

Topography of Mercury from MESSENGER Stereo Images

F. Preusker, J. Oberst, R. J. Phillips, T. R. Watters, J. W. Head, M.T. Zuber, F. S. Turner, S. C. Solomon

Three separate digital terrain models (DTMs) were derived from stereo images obtained by the MESSENGER spacecraft during its Mercury flybys in 2008 and 2009. A total of 516 images were used, which allowed us to reconstruct ~32% of Mercury's surface (24.6 x 106 km²) at 1-km grid spacing, including most of the northern hemisphere. A first DTM was derived from 208 stereo images acquired during the first flyby and was constructed from three individual submosaics.

The DTM includes the ~1500-km-diameter Caloris impact basin. A second DTM was derived from 260 stereo images acquired during the second flyby. The third DTM is the result of combining the two approach mosaics acquired during the second and third flybys. , involving a total of 48 stereo images.

The stereo models include the ground track of the Mercury Laser Altimeter (MLA) profile obtained during the first flyby and marginally touch the profile obtained during the second flyby.

The comparisons between the two topographic data sets give us an opportunity to study the effective resolution and long-wavelength accuracy of the DTMs. Height offsets between the third stereo model and the MLA profile from the first flyby range from 0.3 km to 1.8 km, with an overall trend from east to west. Following orbital insertion in March 2011, MESSENGER will obtain near-global stereo coverage for topographic models that exceed the resolution of the current models by a factor of two at reduced noise. Analysis of the stereo images will be supported by "ground truth" from MLA data in Mercury's northern hemisphere. The models will provide critical new information on the morphology of surface landforms on Mercury and on the impact, volcanic, and tectonic processes by which the surface has been modified.