Organization and variation of Saturn's temperature field from Cassini CIRS and supporting ground-based observations

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An extended set of observations of Saturn's thermal field has been made by Cassini's Composite Infrared Spectrometer (CIRS), complemented by ground-based stations (NASA's Infrared Telescope Facility, Gemini/North Telescope, W. M. Keck Observatory, and the Subaru Japanese National Telescope). Observations by the large telescopes have provided high diffraction-limited spatial resolution of Saturn's disk on the order of 5000 km, although so far these all have been at single points in time. Thermal images from the NASA IRTF are characterized by spatial resolutions of approximately 13,000 km, but have been made at more frequent intervals in time, usually once every month except during solar conjunction. Cassini CIRS observations of Saturn's temperature field have been made primarily in a mode in which a single hemisphere is mapped by scanning the central meridian while Saturn rotates. CIRS spatial resolutions are typically 10,000 km in these maps, but observations with spatial resolutions as high as 3,000 km have been made. These observations, including support imaging stretching several years before the Cassini arrival at Saturn, show a warming of the south polar region as a result of increased seasonal sunlight, a very hot south polar spot, and a possible warm polar vortex in the south polar region. Zonal thermal waves also exist at 16, 28 38 and 52 degrees S (planetocentric), but they are not always present. CIRS measurements of the shadowed north polar region do not show a cold counterpart to the warm south pole, but a more detailed structure. Saturn's equatorial stratospheric temperatures are currently warmer than their immediate surroundings, but this has only been true since 2003, with the equator earlier being one of the coldest regions of the planet in both troposphere and stratosphere. It is not known whether this warming is caused by seasonal radiative forcing, a Jupiter-like Quasi-Quadrennial Oscillation, or some other phenomenon.