EPSC Abstracts,
Vol. 2, EPSC2007-A-00102, 2007
European Planetary Science Congress 2007

UNCERTAINTY ANALYSIS IN TITAN IONOSPHERIC CHEMISTRY MODEL

N. Carrasco (1), E. Hébrard (2), M. Dobrijevic (3), P. Pernot (1)

(1) University of Paris Sud, CNRS, UMR 8000, Orsay, F-91405, (2) University of Paris 12, CNRS, UMR 7583, Cré

nathalie.carrasco@lcp.u-psud.fr

The Ion Neutral Mass Spectrometer (INMS) of Cassini revealed a rich ion-neutral chemistry in the ionosphere, producing heavy hydrocarbons and nitriles ions. The modelling of such a complex chemistry is challenging, as it involves hundreds of ion-molecule reactions, in addition to an even more complex photochemical-transport model for the neutral atmosphere. The reactions are parametrized by rate constants and branching ratios of products, which have been measured with often sizeable uncertainties. Validation of the ionospheric chemistry model presently relies on the comparison of simulated ion mass spectra (MS) with INMS data, and thus on the estimation of prediction uncertainty.

An error budget has been undertaken for the pertinent sources of uncertainty (chemical parameters, neutral densities...). By uncertainty propagation (Monte Carlo sampling) we identified neutral densities as a major source of uncertainty, in comparison to the chemical parameters [1]. Large uncertainties actually characterise the simulated mass spectra, in particular at the higher masses (m/z $>$ 50 amu).

In order to identify the parameters responsible for these large uncertainties, a global sensitivity analysis was started. Based on ionospheric and stratospheric chemistry models, we identified a small set of ion-molecule and neutral-neutral reactions, responsible for the large uncertainties on the model predictions. We point out key reactions in need of more accurate laboratory measurements.

References

[1] Carrasco N, Hébrard E, Banaszkiewicz M, Dobrijevic M, Pernot P. Influence of neutral transport on ion chemistry uncertainties in Titan ionosphere. *Icarus*. Submitted.