



Surface Temperatures As Titan Enters Northern Spring

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Abstract

The Composite Infrared Spectrometer (CIRS) aboard Cassini has been measuring surface brightness temperatures on Titan since early in the mission, covering a period spanning late northern winter into early northern spring. The far-infrared portion of CIRS detects radiation emitted from the surface that reaches space through a spectral window of low atmospheric opacity at 19 microns wavelength. We previously reported surface temperatures from the portion of the mission prior to May 2008 that showed the north to be about 1 K colder than the south, appropriate to northern winter [1]. As Titan passed through northern spring equinox CIRS has been able to demonstrate that a shift took place to a more symmetric north-south distribution in temperatures [2]. Around equinox the temperature at the equator was 93.4 K and the poles were both near 91 K. The equatorial temperature was close to the value found at the surface by Huygens [3]. At equinox there remained a slight offset in peak temperatures toward the south, and the change in this offset from late northern winter suggests a seasonal lag of $\Delta L_s = 9^\circ$ solar longitude. This would place the time of north-south symmetry at the same seasonal phase as the *Voyager* 1 encounter, just following the previous northern spring equinox. *Voyager* IRIS saw a north-south temperature symmetry [4,5], and we conclude that the surface temperature distribution is repeating after one Titan year. Through a comparison with predictions from general circulation models, the measured temperatures and their seasonal changes provide constraints on the characteristics of the surface material. Of the two scenarios of Tokano [6], porous ice regolith and rock-ice mixture, the former is a closer match to the measurements. This implies that the surface has a relatively low thermal inertia. As Titan progresses toward northern summer the seasonal shift in surface heating is expected to alter Titan's weather and global circulation. CIRS will continue to monitor changes in the surface temperatures through *Cassini*'s extended mission.

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