

Analysis of the efficiency of Earth remote sensing means

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The aim of this paper is to analyze the efficiency of use of Earth remote sensing (ERS) means in the light of the trends in their development in the past ten years. The paper analyzes the efficiency of use of ERS means in the interests of socioeconomic development (in cartography, meteorology, climatology, oceanology, hydrology, agriculture, forestry, in local and regional management tasks, and in emergencies), the efficiency of the Indian ERS segment (as an example of one of the leading ERS countries), the basic trends in the development of ERS systems that increase their efficiency (open access to ERS data, private and public-private partnership, information delivery promptness, onboard ERS data processing, and ERS-based analysis), and a comparison of the ERS data market fraction of drones with that of satellites.

As a result, the following global ERS trends that increase the efficiency of ERS data use are identified:

- gradual reorientation from purely obtaining ERS data to making an analysis based thereon;
- intensive development of methods of geospatial monitoring, business analysis, machine learning, neural networks, cloud architecture, and automatic processing of large ERS data arrays;
- despite the ample scope for ERS data use and the reduction of space imagery prices, this information, as estimated by some analysts, is used in the solution of socioeconomic problems only to quite a small extent because less than one per cent of the ERS satellite data can ever find their users;
- in India, China, the Russian Federation, and Ukraine, ERS is funded from the state budget, which is no longer the case in most of the developed countries, where public-private and commercial ERS structures are dominant;
- in the countries where ERS is mostly funded from the state budget, the approach to the distribution of ERS products on the home market with the aim to compensate for the capital costs of ERS satellite development inevitably produces negative results;
- the formation of national ERS data markets is in progress; the features of these markets are open access to ERS data, private and public-private partnership, information delivery promptitude due to the use of web servers and cloud computing, ERS-based analysis, and onboard ERS data processing in the near future;
- in the long term, the future of ERS will depend on breakthrough technologies, innovative solutions, new applications, and the integration of technologies such as VR (virtual reality), AR (added reality), AI (artificial intelligence), MI (machine learning), Big Data, Cloud Computing, and IoT (Internet of things), which will be of crucial importance in the ERS segment.

In the paper, the system analysis method is used.

The practical significance of the paper lies in the possibility of using the global ERS advancement trends in the development and operation of national ERS spacecraft.

Keywords: *drone, virtual reality, Earth remote sensing, ERS data efficiency, spacecraft, users' demands, spatial resolution, cloud computing.*

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