

MARS GLOBAL SURVEYOR RADIO SCIENCE ELECTRON DENSITY PROFILES : INTERANNUAL VARIABILITY AND IMPLICATIONS FOR THE NEUTRAL ATMOSPHERE. S. W. Bougher, *Space Physics Research Laboratory, U. of Michigan, Ann Arbor, MI 48109-2143, USA, (bougher@umich.edu)*, S. Engel, *Lunar and Planetary Laboratory, U. of Arizona, Tucson, AZ 85721 USA*, D. P. Hinson, *Stanford University, Palo Alto, CA 94035 USA*, J. R. Murphy, *New Mexico State University, Las Cruces, NM 88003 USA*.

The Mars Global Surveyor (MGS) Radio Science (RS) experiment employs an ultrastable oscillator aboard the spacecraft. The signal from the oscillator to Earth is refracted by the Martian ionosphere, allowing retrieval of electron density profiles versus radius and geopotential. The present analysis is carried out on five sets of occultation measurements : (1) four obtained near northern summer solstice ($L_s = 74-116$, near aphelion) at high northern latitudes ($64.7-77.6^\circ\text{N}$), and (2) one set of profiles approaching equinox conditions ($L_s = 135-146$) at high southern latitudes ($64.7-69.1^\circ\text{S}$). Electron density profiles (95 to 200 km) are examined over a narrow range of solar zenith angles ($76.5-86.9$ degrees) for local true solar times of (1) 3-4 hours and (2) 12.1 hours. Variations spanning 1-Martian year are specifically examined in the Northern hemisphere.

In four of these datasets, sampling is well distributed over longitude. Specific attention is given to the height and magnitude of the primary F1-ionospheric peak observed in each of these profiles. The height of this photochemically driven peak is controlled by the neutral density structure. Variations are observed as a function of SZA (weak) and longitude (strong), with a mean height of 134-135 km for the near aphelion profiles. The magnitude of this same photochemical peak is controlled by the changing solar flux; a mean ionospheric peak density of $7.0-9.0 \times 10^4 \text{ cm}^{-3}$ was obtained, reflecting solar moderate

conditions.

Seasonal inflation/contraction of the Mars atmosphere, dust storm expansion/abatement, and planetary wave processes are all thought to impact the integrated atmospheric column and the height of the dayside ionospheric peak. The Michigan Mars Thermospheric General Circulation Model (MTGCM) is exercised for Mars conditions appropriate to these RS observational periods in order to understand the underlying neutral atmosphere conditions giving rise to these ionospheric features (mean and variations). Solar moderate fluxes ($F_{10.7} = 130$), aphelion conditions ($L_s = 90$), and low dust opacities ($\tau = 0.3$) are specified. The MTGCM simulations also incorporate wave features resulting from upward propagating migrating plus non-migrating tides as well as in-situ tidal forcing. Longitude variations in the height of the simulated ionospheric peak are contrasted with corresponding RS longitude variations in measured peak heights. Tidal modes responsible for these longitude specific wave features are also identified. The interannual variations in the longitude structure of the height of the F1-peak (Northern hemisphere) are small, signifying the repeatability of the Mars atmosphere during aphelion conditions. Clearly, the height of the dayside ionospheric peak is a sensitive indicator of the changing state of the Mars lower atmosphere. This research is funded by the NASA MGS Data Analysis Program.