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Radio science measurements of atmospheric refractivity with Mars Global Surveyor

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Radio science experiments with Mars Global Surveyor measure the refractive index of the Martian atmosphere from the surface to an altitude of ∼250 km. Two basic data products are derived from these refractivity measurements. In the neutral atmosphere, profiles of temperature and geopotential versus pressure extend from the surface to a pressure of ∼10 Pa. In the ionosphere, profiles of electron density are retrieved at altitudes of ∼90–220 km. Currently, the vertical range of the neutral profiles is restricted by noise, boundary constraints, and practical limitations that arise in automated processing. We are analyzing the refractivity data over its complete altitude range with two main objectives: 1) to characterize the spatial structure of neutral density over an altitude range that extends from the surface to one scale height or more above the top of the standard neutral profiles, and 2) to examine the coherence of atmospheric structure over a wide range of altitudes that includes both the neutral atmosphere and ionosphere. To date, we have analyzed a set of ∼700 refractivity profiles acquired from November 2000 through January 2001 at latitudes of 60°–80°N. The solar longitude Ls ranged from 70° to 110°, corresponding to late spring and early summer of the northern hemisphere. In our initial results, the structure at some zonal wave numbers remains coherent over essentially the full vertical range of the measurements.