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Access of energetic particles to Titan's exobase

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Abstract

In this contribution we use a particle tracing code to trace energetic particles close to Titan in the specific magnetospheric conditions of the Cassini T9 flyby. The particles simulated are H^+ and O^+ ions with energies ranging from 1 keV to 1 MeV and the background electromagnetic field is represented by the output of the A.I.K.E.F. hybrid code for that specific flyby. These tools are used to generate 2D maps showing the access of the particles to the moon's exobase and those maps are subsequently used to normalize the fluxes measured by the Cassini MIMI/CHEMS instrument and estimate the energy deposition at specific positions around the moon. With this, we are able to estimate the importance that the asymmetries in the access of particles to the exobase has in the dynamics of Titan's ionosphere.

1. Introduction

Titan is the only moon in the Solar System known to host a complex and dense atmosphere. Even though the moon does not possess an internal magnetic field [2], the presence of the ionosphere as a conducting obstacle to the corotating plasma from Saturn's magnetosphere creates an induced magnetosphere around the moon. This whole environment is highly variable since Titan can be located outside the magnetosphere (in the unshocked solar wind), in the magnetosheath or in the outer magnetosphere, where in turn completely different plasma environments can be encountered, depending on whether Titan is located above, below or inside the bowl-shaped current sheet [1].

1.1 The flyby

For the present study, the T9 flyby was selected due to the asymmetric nature of the electromagnetic fields observed by the Cassini magnetometer (MAG).

During the flyby, Cassini passed at the moon's equatorial plane through the mid-range magnetic tail of the moon at a distance of 10411 km. The magnetic field presented a strong Saturn-directed component, suggesting that the moon was located below the current sheet.

With the help of a particle tracing software that integrates the Lorentz equation of motion in the specific background fields obtained from the hybrid code, the effects that the different asymmetries on the field have on the access of particles to the moon's exobase (1450 km above the surface) are investigated and the variabilities that this difference in access around the moon have on the energy deposition are discussed.

References

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