

High Vertical and Temporal Resolution Observations of the Martian Atmosphere

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Introduction

Observations of the Martian atmosphere made by the Mars Climate Sounder (MCS) onboard the Mars Reconnaissance Orbiter (MRO) reveal atmospheric structure not previously reported. MCS observes the limb of the atmosphere in eight narrow spectral intervals from 11.5 to 44.5 μm and a broadband interval from 0.3 to 3.0 μm , all with a vertical resolution of approximately 5-km from the surface to 80 km altitude. This paper reports findings related to atmospheric thermal structure and the distributions of dust and condensates.

Observations

Figure 1 links the goals of the MCS investigation with the techniques used to obtain the required measurements. The instrument is a new smaller lighter design of a previously flown sounder, the Pressure Modulator Infrared Radiometer.

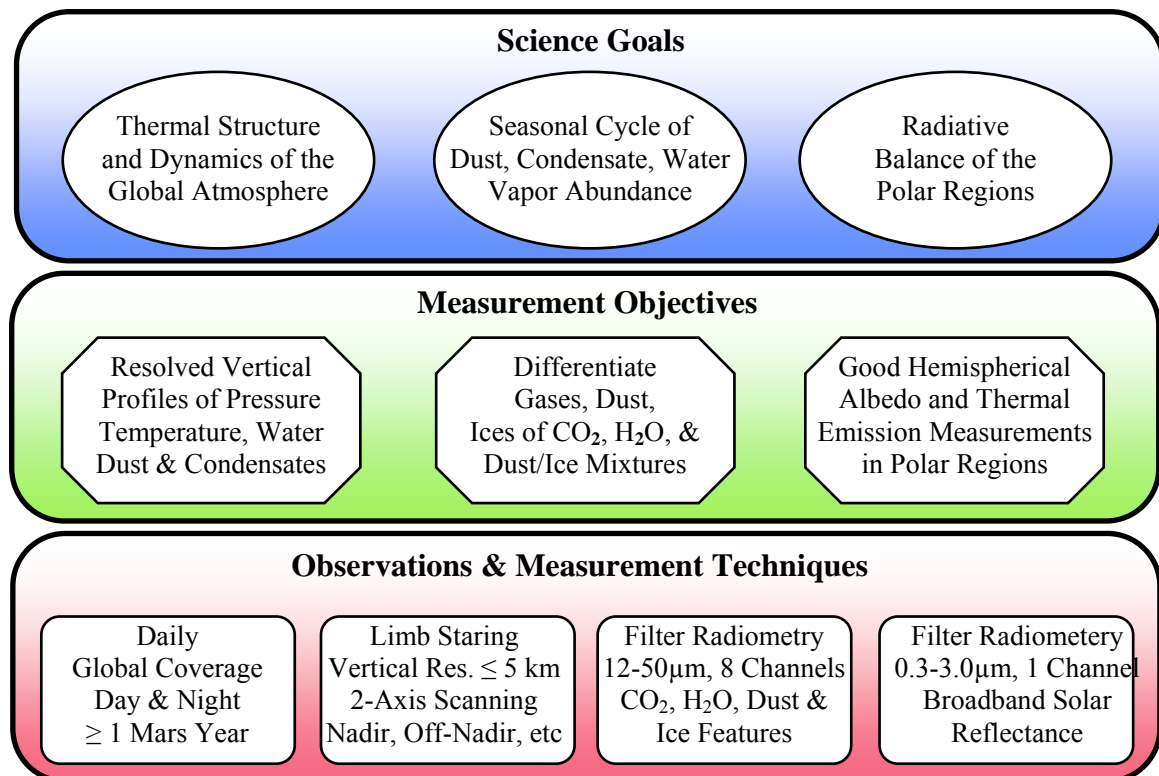


Figure 1. MCS investigation goals, measurement objectives and observational techniques.

During a full repetitive scan, MCS observes the limb of the atmosphere, space for calibration purposes, the surface near-nadir, and the reflectance and emittance of the polar caps at many off-nadir angles in all nine spectral channels. In addition, the instrument views an external blackbody and solar target during the orbital period.

Early results from MCS demonstrate excellent radiometric performance. Anomalous performance of the elevation actuator (an additional identical actuator provides azimuthal viewing) has, on occasion, interrupted nominal scanning. At the time of writing, the anomaly is being investigated.

Results

We will present findings related to winter polar circulation, vertically resolved CO₂ clouds over the south pole, and the occurrence of large regions that are nearly free of dust (factors of 10 less dust than the “nominal background opacity” of 0.1 to 0.2).