SIMULATED SOLAR WIND INTERACTION WITH THE MARTIAN ENVIRONMENT

Ronan Modolo 1, GERARD M. CHANTEUR 2, Eduard Dubinin 3

1 Laboratoire Atmosphère Milieux Observations Spatiales (LATMOS), Vélizy, France
e-mail: ronan.modolo@latmos.ipsl.fr
2 Laboratoire de Physique des Plasmas (LPP), Vélizy, France, e-mail:
gerard.chanteur@lpp.polytechnique.fr
3 Max Planck Institute for Solar System Research (MPS), Katlenburg-Lindau, Germany, e-mail: dubinin@mps.mpg.de

The Martian environment is strongly affected by its interaction with the solar EUV radiation and the solar wind. The remaining crustal magnetic field of the planet is both too weak and too much localized in the southern hemisphere of the planet to protect efficiently the Martian atmosphere from a direct interaction with the solar wind. This interaction has been investigated by means of a three dimensional multispecies hybrid simulation model coupling charged and neutral species via three ionisation mechanisms: the absorption of solar extreme ultraviolet radiation, the impacts of solar wind electrons, and the charge exchanges between ions and neutral atoms or molecules. This interaction modifies significantly the ionized environment and contributes to the atmospheric erosion. This simulation model has been used to investigate the variation of the Martian environment along the solar cycle and the atmospheric escape. It has been recently improved by including a simplified description of the ionospheric chemistry and a detailed computation of photoproduction taking into account photoabsorption. A subgrid resolution scheme is implemented close to the planet for computing chemistry induced variations of the statistical weights of the macroparticles describing the various ionic species. It is assumed that neutral particles are provided by infinite reservoirs with given altitude dependences. The model allows to make detailed diagnostics for solar wind and planetary ions, such as densities or energy spectrogrammes, at various locations and possibly along spacecraft trajectories. The model can also describe non-stationnary situations, for example the modification of the induced Martian magnetosphere following some variation of the solar wind and/or IMF parameters. This model is also useful to estimate escape rates for various planetary ions that can be compared to estimates derived from *in situ* observations y spacecraft like *Mars Express.*

Mars, Solar Wind, simulation

Gérard M. Chanteur, Laboratoire de Physique des Plasmas, 10 avenue de l'Europe 78140 Vélizy, France, tel. +33 1 39 25 49 14, fax +33 1 39 25 49 22, e-mail
gerard.chanteur@lpp.polytechnique.fr