

The ionosphere of Mars: modeling the photochemical dominated region and subjacent meteor layers

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Abstract

The dayside ionosphere of Mars can be divided into several regions. The photochemical dominated regime includes the main peak M2, mainly formed by solar EUV and the lower peak M1, formed by X-ray and impact ionization by solar photo-electrons. The ionospheric topside often contains a “bulge”, an accumulation of electrons above the main peak and a diffusion region, where molecular diffusion dominates the photochemical ionospheric processes. An ionopause can be formed by the interaction of the planetary ionosphere with the solar wind. Sporadic layers of additional electron density (Fig. 1 and Fig. 2) have been identified below M1 in MaRS (Mars Express) and MGS radio science observations.

In situ measurements in the Earth atmosphere revealed accumulations of metallic ions in the lower ionospheric region. A meteoroidic origin for this phenomenon is now generally accepted.

In situ measurements of metallic ions in the ionosphere of Mars do not exist. A 1D photochemical model for the general ionosphere (IonA, Ionization in Atmospheres) is combined with a model for the meteor layers to study the influence of meteoroids on the ionosphere of Mars.

This paper shall present a general comparison between IonA model results and MaRS ionospheric observations. Selected MaRS observations shall be modeled with a combination of IonA and the meteor layer model to gain a deeper understanding of the photochemical processes at this ionospheric altitude region.

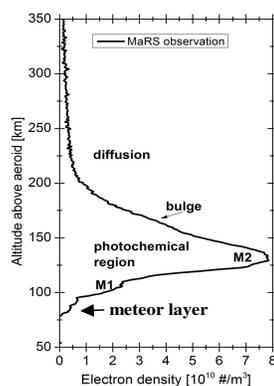


Fig. 1: MaRS electron density profile from DoY 343, 2005, $L_s = 337.7^\circ$, lon. = 298.8° , lat. = 66.5° , zenith angle = 76.5° , meteor layer merged with the base of M1

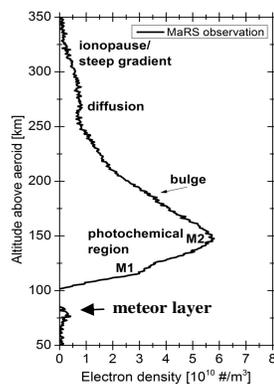


Fig. 2: MaRS electron density profile from DoY 211, 2005, $L_s = 259.6^\circ$, lon. = 333.5° , lat. = 57.6° , zenith angle = 83.0° , meteor layer separated from M1