



Spatial and temporal variations in Titan's surface temperatures from Cassini CIRS observations

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We report the study of Titan's surface temperatures by wide analysis of the moon's outgoing radiance through a spectral window in the thermal infrared at $19\ \mu\text{m}$ ($530\ \text{cm}^{-1}$) characterized by low opacity. We modeled Cassini Composite Infrared Spectrometer (CIRS) far infrared spectra collected from 2004-2010, using a radiative transfer forward model combined with a non-linear optimal estimation inversion method. At low-latitudes, we agree with the HASI near-surface temperature of about 94 K at 10°S (Fulchignoni, M., et al. 2005). By zonally-averaging our results, we also find a systematic decrease from the equator toward the poles, hemispherically asymmetric, of $\sim 1\ \text{K}$ at 50 degrees south and $\sim 3\ \text{K}$ at 50 degrees north, in general agreement with a previous analysis of CIRS data (Jennings, D.E., et al., 2009), and with Voyager results from the previous northern winter. Subdividing the available database, corresponding to about one Titan season, into 3 consecutive periods, in order to avoid bias for eventual seasonal variations we found clear evidence of diurnal variations of the surface temperatures near the equator, observed for the first time: we find a trend of slowly increasing temperature from the morning to noon and increasing again towards the late afternoon. The diurnal change is $\sim 1.5\ \text{K}$, in agreement with model predictions for a surface with a thermal inertia between 300 and $600\ \text{J m}^{-2}\ \text{s}^{-1/2}\ \text{K}^{-1}$.

References

Fulchignoni, M., and 42 colleagues, 2005. In situ measurements of the physical characteristics of Titan's environment. *Nature*. 438, 785.
Jennings, D.E., and 19 colleagues, 2009. Titan's Surface Brightness Temperatures. *Ap. J. L.*, Vol. 691, pp. L103-L105.