

feature large numbers of impact craters that span a range of sizes and degradation states. We estimate that a total of ~ 400 craters larger than 15 km in diameter are included in these three models.

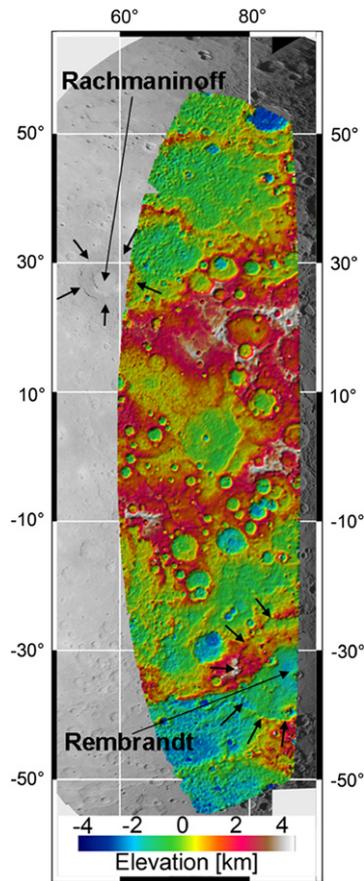


Fig. 6. M3 DTM (hill-shaded, color-coded). Arrows point to the western half of the rim of the Rembrandt impact basin and to the Rachmaninoff basin.

5. Comparison with laser altimetry

Portions of the Mercury Laser Altimeter (MLA) profiles obtained during MESSENGER's first and second Mercury flybys (Zuber et al., 2008; Smith et al., 2010) cross into the areas of the M2 and M3 DTMs. This overlap provides the opportunity to compare the two data sets and in particular to identify their possible relative offsets and differences in long-wavelength trends. Using the high-spatial-resolution and accurate MLA data as a reference, we can also study the effective resolution of the stereo DTMs (Fig. 7).

The MLA profiles obtained during M1 and M2 are both near Mercury's equatorial plane, but on opposite sides of the planet. The laser footprint on the surface varied between 20 and 150 m in diameter along the profiles, in proportion to the height of the spacecraft given the $\sim 80 \mu\text{rad}$ divergence of the laser beam at $1/e^2$ power. The spacing between shots along the ground track was approximately 700 and 600 m for M1 and M2, respectively. MLA profile tracks were plotted on the orthomosaics using the nominal footprint centers of the laser provided by the MLA team (Figs. 8–10). The DTM height profiles were extracted from the DTM along the MLA ground tracks.

5.1. M2 DTM vs. MLA profile from M1

There is only a small region of overlap between the M2 DTM and the MLA profile obtained during M1. This overlap occurs near the southern edge of the terrain model from 14° to 22°E longitude. In total, 231 MLA shots over a distance of 718 km (corresponding to a mean shot spacing of 3.1 km) provide the overlap. MLA was operated off-nadir (by $\sim 58^\circ$) for this part of the track. The comparison between the MLA results and DTM indicates an average height offset of 420 m (Fig. 8).

5.2. M2 DTM vs. MLA profile from M2

The overlap of the M2 DTM and the portion of the MLA profile obtained during M2 from 274° to 286°E longitude is also confined to a small region. In total 221 valid shots were obtained, spread

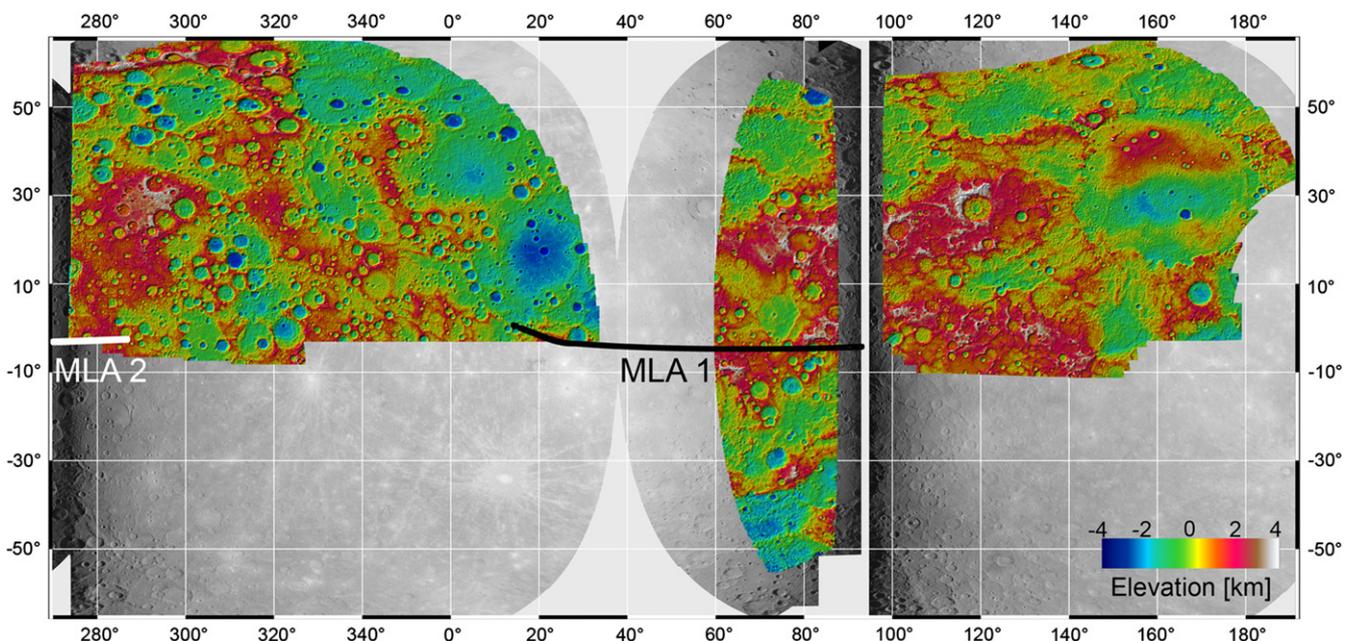


Fig. 7. Comparison of the locations of the MESSENGER stereo topographic models and the MLA profiles obtained during M1 (white) and M2 (black), overlaid on a global image mosaic.