K. Gwinner[1], J. Oberst[1], R. Jaumann[1], G. Neukum[2]

contact: Klaus.Gwinner@dlr.de

[1] DLR Institute of Planetary Research, Berlin, Germany
[2] Institute of Geosciences, Freie Universität Berlin, Germany

DLR

REGIONAL HRSC MULTI-ORBIT DIGITAL TERRAIN MODELS FOR THE MARS SCIENCE LABORATORY (MSL) CANDIDATE LANDING SITES

Scope of work. Building upon the methods and procedures for deriving archival Mars Express HRSC DTM products for individual HRSC datasets [1,2], we applied specific techniques for integration of multi-orbit stereo height measurements to produce regional DTMs with 50 m horizontal resolution (i.e. grid spacing) for each of the current MSL prospective landing sites [3]. The DTMs were derived from stereo information of all currently existing HRSC datasets for the areas, i.e. up to MEX orbit #7422 acquired in October 2009. We discuss the characteristics of these DTMs and possible directions for further analysis of the data. The datasets are available via the EUROPLANET-IDIS web-site at DLR (http://europlanet.dlr.de/msl).

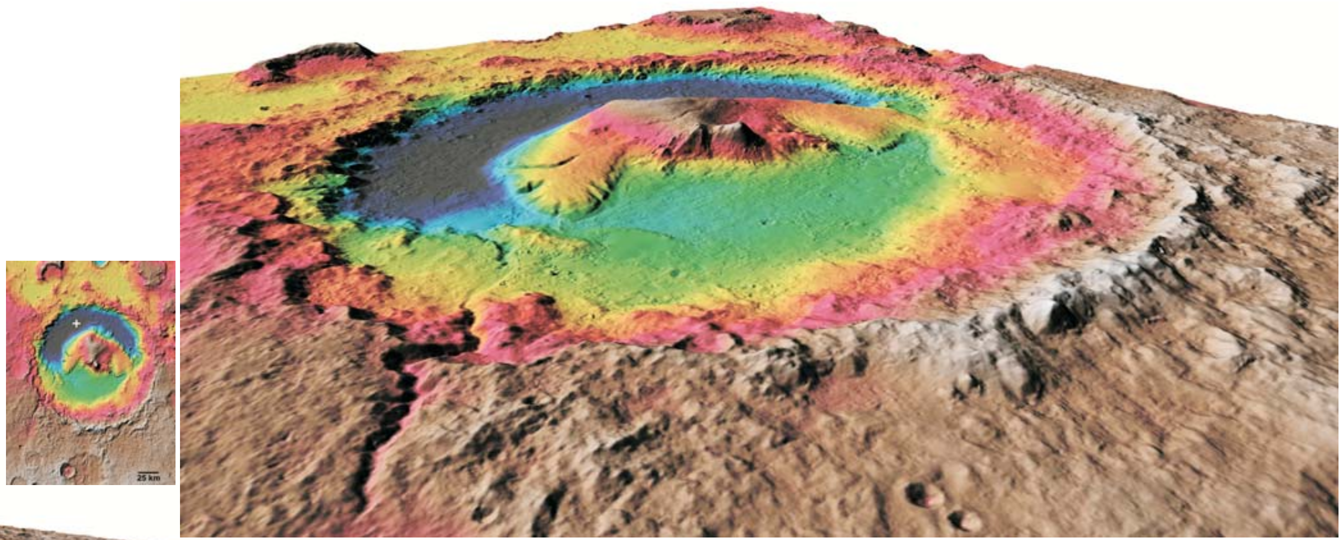
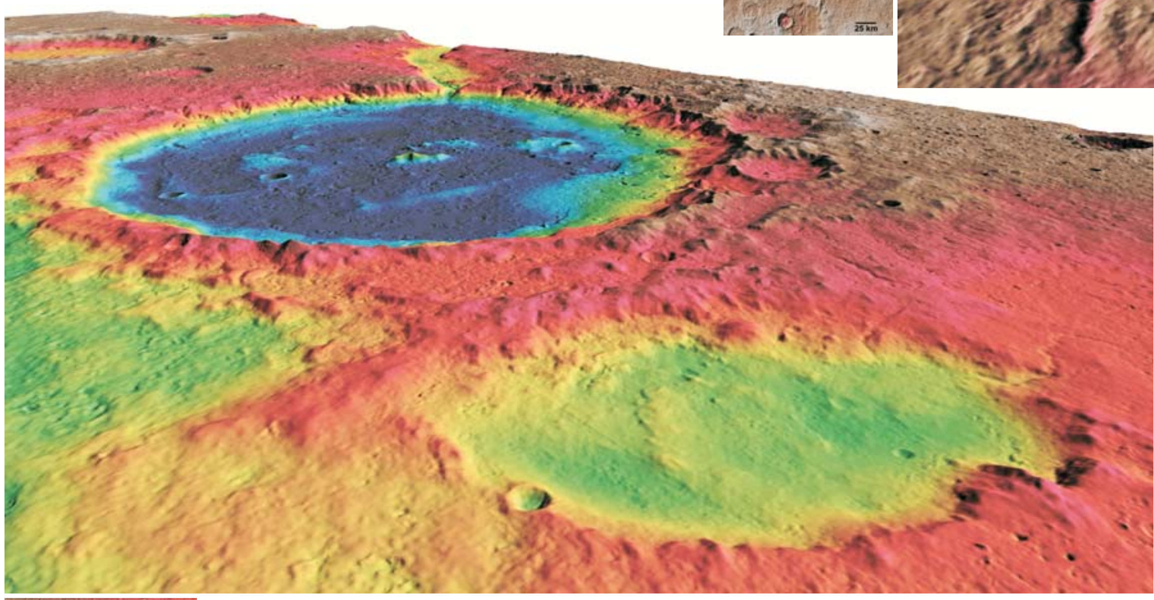
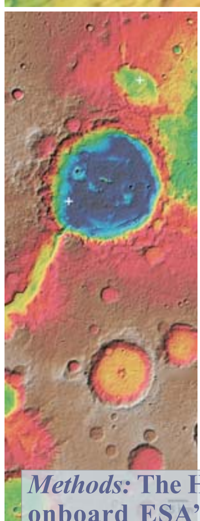


Figure 1. MSL candidate landing site Gale Crater.





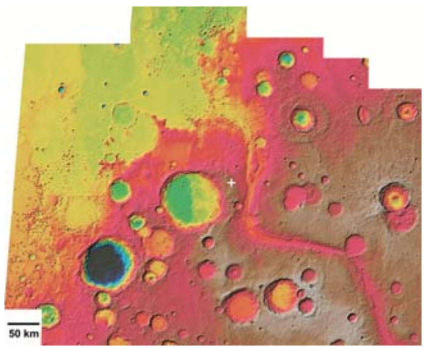


Figure 2. MSL candidate landing sites Holden and Eberswalde Craters.

Site Name	Site Coordinates Lat / Lon	Approx. Lat. Range	Approx. Long. Range	Elevation Range [m]	Grid Spacing [m]	Area Coverage [km]	Deviation with MOLA heights (Std.dev.) [m]
Gale Crater	4.49°S / 137.42°E	3.2°S 7.8°S	135.0°E 139.5°E	-4680 1460	50	275 x 205	29.1
Mawrth Vallis	24.01°N / 341.03°E	19.8°N 28.7°N	334.6°E 346.5°E	-5190 840	50	530 x 650	26.8
Holden Crater	26.37°S / 325.10°E	22.5°S 32.9°S	323.7°E 328.1°E	-3140 1880	50	625 x 235	29.5
Ebersw. Crater	26.37°S / 325.10°E	22.5°S 32.9°S	323.7°E 328.1°E	-3140 1880	50	625 x 235	29.5

Table 1. Properties of the HRSC multi-orbit DTMs for the four MSL candidate landing sites.

Methods: **The High Resolution Stereo Camera (HRSC) [4,5] onboard ESA's Mars Express orbiter is a multiple line pushbroom camera acquiring stereo images in 5 panchromatic channels simultaneously. DTM generation from multiple orbits exploits the full set of stereo analysis techniques applied for single-track processing, which are well established and thoroughly validated [1,2,6]. Some of the latest image datasets for which the full set of adjustment results was not available yet were also included where routine validation procedures using MOLA data [7] indicate compliance with standard accuracy requirements [1] (e.g. horizontal position accuracy better than DTM grid spacing). DTM interpolation of 3D points from multiple orbits is implemented as an adaptive processes applying distance weighted mean interpolation with variable interpolation radii for factoring in variations of point density and precision, ensuring a stronger influence of more precise 3D points on the resulting DTM heights.**

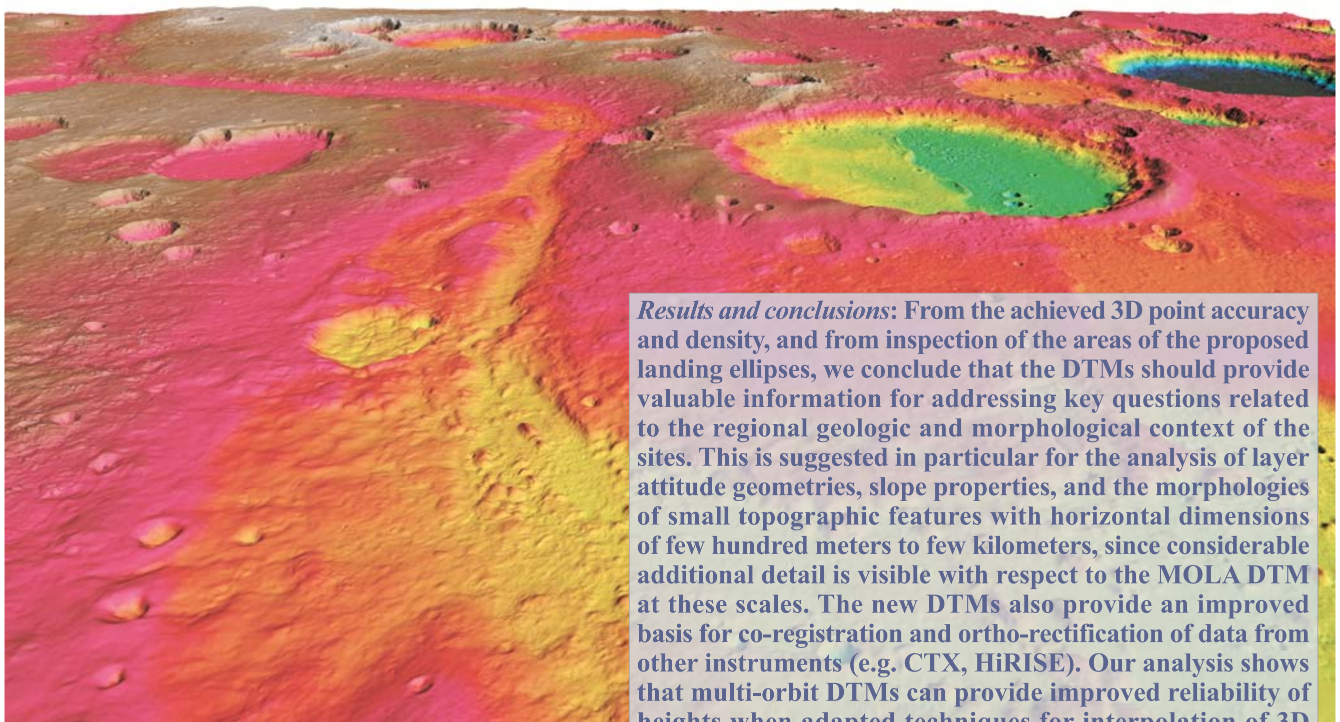


Figure 3. MSL candidate landing site Mawrth Vallis.

Results and conclusions**: From the achieved 3D point accuracy and density, and from inspection of the areas of the proposed landing ellipses, we conclude that the DTMs should provide valuable information for addressing key questions related to the regional geologic and morphological context of the sites. This is suggested in particular for the analysis of layer attitude geometries, slope properties, and the morphologies of small topographic features with horizontal dimensions of few hundred meters to few kilometers, since considerable additional detail is visible with respect to the MOLA DTM at these scales. The new DTMs also provide an improved basis for co-registration and ortho-rectification of data from other instruments (e.g. CTX, HiRISE). Our analysis shows that multi-orbit DTMs can provide improved reliability of heights when adapted techniques for interpolation of 3D points from multiple orbits are applied. This is reflected e.g. by a reduction of height deviation with MOLA (Table 1) as compared to the average value for single-track DTMs (34.5 m, [1]). Note, however, that the deviation from MOLA heights includes uncertainty related to both datasets as well as sampling effects, and thus also measures differences of resolved topographic detail due to the higher horizontal resolution of HRSC, as discussed in [1,2].**

References: [1] Gwinner, K., et al. (2009), EPSL, in press. [2] Gwinner, K., et al. (2009), PERS 75(9), 1127-1142. [3] Golombek, M., et al. (2009), 40th LPSC. [4] Neukum, G., et al. (2004) ESA SP-1240, 17-35. [5] Jaumann, R., et al. (2007), PSS 55, 928-952. [6] Heipke, C., et al. (2007), PSS 55, 2173-2191. [7] Smith, D.E., et al. (2001)., JGR 106(E10), 23689-23722.