer image data, InSAR-DEM and ASTER-DEM of Grove Mountains are obtained. To compare with the field surveying data and to assess the precision, five to six profiles are set through the DEMs respectively. Ignoring the obvious error, the average standard deviation for InSAR-DEM and ASTER-DEM profiles are 15.5m and 26.0m respectively. Further study should be taken on the key and difficult data processing steps, and GCPs should be adopted to get better precision. Basing on the results and experience of the experimental area, SAR image and ASTER stereo image can be used to generate DEM for larger area of Grove Mountains and other areas in Antarctica.

Preliminary Results about the Dynamic Characteristics of Amery Ice Shelf from Precise Point Positioning Solution

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Abstract

The main activities of joint Amery Ice Shelf expedition between China and Australia are introduced. Five days continuous GPS observation data collected on one site of Amery ice shelf was post-processed with precise point position (PPP) technology based on precise ephemeris of IGS. Dynamic characteristic of the surface ice of Amery can be derived from PPP solution. Preliminary derived velocity of the site is 2.25 meters per day, the motion direction is in northeast. Semidiurnal oceanic tide and diurnal oceanic tide signal of that site can be achieved from the height variation series of PPP solution. The above solution can be used to the consequent mass balance calculation.