



Local plasma processes and enhanced electron densities in the lower ionosphere in magnetic cusp regions on Mars.

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The MARSIS ionospheric sounder and the charged particle instrument package ASPERA-3 are both experiments on board the Mars Express spacecraft. Joint observations have shown that events of intense ionospheric electron density enhancements occur in the lower ionosphere of magnetic cusp regions, and that these enhancements are not associated with precipitation of charged particles above a few hundred electron Volts (< 300 eV). To account for the enhancement by particle precipitation, electron fluxes are required with mean energy between 1 and 10 keV. No ionizing radiation, neither energetic particles nor X-rays, could be identified, which could produce the observed density enhancement only in the spatially limited cusp regions. Actually no increase in ionizing radiation, localized or not, was observed during these events. It is argued that the process causing the increase in density is controlled mainly by convection of ionosphere plasma driven by the interaction between the solar wind and crustal magnetic field lines leading to excitation of two-stream plasma waves in the cusp ionosphere. The result is to heat the plasma, reduce the electron-ion recombination coefficient and thereby increase the equilibrium electron density.