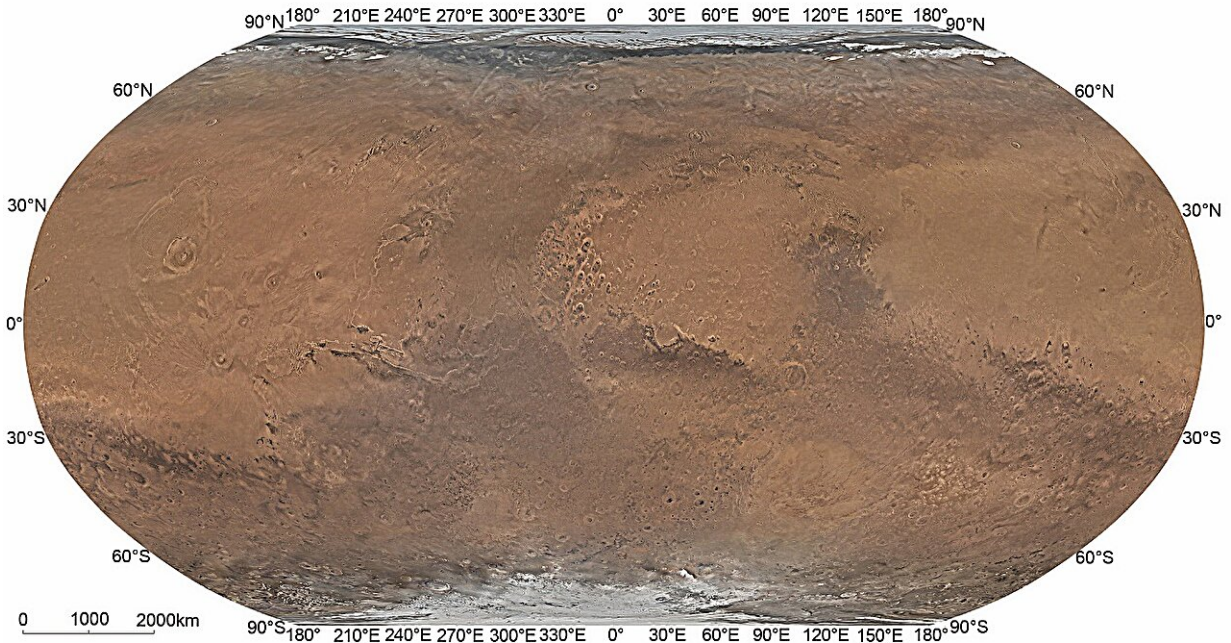


# Research team releases a 76 m-per-pixel global color image dataset and map of Mars

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A true color Mars global image map in Robinson projection is created with Tianwen-1 MoRIC image data, the resolution of the original data is ~76 m per pixel, and the horizontal accuracy is 68 m. Credit: Science China Press

Remote-sensing images of Mars contain rich information about its surface morphology, topography, and geological structure. These data are fundamental for scientific research and exploration missions of Mars. Prior to China's first Mars exploration mission, data from six

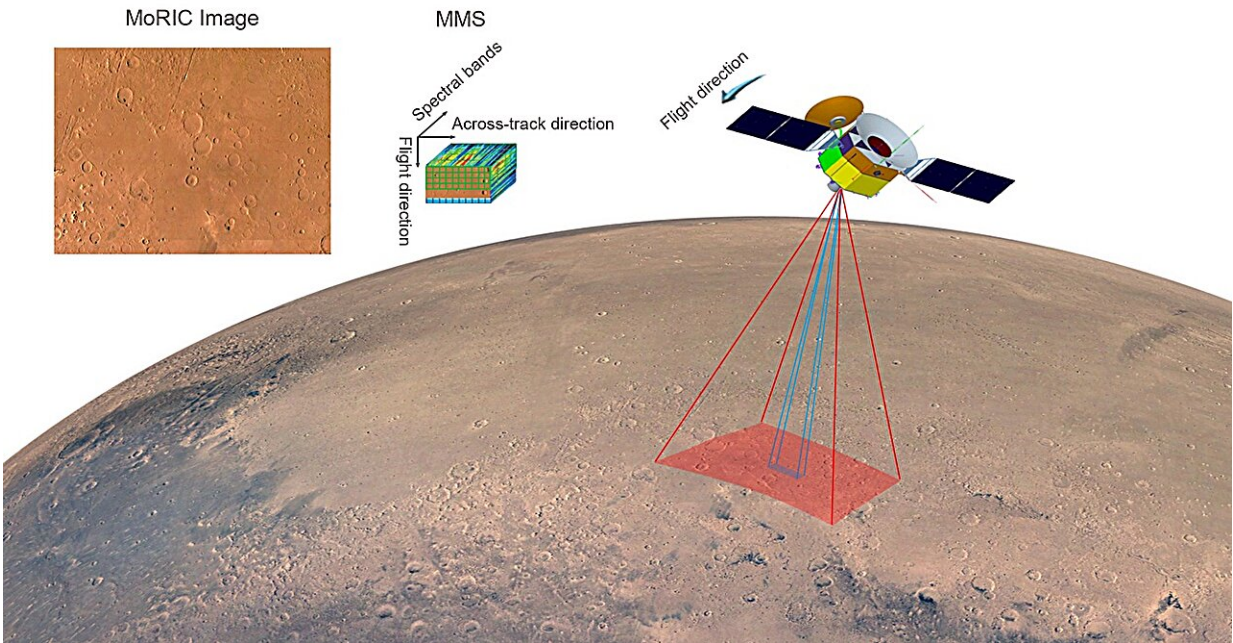
advanced optical imaging systems of different missions in the Martian orbit was used to generate Mars global/near-global image datasets with spatial resolutions better than 1 km.

However, in terms of global color images, the best version of Mars Viking Colorized Global Mosaic has a [resolution](#) of approximately 232 m/pixel. There is a lack of global color images of Mars at the hundred-meter scale and higher resolution.

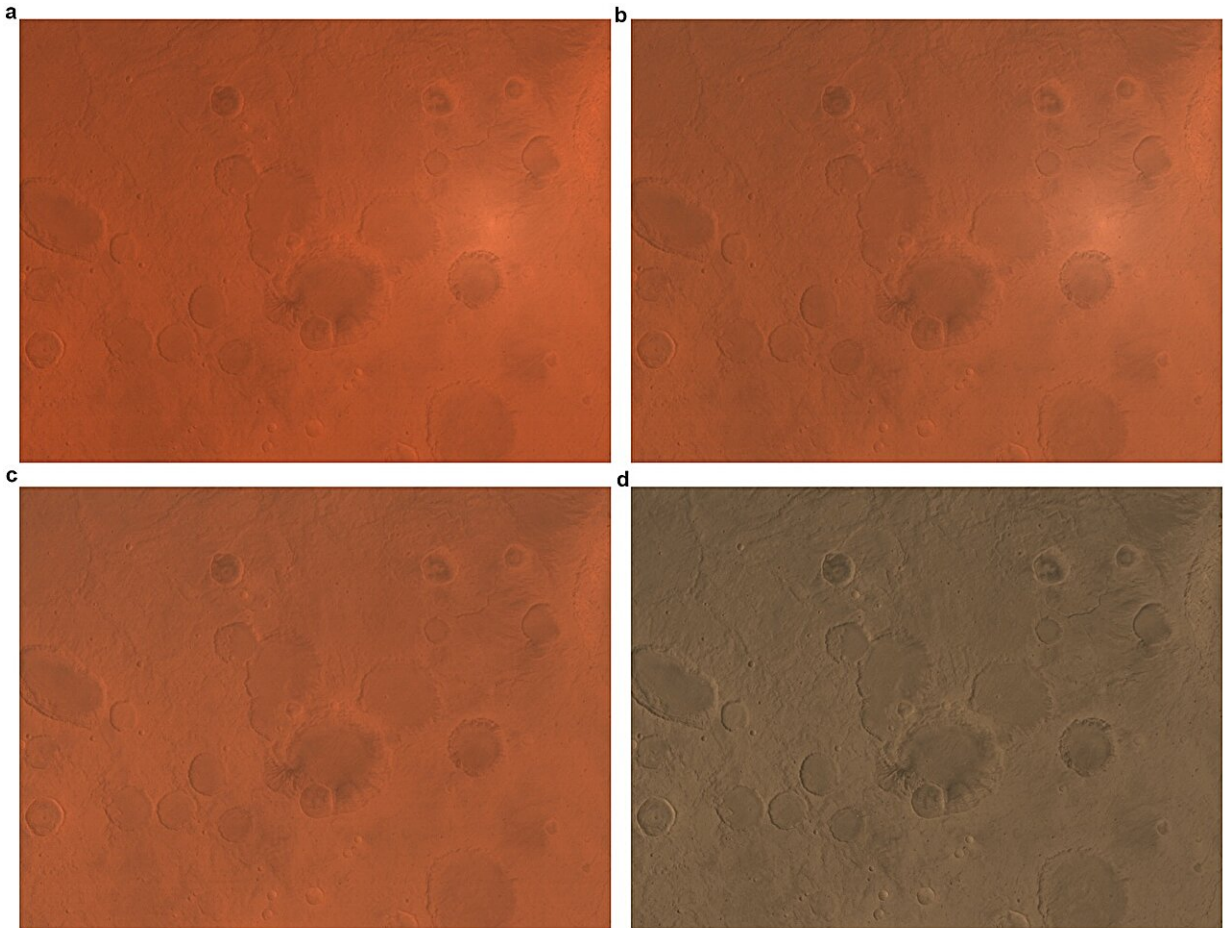
New data obtained by the Tianwen-1 [mission](#) has laid the foundation for the development of a high-resolution global color-image map of Mars with high positioning accuracy. As of July 25, 2022, Tianwen-1 Moderate Resolution Imaging Camera (MoRIC) had completed imaging over 284 orbits during its remote-sensing mission period, acquiring 14,757 images with spatial resolutions between 57 and 197 m.

The collected images achieved global coverage of the Martian surface. At almost the same time, a total of 325 strips of data in the visible and near-infrared bands were obtained by the Tianwen-1 Mars Mineralogical Spectrometer, with spatial resolutions varying from 265–800 m.

Using the above-mentioned data, Professor Li Chunlai at National Astronomical Observatory of the Chinese Academy of Sciences and Professor Zhang Rongqiao at Lunar Exploration and Space Engineering Center led the Tianwen-1 science team and collaborators to conduct research on image data processing and global mapping of Mars. The research is [published](#) in the journal *Science Bulletin*.



The optical camera (MoRIC) and imaging spectrometer (MMS) onboard the Tianwen-1 orbiter were used to obtain remote-sensing images of the entire Martian surface. Credit: Science China Press



(a) Level 2C data product as the input, (b) image corrected by atmospheric correction, (c) image corrected by photometric correction, and (d) image corrected after color correction. Credit: Science China Press

This study used the bundle adjustment technology to optimize the original orbit measurement data by treating Mars as a unified adjustment network, reducing the position deviation between individual MoRIC images to under 1 pixel, and achieving pixel-level "seamless" global image mosaicking.

Brightness and color consistency of the global images was ensured

through color correction and global color uniformity. The true colors of the Martian surface were measured using the MMS onboard the Tianwen-1 orbiter, and a true-color reference for the Martian surface was established for true color restoration.

Through this study, a global color image dataset and map of Mars (Tianwen-1 Mars Global Color Orthomosaic 76 m v1), with a resolution of 76 m and a horizontal accuracy of 68 m was produced and released.

The Tianwen-1 Mars Global Color Orthomosaic data products fill the gap in the high-precision positioning of Mars global color-image data products at a scale of tens of meters. It is currently the highest resolution global true-color image map of Mars, and significantly improves the resolution and [color](#) authenticity of commonly used global Mars images.

This mapping product can serve as a new Mars global base map, providing a higher-quality geographic reference for international peers to conduct Mars image mapping at scales of tens of meters, meters, and submeters, as well as supporting subsequent Mars exploration missions and scientific research.

**More information:** Jianjun Liu et al, A 76-m per pixel global color image dataset and map of Mars by Tianwen-1, *Science Bulletin* (2024). [DOI: 10.1016/j.scib.2024.04.045](https://doi.org/10.1016/j.scib.2024.04.045)

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