3.4. True orthoimage mosaics

Images were resampled to derive orthoimage mosaics. From the topography models, each image pixel was referenced to latitude and longitude using ray intersection points with the terrain model. These true orthoimages are thus free of parallax errors and suited for the production of geometrically correct image mosaics, as needed for further analysis, e.g., for comparison with laser altimetry (see below).

4. Digital terrain models

4.1. M1 DTM

The M1 DTM was derived from 208 stereo images acquired during the first flyby. The images were combined into three individual sub-mosaics (Table 1). In total 241 individual matching runs were carried out on at least double- or triple-overlapping images to yield 150 million object points with a mean intersection error of ± 250 m. The M1 DTM covers 12% (8.8×10^6 km^2) of Mercury's surface (Fig. 4) and includes the Caloris impact basin (1550 km diameter). The coverage of the model is increased towards the limb over what was reported previously (Oberst et al., 2010). Large portions of the DTM show topographic fabric consisting of relatively narrow, positive- and negative-relief landforms oriented radial to Caloris, most prominently expressed to the southwest and east-northeast of the basin (see arrows on figure). In addition, the DTM features a large and complex fault system near Beagle Rupes, one of the largest lobate scarps seen on Mercury (Watters et al., 2009a).

4.2. M2 DTM

The M2 DTM, the largest among the three DTMs, was derived from 260 stereo images acquired during the second flyby and includes four sub-mosaics (Table 1, Fig. 5). 220 million object points with a mean intersection error of $\pm$ 290 m were computed from 226 individual matching runs. The M2 DTM covers 15% (11.3×10^6 km^2) of Mercury's surface and is limited by the

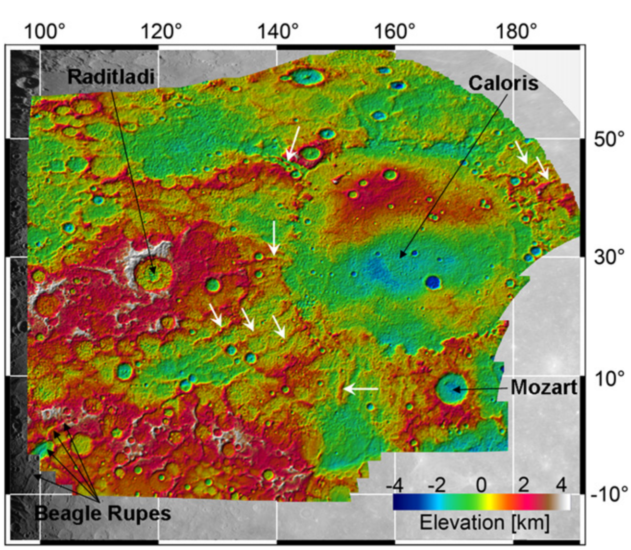

Fig. 4. M1 DTM (hill-shaded, color-coded). Heights are given with respect to a sphere of radius 2440 km. Several notable features are indicated with black arrows. White arrows denote examples of topographic fabric radial to the Caloris impact basin.

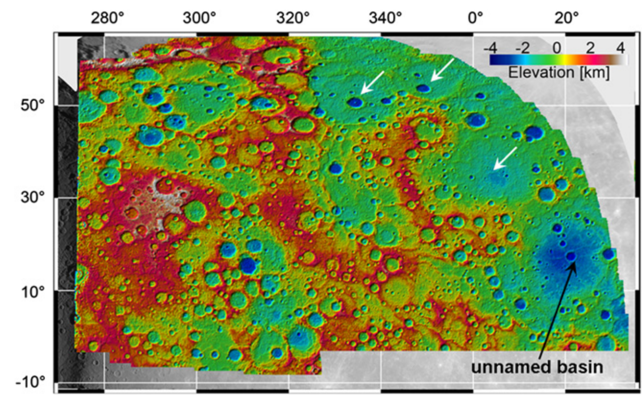

Fig. 5. M2 DTM (hill-shaded, color-coded). The black arrow indicates the location of a newly recognized, unnamed basin, and white arrows denote the locations of possible degraded impact basins.

positions of the limb and the terminator (at the time of M2) to the east and west, respectively. The DTM covers mostly heavily cratered terrain, in contrast to the M1 DTM. A large ($\sim$800-km-diameter) unnamed impact basin (centered at 16.4°N, 19.6°E), not evident in the corresponding images because of low incidence angles (measured from the local vertical), is a prominent feature in the DTM. Several more highly degraded basins are visible in DTM. Like the M1 DTM, this second DTM also shows a number of high-relief fault structures, some extending over distances of up to several hundred kilometers (Fig. 5).

4.3. M3 DTM

Finally, the M3 DTM was produced from a combination of the two approach mosaics constructed from images acquired during the second and third flybys. Owing to favorable stereo geometry with stereo angles of $\sim$25°, the geometric accuracy of this DTM is the best among the three (Fig. 3). However, because the two mosaics were taken at different local times, i.e., different illuminations, the stereo matching is subject to error in regions with shadows. In total 48 stereo images were used to compute 34.5 million object points with a mean intersection error as small as $\pm$160 m. This smallest among the three DTMs is elongated, extending from high northern to high southern latitudes, and covers $\sim$5% (4.5×10^6 km^2) of Mercury's surface. Prominent in this DTM is the Rembrandt impact basin, approximately half of which is covered by the terrain model (Fig. 6). The DTM also includes several prominent lobate scarps in the southern hemisphere, including the longest scarp yet found on Mercury that crosscuts the Rembrandt basin (Watters et al., 2009b).

4.4. Some general attributes

All DTMs were produced with a common grid spacing of 1 km, a value chosen to yield $\sim$15 object points per DTM pixel on average. The three separate DTMs were merged to a single global DTM (Fig. 7), which covers approximately one third of Mercury's surface. Although the DTMs were generated separately, average heights and topographic trends appear consistent. The total range of height over all DTMs is approximately 9.5 km (-4.5 to 5 km relative to the planetary datum). The average DTM height is 260 m, implying an average planetary radius for the regions of these DTMs of 2440.3 km. (An ellipsoid oriented to match Mercury's principal coordinate axes and fit to these terrain models has semi-major axes a=2441.1 km, b=2439.8 km, and c=2439.6 km, with a and b constrained to lie within Mercury's equatorial plane and c along the spin axis). The terrain models