INTEGRATING REMOTE SENSING
IN GEOGRAPHICAL RESEARCH

Key words: remote sensing, satellite images, space cartography, geography, Geographical
Informational Systems

Abstract: Remote Sensing, a component of spatial high technologies, has become a very useful
technique of Earth investigation as a planet and geographical environment. It is used together
with traditional techniques and methods and has a lot of advantages. Geography uses on a
large scale, the products of satellite images and spatial cartography, and also quantitative data
regarding geographical elements and processes, which are recorded by orbital sensors. Satellite
information is integrated in all fields of geographical research: the study of geospheres, of
geographical environment components respectively, with special results for physical geography,
human geography and their domains; the study of geographical landscapes (regional
geography); the study of environment; hazards (risks) research and management (the
geography of risks); a new scientifically approach regarding the Earth system (general
geography). So, there is no geographical domain, which does not use remote sensing, because
there is no element, and process, which cannot be seen, recorded, supervised and measured by
Earth Observing satellites. The paper presents the main themes of geographical research
(including Romania) by using spatial information.

Remote sensing, which is part of the newest space technologies, has become a
technique largely involved in the investigation of the Earth as a planet and as geographical
environment. Raw (unprocessed) satellite information, acquired thanks to high quality
sensors located on the circumterrestrial platforms (optical sensors, thermo infrared sensors,
radar and lidar) must undergo different geometrical and radiometrical corrections by means
of IT processing techniques in order to become comprehensible. In this way it is possible to
obtain high resolution digital images, satellite maps on different scales (especially large
scales), Digital Territorial Models and extremely precise data concerning the geographical
elements and processes. These products of satellite remote sensing, presenting numerous
advantages (they are synoptic, universal, homogeneous, objective, digital, repetitive, precise
etc.) are interpreted, usually with the help of information technology. It becomes possible
therefore to interpret exactly and almost in real time the objects and processes, to continually
monitor the geospheres, to understand the interactions between them and the ecosystem
mechanisms with their different levels of organization (local, regional and global). Thus the
denomination of "space geography" given to the geography based on orbital observations
becomes justified.

From a geographical perspective, the main objectives of the remote sensing of our
planet are:
- getting a better knowledge of the elements and processes, both statistically and
dynamically;
- discovering and explaining the interactions within and between the geographical
systems, in their organization as hierarchical systems up to the system Earth;
- identifying, monitoring and explaining the extreme phenomena, perturbations and
anomalies that appear in the functioning of the geospherical and geographical systems;
- discovering the indicators of change in the local and regional systems and at the global level;
- building a new vision concerning our planet (from locality to planet), in order to correctly approach the practical problems related to the habitat, to the use of conditions and resources, to space arrangement, to environment protection etc.

These objectives are subordinated to the acute needs of nowadays’ world: the conservation and improvement of the environment conditions and resources for a durable development of human society, ensuring the prosperity and safety of mankind.

In order to serve these universal objectives as well as possible, at present remote sensing is deeply involved in the World Earth Observing System (the Program Geosphere-Biosphere, the Program The Human Dimension of Global Change, The World Climate Research Program). The most important space programs developed for observing the Earth are: Earth Observing (proposed and administered by NASA, U.S.A.), whose main role is to offer an explanation on the functioning of the Earth as a system, and Global Monitoring for Environment and Security (GMES), a program initiated by the Space European Agency and the European Union.

We must mention that satellite information (Space Information System) has a complementary character in the general framework of Earth observation, being correlated with the information obtained by means of classical methods: in-situ observation, aerial remote sensing (photogrammetry), topographical measurements. Consequently, it is an important layer in the structure of the Geographical Informational Systems.

Satellite information, immense and precise (due to the technology by means of which it is acquired, processed and rendered), referring to any region of the Earth and to the planet as a whole, has large uses in all the sciences of the Earth, in the sciences whose object of study is the environment or the terrestrial space.

We consider that today, worldwide, geography is one of the main beneficiaries of satellite images and space geography. There is no domain or geographical discipline (physical geography, human and economic geography; regional and general geography) that does not make use of the information provided by the Earth observing satellites, processed in specialized institutions and distributed by expert societies, because there are no elements or processes that cannot be detected, supervised, controlled or even measured by the sensors on board the satellites that move on circumterrestrial (quasi-polar and equatorial) orbits.

As a consequence, remote sensing has many applications in:
- the research of the geospheres and of all the components of the geographical environment, with exceptional results in meteorology and climatology, continental hydrology and oceanography, geomorphology, biogeography and pedogeography, the geography of settlements, the geography of agriculture etc.;
- the study of geographical landscapes (regional geography) and of environments (environment geography)
- the research and management of risks and hazards (the geography of risks and hazards)
- the detection and evaluation of the indicators of change in the environment at different levels of the hierarchical system of organization of the Earth and at different scales
- the configuration of a new (comprehensive and objective) scientific vision concerning the Earth system (general geography).
Remote sensing, satellite images and informatic techniques have opened the road for the development of space cartography. Space cartography is automatic and digital. It also includes tri-dimensional cartography. Satellite topographic maps (especially large scale ones) allow the geographers to obtain maps on various themes, which are extremely useful in specialized study. They can and must be correlated with classical topographic maps and with aerial images. Moreover, the creation of Digital Elevation Models (DEM) based on stereoscopy makes it possible to obtain tri-dimensional models (geomorphological, hydrological, oceanographic, urban, geoeconomic models etc.).

Furthermore, satellite information, under the form of the products mentioned above and of the tables containing different indicators, is an indispensable component of the Geographical Informational Systems, which today represent a vital instrument in the studies dedicated to space arrangement projects, to environment protection etc.

In the following paragraphs we are going to indicate the newest orientations and the most important achievements in the Romanian and world geographical research based on the use of satellite information.

1. Researching the geospheres and the components of the geographical environment by means of remote sensing. The applications of remote sensing in physical and human geography

1.1. The atmosphere

The atmosphere is studied, in all its complexity, using optical, thermo, radar and lidar(radar-laser) remote sensing sensors.

The geostationary meteorological satellites (METEOSAT, GOES, GOMS, GMS, INSAT) as well as the heliosynchronous ones (NOAA, METOP, METEOR) and those specialized in the investigation of the high atmosphere have an exceptional contribution in meteorology, climatology and aeronomy, with benefits in various practical domains. These consist in:

- the detection of cloud layers and the realization of cloud analyses, which makes it possible to determine cloud groups and morphological types of clouds and the meteorological processes associated to them;
- the measuring of different meteorological parameters: the air temperature at the surface of the land and of the sea, the temperature of the air at different altitudes, the atmospheric pressure, the moisture in the air, the direction and speed of the wind;
- improvement of the meteorological prognoses for different periods and of the climatic predictions;
- detection and monitoring of meteorological risks (cyclones, tornadoes, turbulences, storms and fog);
- seizing the indicators of climatic change by analyzing the acquired data and by correlating them with the in-situ data (significant modifications in the radiation balance, perturbations in the annual and pluriannual temperature, precipitation and air circulation regime);
- the elaboration of meteorological and climatic models (including simulations of the global climatic change);
- measuring the concentration of the components of the atmosphere, especially of greenhouse gases and of the stratospheric ozone using high quality spectrometers (with
spectral absorption and emission) located on board remote sensing satellites (UARS, ERS, TERRA, ENVISAT);
- meteorological and climatic mapping: realization of synoptic maps, updating of the climatic maps of different countries, of the continents and of the Earth.

The themes mentioned above are the ones most frequently encountered in the programs of the scientific events and in the specialized publications under the aegis of certain organizations of U.N.O. (United Nations Office for Space Affairs, United Nations Environment Program - UNEP), of O.M.M.(L'Organisation Mondiale de Météorologie), of ISPRS (The International Society of Photogrammetry and Remote Sensing), of IGU (The International Geographical Union) as well as of some renown universities and research centers.

1.2. The waters

Remote sensing has a wide range of applications in the research of the Earth’s waters. The disciplines dealing with the continental hydrology and oceanography have gained much of their actual scientific progresses through the investigation by means of remote sensing, satellite information becoming a crucial complement to traditional data sources (in-situ observations, topographic, geological and geographical data).

In the domain of land hydrology, satellite data are used for numerous purposes:
- integrating remote sensing and GIS for the evaluation of underground water resources;
- the study of water reserves and flood prevention;
- monitoring of the hydrological regime and flood control;
- water resource management in the hydrographic basins through the use of high resolution satellite images (IKONOS) and of GIS;
- monitoring of the snow and of the ice;
- the study of the permafrost and of the snow layer (for instance in Switzerland);
- the operative estimation of the surface covered by snow for hydrological modeling;
- the determination of the water quantity coming from the melting of snow by means of radar measurements (in Canada);
- the study of the ice caps by means of optical remote sensing (NOAA- AVHRR) and radar remote sensing (ERS, RADARSAT, ENVISAT, etc.);
- determining the reaction of the glaciers to global warming;
- measuring the speed of the glaciers by means of high resolution images (SPOT 5).

The current use of remote sensing satellites in the research of the seas and of the oceans has led to the development of space oceanography. The research of oceanography that takes place based on different space programs deals with a large number of problems of great scientific and practical importance:
- the temperature of the surface of the sea (SST) (by means of thermo detection – NOAA-AVHRR, TERRA, ENVISAT);
- the dynamic topography of the surface of the seas and of the oceans and, consequently, the movements of the ocean water (by means of the technique of space altimetry used by the missions TOPEX-POSEIDON and JASON);
- ocean circulation, with the recording (by means of thermo and radar remote sensing) of some large scale perturbations, with regional and global climatic consequences (the El Niño – La Niña episodes);
- detection of the chlorophyll concentration in the sea water, especially in the coastal waters affected by upwelling (for instance the satellite SeaWiFS);
- detection of the oil layers at the surface of the sea waters by means of optical and radar sensors;
- monitoring of the sea ice and of the icebergs by means of optical and radar sensors (SAR);
- mapping of the morphological changes of the sea shores and of the bottom of the coastal waters;
- monitoring of the coastal risks.

1.3. The Earth crust and the relief

The compatibilities between remote sensing and the study of the relief are multiple. By recording images from the visible domain (LANDSAT 7 TM; LANDSAT 7 ETM; SPOT 5; IRS) and from the domain of hyperfrequencies (ERS 1,2; RADARSAT 1,2; JERS; ENVISAT) one can visualize, interpret and map:
- the forms of relief of different dimensional orders and genetic types (for instance, fluvial relief, glacial relief, structural relief);
- zonal, in tiers and azonal and morphogenetic systems;
- nowadays' geomorphological processes and risks.

The geomorphological analysis based on space images and maps allows the achievement of maps on different themes and of general geomorphological maps. The topics of interest in the latest world geomorphological literature based on the integration of satellite images and maps, of DEM, in relief analysis are the following:
- the uses of the information provided by remote sensing in the study of neotectonics;
- the seismo-tectonic activity studied based on satellite data (for instance in the Alps);
- the determination and characterization of the fault systems and of the geomorphological features by means of remote sensing and GIS;
- monitoring and estimation of the deformation of different terrains caused by terrain gliding and subsidence by means of the SAR technique (Synthetic Aperture Radar) and InSAR (Synthetic Aperture Radar Interferometry), by means of laser scanner (Laser Scanning) and of digital photogrammetric techniques; the impact on the environment;
- monitoring of volcanic deformation by means of InSAR techniques (the case of Vesuvium);
- monitoring and evaluating the risk of terrain gliding, stone falls and avalanches;
- the estimation of the dynamics of stone glaciers;
- detection and mapping of the alluvial deposits in suspension and of the sediment deposits based on LANDSAT, 7MSS, ETM, SeaWiFS, TERRA images in the littoral waters: in the estuaries (for instance Rio de la Plata), in front of the deltas (Danube Delta, Ganges Delta, Mississippi Delta etc.)
- precise geomorphological mapping (for instance, the use of neural systems in the mapping of the possibility of occurrence of terrain glidings, using high resolution satellite images and digital topographic data);
- the methodology of realization of geomorphological maps based on satellite images and maps;
- the elaboration of DEM for geomorphological studies (especially for morphodynamics).
1.4. The vegetation and biodiversity

The vegetation of our planet, the ecosystems with their different complexities and geographical extents and the biodiversity are studied not only using classical methods, but also using modern methods like remote sensing. The main problems approached by integrating and analyzing satellite data are:

- the monitoring of the vegetal layer, regionally and world wide; in this sense the contributions of the missions SPOT 4 and SPOT 5 VEGETATION, which have provided continuous and rigorous information on Terra's vegetation since 1998 (the repartition and seasonal, annual and pluriannual evolution of the vegetation, as well as its random modifications); based on the vegetation index one can determine the density of the vegetal layer and implicitly the phase of vegetation and the condition of the vegetation, the risk of drought and of spontaneous fire in the forests, savannahs or steppes;

- the monitoring of the forests (regionally and globally) with passive sensors (optical like AVHRR on the NOAA satellite and radar sensors);

- the detection of the changes of the vegetation (especially concerning the forests) in the long run using satellite data;

- the detection of the changes in different terrestrial ecosystems (for instance, lake ecosystems like those of the lakes Chad or Aral; deltaic ecosystems like that of the Danube Delta);

- the estimation of the herbaceous and forest biomass;

- evaluations and predictions on biodiversity;

- monitoring of deforestations and fires, of droughts and desertification, of the damages caused by volcanic eruption by using the information provided by LANDSAT 7TM, SPOT XS, SPOT 4 and SPOT 5 VEGETATION;

- mapping of the vegetation (especially of the forests) in the long run based on optical images (SPOT 4 and SPOT 5 VEGETATION) and on radar images allows the updating of the existing maps and the realization of new maps for hardly accessible or unmapped regions; moreover, the radar data, like the ones provided by the Advanced Synthetic Aperture Radar (ASAR) on board of ENVISAT, allow the achievement of precise studies by means of the InSAR technique; by combining several images it becomes possible to clearly see the forest areas and to determine some forest parameters like the density of the forests, the height of the trees, the age of the forest, the composition of the flora;

- mapping of the terrestrial and marine habitats.

1.5. The use of terrains. Plant cultivation

The research concerning the use of terrains and plant cultivation frequently benefits by high resolution satellite images. By interpreting them one can get information about a series of themes of great economic interest:

- classification and mapping of different categories of terrains according to their uses; such maps were obtained based on the images from SPOT 4 and SPOT 5 VEGETATION, TERRA-MODIS, IKONOS, ENVISAT-MERIS etc.

- analysis and mapping of the changes in the structure of the way terrains are used, based on satellite data (LANDSAT 7 TM, SPOT 5, CORONA, ENVISAT);

- monitoring of the cultures and agricultural areas, regionally and globally, based on radar techniques (ENVISAT-ASAR) and on multispectral optical data (ENVISAT-MERIS); real time study of plant growth and crop prediction are very difficult in cloudy areas (for
instance in the tropical monsoon areas, during the wet season); in such cases, in order to monitor plant growth and to predict the crops, remote sensing based on radar images is the best data source;
  - evaluation of culture condition by means of the vegetation index;
  - realization of semi-real time monitoring systems of the disasters in agriculture (for instance, by using the information provided by NOAA-AVHRR);
  - monitoring of drought conditions;
  - irrigation planning and management with remote sensing and GIS;
  - the use of remote sensing in the domain of food security;
  - the estimation of the organic matter from the agricultural soils based on spectroradiometric and ASTER data (for instance in Canada).

1.6. The urban and rural habitat

The urban and rural habitat is under the permanent and attentive supervising of the Earth observing satellites. As a result, today the geography of settlements has at its disposal very valuable high quality information provided by remote sensing satellites with resolutions of 1m (IKONOS) and less than 1m (QUICKBIRD). Remote sensing and GIS have become essential instruments, especially in the studies of urban geography. High resolution satellite images are useful in the approach of several important themes of urban geography:
  - analysis and mapping of town morphology, of the surface traffic network, of environment quality, of urban space dynamics with a view to developing and carrying out the projects of urban development;
  - analysis, classification and mapping of the categories of terrains from the urban areas using IKONOS, QUICKBIRD, TERRA images;
  - utilization of high resolution satellite images for the estimation of the population in between censuses (evaluation of the demographic growth);
  - utilization of satellite data in order to create models of urban development (tri-dimensional town models obtained by using adequate Informatic techniques);
  - monitoring of the towns and of the interactions with the environment.

2. Landscape research by means of remote sensing. The applications of remote sensing in regional geography

Finally, geographical research based on components must have as a result the discovery and explanation of the interaction between them, in their concrete spatial and temporal manifestation, the determination of geographical (territorial) systems of different dimensions and structural-functional complexities, with certain environmental features, the discovery and delimitation of geographical landscapes, of concrete geographical regions, as they are organized in hierarchical systems on the surface of our planet.

At present, the geographical research is called to answer a major scientific purpose, that of understanding the Earth as a system, locally, regionally and especially globally. In this sense, the satellite information that has been collected so far is so rich and so valuable that it can crucially help us to improve our understanding of the Earth as a dynamic system, however a fragile system that can undergo dramatic changes, to rigorously seize the functioning mechanism of the sub-systems of different orders and to manage the environment in which we live. Therefore, at the present time, regional and general geography
has at hand a new type of information and a new method in the research of the terrestrial landscape.

The topics that concern the study of the landscapes using remote sensing are very important:
- landscape monitoring;
- landscape visualization and modeling; creation of virtual landscapes by means of tri-dimensional simulation;
- detection of environment changes and updating of the data bases for different regions of the Globe;
- the study of landscape dynamics based on satellite and GIS data;
- use of remote sensing data in durable development projects;
- global change monitoring and modeling
- the impact of global change in different areas of the Globe (for instance in the region of the Mediterranean Sea);
- environment detection, monitoring and mapping;
- environment dynamics and risks; realization of the GIS for the environment;
- remote sensing and GIS for studies of environment sensitivity;
- crisis management – environment crises caused by natural disasters or technological (accidental or deliberate) disasters;
- implementation of the recommendations of the conference UNISPACE III for a Global System of Disaster Management.

3. The research of environment risks based on remote sensing

The issue of risks is a theme of large scientific interest. And this is because man and his activities are under the threat of phenomena that are hard to control, some of them being caused by man himself. Given its object of study, geography is one of the sciences that have included the problem of natural, technological and mixed risks in the sphere of their actual preoccupations.

In the research of risk different information sources are used, some of them being the terrestrial observation network and the Earth observing systems from space. Space techniques (positioning, telecommunication and remote sensing techniques) can positively contribute to the improvement of risk and disaster management at different levels: information, prevention, alert, crisis management, post-crisis analysis, rehabilitation, education and training. Combined with the traditional information sources and the usual methods, space techniques can provide dependable real-time (or almost real-time) data to all those involved in the management of a crisis (institutions, organizations etc.) – before, during and after the crisis.

For information and reflection we point out the most frequent themes of interest for scientists, inclusively for geographers:
- prediction of earthquake risk, detection and evaluation of the damages caused by earthquakes and eruptions by means of high resolution satellite images (QUICKBIRD, in the case of the earthquake from Algeria from 2003);
- utilization of interferometry in the study of earthquakes and of volcanic activity starting from the registrations of ERS 1 and ERS 2 (China, Turkey);
- monitoring and estimation of the damages caused by terrain gliding by means of InSAR techniques;
- evaluation and mapping of the possibility of occurrence of terrain gildings;
- monitoring of the disasters produced by tropical cyclones, by downpours and
drought using satellite images (NOAA, SPOT, ENVISAT, etc.);
- mapping of the air pollution above the towns based on satellite data;
- evaluation of the risk of floods, flood monitoring and management by means of
remote sensing;
- monitoring of degraded areas using remote sensing data;
- monitoring and evaluation of desertification (activities developed by an Arab
network of remote sensing centers);
- detection, monitoring and management of oil pollution (for instance by means of
ENVISAT-ASAR data);
- monitoring of algae proliferation (especially of toxic ones, as for instance Pseudo-
nitzschia spp. in the Gallic coastal waters);
- evaluation of the Tsunami phenomenon through the use of high resolution satellite
information (IKONOS) and of DEM;
- correlation between the indicators of drought and the incidence of forest fires based
on remote sensing data;
- neural network for the spatial and temporal monitoring of fires by means of NOAA-
AVHRR images;
- mapping of forest fires and completion of the World Atlas of Forest Fires based on
Landsat TM, NOAA-AVHRR, TERRA-MODIS, QUICKBIRD images;
- risk/disaster mapping and management;
- use of GIS and remote sensing technology in the simulation and management of
disasters;
- risk monitoring by means of thermo remote sensing (TERRA-ASTER);
- software development for environment monitoring.

The integration of satellite information in the research of risks has a very definite
purpose: a better management of these phenomena in order to ensure the population’s
security and the reduction of the damages and of the impact on the environment.

In the European Union, civil protection and the authorities of the member states are
involved in crisis management. Therefore, in case of major crises, the authorities in charge of
the civil protection from the countries under threat can make use of the International
Charter on Space and Major Disasters. This is how they can access satellite data and ask the
specialized services to interpret different data.

4. The uses of remote sensing in geographical mapping and in GIS

High resolution images and space topographical maps on large scales, DEM and the
quantitative data obtained through the analysis of digital documents and spectral
measurements are the main sources used in geographical mapping. As a result, very useful
maps on various themes are obtained. We have already presented a series of opportunities
offered by remote sensing and Informatic techniques in specialized mapping (in
geomorphological, meteorological and climatic mapping, in hydrological and biogeographical
mapping, in human geography and economic geography, in the geography of the
environment). We will mention here only the latest and newest ones:

- the use of high resolution satellite images (IKONOS, QUICKBIRD etc.) for large
scale mapping;
- the use of high resolution satellite images for cadastral applications;
- the development of software for mapping applications;
- real time mapping technologies;
- digital mapping and registration of data;
- satellite images as a basis for traveler’s maps
- tri-dimensional landscape simulation;
- tri-dimensional town models;
- processing of satellite images for generating high resolution DEM;
- obtaining DEM by means of laser scanning and SAR registration;
- generating high resolution DEM based on TERRA-ASTER data;
- realizing digital relief (terrain) models (DEM) based on topographic maps and space images and using them in geomorphological analyses (the density of relief fragmentation, slope orientation), climatic analyses (direct solar radiation, air temperature, precipitations, local climates), hydrological analyses (flow direction, concentration, morphometry of the hydrographic basins, hierarchy and density of the hydrographic network);
- completion of general geomorphological maps in GIS system.

5. Integrating remote sensing in the Romanian scientific research (especially the geographical one)

In Romania the satellite information concerning the terrestrial environment is used more and more in the fundamental and applied scientific research. The research themes (doctoral theses, grants) that turn to good use the data provided by satellite images, either separately or together with other sources, generally concern practical problems. The respective projects take place in different public institutions and research centers (Institutul Național de Cercetare-Dezvoltare pentru Protecția Mediului – The National Institute of Research and Development for the Protection of the Environment; Institutul Național pentru Cercetare-Dezvoltare Delta Dunării – The National Institute of Research and Development The Danube Delta; Administrația Națională de Meteorologie –The National Administration of Meteorology; Compania Națională Apelor Române – The National Company The Romanian Waters; Centrul Român pentru Utilizarea Teledeteceției în Agricultură – The Romanian Center for the Use of Remote Sensing in Agriculture; Institutul de Cercetări Nucleare –The Institute of Nuclear Research; Institutul de Geografie – The Institute of Geography etc.) and universities (“Al.I. Cuza” University of Iași – the Laboratory of Remote Sensing and Geoinformation, Bucharest University – The Laboratory of Remote Sensing and Geographical Aerophotointerpretation; “Babeș-Bolyai” University from Cluj-Napoca, “Valahia” University of Târgoviște, The Technical University of Civil Engineering from Bucharest – the Laboratory of Photogrammetry and Remote Sensing etc.).

Concerning the integration of remote sensing in nowadays’ geographical research we would like to highlight a few of the significant preoccupations and achievements of the last few years:
- digital processing of space images in order to extract the data needed by the Geographical Informational Systems;
- methods of processing geospatial information for the monitoring of the environment;
- the use of remote sensing in water resource management;
- evaluation and monitoring of water resources coming from the snow layer from the Carpathian basins using traditional geographical information and satellite data;
- evaluation and monitoring of flood risk by means of geographical information and remote sensing;
- systems of flood prediction and supervising in the basin of Mureș River;
- inventory of the categories of terrain in the inferior basin of the Danube River;
- analysis of the LANDSAT and SPOT satellite images in the study of the relief, of the vegetation and of the ways terrains are used in different areas of the Moldavian Plateau and in Vrancea;
- the use of satellite images and maps in geomorphological mapping;
- risk management in the Romanian sector of the Danube;
- environment monitoring for the development of ecological tourism;
- the use of satellite images in the analysis of the geomorphological changes in the Danube Delta Biosphere Reserve;
- the detection of environment changes in the Danube Delta based on SPOT-HRV images; evaluation of the accuracy of remote sensing data used in the highlighting of environment changes in the Romanian sector of the Black Sea coast;
- determination of the features of the environment by means of the analysis of high resolution satellite images.

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