Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02912, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02912
EGU General Assembly 2008

The thermal structure of Titan's atmosphere

F. M. Flasar (1), P. J. Schinder (2), E. A. Marouf (3), R. K. Achterberg (4), R. G. French (5), C. A. McGhee (5), A. J. Kliore (6), N. J. Rappaport (6)

(1) NASA Goddard Space Flight Center, Greenbelt, Maryland, USA, (2) Cornell University, Ithaca, New York, USA, (3) San Jose State University, San Jose, CA, USA, (4) University of Maryland, College Park, Maryland, USA, (5) Wellesley College, Wellesley, MA, USA; (6) Jet Propulsion Laboratory, Pasadena, CA, USA (f.m.flasar@nasa.gov)

The radio occultations during the Cassini prime mission have provided eight soundings at latitudes between 74 N and 74 S in northern winter. These give vertical profiles of temperature with high spatial resolution, if the vertical profile of composition ($i.e.$, CH_4) is specified. Cassini thermal-infrared spectra (from CIRS) have provided global temperature maps in the upper stratosphere and lower mesosphere. In both data sets, the most striking aspect of the stratosphere below 200 km is the cold north-polar region, which is 20-30 K cooler than the temperatures at low latitudes. At latitudes $>$50 N the radio-occultation temperature profiles between 80 and 100 km depart from the stable stratospheric norm and show an unusual vertical structure that may be caused by an optically thick cloud in the thermal infrared. At these latitudes, CIRS sees strong signatures of condensates in the lower stratosphere. In the lower troposphere, the meridional contrast in temperature in the radio-occultation profiles is muted, and temperatures in the lowest two kilometers differ by $<$3 K. The lapse rates of the retrieved temperature profiles at low latitudes near the surface are nearly adiabatic, but at high latitudes the profiles are more stably stratified in both hemispheres. The temperatures have stable inversions above the surface at high northern latitudes. Retrievals made with varying assumptions of the vertical variation of tropospheric CH_4 indicate that the strength of the inversion depends on whether the vertical profile of CH_4 is constrained by a saturation law near the surface. The intensity of the received signal at Earth in the radio occultations is attenuated both by refractive defocusing and pressure-induced absorption from N_2-N_2 and CH_4-N_2 pairs. Because the absorption

strength is different for the two sets of pairs, matching the retrieved absorptivity profile can in principle yield the vertical variation in CH_4 in the troposphere.