Geophysical Research Abstracts
Vol. 12, EGU2010-14232, 2010
EGU General Assembly 2010

Dayside Ionospheric Conductivities at Mars

Hermann Opgenoorth (1,2), Ranvir Dhillon (3), Lisa Rosenqvist (1,4), Mark Lester (3), Niklas Edberg (1,3), Steve Milan (3), Paul Withers (5), and David Brain (6)

(1) Swedish Institute of Space Physics, Uppsala Division, Uppsala, Sweden (hermann.opgenoorth@esa.int), (2) Max-Planck-Inst. f. Sonnensystemforschung, Max-Planck-Str.2, 37191 Katlenburg-Lindau, Germany , (3) Dept. of Physics and Astronomy,
Univ. of Leicester, Leicester
LE1 7RH, UK , (4) Försvarets Forskningsinstitut, 16490 Stockholm, Sweden , (5) Center for Space Phys., Boston Univ., 725 Commonwealth Ave, Boston MA 02215, USA , (6) Space Sciences Lab, University of California, 7 Gauss Way, Berkeley CA 94720, USA

We present results on dayside ionospheric conductivities at Mars, based on magnetic field measurements by Mars Global Surveyor (MGS) at altitudes down to $\sim$100 km during aero-braking orbits early in the mission. We find that the ionosphere is highly conductive in this region, as expected, with peak Pedersen and Hall conductivities of 0.1-1.5 S/m depending on Solar illumination and induced magnetospheric conditions.
Furthermore, we found a consistent double peak nature in the altitude profile of the dayside Pedersen conductivity, similar to that on Titan found by Rosenqvist et al. (2009). A high altitude peak, located between 180 and 200 km, is equivalent to the terrestrial peak in the lower F-layer. A second and typically much stronger layer of Pedersen conductivity is observed between 120-130 km, which is below the Hall conductivity peak at about 130-140 km. In this altitude region MGS found a sharply decreasing induced magnetic field strength at the so-called inner magnetospheric boundary (IMB), while the dayside electron density remains high until down to about 100 km.
Above regions of strong crustal magnetic anomalies the dual peak behaviour of the Pedersen conductivity is reduced to a more Earth-like conductivity distribution with one strong Pedersen peak above the Hall conductivity peak. Here both conductivities are 1-2 orders of magnitude smaller than above only weakly magnetised crustal regions, depending on the strength of the crustal anomaly field at ionospheric altitudes.
This nature of the Pedersen conductivity together with the structured distribution of crustal anomalies all over the planet should give rise to strong conductivity gradients around such anomalies and also at the terminators. Under the influence of any applied electric field, such an ionospheric conductivity structure should give rise to complicated ionospheric electrodynamics, including three-dimensional field-aligned current flow, particularly in regions where of more radial magnetic field directions (e.g. in the localised cusps of crustal magnetic anomalies) and strong conductivity gradients coincide.