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The Martian Neutral Atmosphere as seen by the Radio Science Experiment MaRS on Mars Express

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Abstract

The Radio Science Experiment MaRS on Mars Express is sounding the Martian atmosphere and ionosphere using the spacecraft radio subsystem [e.g. 1].

The path geometry within the atmosphere and ionosphere is altered due to the radial variation of refractivity. The resulting frequency shift of the signal can be used to calculate the degree of bending, the ray periapsis, and the projection of the ray path onto the planetary surface. The refractivity of the atmosphere at the ray periapsis can be deduced via an Abel transform [2]. The neutral number density is directly related to the refractivity profile through a constant factor C_1 which depends on the atmospheric composition of the atmosphere.

Radial profiles of neutral number density are used to derive vertical profiles of temperature and pressure from the surface boundary layer up to ~50 km with a vertical resolution of only a few hundred metres.

The highly elliptical orbit of Mars Express allows us to study a large range of local times and locations and can therefore be used to investigate latitudinal, diurnal and seasonal variations. More than 570 profiles of temperature, pressure and neutral number density have been obtained so far, covering all latitudes during almost all seasons.

Atmospheric waves can be identified in several of the temperature profiles. Figure 1 shows typical temperature fluctuations caused by vertically propagating gravity waves. Atmospheric waves will be investigated with regard to their spatial and temporal occurrence in the different latitude ranges.

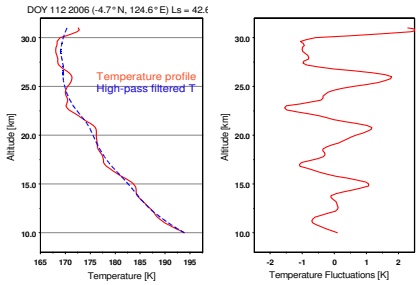

Figure 1: *Left:* Typical temperature profiles (red). A high-pass filtered temperature profile (blue) is used to extract the temperature fluctuations (*right*).

Several temperature profiles are located in the polar regions of both hemispheres. These measurements will be used to show the seasonal variations in the high latitude range. The high vertical resolution of these temperature profiles allows us to investigate the CO_2 super saturation and condensation in the polar regions as a function of altitude.

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References

[1] Pätzold, M. et al. (1994), ESA Special Publication, SP-1240.

[2] Fjeldbo, G. et al. (1971), Astron. J., 76, 123-140.