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PDS Release of Phobos data from HRSC on Mars Express: Shape Model, Orthoimages and Maps

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Abstract

We are pleased to announce the delivery of geodetic data products of Phobos derived from images of the High Resolution Stereo Camera (HRSC) on Mars Express to the NASA Planetary Data System (PDS), which include a new Phobos shape model, large sets of orthoimages as well as maps. The new data will help prepare new missions to Phobos and Deimos and resolve open questions on the origins and evolutions of the two satellites [1].

1. Phobos Data

From the beginning of the Mars Express mission 2004 until November 2012, the spacecraft has engaged in 201 Phobos flybys at distances between 92 and 5578 km, during which observations have been carried out by the HRSC [2, 3]. During 49 of these flybys, the HRSC was commanded to take images in "full stereo mode" in which all five stereo channels were activated (Stereo1, Photometry1, Nadir, Photometry2, and Stereo2 channels of each orbit), allowing the production of local and global terrain models by stereo-photogrammetric techniques.

2. Shape Model

Stereo-photogrammetric methods were applied to derive a global shape model on the basis of HRSC and Viking Orbiter images [4]. This model was prepared in the form of a gridded file (Digital Terrain Model, DTM) with 100 m/pixel resolution [4, 5] (see Figure 1), a spherical harmonic function model (degree and order 45), as well as a binary "plate model", already released previously [6].

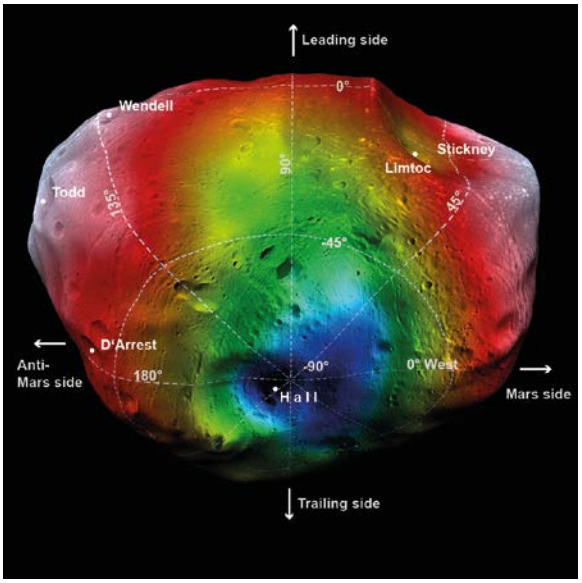

Figure 1: Perspective view of the color-coded Phobos DTM with the draped HRSC image mosaic showing the South pole.

3. Orthoimages, Mosaic and Maps

A photogrammetric adjustment was carried out for images from 18 selected HRSC orbits [4], which yields improved orientation data for a total of 90 HRSC images with varying, image resolutions from 3.7 m/pixel to 98.5 m/pixel. 10 Nadir images were finally selected for a global mosaic. These images were ortho-rectified to the shape model, resampled to a uniform resolution of 16 pixels/ degree or 12.11 m/ pixel. The overlapping images were analyzed to select only best data to be combined for a mosaic. The mosaic was the basis to produce a set of two map sheets in a scale of 1: 50,000, which comprise three maps each (see Figure 2) [7]. Sheet 1 displays contour lines derived from dynamic heights obtained from gravity field modelling [8, 9]. On sheet 2, contour lines represent geometrical heights above the sphere (R_{mean} = 11.1 km).

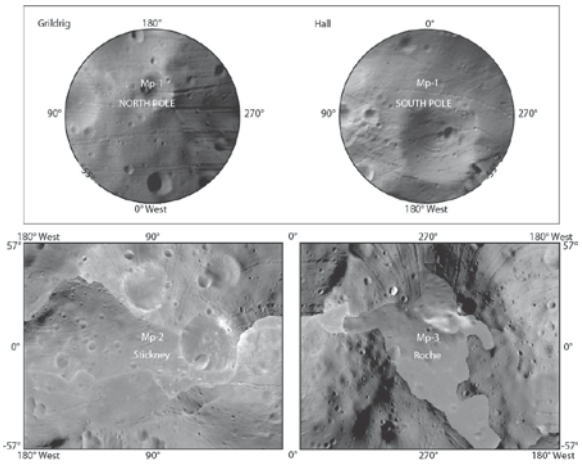

Figure 2: Quadrangle scheme of the atlas used for sheet 1 and 2, filled with the HRSC mosaic.

4. Summary and Conclusions

A Digital Terrain Model, a plate model (already available), 90 controlled ortho-images and an atlas are in preparation for PDS release. This will help the community in the scientific work and planning of future missions.

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