Compiling Mercury relief map using several data sources

Maria Zakharova and Evgeniy Lazarev

There are several data of Mercury topography obtained as the result of processing materials collected by two spacecrafts – the Mariner-10 and the MESSENGER during their Mercury flybys.

The history of the visual mapping of the Mercury begins at the recent times as the first significant observations were made during the latter half of the 20th century, whereas today we have no data with 100% coverage for the entire surface of the Mercury except the global mosaic composed of the images acquired by MESSENGER.

The Mercury relief map has been created with the help of four different types of data:

- global mosaic with 100% coverage of Mercury's surface created by using MESSENGER orbital images (30% of the final map);
- Digital Terrain Models obtained by the treating stereo images made during the Mariner 10's flybys (10% of the map) (Cook and Robinson, 2000);
- Digital Terrain Models obtained from images acquired during the Messenger flybys (20% of the map) (F. Preusker et al., 2011);
- the data sets produced by the MESSENGER Mercury Laser Altimeter (MLA) (40 % of the map).

The main objective of this work is to collect, combine and process the existing data and then to merge them correctly for one single map compiling.

The final map is created in the Lambert azimuthal Equal area projection and mainly shows the hypsometric features of the planet. It represents two hemispheres – western and eastern. In order not to divide data sources the eastern hemisphere takes an interval from 50 degrees east longitude to 130 degrees west longitude and the western one takes respectively the interval from 130 degrees west longitude to 50 degrees east longitude.

References:

Global mosaics of Mercury's surface. Available mosaics include one created prior to MESSENGER's orbital operations, high resolution versions that use MESSENGER's orbital images that are available in NASA's Planetary Data System (PDS) (http://messenger.jhuapl.edu/the_mission/mosaics.html).

Cook, A.C., Robinson, M.S., 2000. Mariner 10 stereo image coverage of Mercury. J. Geophys. Res. 105, 9429–9443.

Preusker, F., Oberst, J., Head, J.W., Watters, T.R., Robinson, M.S., Zuber, M.T., Solomon, S.C., 2010. Stereo topographic models of Mercury after three MESSENGER flybys. Planetary and Space Science 59 (2011), 1910-1917.

The MLA is a time-of-flight laser rangefinder that uses direct detection and pulse-edge timing to determine precisely the range from the MESSENGER spacecraft to Mercury's surface (http://pds-geosciences.wustl.edu/missions/messenger/mla.htm).