MARTIAN MIDDLE-LATITUDE ATMOSPHERIC STATIONARY WAVES AS MANIFESTED IN MRO MCS RETRIEVED TEMPERATURE DATA. David A. Teal[1], J.R. Murphy[1], and M.A. Kahre[2] [1]Department of Astronomy, New Mexico State University, Las Cruces, NM 88003, USA, dteal@nmsu.edu, [2]Bay Area Environmental Research Institute, Sonoma, CA 95476, USA

Introduction: The Mars Climate Sounder (MCS) instrument onboard the Mars Reconnaissance Orbiter (MRO) is providing vertically extended derivations of atmospheric temperature and aerosol content at significant spatial and temporal resolution [1,2]. The extended vertical coverage provided by MCS compared to similar data sets (Mars Express PFS, Odyssey THEMIS, MGS TES, Viking IRTM) affords the opportunity to enhance our understanding of the structures of large scale atmospeheirc waves as they propagate upward from lower-level forcing regions [3,4]. The MCS temporal coverage at upper levels (60-80 km) complements the less frequent thermal and mass structure derivations provided by Mars Express SPICAM stellar and MGS radio occultation measurements [5,6]. In this presentation we will discuss results of analyses of the MCS-derived temperature data and what these data indicate about the structures and temporal/seasonal variability of middle latitude stationary waves at Mars' middle latitudes.

MCS Data Description: MCS has been obtaining infrared observations from its position in Mars orbit since late 2006. MCS provides ~5 km vertically resolved temperature profiles up to altitudes of ~80 km derived from limb views of the atmosphere [1,2]. Dust, water vapor, and condensate abundances are also extractable from MCS' infrared measurements. MRO's sun-synchronous orbit results in MCS derivations being available at ~3 AM and 3 PM local times at most latitudes. The presence of aerosol opacity (dust, condensate cloud particles) has negatively affected the derivation of temperatures at those latitudes and seasons with small to modest aerosol loading [2].

Approximately one full martian year of MCS retrievals is available from NASA's Planetary Data System Planetary atmospheres Node [7]. We have spatially (latitude , longitude) and temporally (L_s) binned the data at the available pressure levels to maximize the longitudinal coverage from which zonal (east-west) wave structures can be diagnosed as a function of altitude and pressure level.

Our Work: With an emphasis upon diagnosing the magnitudes and structures of large scale stationary waves within Mars' atmosphere, our analysis involves Fourier decomposing longitudinal thermal structures of waves present in the binned MCS temperatures (and the other MCS-provided aerosol fields). [2] has already shown that the MCS temperatures exhibit temporal and spatial characteristics of atmospheric thermal tides. Some of those tidal components can manifest themselves as stationary wave features when viewd in a sun-synchronous framework. Numerical modeling will be employed to attempt to remove those aliased waves from the true stationary wave signature.

We will present results illustrating the amplitudes (in Kelvin) of the stationary waves, as well as their latitudinal and vertical structures. Theory, and previous modeling and data analyses [3,4,6] have indicated the 'trapping' near the surface of smaller (zonal wavenumbers 2, 3, and 4) wavelengths nearer to the surface than zonal wavenumber 1. The vertical propagation characteristics of these waves are dependent upon (and diagnostic of) the vertical structures of the east-wind wind field and temperature structure. Being able to trace the features of these waves between the bottom scale height of the atmosphere up through the 70-80 km altitude range will improve our ability to understand the dynamical effects of these waves upon both tropospheric and thermospheric conditions.

The vertical structures of these waves provides insight in to the north-south fluxes of heat and momentum these waves can produce. Where available and appropriate, MCS derived aerosol fields will be correlated to the diagnosed stationary wave structures with the intent of investigating the meridional (north-south) transport of those species by these stationary wave patterns.

References: [1] D. J. McCleese et al. (2007), *JGR*, *112*. [2] C. Lee et al, (2009) JGR, *114, E03005*. [3] D.B. Banfield et al. (2000), *JGR, 105*, 9521-9537. [4] D.B. Banfield et al. (2003), *Icarus, 171*, 319-345. [5] F. Forget et al. (2009), JGR, 114. [6] D.P. Hinson et al. (2001), *JGR, 106*, 1463-1480. [7] NASA PDS Atmospheres Node, http://atmos.nmsu.edu