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Observations of Carbon Monoxide in the Martian Atmosphere- the comparison of the measurements done by PFS MEX, OMEGA MEX and HIFI on Herschel

Maria I. Błęcka(1), Therese Encrenaz(2), Paul Hartogh (3), Christopher Jarchow (3), Emmanuel Lellouch (2), Giuseppe Sindoni (4), Miriam Rengel (3) and *Herschel*/HIFI Team.
(1)Space Research Centre, Polish Academy of Sciences, Warsaw, Poland (mib@cbk.waw.pl /Fax: +48-22-840-31-31)
(2) LESIA, Observatoire de Paris, Meudon, France, (3) Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany, (4) Istituto di Fisica dello Spazio Interplanetario (IFSI) – INAF,Roma, Italy

Abstract

Mars has been observed with the HIFI instrument [2] on Herschel Space Observatory in April and June 2010. Almost in the same time spectrometric observations of Martian atmosphere were performed from Mars Express.
We report the analysis of *Herschel*/HIFI, *OMEGA*/MEX and *PFS*/MEX observations of the Martian atmosphere performed mainly between 11 and 16 of April 2010.
HIFI on board Herschel is a high-resolution heterodyne spectrometer. This instrument can observes Martian atmosphere in seven bands covering 480 to 1910 Ghz, or the wavelength range 157-625 μm [1].
The Planetary Fourier Spectrometer (PFS**)** on board MarsExpress an instrument optimized for atmospheric studies covers the spectral range from 1.2 to 45 μm [5]. The spectro-imaging instrument OMEGA gives the spectra of the surface and the atmosphere between 0,35 and 5,2 μm. The spectral resolution (from 13 to 20 nm) is sufficient to study the abundance and variability of minor components of the Martian atmosphere [3, 4].
From PFS SW channel data we have retrieved CO mixing ratios at 4235cm^{-1} band from the spectra of orbits 8039, 8040 and 8049. To reach a good signal from PFS data we excluded the instrumental effects in spectra and the mean spectra were build.
Also rather low intensity of the same band were analyzed in the spectra from OMEGA instrument. The measurements with maximal CO band depth were selected.
From HIFI observations we selected the (7-6) rotational transitions of the isotopes ^{13}CO and C^{18}O at 771 and 768 GHz respectively in order to retrieve the mean volume mixing ratio of carbon monoxide. The spectral bands and lines observed by three instruments have been modeled using a radiative transfer code: Mars was assumed as a sphere surrounded by a concentric atmospheric layers. Within each layer the atmospheric temperature, pressure and volume mixing ratio have been assumed constant. The surface continuum emission was modeled as a blackbody emission with temperatures depend on geometry.
The carbon monoxide mixing ratio from HIFI data was determined to be 980±150 ppm from PFS SW is situated in the range about 400-1600 ppm with the error about 20%.
The work is still in progress and we think that it is also reasonable to compare the results with the values predicted by existing models (GCM).

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