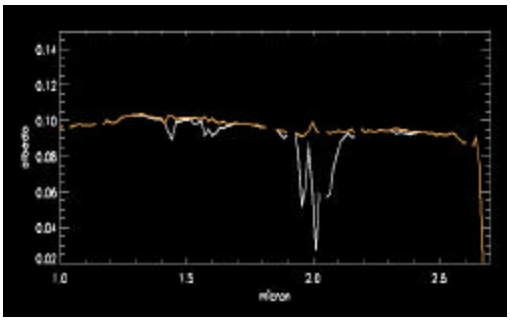
ATMOSPHERIC STUDIES WITH OMEGA/MARS EXPRESS. P. Drossart[1], F. Forget[2], T. Encrenaz[1], R. Melchiorri[1], T. Fouchet[1] S. Vinatier[1], B. Bézard[1], M. Combes[1], J.P. Bibring[3], Y. Langevin[3], B. Gondet[3], N. Ignatiev[4], L. Zasova[4], M.A. Lopez-Valverde[5], N. Garcia-Comas[5] and the OMEGA team; [1]LESIA, Observatoire de Paris, 5 place Janssen, 92195 Meudon, France, [2]Laboratoire de Météorologie Dynamique, ENS, 28 rue Lhomond, Paris, France [3]IAS, Orsay University, 91405 Orsay, France, [4]IKI, Moscow, Russia, [5]IAA, Grenada, Spain

Introduction: Extensive studies have been performed on the atmosphere of Mars from OMEGA/Mars Express data [1], in the visible/infrared spectral range (0.4-5µm) with several approaches:

- a first order atmospheric pressure and minor constituents retrieval, in an automatic procedure to correct OMEGA IR reflectance spectra from atmospheric features ,
- minor constituents (CO, H_2O) retrieval, with search for spatial variations related to local or global meteorological effects,
- dust opacity study, both from limb observations and nadir pointing observations, aimed to retrieve the vertical or horizontal dust distribution respectively.
- limb emission, by fluorescent emission of CO_2 and CO, observed at 4.3 and 4.6 µm.

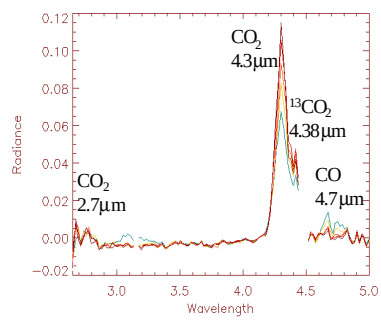
Atmospheric correction: The CO_2 pressure is retrieved in each OMEGA spectra by interpolation methods from line-by-line calculations over the Martian atmosphere; using the nominal seasonal conditions for H_2O abundance and constant CO pressure, a first order atmospheric absorption spectrum is obtained in the reflected solar light. An example of the original spectrum, together with the spectrum corrected from atmospheric absorption is shown below. From the pressure retrieval, it is possible to search for pressure waves in the OMEGA observations, and some pressure periodic variations are observed in the North regions, possibly due to lee wave activity.



Dust retrieval: Dust opacity effects are prominent in the limb geometry, where vertical variations are observed in the dust opacitywith a vertical resolution of ~2 km. A wide variety of vertical profiles are retrieved : some show several detached layers up to 60 km, implying H_2O condensation and subsequent sedimentation, while some a homogeneous vertical structure. We also retrieve the mean particle size as a function of altitude. In addition to dust retrieval, H_2O and CO_2 clouds are observed in nadir pointing, with both temporal and spatial variations

Non-LTE emission: Prominent off-limb emission in CO_2 correspond to fluorescent emission of solar light in non-LTE regime. Spatial/spectral scans allow us to observe the vertical structure of the atmosphere at a kilometric vertical scale. CO fluorescence is also observed, and vertically resolved, with peak altitude at ~50km. Variation in intensity and in altitude of the peak emission is observed from orbit to orbit, which seem to indicate atmospheric variability in the upper atmosphere, possibly related to atmospheric structure. Observations in limb geometry will continue with Mars Express to cover other latitude and longitude during the nominal mission. In addition to CO

Full spectrum (SWIR-L channel)



and CO_2 emission, O_2 dayglow emission is also detected in the Northern regions, with a strong latitudinal variation.

Conclusion: Future OMEGA observations will be combined with other Mars Express observations by PFS and SPICAM in order to achieve for the first time a complete wavelength coverage from UV to mid-IR on Mars from orbit.

References: [1] Bibring, J.P. et al, (2004) ESA-SP1240. [2] Bibring, J.P. et al. (2004 *Nature*, **428**, 627-630.