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# The Mars Upper Atmosphere

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The 2006 Mars Reconnaissance Orbiter (MRO) Accelerometer Experiment measurements above 100km give neutral densities and inferred neutral temperatures over the entire Southern Hemisphere of Mars. When combined with our previous accelerometer experiments on Mars Global Surveyor and Mars Odyssey global measurements are obtained showing variations with latitude, seasons, planetary scale waves, day/night, aphelion/perihelion, and solar activity. The measurements also show a stability of climatology when compared with MEX Stellar Occultation measurements from the previous Mars year. Consistency of inbound and outbound trajectories at different latitudes also shows stability of climatology. Emphasis in this paper is on thermospheric and exospheric temperatures. Temperatures are found to be fairly constant within 40˚ latitude of the equator rising with altitude due to solar euv radiation absorption at higher altitudes. Exospheric temperatures are discovered to be near 130 K on the nightside (3am) and near 200K on the dayside (3pm). MTGCM models are about the same as observed at night, but somewhat warmer than observed on the dayside. The cooler dayside observations may indicate somewhat less atmospheric escape than the MTGCM temperatures would predict. We have discovered winter polar warming in the lower thermosphere from the accelerometer measurements. Apparently, meridional flow from the summer to winter hemisphere results in strong adiabatic heating near the winter pole causing the warming. This effect is stronger at winter North Pole than winter South Pole apparently due to the planet being near perihelion at North Pole winter. Evidence of adiabatic warming at lower latitudes due to meridional transport rising from the summer hemisphere and sinking in the winter hemisphere was also recently discovered.