

Results of the Processing Remote Sensing Data of the Extraterrestrial Territories

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Works devoted to studying and mapping of the planets and small bodies of the Solar system Moscow state university of the geodesy and cartography (MIIGAiK) have been activated since 2010 in connection with opening of the MIIGAiK Extraterrestrial Laboratory (MExLab). In these works are been developing methods and technologies of the photogrammetric, thematic and other types of the remote sensing data processing for complex geoinformation mapping of the celestial bodies. Moons of the Earth and the Mars (Selene and Phobos) and other Solar system small bodies (Jupiter's moon Io, Saturn's moon Enceladus) are the most important objects of studying on this stage.

Successful goal achievement of the geoinformation mapping of the extraterrestrial objects is based on the results of photogrammetric processing of space images of surface. For this purpose new algorithms of the photogrammetric processing of the space images of Solar system small bodies have been developed and approved on different celestial bodies by the DPC «PHOTOMOD». In the result of processing new data with different characteristics of the extraterrestrial objects such as: catalogues of the ground control points and parameters of figures of the celestial bodies, global and detailed DEM which have been used for making orthomosaics and orthoimages - have been firstly produced in Russia.

Using combined spectral images of Phobos mosaic coverages have been made for each spectral channel with registration of multispectral images to orthophoto. With mosaics of the spectral channels have been produced color synthesized images either in natural colors (blue, green and red spectral diapasons) or in pseudo colors using infrared channel. On base of these images different spectral indexes including color ratios V/NIR where V – spectral brightness in visible diapason (which had been got by addition of blue and green channel and deviding this sum on, NIR – spectral

brightness in near infrared diapason have been calculated.

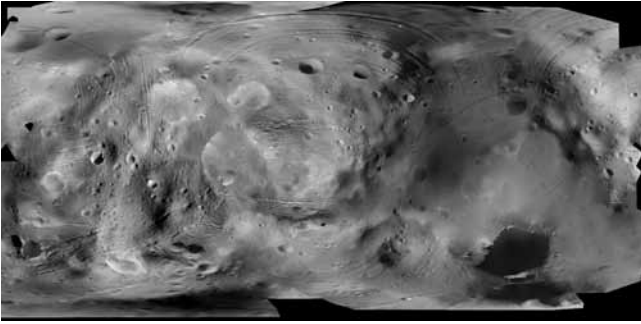
For each of the research celestial body is being formed data base for further study of the surface including geomorphologic, spectrometric and other types of analysis

These and similar information products are used for geoinformation mapping of the extraterrestrial objects served by ArcGIS software.

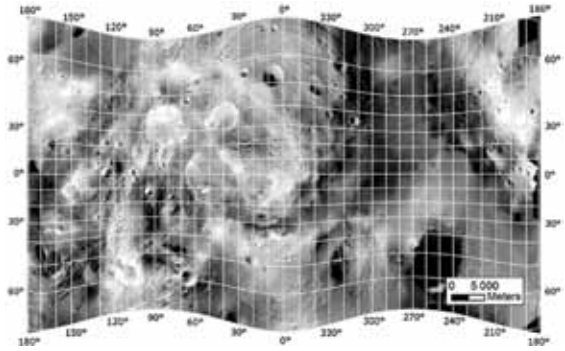
On the results of the processing of Selene have been performed mapping on different stages of detailing, global mapping of Phobos, Io and Enceladus. Under the mapping work estimation of the studying objects crater statistic has been carried out with the maps making with spatial density and evaluation of the cumulative density of craters. It also has been calculated slopes and roughness of the topographic surface, which have been used for the estimation of safety landing fields for landing modules of future Russian missions including Phobos and near polar areas of Selene.

Processing results of the new remote sensing data in GIS are used also for comparing with data had been got in soviet moon projects. Analysis of the landing places of the automatic interplanetary stations and refinement of the routes passed by Lunohod-1 and -2 has been made. Works on reconstructing the moon panoramas have been got by soviet cameras on the soviet rovers are still going on nowadays. By the results of the detailed researching and GIS-analyzing of the Lunohod-1 route have been proposed and approved by IAU new names of 12 craters.

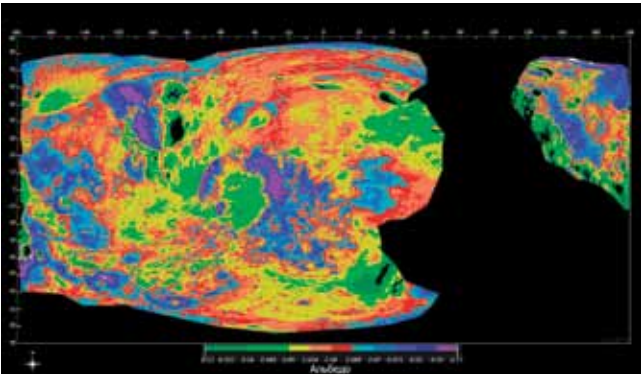
As the result in MIIGAiK new important results providing new coordinate cartographic and thematic base for studying celestial bodies of the Solar system habe been got. Examples of generated maps of Phobos, Selene, Enceladus and Io are shown on img. 1-10.



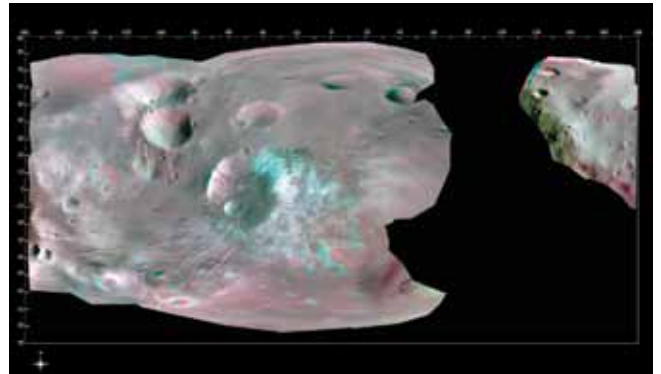
Img. 1. Orthoimage of Phobos based on the new control catalog (MIIGAiK, 2012).



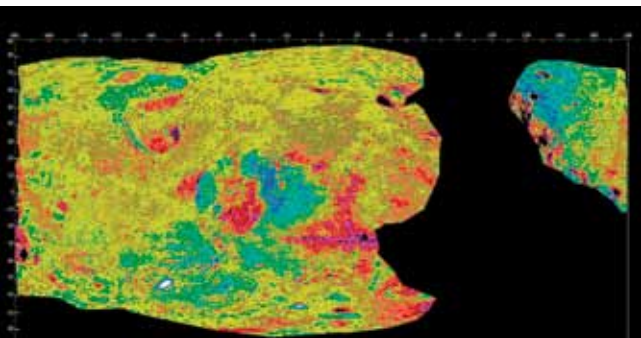
Img. 2. Map of Phobos equatorial area (triaxial ellipsoid, the Bugaevskiy's projection).



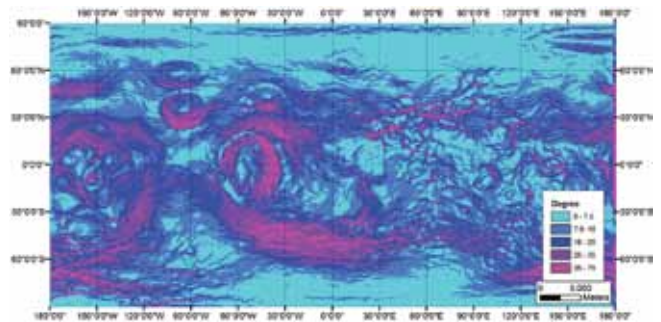
Img. 3. Map of Phobos surface that shows distribution of the albedo values in GR-channel.



Img. 4. color synthesized image of Phobos surface in natural colors (red, green and blue channels).



Img. 5 Mosaic of index images based on MarsExpress data (index V/NIR).



Img. 6 Slopes map of Phobos.

