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Global Topography of Mars from High Resolution Stereo Camera (HRSC) Multi-Orbit Data Products: the first Quadrangle (MC-11E) and the Landing Site Areas of ExoMars

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After more than 10 years of operation, the High Resolution Stereo Camera (HRSC) of ESA's Mars Express mission covered about 70% of the surface by panchromatic images at 10-20 m/pixel, and about 98% at better than 100 m/pixel. As the areas with contiguous coverage by stereo data are increasingly abundant, the HRSC team has recently started a coordinated effort for the systematic mapping of Mars by multi-orbit digital elevation models (DTMs) and image mosaics, using the complete HRSC mission data record. The new global mapping program is based on the USGS MC-30 quadrangle scheme, where quadrangles are split into eastern and western parts to limit data volumes. We present the DTM and orthoimage mosaic (grid spacing of 50 m and 12.5 m, respectively) for the first half-tile, MC-11E (Eastern Oxia Palus), and highlight their use for characterizing the landing site areas of ESA's ExoMars landing mission to be launched in 2018.

HRSC is designed to map and investigate the topography of Mars and its satellites. As a push broom scanning instrument with nine CCD line detectors mounted in parallel, its unique feature is the ability to obtain along-track stereo images and four colors during a single orbital pass. The sub-pixel accuracy of derived 3D points allows producing DTMs with grid sizes of up to 50 m and a height accuracy on the order of one pixel on the ground and better. Such data products have been produced for individual HRSC strips covering approximately 40% of the surface of Mars so far. HRSC also bridges the gap between laser altimetry and topography data derived from other stereo imaging instruments, and provides geodetic reference data and geological context to a variety of stereo and non-stereo datasets.

A quality assessment of the MC-11E (Eastern Oxia Palus) quadrangle products shows that, using bundle block adjustment, adjacent image strips can be co-registered with an accuracy of approximately one pixel at the highest image resolution available. We will discuss the resolution of topographic detail in these datasets, including improvements with respect to the case of single-strip data products and a comparison with external datasets. The quadrangle contains two of the four remaining landing sites for the ExoMars 2018 rover, and also the other two candidate sites are well covered by HRSC. HRSC data products are valuable to analyze large-scale topographic parameters (e.g., slopes over long baselengths) that are relevant for landing site safety assessments. Moreover, HRSC data enable investigating the geological context of landing sites, including the role of endogenic and exogenic processes. In particular, local and regional HRSC-derived topography serves as a basis for quantitative analyses of aqueous processes, e.g., discharge rates, sediment transport, and depositional geometries. We discuss the use of HRSC data products for landing site assessment and regional characterization of candidate landing site geology.