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NEW GIS-TECHNOLOGIES FOR ENVIRONMENTAL MONITORING AND NATURE-USE PROBLEMS

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In the report we discuss the main issues of information and analytical supporting of environmental monitoring tasks, such as:

- storage, systematization and operative analysis of the vast volumes of monitoring data,
- geological and ecological researching (such as forecast of mineral deposits, estimation of ecological state of a mining region, etc.),
- decisions acceptance for situational management.

We would like to present our techniques and home-brewed software packages providing technological solution of these problems. The approach is based on integrated analysis of data about geological or ecological situation/object/process from different sensing levels of the Earth. Presented technologies obtain all steps of data processing and presentation: from data acquisition, georeferencing, data integrity and quality assurance, through multi-level analysis to pre-print of hard-copies of published maps or decision-making support systems for mineral exploitation and environmental protection management – and combine all tools of information technologies: Relational Database Management System (RDBMS), Internet-based distributed computing framework, analytical procedures including mathematical and heuristic algorithms and, of course, Geographical Information Systems (GIS).

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SEISMOGENIC POTENTIAL AND EARTHQUAKE HAZARD ASSESSMENT IN IRAN: A GIS-BASED APPROACH

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Iran is among the most seismically countries of the world. Seismicity of this region is controlled by many active faults with completely different mechanisms. During the past decades, this region has experienced many large and destructive earthquakes that resulted in extensive damage and loss of life. In this research, seismogenic potential and earthquake hazard of Iran were assessed using a GIS-based spatial analysis of the seismicity and active faulting data. For this purpose, the seismic data of the Iranian region, covering a time period of nearly 115 years (1900-2015), extracted from different catalogs and also the data concerning with active faulting of the region also was extracted from map presented by Hessami et al. (2003). In order to obtain a temporarily homogeneous catalog, the seismic data were filtered and categorized into three periods: data with low accuracies and precisions (M>4.5, 1900-1955); moderately accurate and precise data (M>4.0, 1956-2005); well located precise data (M>3.0, 2006-2015). Then, density maps showing the spatial variation of seismicity and active faulting of the Iranian region were prepared based on the analysis of these data. Finally, by overlying and combining seismicity and active faulting data layers, main potentially seismogenic zones of the region, with three levels of low, moderately, and high potentials, were identified. The good consistency observed between the obtained results here in this research and the results of the previous works indicates that GIS-based spatial analysis techniques can be reliably used for seismic hazard assessment and identifying seismically hazardous zones in tectonically active regions.

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ADVANCED INTERNATIONAL STUDIES IN THE CIRCUMPOLAR ARCTIC

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Study of the Arctic geology held in recent years is of utmost importance for the assessment of its oil, gas, and mineral potential, for improving the environmental safety, and securing the geopolitical interests of the Russian Federation during delimitation of the outer limits of the continental shelf.

This work has been carried out since 2003 at the international level under the joint project "Atlas of Geological Maps of the Circumpolar Arctic", which is implemented by geological surveys of the Arctic states: Russia, Norway, Denmark, Canada, and the USA with the participation of national universities and academies of sciences with the active support from the UNESCO Commission for the Geological Map of the World. Currently, the Atlas includes maps of potential fields, geological and tectonic maps; the map of mineral resources and the Quaternary deposits map are being compiled. We consider the creation of climatic maps, geohazard maps and others using modern GIS technology.

Compilation of the tectonic map, under the responsibility of Russia, has showed that the submerged Amerasian part of the Arctic is a continental "bridge" formed by thinned and stretched continental crust connecting Laurentia and Eurasia. Morphological, geological, and tectonic criteria such as rift stretching of the continental margin, the nature of accompanying magmatism, continental type of crust and close structural links with the shallow shelf in geomorphology, sedimentary cover, consolidated crust, and Moho enabled us to consider the structural complex of the Central Arctic Submarine Elevations as natural components of the continental margin. These materials form the basis of Russia’s Submission for an extended continental shelf filed in spring 2016 to the CLCS.