LIMB OBSERVATIONS OF INFRARED FLUORESCENCE OF CO_2 FROM OMEGA/MARS EXPRESS

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Introduction:

Observations with OMEGA/Mars Express since January 2004 have provided regular observations of CO_2 emission on the day-side limb of Mars, interpreted as non-LTE fluorescent emission of carbon dioxide in the upper atmosphere. Fourteen limbs have been interpreted with various illumination conditions, latitudes and seasons, providing already a sample of Martian typical conditions.

Data reduction

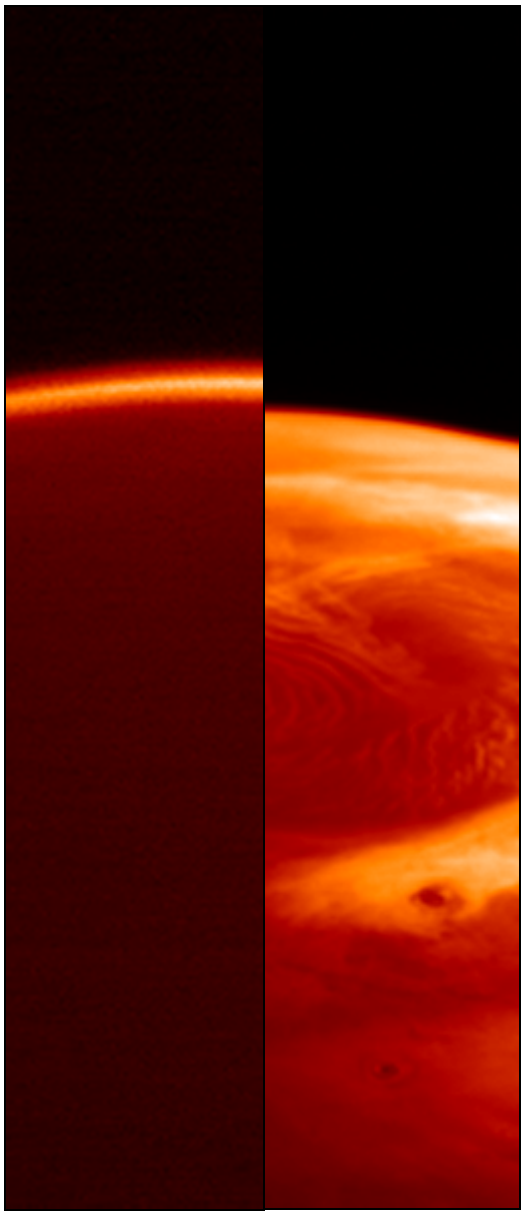
Observations with OMEGA in three-axis stabilized mode are used, with ingress or egress observations depending on the orbit of Mars Express. OMEGA data consist in spectral images with usually 16, 32, 64 or 128 width, the orientation of the other spatial dimension being approximately along a Martian meridian. The spatial information along the limb is averaged in the data after reinterpolation of the data.

Interpretation

A model derived from non-LTE modeling of Martian atmosphere (Lopez-Valverde et al., 1998), recently used to interpret global disk ISO/SWS Mars observations (Lopez-Valverde et al., 2005), has been adapted to the OMEGA observations in limb configuration. The model includes the pumping of solar photons in the main 2.7 μm band and the relaxation of the CO_2 molecule in the 4.3 μm band system. High spectral resolution prediction are compared to the observations.

Results and interpretation

The peak altitude of the emission within the CO_2 band is easily retrieved from the spatially resolved observation, and is usually located around ~80 km above the surface. This altitude correspond to the very upper layers of the atmosphere. Some variability in the altitude peak emission is observed with extremes between 50 and 95 km. The fluorescence of CO is also observed, with peak altitude around 50 km; this observation is the first spatially resolved observation of CO emission, which has long been observed from ground-based observations in the past (Billebaud et al, 1998). Anomaly in the simulation of the CO_2 shape at 4.3 μ m are observed and can be interpreted as an additional absorption by a CO_2-ice layer.



OMEGA images in the continuum (right) at ~2.2 μm compared to fluorescent emission by CO_2 at 4.3 μm (left). The altitude of the peak CO_2 emission in this image from orbit 647 (North Pole, 07/22/04) is about 75 km)

References

Billebaud, F., Rosenqvist, J., Lellouch, E., Maillard, J.P., Encrenaz, T., Hourdin, F. 1998. Observations of CO in the atmosphere of Mars in the (2-0) vibrational band at 2.35 microns. Astronomy and Astrophysics, 333, 1092-109

Lopez-Valverde, M., Edwards, D., Lopez-Puertas, M., Roldan, C. 1998 Non-local thermodynamic equilibrium in general circulation models of the Martian atmosphere 1. Effects of the local thermodynamic equilibrium approximation on thermal cooling and solar heating. J. geophys. Res. 103, 16799-16812.

Lopez-Valverde, M.A., Lopez-Puertas, M., Lopez-Moreno, J.J., Formisano, V., Grassi, D., Maturilli, A., Lellouch, E., Drossart, P. 2005., Analysis of CO_2 non-LTE emissions at 4.3μm in the Martian atmosphere as observed by PFS/Mars Express and SWS/ISO. Planet. Space Sci., 53, 1079-1087.