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Electron impact ionization in Titan's sunlit ionosphere

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Abstract

Solar EUV driven model calculations of the thermal electron balance in Titan's sunlit ionosphere overestimate the Langmuir probe derived electron number densities by a factor of ~2 [1]. Whether the cause of the discrepancy is overestimated plasma production, underestimated plasma loss or a combination of the two is an open question. In the present work we show and discuss comparisons of model derived suprathermal electron intensities with CAPS/ELS [2] spectra in Titan's sunlit ionosphere (focusing on the T40-T42 and T48 Titan flybys by the Cassini spacecraft). The model accounts only for photoelectrons and associated secondary electrons with the main input being the impinging solar EUV spectrum at the day of the investigated flybys, as measured by TIMED/SEE (Level 3) [3] and extrapolated to Saturn. Associated electron impact ionization rates have been derived by integrating the electron intensities over energy, invoking the ambient number densities of N_2 and CH_4, and the related energy dependent electron-impact ionization cross sections. Focusing on the altitude regime 1000-1200 km the electron impact ionization rates derived with modeled intensities are on average ~80% higher than values derived with CAPS/ELS based intensities. This is counter-intuitive and potential reasons will be discussed. The results indicate that overestimated plasma production through photoionization *possibly* contributes to the present difficulties in accurately reproducing number densities of free thermal electrons in Titan's main sunlit ionosphere. This requires, however, further studies to be confirmed or dismissed.

References

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