Space-born monitoring and modeling of environmental impact of the Caspian shelf oil extracting

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Oil and gas deposits of the Kazakhstan part of the Caspian Sea are the key issue for Kazakhstan economy. The main problem in this case is to control development and operation of these deposits and the potential environmental impact. A monitoring system should serve as an informational basis for this task.

In this report the results of designing and trial operation of a system for oil extracting space-born environmental monitoring in the Kazakhstan part of the Caspian shelf are presented.

The structure of the system consists of three large units:

1. The center for acquisition and preprocessing of remote sensing data from satellites Terra/MODIS Aqua/MODIS (USA, MODIS scanner), IRS (India, PAN and LISS III sensors), RADARSAT (Canada, radiolocation) and Meteor 3M (Russia, MSU-E scanner). The center is located in Atyrau city.
2. The subsystem «Performer», where the thematic processing of space images in conjunction with the results of ground measurements and numerical modeling is performed. As the result the subsystem produces the diagnosis and forecast of industrial pollutions of environment. The results are collected into the corresponding base. The unit is located in Almaty city.
3. The subsystem «Customer», where the results base with corresponding software for visualization and data analysis is mirrored. Besides this subsystem forms the Request in case of emergency on objects of monitoring. The unit is located in Astana city where the country administration is located.

The main unit of the system is “Performer” where the procedures of reports on space-born monitoring data and environmentally important territorial processes are equipped. The unit includes geoinformational models for a diagnosis and forecast of following processes:

- Pollutants transport and dispersion in the atmosphere (certified model OND-86 and numerical model IAP Model –Industrial Air Pollution Model);
- Sea diffusion of oil patches (MIKE 21 model with modules AD and SA);
- Run-down and run-up effects (MIKE 21 model with modules PP and HD);
- Caspian ice situation with the assessment of ice load on marine constructions.

Ice shift processes and wind tides play an important role in forming of Caspian environmental situation. Ice fields movement resulted in destruction of some oil wells which leads to sea pollutions by huge amounts of oil. Floods

lead to destruction of protecting dams which block the oil producing wastes. The result is a great drop in marine biodiversity and extinction of precious fish and seals.

It is significant that the system is designed as a multifunctional system of an open type with developed possibilities for modification and flexible setting.