

Databases and Internet services for the Environmental Sciences projects : overview and local solutions

メタデータ	言語: English 出版者: 公開日: 2017-10-05 キーワード (Ja): キーワード (En): 作成者: メールアドレス: 所属:
URL	http://hdl.handle.net/2297/6508

Databases and Internet services for the Environmental Sciences projects: overview and local solutions.

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A huge amount of environmental information of different origin (texts, results of analyses, maps, tables, diagrams, etc.) accumulated in the world during last decades is gradually adding to the databases. Complexity of these inputs is the major problem of the database construction and of subsequent processing of the data. Database should provide us convenient access to the data and options for its display, reorganization, recalculations, and outputs. Modern computer technologies offer various solutions for this, and their selection depends on many reasons. Among them, the following rules have high priority for consideration: (i) goal of the database construction, (ii) structure and bulk of the data, and (iii) services desired by the data providers and users. Internet now is a very convenient media of the data accessibility and services, and its capacities and requirements are also accounting in the databases and services construction.

Databases and Internet service are demanded now in local studies and small projects of different research fields. NRCGIT provides such facilities for laboratories and research teams of UIGGM. A variety of applications is completed and developed now, and their structure indeed strongly depends on the requirements mentioned above. In this presentation, we describe peculiarities in the solutions, which have been chosen in different geological applications.

Volcanology water geochemistry database. Results of geochemical investigations of active volcanoes in Kuriles and Kamchatka are stored in this database. The database has relational structure and supports easy operation with the data including statistics, correlation analysis, and modeling in order to make clear genesis of the thermal water. Several interface forms provide the following functionality: the records insertion and revision; database query; export of the selected data to other applications, e.g. "Statistics" and "SelectorWin" thermodynamic modeling software (Karpov, 2001). Export formats are extendable and this data can be easily transferred to other programs for the analysis, modeling and forecast of the chemical elements behavior.

Information system on radioactive nuclides and heavy metals. This system integrates a huge amount of measurements of these elements in the soil profiles and living plants in the Altai region (both mountain and piedmont plain parts), where more than 3000 samples were collected with annual periodicity during the last decade. This information system is aimed to help researchers to open regularities in the spatial distribution of the radioactive nuclides and heavy metals make clear their origin and ways of transportation, and to conclude on their impact on the human health.

The core chemical analysis data base has a few thousands records. It has query interface and some macrocommands providing the following functions:

- Addition and review the data by friendly to user interface forms;

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- Search under the given parameters (geographic coordinates; chemical component measurement values, sampling time etc.);
- Calculation of average values of radioactive nuclides and heavy metals for soil profile and for separate soil level;
- Calculation (prediction) of Cs137 content in the measured sites for any time interval;
- Database has connection to the ArcGIS software for its cartographic visualization and spatial analysis. Except the research capacities, this system will have the Internet service extension, developing now.

Reference information system “Sangilen”. Sangilen plateau (South Tuva) is the unique geological polygon for correlation tectonic, magmatic and metamorphic processes in collision-accretion belts. It has importance for the understanding the Earth crust formation and allows to verify some basic geological concepts. This region was studied in details during the last decades, and a bulk of petrographic, geochemical and isotopic data is accumulated now. The systematization is required to this data; that’s why the “Sangilen” project was started at November 2004. Its database mainly contains references to the thematic data and scientific publications and serves for research and education purposes. For students, it includes self-examination questionnaire, tests, and glossary of geological terms. Now this information system operates as local installation, but we have planned to make the Internet version in the near future.

Metadatabase “CLIMAN” (<http://www.giscenter.ru/anna/climan/html/info.htm>). This metadatabase supports the international multidisciplinary project “Holocene climatic variability and evolution of human settlement in the Aral Sea Basin (CLIMAN)”, 2002-2005 funded by INTAS. Aral is the great brackish-water lake, 4th in the world before 1960th, catastrophically drying during last decades. Different thematic studies were made in the framework of this project: archaeological and geomorphologic investigations, seismic survey, drilling of lake sediments, reconstructions of the climatic and lake level changes. In addition, a fair amount of spatial data (satellite images and maps) was collected for the project purposes. The metadatabase is aimed to disseminate the information about the available paleoenvironmental and archaeological data for the Aral basin. Therefore it was designed as the Internet service from its first steps. The metadata standard ISO 19115 was used for this service. We did not develop special scripts, but borrowed ones already used in some Internet metadatabase projects, like “Gas hydrates” (<http://www.giscenter.ru/gas/>) and “Altai-ecoregion” (<http://www.giscenter.ru/altai>). However, some interface changes and functionality shrinkages were made in order to fit this application to the project purpose. Metadatabase «CLIMAN» has three types of search queries:

- Simple search (by keyword);
- Thematic search (combination of search by keyword and by thematic sections of the metadatabase);
- Geographic search (by map query using Java-applet jMapper).

JMapper is Java-applet designed in NRCGIT for remote visualization the map and attributive data stored in ArcView format. JMapper also provides hyperlinks to the supplementary data via http-connection. JMapper is running from the server, but operates in the client-machines. However, attributive search in the server databases is also available by the script extensions. Currently, the “CLIMAN” metadatabase incorporates only spatial data, but we believe that after finishing the analytical work more thematic data will be added there.