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Mars moons relief mapping and modelling: problems and solutions

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The compiling of Solar System objects hypsometric maps having irregular shapes is not only the most important part of thematic mapping, but it helps to investigate different features of the satellite surface. These maps can help during development space missions including landing on the celestial bodies, and moreover, they can make clear the object origin and geology. Besides, satellite mapping plays a large part in popularization of science and these materials can be used in educational work. Furthermore, Russia and European Space Agency (ESA) project "Phobos-Grunt" is being prepared to launch in November, 2011[4], so now the Phobos map creation seems to be actual and up-to-date.

Due to irregular shapes of Phobos and Deimos, there are some problems while mapping their relief. First of all, these objects cannot be approximated with biaxial ellipsoidal or spherical model precisely and it's better to use triaxial ellipsoidal model to obtain more accurate results. Nevertheless, geographic information system (GIS) software designed especially for the terrestrial mapping cannot afford to manage it. As to ESRI software ArcGIS 9.3.1, we used for Mars satellites maps compiling, there is no possibility to use triaxial ellipsoidal models. Therefore, the map of Phobos and Deimos were based on biaxial ellipsoidal model with the defined axes parameters, for example, for Phobos 11,2 km×9,2 km, instead of triaxial model with axes 13,4 km×11,2 km×9,2 km [1]. In order to avoid some distortions on the map, occurred as a result of biaxial ellipsoidal model applying, and furthermore to demonstrate the celestial body much more pictorial, the orthographic projection were used and the special color height scale corresponded to the real colors of the satellite surface was designed too.

The second significant part in map compiling is DTM resolution. The DTM we used for Phobos mapping has 0,5 degree resolution [2] and 5 degree for Deimos[3]. That is why it was very important to choose the most suitable and the correct way of contours interpolation and hillshade, that can allow avoiding errors caused by accuracy of DTM.

Finally, 3D models help to represent the satellite surface relief more real and to study craters morphological features. Unfortunately, it is difficult enough to create 3D models using Earth-oriented GIS-software products and taking into account the irregular form of the celestial bodies. Therefore, the smaller area has less distortion in the 3D model, depended on the size of modeled region.

Taking into account the above aspects of Solar System objects hypsometric maps compiling the Phobos and Deimos relief maps and 3D models of several craters were created. The maps are compiled in orthographic projection on a scale 1:90 000. These maps were based on two DTMs that have been were calculated using the data from Mars Express and Viking spacecrafts [2,3].

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