Operational Satellite Monitoring Using the Russian and Foreign Spacecraft Data Acquired at NTs OMZ for Assessment of Environmental and Land Use Conditions

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Abstract – NTsOMZ role within the Environmental Monitoring Infrastructure in Russia is shown. It is receiving, processing, archiving and distributing of Russian and foreign satellite data. In addition to data products of standard processing levels, consumers may be provided with data products underwent value-added processing as an option. NTs OMZ has gained the experience in monitoring based on satellite data processing methods and technologies of its own that enables an integrated space monitoring and the assessment of various environmental objects conditions and emergency evolution. Environmental and agricultural monitoring based on integrated satellite data use is illustrated by the several examples.

Keywords: space, monitoring, environmental, remote, sensing, data, agricultural, land use

Within the Russian infrastructure of space monitoring realized under the "State Environmental Monitoring" and "Federal Space Program" governmental programs, Research Center for Earth Operative Monitoring (NTs OMZ) as a parent organization of Federal Space Agency, responsible for remote sensing data acquisition, processing, archiving, and dissemination is one of the major links of the information system that provides a wide range of consumers with operational and archived remotely sensed data in the form easy for further analysis, thematic decoding, interpretation, and decision-making.

The NTs OMZ computer-based system for remote sensing data acquisition and processing provides the following functions:

- Acquisition of data from the Russian and foreign spacecraft (METEOR-3M №1, SICH-1M, NOAA, TERRA, ERS-2);
- Data acquisition on requests of consumers from Russia and foreign countries in direct readout and data storage modes;
- Operational data preprocessing, cataloging, and archiving;
- Operational e-catalog completion and the NTs OMZ site update;
- Consumer application acceptance and provision of an operational data of standard processing levels in remote access mode;
- Provision of consumers with the results of high-level processing of remotely sensed data including thematic
- decoding and interpretation;
- Integration of value-added processed data with reference data and GIS layers, provision of consumers with end products in the form of thematic maps.

A successful environmental space monitoring requires an integrated use of data from multiple space systems differing in imaging bands, spatial resolution, imagery frequency, terrain coverage, and other features. The Research Center for Earth Operative Monitoring (NTs OMZ) has gained the experience in monitoring based on satellite data processing methods and technologies of its own that enables an integrated space monitoring and the assessment of various environmental objects conditions and emergency evolution. The types of space monitoring are as follows:

- Monitoring of floods and river plain flooding;
- Monitoring of inland water bodies (lakes, reservoirs, inland seas, etc.);
- Monitoring of forest fires;
- Monitoring of forests;
- Monitoring of agricultural land use (crop composition, forest belts and lea discrimination, assessment of areas under crops, crop conditions, yield prediction).

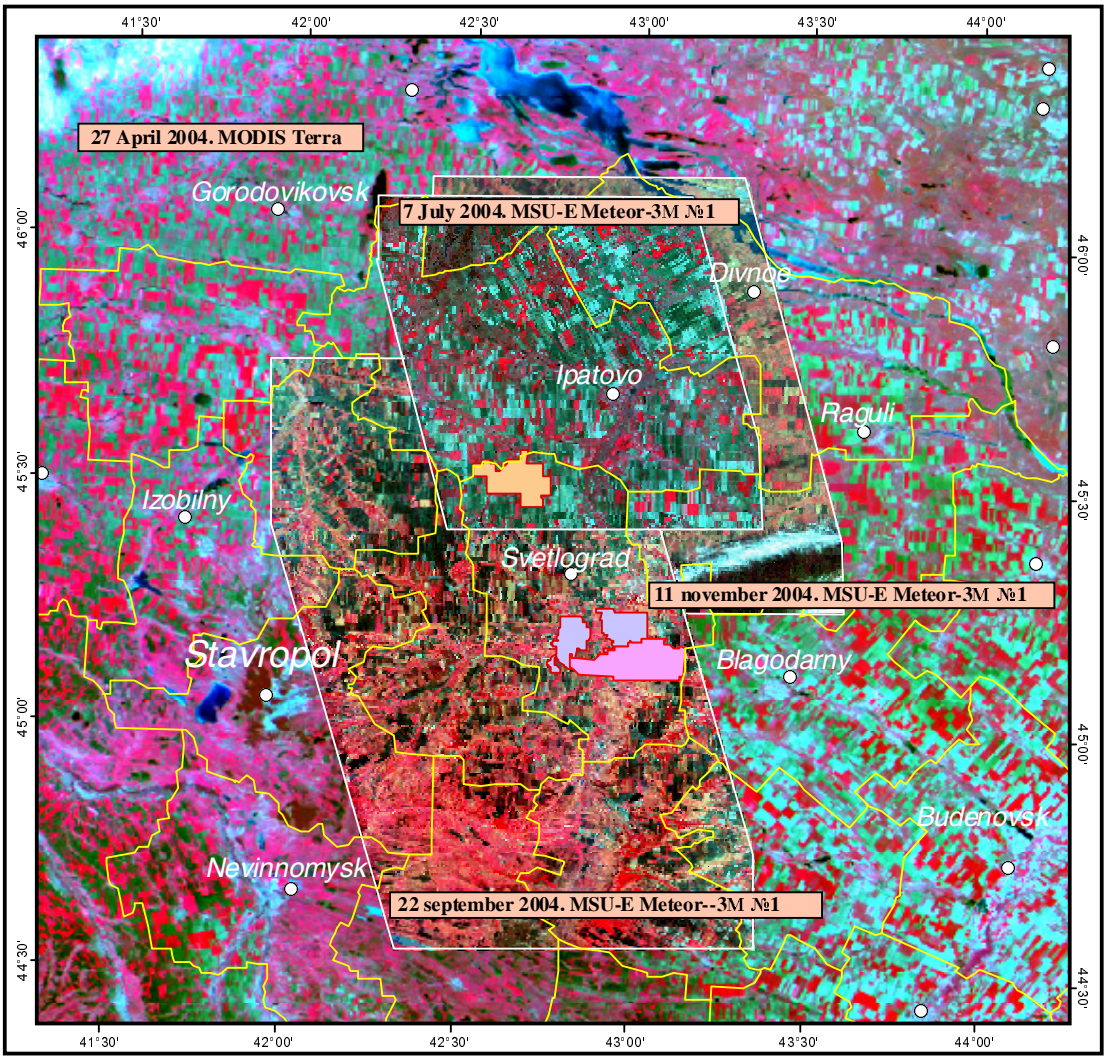
Environmental monitoring based on integrated satellite data use will be illustrated by the following examples: monitoring of the Northern Dvina floods in spring 2003-2004; the dynamics of change in the Aral Sea water surface for 10-years period; monitoring of forest fires in the Southern Siberia in summer 2004; monitoring of the Stavropol Territory agricultural lands in summer 2004.

As an illustration we present the data of agricultural land use monitoring realized in the Stavropol Territory, Russia, to the benefit of the Ministry of Agriculture in 2004 (Fig.1a and 1b).

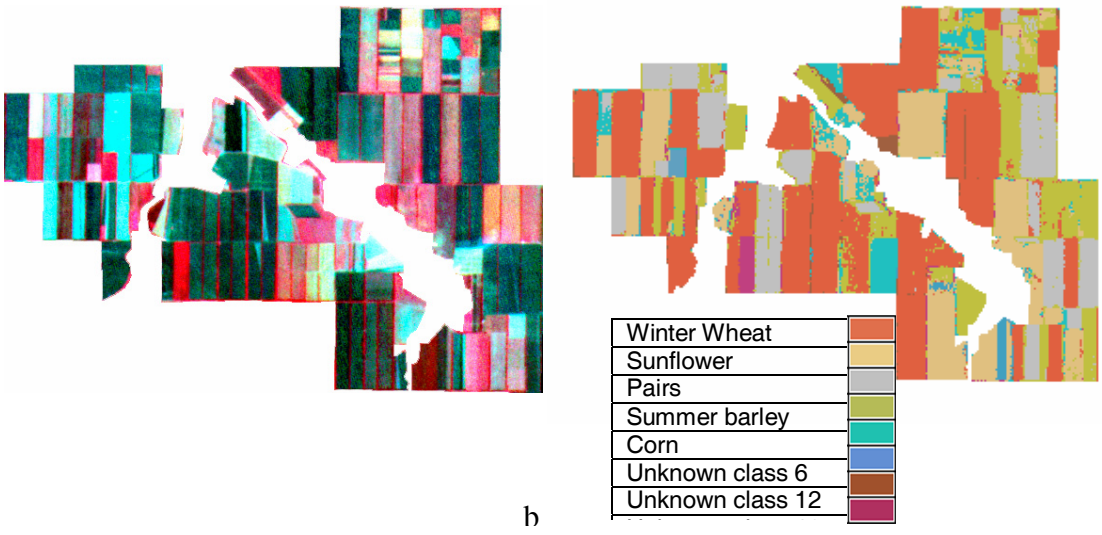
In accordance with the consumer request during the period July-November 2004 the NTs OMZ performed the Stavropol Territory imaging from the Russian METEOR-3M №1 spacecraft using the MSU-E multi-band scanner with the following characteristics: swath width – 76 km, resolution – 32 m, 3 spectral bands. During the imaging 24 MSU-E scenes (76km × 76km) were selected by cloudiness (no more than 10%) to undergo value-added processing. In addition to the MSU-E data there were used data from the MODIS/TERRA multi-spectral optical radiometer (NASA) acquired at NTs OMZ. A wide 2320 km swath provides a daily coverage of the entire Stavropol Territory enabling the assessment of vegetation condition as a whole over the entire Territory even with the MODIS low resolution data (250 m).

Fig.1a shows an example of the MODIS and MSU-E image combined analysis. There were used the following vector layers in the Project: cities, the Stavropol Territory regions boundaries, and the boundaries of the Petrovsky Region farms that have been used as reference in crop identification. A consumer was provided with the UTM-transformed MSU-E and MODIS images, zone 38, and crop classification maps. Fig.1б gives the value-added processed data on one of the farms in the Petrovsky Region of the Stavropol Territory: left – the MSU-E initial image, right –

a crop classification map compiled from the MSU-E processed scene using the Petrovsky Region's reference crop chart.



a



b

Fig. 1

a – complex analysis crop fields in Stavropolsky kray using MSU-E and MODIS data;

b – MSU-E image and crop classification map for agriculture enterprise «Shangalinsky» in Petrovsky district.