Seasonal Changes in Titan's Surface Temperatures

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ABSTRACT

Cassini's extended mission has provided the opportunity to search for seasonal variations on Titan. In particular, surface temperatures are expected to have shifted significantly in latitude during the completed portion of the mission[1]. Spectra recorded by the Composite Infrared Spectrometer (CIRS) during the nominal mission (2004-08) and the Equinox mission (2008-10) have already shown changes in temperature. CIRS has detected a seasonal shift in the latitudinal distribution of surface brightness temperatures by comparing zonal averages from two time segments, one period in late northern winter centered on $L_S \sim 335°$ and a second period centered on the equinox ($L_S \sim 0°$). The earlier period had a meridional distribution similar to that previously reported[2]: 93.5 K at the equator, 91.7 K at 85 S and 89.9 K at 85 N. The newly measured distribution near equinox shows a cooling in the south and a warming in the north, both by about 0.5 K. We estimate that the centroid of the distribution moved from approximately 16 S to 7 S between the two periods. This gives a seasonal lag behind insolation of $\Delta L_S \sim 13°$. The CIRS equinox results are consistent with those of Voyager IRIS[3, 4], which encountered Titan in November 1980, just following the previous northern equinox ($L_S = 10°$). When compared with predictions from general circulation models, seasonal variations of surface temperature can help constrain the identification of surface materials. Our measurements most closely match the case of a porous ice regolith treated by Tokano[1], but with some apparent differences between the northern and southern hemispheres. CIRS will extend its study of seasonal variations in surface temperature on Titan as Cassini continues through northern spring.

REFERENCES

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