Objectives of exospheric developments

Present state of the exospheric model

3D Monte Carlo model of the exospheric oxygen component:
- spherically symmetric thermosphere model for both thermal and non-thermal components,
- SZA dependency of the ionospheric component,
- Dissociative recombination using background ionosphere,
- Sputtering model using the magnetospheric outputs.

3D hydrogen model:
- thermal component considering spherically symmetric thermosphere/ionosphere
- Chamberlain approach

Coupling with the magnetospheric model
- Ion escape rates and structure (but limited by spatial scale),
- Incident ion rates and spatial structures.

What should be done?

Multi-species model of the exospheric model

- Introduction of a realistic thermosphere and ionosphere,

- Descriptions of the exospheric composition with respect to latitude, longitude and altitude,

Coupling with the thermospheric/ionospheric model :

- the seasonal and diurnal variations of the exosphere (Valeille et al. 2009...),

- the seasonal and diurnal variations of the escape rates (Valeille et al. 2009...)

- Coupling with a refined hybrid model: role of the seasons on the magnetosphere

How should it be done?

Multi-species model of the exospheric model

- based on Titan development (Michael et al. 2005),

- Cross section of collision (not hard sphere collision as in Valeille et al. (2009) because overestimate the escape rates and exospheric densities),

Coupling with the thermospheric/ionospheric model:

- 3D DSMC model to describe both thermal and non-thermal components,

- Parallelization of the model

Expected results

The 3D composition of the exosphere – Which signatures for dissociative recombination and sputtering?

The relative escape rates of hydrogen, carbon and oxygen – Where does go the water and the carbon?

The signatures of the thermosphere/ionospheric seasons in the exosphere and magnetosphere – Comparison with Valeille et al. (2009)

The relative role of the thermal/non-thermal components in the exosphere and the interaction with the solar wind – Comparison with Venus

The exospheric ion escape rates – Comparison with MEX