This bundle contains version 2 MRO MARCI Mars Daily Global Maps (MDGMs). Each MDGM is a daily global mosaic of Mars (90°S-90°N, 180°W-180°E) on a regular latitude / longitude grid (with 0.1° standard or 0.05° double resolution). Each map is composed of 13 consecutive global map swaths taken by the MRO MARCI instrument. A global map swath is a pole-to-pole, limb-to-limb wide-angle image which is gradually built up by the camera during the visible portion of the spacecraft's 3AM-3PM 2-hourly polar orbit. Consequently, a MDGM represents Mars as seen at around 3PM on each Mars day (sol). There is 1 overlap swath between consecutive days. For example, the 13th swath for day 1 is the same as the 1st swath of day 2, and so on. Missing or unusable swaths are treated as missing data for the corresponding day. The MDGMs in this bundle is in TIFF format.

Since a MDGM includes data taken during a period of approximately one day, it corresponds to a range of imaging time and solar longitude (L_s) values. We provide the list of MARCI filenames used to create each MDGM in the index folder for each filter. A user can use the "START_TIME" and "STOP_TIME" in the header of each MARCI image (available at the PDS) to obtain the exact time range. The MARCI filename is in the format of PPP_NNNNN_TTTT_MX_00NBBBW, where PPP is the mission subphase and TTTT is the solar longitude at the start of the image (in units of 0.1°). TTTT can therefore be used to represent the approximate L_s value for the MARCI image swath. A full description of MARCI filename convention can be found in the marcisis file in the MARCI PDS archive. To simplify the usage of MDGMs, we provide the Mars year and approximate L_s value for each day in the "PPP_ls.txt" file in the index/color folder. The L_s value corresponds to the middle swath used for the MDGM.

The version 2 MRO MARCI MDGMs [Wang and Gonzalez Abad, 2021] result from an upgrade from the version 1 MRO MARCI MDGMs [Wang and Richardson, 2015]. A replication of the 0.1° color maps in JPEG and PNG format for this product can be found on Harvard Dataverse (doi.org/10.7910/DVN/U3766S). The version 1 MRO MARCI MDGMs can be found at Harvard Dataverse (doi.org/10.7910/DVN/G2VENZ). The MGS MOC MDGMs can also be found at Harvard Dataverse (doi.org/10.7910/DVN/WWRT1V). In general, MARCI images are more difficult to process than MOC images because of the larger range of emergence angles.

The procedure used for version 2.0 MRO MARCI MDGMs is described in the "processing" file in this folder and the updates for version 2.1 is described in Wang and Gonzalez [2021]. Version 2 includes both 0.1° and 0.05° maps for the visible filter. More extensive image processing is performed to reduce artifacts (e.g., seams, opposition surges, polar transition) in the final product. In spite of the effort, some residual artifacts inevitably remain. These are not treatable using the current processing pipeline automatically. Further improvement will require manual correction on a case-to-case basis. The "errata" file in this folder lists some known issues that complicate processing.

MARCI has 5 visible (band1: blue, band2: green, band3: orange, band4: red, band5: nir) and 2 UV (band6: short_uv, band7: long_uv) filters [Bell et al., 2009]. Therefore, there are usually 7 black-and-white MDGMs for each spatial resolution (0.1° or 0.05°) on each day - one for each filter. Occasionally, a MARCI image swath only has 3 visible filters (band1, 2, and 3). In addition to black-and-white MDGMs on each day, a color MDGM is created for each resolution by combining 3 visible MDGMs (normally band4, band2, and band1, or occasionally

band3, band2, and band1). The 0.1° MDGMs are in the data/ folder. The 0.05° MDGMs are in the data_resx2/ folder.

The MRO MARCI MDGM dataset is meant to provide a quick-and-easy way of showing weather and surface albedo features (dust storm, condensate cloud, surface, polar cap) on Mars each day and keep a long-term record. Users are free to stretch the maps in any way they desire. Please note that MDGMs are not intended to be converted to physical units for radiance related studies. For those studies, direct radiometric calibration on MARCI EDR images is more appropriate. The photometric function and parameters used in image processing are solely for the purpose of flattening the geometry related brightness variation of image swaths. The values are non-unique and do not represent the true photometric behavior of the Mars surface and atmosphere.

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Reference

Bell III, J.F., Wolff, M.J., Malin, M.C., Calvin, W.M., Cantor, B.A., et al., 2009. Mars Reconnaissance Orbiter Mars Color Imager (MARCI): Instrument description, calibration, and performance. JGR, 114, E08S92, doi:10.1029/2008JE003315.

Wang, H. and Richardson, M.I., 2015. The origin, evolution, and trajectory of large dust storms on Mars during Mars years 24-30 (1999-2011), Icarus, 251, 112-127, doi:10.1016/j.icarus.2013.10.033.

Wang, H. and Gonzalez Abad, G., 2021. Cloud masks derived from the Mars Daily Global Maps and an application to the tropical cloud belt on Mars. Geosciences, 11, 324, doi:10.3390/geosciences11080324.