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Mapping of Mars crustal magnetic field using Equivalent-Pole-Reduction method

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Mars has presently no a planetary, dynamic magnetic field. This planet has, however, strong, localized magnetic fields of lithospheric origin, which is much lager than the terrestrial lithospheric magnetic field. To assess the origin of the magnetic field of Mars, it is indispensable to make a magnetic field map in detail.

In this study, the Mars magnetic field is represented by surface poles using the Equivalent-Pole- Reduction (EPR) method of Toyoshima et al. (2008). It has already been applied to the moon magnetic field and has given stable results to draw the magnetic anomaly map.

The data used here is from magnetometer on board the Mars Global Surveyor spacecraft operated from 1996 to 2006. Previous studies have focused on making global Martian magnetic field map, while this study focus on more detailed maps of several regions where some prominent features is seen on the previous maps; Tharsis Bulge including Olympus Mons the tallest volcano in the Solar-System, Valles Marineris the largest canyon on Mars, Herras Planitia the largest impact crater on Mars, Terra Cimeria and Terra Sirenum with very intense magnetic anomaly.

The surface magnetic charges computed using EPR method are used to generate an altitude-normalized magnetic map from different altitudes data. We superimpose the magnetic anomaly maps on the topographical maps. The correlation of these two maps seems to go down to smaller scale than that argued in the previous studies.

Keywords: Mars, crustal magnetic field, Equivalent-Pole-Reduction method, Mars Global Surveyor