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Temperature structure of Saturn's upper troposphere and stratosphere: Joint analysis of Cassini CIRS spectra and ground-based infrared images in 2004 and 2005.

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The vertical temperature structure of Saturn was determined in some detail for the upper troposphere and stratosphere by the Cassini Composite Infrared Spectrometer (CIRS), in a set of observations in October 2004 using focal plane 3 (FP3) at a resolution of 25.67 cm^{-1}. This is one of a pair of focal planes in a Michelson interferometer covering the mid-infrared spectrum of thermal radiation. A non-linear optimal estimation retrieval code developed at Oxford was used to deduce temperature profiles from the 600-700cm^{-1} region of the spectrum, using 20,000 spectra covering the southern hemisphere, binned in latitudinal strips. Weighting functions peaked between 0.06 and 0.20 atm. The limited spatial mapping provided by this sequence was supplemented by ground-based observations made by the middle-infrared imager MIRSI at the NASA Infrared Telescope Facility within a few days of the CIRS observations. MIRSI observations were also made in 2004 February, March and December and in 2005 January and February, supplemented by high-angular resolution mosaics of Saturn made at the Keck II Observatory in 2004 February. It is clear that the high temperatures at the south pole derive not only from radiative forcing but also dynamics, because there are sharp temperature increases near 72° and 97°S (planetocentric) which do not correlate with the smooth meridional variability of insolation. The most prominent zonal variability is manifested in thermal waves, similar to those in Jupiter, the strongest of which ($\sim$0.5 Kelvin amplitude) are found near 32°S in observations at several different epochs.

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is dedicated, in part, to the memory of Lynne Deutsch, one of the designer/builders of the MIRSI instrument.