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Atmospheric temperature profiles from optical measurements in the limb

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Measurement of the atmospheric temperature profile from limb observations made with satellite instrumentation has been reported for a number of years but the use of a single technique over a wide altitude range, e.g. 5-110 km, has been problematic. The Odin satellite that was launched on February 20, 2001, includes two instruments: a sub-millimeter radiometer (SMR) that resolves the line shape associated with a spectral emission to provide altitude information of the emitting species, and an optical spectrograph infra red imager system (OSIRIS) that provides observations of both the airglow and the scattered sunlight limb spectra, over the wavelength range 280 – 810 nm, as well as limb images of the oxygen infrared atmospheric band and the OH Meinel band airglow. In this wavelength range the OSIRIS measurements include the oxygen atmospheric A-, B- and γ- band signatures. Although the recorded spectra only have a 1 nm resolution it is possible to use these measurements to determine the atmospheric temperature profile. As the OSIRIS observations are made in the orbit plane it is possible to use a tomographic type inversion to remove the ambiguities associated with out-of-plane observations. These temperature determinations are possible in both the presence and absence of PMCs, which are also unambiguously identified by OSIRIS. Examples of the observations, the retrieved temperature profiles and the global temperature distribution for a number of days will be presented. The limitations of the method will also be discussed but it will be shown that an improved knowledge of the temperature dependence of many important atmospheric reactions is also possible.