Pre-Cassini Infrared Characterization of Saturn's Atmosphere

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We report 23 years of infrared remote sensing observations of Saturn, primarily at the NASA Infrared Telescope Facility to establish a long-term baseline against which the Cassini remote-sensing instruments can be compared. Cloud structure is constrained by near-infrared reflected sunlight, where images reveal stratospheric haze between -11° and +18° degrees latitude, but not at the poles (unlike Jupiter). Thermal emission at 5.2 μm, insensitive to gaseous absorption, senses clouds near and above the 2–3 bars, which are strikingly inhomogeneous with large zonal variations near the equator and 45°S. Stratospheric temperatures near 10 mbar are sensed by 7.85-μm CH_4 emission and (with C_2H_6 abundance variations) by 12.2 μm C_2H_6 emission. Trosospheric temperatures near 100–400 mbar are sensed by H_2 collision-induced emission between 17 and 24 μm. Strong seasonal forcing of stratospheric temperatures is evident, with temperatures tracking the insolation variations with a several-year delay. A target-of-opportunity observation during a Keck engineering night shows a strong peak of stratospheric temperature (or C_2H_6 abundance) poleward of 81°S latitude. Just as for Jupiter, meridional variations of stratospheric and tropospheric temperature are not correlated with one another. Planetary-scale zonal waves as large as 1 Kelvin amplitude are seen in the stratospheric temperature field, with some evidence for even larger-amplitude waves in the troposphere. Similar to vortices in Titan and Jupiter, we might expect Cassini to detect a polar vortex (*e.g.* a region of depressed temperatures with a sinusoidal boundary), if driven by the seasonal loss of insolation poleward of its arctic circle.

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