

# Topographic mapping of the Mars MC quadrangles using HRSC data

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## Abstract

Panchromatic stereo and color images from single orbits of the High Resolution Stereo Camera (HRSC) have been used to produce digital terrain models (DTMs) and orthoimages of the Martian surface since 2004. Since 2014 new HRSC multi-orbit data products are generated. We report on the aim to use these products for a controlled topographic color orthoimage map series of Mars at a scale of 1:700,000.

## 1. Introduction

The High Resolution Stereo Camera (HRSC) of ESA's Mars Express mission [1, 2] 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 height accuracy on the order of one pixel on the ground and better [3].

## 2. Data

Based on continuous coverage of an area of the Martian surface by adjacent HRSC stereo images, regional DTMs and orthomosaics can be produced by combining image data from multiple orbits using specifically adapted techniques for block-adjustment, DTM interpolation and image equalization [4]. The resulting DTMs and color orthomosaics are the baseline for our maps.

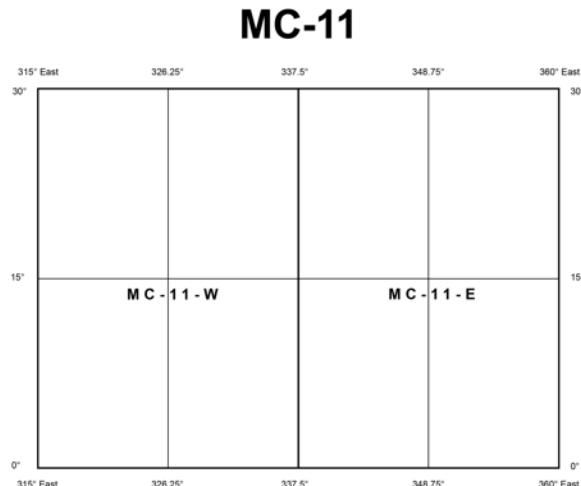


Figure 1: Tiling scheme of MC-11

## 3. Maps

We adopt the MC30 (Mars Chart) global mapping scheme of Greeley and Batson [5], which subdivides Mars into 30 quadrangles. To limit data volumes and map sizes, each quadrangle is further subdivided into 8 tiles (Fig. 1). Each tile has a map scale of 1:700,000, which is a compromise between the high DTM and orthomosaic resolution of 50 m/pxl and an acceptable hardcopy format of about 1 m in width to 2 m in height. This results in a printing scale of 14 pxl/mm (350 pxl/Inch). An example of the maps is shown in Figure 2. All maps will become available for the public at the Europlanet website (<http://europlanet.dlr.de>).

## 4. Summary and Outlook

After the completion of the first HRSC MC-30 half-tile DTM and color mosaic we developed a workflow to create the first four topographic maps [6]. We plan to finish the maps of the second half-tile within this year. We hope to generate a whole series of topographic maps from the upcoming MC quadrangles and with it to give the community a better overview and understanding of the mapped regions.

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## References

- [1] Neukum, G., Jaumann, R., and The HRSC Co-Investigator Team, HRSC: The High Resolution Stereo Camera of Mars Express. Mars Express: The Scientific Payload, ESA Special Publication, 1240, pp. 17-36, 2004.
- [2] Jaumann, R., et al., The high-resolution stereo camera (HRSC) experiment on Mars Express: Instrument aspects and experiment conduct from interplanetary cruise through the nominal mission. Planetary and Space Science 55, pp. 928-952, 2007.
- [3] Gwinner, K., et al., Topography of Mars from global mapping by HRSC high-resolution digital terrain models and orthoimages: Characteristics and performance, Earth and Planetary Science Letters, 294, pp. 506-519, 2010.
- [4] Gwinner, K. et al., The High Resolution Stereo Camera (HRSC) of Mars Express and its approach to science analysis and mapping for Mars and its satellites, Planetary and Space Science, 126, pp. 93-138, 2016.
- [5] Greeley, R. and Batson, G., Planetary Mapping, Cambridge University Press, Cambridge, 1990.
- [6] Schulz, K., Topografische Karten der Mars Region MC-11-E, Bachelor Thesis, Beuth Hochschule für Technik Berlin, 2017.

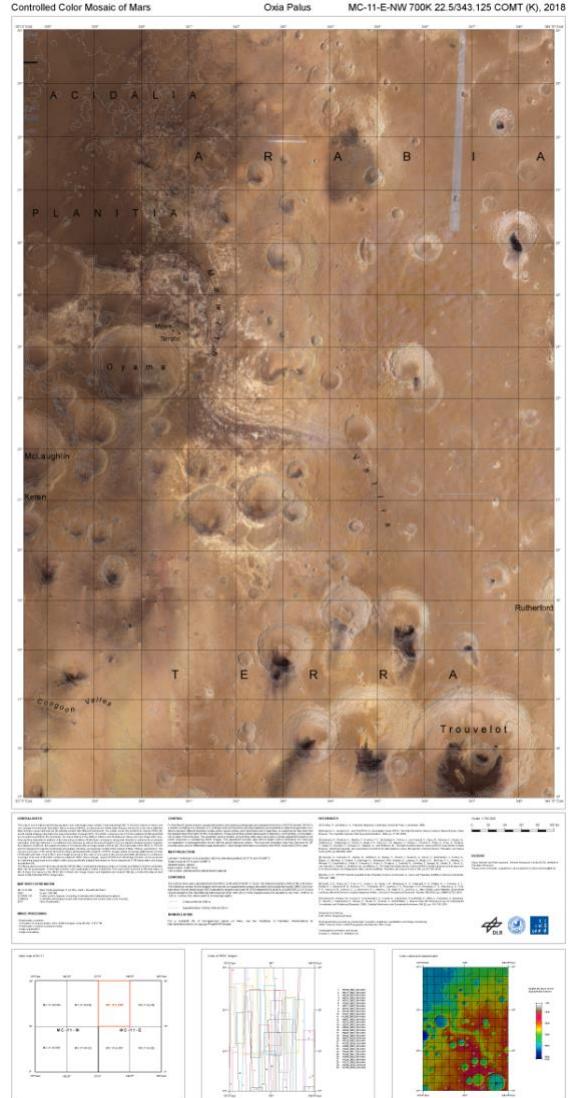


Figure 2: Topographic map of MC-11-E-NW