Geophysical Research Abstracts, Vol. 8, 05130, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05130

Thermal tides on Mars as observed through radio occultations with Mars Express and Mars Global Surveyor

D. P. Hinson (1), M. Pätzold (2), R. J. Wilson (3)

(1) Department of Electrical Engineering, Stanford University, USA, dhinson@stanford.edu, (2) Institut für Geophysik und Meteorologie, Universität zu Köln, Germany, (3) Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University, USA

The Radio Science (RS) investigations of both Mars Express (MEX) and Mars Global Surveyor (MGS) include radio occultation experiments that sound the neutral atmosphere from the surface to an altitude of 40–50 km. Each experiment yields profiles of temperature and geopotential versus pressure with a vertical resolution of $<$1 km. We are using selected data from these RS experiments along with simulations by the GFDL Mars General Circulation Model (MGCM) to investigate thermal tides at tropical and middle latitudes on Mars. During June–July 2004, MEX occultations sounded the atmosphere at latitudes of 40°N to 20°S during midspring of the northern hemisphere ($L_s = 40°$–$70°$) at a fixed local time of $\sim$1700. Simultaneous MGS occultations provided complementary results near 35°N at a fixed local time of $\sim$0400. A solar-asynchronous diurnal tide strongly modulates the geopotential measurements at these two local times. Through MGCM simulations of the observed zonal and vertical structure, we identify the disturbance as an eastward-propagating diurnal-period Kelvin mode with zonal wave number 1. This mode also has a profound effect on zonal variations of atmospheric density at aerobraking altitudes (110-160 km) [e.g., Withers et al., Icarus, 164, 14–32, 2003]. The complementary coverage in local time of the RS profiles from MEX and MGS also allows clear identification of the solar-locked diurnal tide, which appears in these high-resolution profiles as a temperature inversion or inflection that descends steadily with increasing local time. MGCM simulations are particularly useful for exploiting RS observations that are dispersed among different local times, latitudes, and seasons. At the same time, the RS measurements provide unique constraints for validating the MGCM.