

**PERSISTENT PLANETARY-SCALE WAVE-2 AND WAVE-3 DENSITY  
VARIATIONS OBSERVED IN MARS UPPER ATMOSPHERE FROM MGS  
ACCELEROMETER EXPERIMENT**

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Over 1600 in-situ measurements of vertical structures of the Mars thermosphere have been obtained from the Mars Global Surveyor (MGS) Accelerometer Experiment during MGS aerobraking (1997 – 1999). Measurements of latitudinal and longitudinal variations in density, scale height, temperature and pressure have been obtained in the Northern and Southern Hemispheres on the dayside and in the Southern Hemisphere on the nightside. Large Wave-2 (two sine waves over 360 degrees longitude) and Wave-3 longitudinal variations in density were discovered in the thermosphere, which endangered the spacecraft during aerobraking. Studies were performed with the NOAA Geophysical Fluid Dynamics Laboratory (GFDL) Mars General Circulation Model with a raised upper boundary to simulate the planetary-scale wave activity observed. The Wave-2 features extending from 60°N to 60°S latitude are apparently produced principally by a zonal Wave-1 diurnal Kelvin wave increasing in amplitude as it propagates upward from the lower atmosphere. The Kelvin Wave-1 appears as a near stationary Wave-2 when viewed from a near sun-synchronous orbit. The Wave-3 features are apparently produced mostly by a combination of the zonal Wave-2 diurnal Kelvin wave and the Wave-1 (non-migrating) semi-diurnal tide. The Wave-1 and Wave-2 diurnal Kelvin waves apparently result from modulation of the diurnal migrating tide by Wave-2 and Wave-3 topography respectively.