Interannual observations of the Martian ionosphere with Mars Global Surveyor electron density profiles

K. Cahoy[1]

[1]Stanford University, Department of Electrical Engineering, 350 Serra Mall Rm. 325, Stanford, CA 94305, USA, kcahoy@stanford.edu

This work presents a comprehensive overview of 5,229 electron density profiles from the Mars Global Surveyor radio occultation experiment. The data range from November 2000 to June 2005, and cover three consecutive northern summer seasons on Mars (Mars Years 25–27). Profiles extend from roughly 90-220 km altitude, and exhibit well-defined primary peak structure around 135 km. A secondary peak, or shoulder, is generally detectable, although it has a more variable morphology. The altitude of the primary electron density peak is determined by the depth of penetration of extreme ultra-violet (EUV) radiation, and the secondary peak by soft X-ray radiation (Bougher et al., GRL 28(16), 2001; Bougher et al. JGR 109 E03010, 2004). Chapman theory, with acknowledged limitations, captures the main features of the Martian ionosphere observed in MGS occultations with both SZA and altitude. Electron density profiles from MGS also show the effects of the 11-year (Schwabe) cycle in solar radiation and the 27-day quasi-periodic solar rotational (sunspot) cycle with altitude. Results are in general agreement with simulations of the Martian ionosphere at high and low solar activity levels by Fox and Yeager (JGR 111 A10309, 2006).

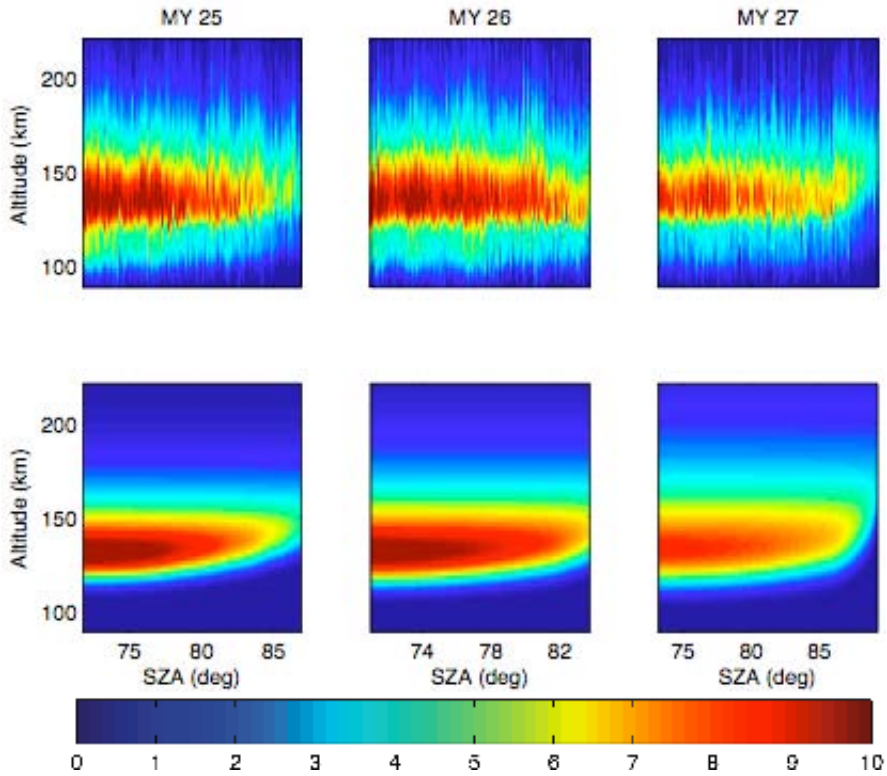

Figure 1: Upper panels, electron density x 10^4 cm^{-3} vs. altitude and SZA for three consecutive northern summer seasons on Mars (Mars Year 25, 26, and 27) as measured by the radio occultation experiment on Mars Global Surveyor. Lower panels, Chapman-like models of the ionosphere as fitted to the measurements.