



The dayside current system associated with the Martian crustal field: inferred from the MGS/MAG measurements

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Mars has not significant global dipole magnetic field but keeps significant remanent magnetic field of rocky crust on the southern hemisphere. The local crustal magnetic field would result in a mini-terrestrial-like magnetosphere due to the interaction with magnetosphere, though the global magnetosphere is Venusian-like. Many studies show that the crustal magnetic field plays an important role in the interaction with solar wind plasma, e.g. the energetic particles can be guided by the crustal magnetic field into the atmosphere, the differential motion of ambient plasma relative to the field can induce motional electric field which can drive more plasma dynamics. Some researchers even found the auroras on Mars, which are just associated with the crustal magnetic field.

As well known, the interaction of Earth geomagnetic field with solar wind plasma can generate complicated magnetospheric current systems. Similarly, the Sq current system in ionosphere is induced by the interaction of geomagnetic field with ionospheric plasma. Being motivated by the current systems associated geomagnetic field, one may naturally ask that whether any electric currents associated with the Martian crustal magnetic field can be induced. To clarify this issue can advance the knowledge how the role the crustal magnetic field played in the martian space environment.

The magnetometer onboarding MGS provide wide measurement of martian crustal magnetic field over nearly 7 years (1999-2006) after the orbit maneuver. Many crustal magnetic field models were established based on the data set collected by the magnetometer of MGS. However, to avoid the disturbance of dayside space current, most of these models just consider the data of night side measurements.

Here, following the idea of constructing these models, the nightside magnetic field measurement of MGS is seen as the baseline of crustal field in our study. Using the magnetic field data of MGS, we subtract the nightside baseline from the dayside field data in the geographic coordinates, so that the magnetic field disturbance of day side current can be obtained. The preliminary analysis of the field disturbance find that, at least two kind electric currents in dayside can be identified. The one is the diamagnetic current which is associated with the enhanced amount of ionized particles due to the solar irradiance. The other one is the field-aligned current, which flows along the magnetic field into or out of the martian atmosphere. The field-aligned current is probably responsible for the Martian auroras as reported by previous studies.