The concept of creation of information system for environmental monitoring based on modern GIS-technologies and earth remote sensing data

To cite this article: Yu P Yuronen et al 2015 IOP Conf. Ser.: Mater. Sci. Eng. 94 012023

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THE CONCEPT OF CREATION OF INFORMATION SYSTEM FOR ENVIRONMENTAL MONITORING BASED ON MODERN GIS-TECHNOLOGIES AND EARTH REMOTE SENSING DATA

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Abstract. In this article the creation concept of the center of expeditious supervision and reaction for the solution of problems of environmental monitoring and support of adoption of administrative decisions is considered. The authors prove need of creation of the similar center in the territory of Krasnoyarsk region as the object consolidating existing and planned systems of land supervision and system of remote sensing.

Keywords: GIS-technologies, Earth remote sensing, regional information system.

Now in the territory of Krasnoyarsk region there is no integrated formalized system of expeditious environmental monitoring of natural and anthropogenic complexes. There are only separated for various reasons (lack of interdepartmental interaction, inconsistence or ignorance of opportunities of the existing centers) systems of conditionally expeditious monitoring of an environment's state in some parameters, such as air and water pollution, a radiation situation, a condition of a forest cover, etc. Thus there is a necessity of consolidation of the existing centers of reception, storage and data processing, both the Earth remote sensing, and these land supervision, for creation of united available system of environmental monitoring of the territory capable in real time quickly to reflect the existing situation on all square of supervision.

This problem can be solved by creation of the integrated center of collecting, storage and information processing from sources of land supervision (contamination control stations) and materials of Earth remote sensing which allow extrapolate and compare data of land supervision with space spectrozonal pictures. In the subsequent, with introduction of these data in the geographic information systems (GIS) supporting modern cartographical informational and WEB technologies, there is an opportunity to make a natural environment...
status evaluation in the territory of Krasnoyarsk region in real time [2]. Eventually it allows to react quickly to arising negative impacts and to develop optimum administrative and managerial decisions at various levels of executive power of the region [1].

The ideology of creation of system of environmental monitoring on the basis of a small, separate and uneven network of land stations and materials of space shootings allows trace and control an ecological situation. The advantage of this ideology is that there is an opportunity to trace and control an ecological situation in the territory with a big area as small local sites with big environmental risks, and ecology of a region “an masse”. Thus, it is possible to say about scalability of this system what to allow essentially reduce the costs of creation of a uniform network of stations of the land supervision which number if necessary can be increased.

Supervision over sources and factors of impact on a natural or anthropogenous complex

Assessment of an actual state of environment of levels of anthropogenous influence and possibility of an environmental risk

Forecasting and assessment of influence of factors of natural and anthropogenous impact on environment components

Information support with support of adoption of administrative decisions in the field of environmental protection and ecological safety

**Figure 1.** Scheme of creation of system of environmental monitoring.

In general the space pictures of Earth possess the following properties doing them by unique at expeditious environmental monitoring of territories:

- single multi-scale supervision of all territory;
- high degree of efficiency of obtaining information
- existence of continuous archives of space shooting;
- objectivity and reliability of received information;
- possibility of verification according to land supervision with the subsequent extrapolation on big squares;
• the automated generation of information products for the end user;
• various level of generalization and spectral characteristics;
• distributed access to databases.

These properties make space pictures by the irreplaceable tool at different solution of problems of an assessment of an ecological condition of all region or its local areas on which the risk of change of an ecological state is great.

The generalized function creation chart of such system can look as follows (fig. 1).

Having assumed as a basis the general scheme of creation of system of environmental monitoring on the basis of data of Earth remote sensing it is necessary to carry out the analysis of an existing state in this area in the territory of the region and to estimate needs for expeditious environmental monitoring. Further it is necessary to reveal a demanded data set and to develop the technological model of system allowing in an operational mode to carry out a complex assessment of an ecological condition of the region with the subsequent forecasting.

As a result of this work the following generalized scheme (fig. 2) which reflects as existing segments of planned system (the blocks allocated with green color), and those elements of system which demand creation or completion (the blocks allocated with blue color) will be received.

In general, the successful functioning of system first of all requires existence of data of Earth remote sensing. It is necessary to carry out retrofitting of existing stations of reception of satellite information to provide possibility of reception of data from satellites, both Russian, and foreign space segments (on the scheme are italicized the name of the satellites which are minimum demanded for functioning of system which aren't accepted now by any of the existing centers of reception of space information in the territory of Krasnoyarsk region).

The following step for the solution of a problem of creation of uniform system of environmental monitoring of edge is coordinating of activities of the existing centers of space monitoring of the Siberian federal university, the Siberian state aerospace university and the Ministry of Emergency Situations. It will allow to organize reserve systems of reception of space information and to relieve the centers of space monitoring of transmitted data duplication, and also to organize the coordinated uniform system of reception of given Earth remote sensing from numerous space group of satellites as being in operation, and only planned to a conclusion to an orbit.
Figure 2. The generalized scheme of system of environmental monitoring.
Besides, productivity of functioning of the center of ecological monitoring and the organizations consumers of space information will depend in many respects on existence in the region of the specialized training center, capable to realize programs, both higher education, and short-term advanced training courses for specialists of various branch enterprises and executive authorities.

The center of environmental monitoring of the region with functions of coordinating, collecting, storage, data processing of space shooting and results of land supervision over a state of environment will be result of association of all these components. All obtained as a result of work of this center data can be informed to the consumer of information (both state, and private structures) by means of modern GIS in an operational mode.

Now it is necessary to consider in more detail structure of the center of monitoring of an ecological condition of Krasnoyarsk region (fig. 3). Apparently from this scheme the center can have branched system of the divisions having various functions and united by the general GIS and information system of collecting storage and processing of various data. [3]

All this allows system to function as a unit and to aggregate all production cycles in one program environment that minimizes temporary delays at the organization of operational system of monitoring of an ecological condition of the territory and to accelerate process of development of the administrative and managerial decision. In addition in system the system of public informing of the population and feedback for rapid response to public statements can be realized.

In summary it is possible to tell there is an urgent need in the organization of such system in the territory of the considered region. It is dictated both a geographical arrangement, and the area on which it is required to conduct expeditious monitoring. Besides, active social and economic development of the region and, as a result, probability of emergence of the environmental risks connected with development of industrial infrastructure, active mining and carrying out exploration in all territory of Krasnoyarsk region is of great importance. Also offered scheme in the basis assumes high extent of adaptation to arising tasks not only ecological character, it can include the regional monitoring systems founded on results of land supervision. Considering that fact that all system initially has to use modern GIS-technologies, there is a possibility of realization on this platform of information and analytical system for support of adoption of administratively administrative decisions at the level of the region.
Center of monitoring of an ecological condition of Krasnoyarsk region

Coordination center of expeditious reception of space information and information of land posts of supervision

System of access to operational and archival data of space shooting

Preliminary processing of space-shooting data

Data processing of land supervision

Department of technical support and system administration

Thematic processing of Earth remote sensing data

Assessment of an ecological situation of a natural complex (forest, water, mineral, resources and conditions of the atmosphere)

Anthropogenous loading (influence of city agglomerations, monitoring of the industrial enterprises, large technogenic objects, etc.)

Geographic information systems

Assessment of environmental risks and damage

Interpretation of Earth remote sensing data and land supervision

WEB cartography

Work with the customer

Figure 3. The integrated structure of the center of monitoring of an ecological condition of Krasnoyarsk region on carried-out functions of divisions.

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