The Mars neutral atmosphere at ionospheric altitudes: A method to derive neutral atmospheric profiles from MaRS electron density observations

K. Peter (1), M. Pätzold (1), G. Molina-Cuberos (2), O. Witasse (3), S. Tellmann (1), B. Häusler (4) and M. K. Bird (1,5)

(1) Rheinisches Institut für Umweltforschung, Abt. Planetenforschung, Cologne, Germany (2) Universidad de Murcia, Murcia, Spain (3) Research and Scientific Support Division of ESA, ESTEC, Noordwijk, The Netherlands (4) Institut für Raumfahrttechnik, Universität der Bundeswehr München, Munich, Germany (5) Argelander-Institut für Astronomie, Bonn, Germany

Since 2004, the radio science experiment MaRS (Mars Radio Science) on Mars Express is sounding the lower neutral atmosphere and ionosphere of the planet Mars. Far more than 600 complete profiles of the lower neutral atmosphere and ionosphere have been observed until today.

The consecutive observation of the Martian ionosphere and lower neutral atmosphere by MaRS gives the unique opportunity to gain also information about the neutral atmosphere at ionospheric altitudes.

A simple neutral atmospheric model is combined with the photochemical 1D IonA (Ionization in Atmospheres) ionospheric model to provide neutral number density and temperature boundaries for the lower ionosphere at the time of the MaRS ionospheric observation.

The neutral atmosphere start parameter range (neutral number density and temperature) at the base of the ionosphere shall be extrapolated from the MaRS neutral atmospheric profiles. A range of temperature/altitude profiles is generated from these start parameters and used to produce neutral atmospheric profiles (CO_2, N_2 and oxygen) with the time-independent continuity equation:

$$\frac{\partial \Phi_1}{\partial z} = 0$$

where z is the altitude and Φ_i is the flux of the species i.

The resulting neutral atmosphere profiles are used as input for the IonA model, which constructs a 1D ionosphere. The agreement with the observed MaRS electron densities implies the possible state of the neutral atmosphere at ionospheric heights at the time of the MaRS ionospheric observation.

This presentation will show the development status of the software tool and first derived temperature and neutral number density profiles in the lower ionospheric altitude range.