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Observations of tides and temperatures in the martian atmosphere by Mars Express SPICAM stellar occultations

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The SPICAM UV spectrometer instrument on the ESA Mars Express spacecraft has used stellar occultations to measure over 400 vertical profiles of atmospheric density, pressure and temperature between 20 km and 140 km. This extensive dataset is well-suited to studies of the dynamics and thermal state of the middle atmosphere. We shall report on two investigations.

First, comparison of data from SPICAM, data from aerobraking accelerometers, and published predictions from a thermospheric general circulation model. Several restricted regions of parameter space can be defined, typically spanning thirty degrees of Ls, thirty degrees of latitude and three hours of LST, for which SPICAM, accelerometer and model data are all available. We shall discuss the consistency of the SPICAM and accelerometer datasets, and also the results of model-data comparisons.

Second, characterization of non-migrating thermal tides in SPICAM data. Thermal tides are known to cause zonal variations in densities measured between 100 km and 160 km at fixed local solar time by aerobraking accelerometers. We shall characterize thermal tides in density, pressure and temperature data between 20 km and 140 km. There are two primary objectives. (A) To extend the characterization of thermal tides downwards into the middle and lower atmosphere in order to see how the amplitudes and phases of tidal modes change as tides propagate upwards. (B) To compare tidal structures in density, pressure and temperature data in order to test predictions that tidal effects on density and temperature are anti-correlated.