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The ionospheric electron density of Titan as measured by RPWS/LP during TA-T100

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Abstract

We present measurements from the Cassini Radio and Plasma Wave Science/Langmuir probe (RPWS/LP) instrument of the electron density in the ionosphere of Titan from the first 101 close flybys (TA-T100). The electron density has been shown to vary significantly from one flyby to the next, as well as on longer time scales, and we discern some of the reasons for this variability. Firstly, following the rise to the current solar maximum we show how the ionospheric peak density, normalized to a common solar zenith angle, N_{norm} varies with the ~11-year solar cycle (Figure 1). N_{norm} correlates well with the solar energy flux F_e and we find that $N_{norm} \propto F_e^k$, with k = 0.54 ± 0.18, which is close to the theoretical value of 0.5 [1]. Secondly, we present a case study from the T85 flyby when Titan was located in the magnetosheath of Saturn as opposed to the magnetosphere. Concurrently, the highest ever electron densities in the ionosphere of Titan were measured (N_{peak} = 4310 cm-3). We show that this could be caused by increased particle impact ionization during a CME impact on the Saturn system [2]. Thirdly, we also present results that indicate that the ionospheric density in the topside ionosphere (altitude range 1200-2400 km) are generally significantly increased, roughly by a factor of 2, when Titan is located in the post-midnight sector of Saturn, i.e. at Saturn local time 00 - 03 h, compared to other local time sectors. We suggest that this increase could be caused by additional particle impact ionization from reconnection events in the Saturn tail.

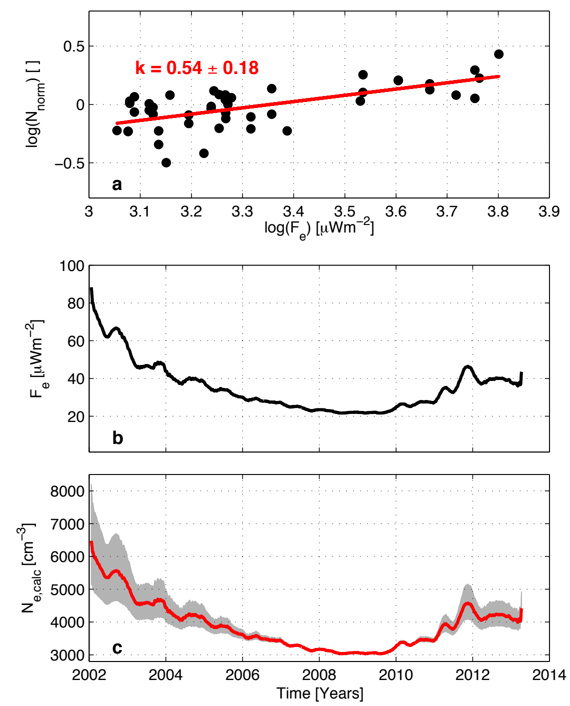

Figure 1: (a) SZA-independent peak electron density, N_{norm}, plotted versus the solar energy flux F_e. The best fit line (red) to the data has the form $\log(N_{norm}) = 0.54(\pm 0.18)\log(F_e) - 1.81(\pm 0.63)$. (b) A 100 day running average of the integrated (1–80 nm) solar energy flux measured by TIMED/SEE. (c) The expected ionospheric peak electron density calculated using the above relation. The shaded area corresponds to the range in density from the uncertainty interval of the power law exponent k.

3 Figures

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References

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