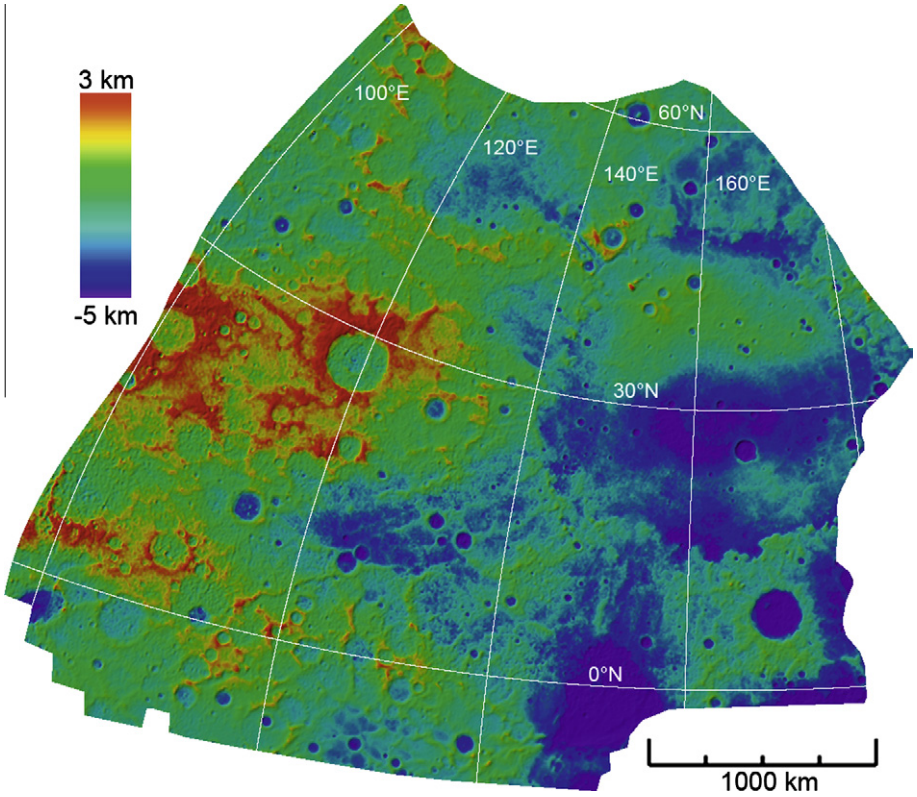

Fig. 1. Caloris area digital terrain model (DTM). The model has a grid size of 1000 m and covers an area of approximately 8.8×10^6 km^2. Heights are with respect to a sphere of radius 2440 km.

4. Basin morphology

The DTM is a rich source of information on diverse aspects of Caloris geology, in particular the Caloris basin rim, its ring structure, basin infilling, and possible pre-impact topography.

4.1. Basin rim-crest topography

The Caloris basin rim is well covered (except for parts of the southeastern sector, located beyond the planet limb) and can be clearly identified in the DTM. Along the northeastern margin, the rim is characterized by rugged massifs, which may represent what was identified as "Caloris Montes" in Mariner 10-based terrain classification schemes (Guest and Greeley, 1983; Spudis and Guest, 1988). These massifs have elevations above their surroundings of 1.5–3 km. Along the northwestern basin margin, the rim is represented by knobs within comparably smooth plains ("knobby plains"). Inspection of individual knobs indicates that these have typical horizontal scales of several kilometers and elevations of 1–2 km above their surroundings.

In other parts of the basin margin there is a lack of any obvious elevated ring structure at the resolution of the DTM. Rather, there appears to be a sudden drop from the surrounding elevation level toward the flat basin floor. This geometry is best seen along the meandering southern margin of the basin, where elevations fall from the surrounding terrain to the basin floor by 2–3 km over a linear distance of 20 km (Fig. 6). On the northern margin, the rim appears similar, but it is disrupted by craters and troughs.

Ridges and troughs oriented radially to the basin center disrupt the basin rim in several places. In the Mariner 10 classification schemes, these landforms have been grouped within the "Van Eyck Formation" (Guest and Greeley, 1983; Spudis and Guest, 1988; Fassett et al., 2009). The troughs represent a combination of secondary crater chains and graben that originated during basin formation. The most prominent of these features is located on the northwestern margin of Caloris [Fig. 4; see also Fig. 7a of Fassett et al. (2009)] and is characterized by two parallel troughs flanked by steep (5–6° slope) ridges on either side that extend for about 400 km and rise above the trough floors by approximately 2000 m (Fig. 4). Along the trough floor (Fig. 4, profile cc′), slopes cannot be distinguished from zero. The mean depth of the trough is 1.4 km below the reference datum.

4.2. Basin ring structure

Whereas the Mariner 10 images of the eastern margin suggested a diameter of the main Caloris basin ring of 1300 km (Guest and Greeley, 1983; Spudis and Guest, 1988), the MESSENGER images reveal a larger diameter of 1550 km (Murchie et al., 2008). Moreover, Fassett et al. (2009) argued for an elliptical shape for Caloris with long and short diameters of 1525 km and 1315 km, respectively.

Although the heavily eroded ring structure is difficult to identify in image data, owing to illumination conditions, the DTM gives us a fresh look at the basin structure. The DTM hints at residual ring structures in several areas (see arrows in Fig. 2 or rings in Fig. 7), but these features are not easily matched to other parts of a rim represented by a single circular or elliptical shape. An isolated chain of mountain peaks at the northwestern margin, the highest point within Caloris, is a prominent example (Fassett et al., 2009). We suggest that elevated topography of the basin rim region can be represented by two concentric circles, having diameters of 1380 km and 1700 km (Fig. 7). The mean of the two values (1540 km) agrees with the 1550-km diameter reported by