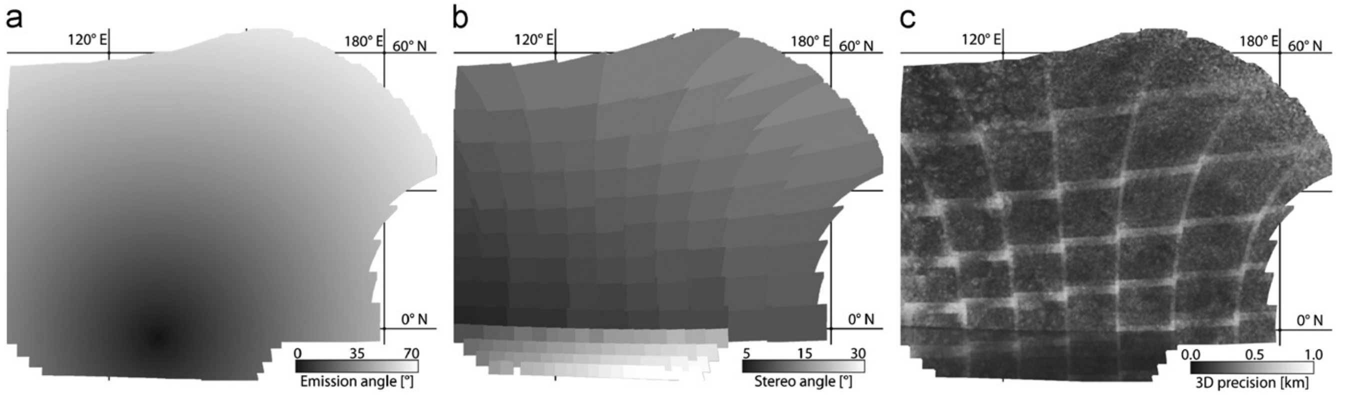


**Fig. 2.** (a) Graphical depiction of emission angles for images in the M1 departure mosaic, which was used to compute the M1 DTM. (b) Stereo convergence angles between the M1 departure mosaic and the two mosaics M1 H1 and M1 H2, all of which were used to compute the M1 DTM. (c) Three-dimensional (3D) point accuracies for the M1 DTM. The largest point errors (approximately 500 m) are well below the DTM grid size.

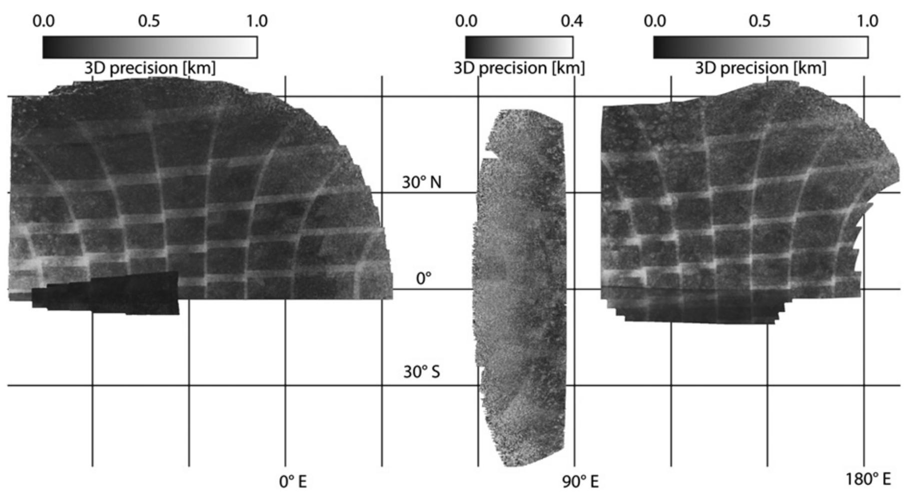


**Fig. 3.** Three-dimensional point accuracies for the three DTMs, for comparison with Fig. 2c. Note the relatively small errors for M3 DTM.

**Table 2**
Block adjustment results.

| Block | Image count | Tie-point count | Control-point accuracy (m) | |
|---|---|---|---|---|
| | | | Before | After |
| M1 block | 208 | ~12000 | ~6300 | 220 |
| M2 block | 260 | ~15000 | ~5100 | 265 |
| M3 block | 48 | ~5600 | ~2000 | 145 |

stability to the adjustment solution for each block. As a result of the block adjustment, we obtained improved orientation data, which were used in all further processing described in this paper.

### 3.2. Image matching

The images were pre-rectified on a reference sphere with a radius of 2440 km using the improved orientation data, as described above. A multi-image matching technique was applied to derive tie points between images that form stereo observations. The pre-rectification warrants that the search for tie points be limited to small areas. Hence, point misidentifications and gaps were reduced to a minimum. The matching algorithm is an area-based image correlation to derive approximate values for the match-point coordinates, which are refined to sub-pixel accuracy by least-squares matching (Wewel, 1996). After the matching, the derived image coordinates (which refer to pre-rectified images) were transformed back to the geometry of the raw images, using the history files generated during the pre-rectification. The accuracy of this back-transformation is better than 0.1 pixel (Scholten et al., 2005).

### 3.3. DTM generation

Beginning with the large numbers of coordinate pairs for the matched points, the geometric calibration and improved orientation data were used to compute object point coordinates by means of forward ray intersection. Here, least-squares adjustment was applied for this over-determined problem. As a result, we obtained object point coordinates and their relative accuracy in Mercury body-fixed Cartesian coordinates.

For the generation of a gridded DTM, the object points from the different stereo models were merged. The object points were first transformed from Mercury body-fixed Cartesian coordinates to geographic latitude/longitude/height and then transformed to chosen map projections (simple cylindrical equidistant). A pixel scale of 1 km was chosen. Object points located within a DTM pixel were averaged using neighborhood statistics (Gwinner et al., 2010). For regions that lack any object-point information, a gap-filling algorithm using DTM pyramids with reduced resolution was applied.