EPSC Abstracts,
Vol. 4, EPSC2009-9, 2009
European Planetary Science Congress,

Titan's plasma environment for T9 encounter: 3D hybrid simulation and comparison with observations

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Abstract

We discuss the results of the hybrid simulation of Titan's environment in case of T9 encounter. The simulations are based on recent analysis of the Cassini Plasma Spectrometer (CAPS) ion measurements during the T9 flyby through the induced magnetic tail of Titan [1]. This new result changes our previous model of the interaction of Saturn's rotating magnetosphere with Titan from one that was discussed in the recent publications. In our model the background ions, all pickup ions, and ionospheric ions are considered as a particles, whereas the electrons are described as a fluid. Photoionization, electron-impact ionization and charge exchange are included in our model. The temperature of the background electrons and pickup electrons was also included into the generalized Ohm's law. We also take into account the collisions between the ions and neutrals. The current simulation shows that mass loading by pickup ions H^+, H_2^+, CH_4^+ and N_2^+ is stronger than in the previous simulations. The background plasma contains only H^+ ions. In our hybrid simulations we use Chamberlain profiles for the exosphere's components. We also include a simple ionosphere model with $M = 28$ ions that were generated inside the ionosphere. The moon is considered as weakly conducting body. We use an implicit scheme for time integration of the electromagnetic equations. For the particle time integration we use a trapezoidal numerical scheme [2]. The computational resources were provided by the NASA Ames NAS Division (SGI-Columbia). Special attention will be paid to comparing our numerical results with Cassini T-9 observations. We shall estimate the mass loading rate and the energy input to the upper atmosphere from ambient and pickup ions for the T9 encounter.

References

[1] Sittler, E.C. et al. (2008) *Spring AGU Meeting*.

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