Geophysical Research Abstracts, Vol. 7, 03726, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03726

Radio occultation measurements of planetary scale waves in the northern hemisphere of Mars

D. P. Hinson

Department of Electrical Engineering, Stanford University, dhinson@stanford.edu

The Radio Science (RS) investigation of Mars Global Surveyor (MGS) includes radio occultation experiments that sound the neutral atmosphere from the surface to an altitude of ~ 40 km. Each experiment yields profiles of temperature and geopotential versus pressure with a vertical resolution of ~ 500 m. At mid-to-high latitudes of the northern hemisphere, where ~ 9000 profiles are currently available, the RS measurements reveal a spectrum of planetary scale waves that varies dramatically with season. This includes stationary Rossby waves excited by surface forcing as well as traveling baroclinic eddies, which arise from instability. Remarkably intense wave activity occurs at some seasons within the lowest scale height above the surface, and the RS measurements provide unique insight into the dynamics in this region. For example, the dominant disturbance at 70°N during $L_s = 190^\circ$–200° of Mars Year 26 (MY 26) is an eastward moving baroclinic eddy with zonal wave number 2 and a period of ~ 2.9 sols. The amplitude in temperature is ~ 10 K at 610 Pa but decreases to 1–2 K at pressures < 200 Pa. Meridional winds implied by geostrophic balance at 610 Pa have an average amplitude over this 20-sol interval of 10–15 m s^{-1} and a 10% probability of exceeding 20 m s^{-1}. In another notable example, the dominant disturbance at 63°N during $L_s = 315^\circ$–335° of MY 25 is a shallow, eastward moving baroclinic eddy with zonal wave number 3 and a period of ~ 2.3 sols. The amplitude in temperature is ~ 6 K at 610 Pa, decreasing to ~ 1 K at pressures < 200 Pa. Meridional winds at 610 Pa have an average amplitude of 10–15 m s^{-1} during this 30-sol interval and an 8% probability of exceeding 25 m s^{-1}. These eddies may be responsible for the lifting and advection of dust that has been observed at these seasons by the MGS Mars Orbiter Camera [e.g., *Cantor et al., J. Geophys. Res., 106*(E10), 23,653–23,687, 2001; *Wang and Ingersoll, J. Geophys. Res., 107*(E10), 5078, doi:10.1029/2001JE001815, 2002; *Wang et al., Geophys. Res. Lett., 30*(9), 1488, doi:10.1029/2002GL016828, 2003].