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Preliminary retrievals of CO_2 column densities using the first data of TGO/NOMAD

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Abstract

The NOMAD (Nadir and Occultation for MArs Discovery) – operating on board the ExoMars 2016 Trace Gas Orbiter mission – started to acquire the first scientific measurements on 21 April 2018.

Here, we will present first retrievals of CO_2 column density and surface pressure measured by the NOMAD LNO channel in the nadir mode.

1. The NOMAD LNO channel

NOMAD is a spectrometer operating in 3 channels: 1) a solar occultation channel (SO) operating in the infrared (2.3-4.3 μm); 2) a second infrared channel LNO (2.3-3.8 μm) capable of doing nadir, as well as solar occultation and limb; and 3) an ultraviolet/visible channel UVIS (200-650 nm) that can work in the three observation modes [1,2]. The LNO infrared channel has a high spectral resolution ($\lambda/d\lambda$~10,000) provided by an echelle grating in combination with an Acousto-Optical Tunable Filter which allows the selection of spectral windows (diffraction orders).

In nadir mode, LNO has an instantaneous footprint of 0.5x17 km^2, therefore it is very well suited to measure the horizontal and local time distribution of total column density of several species such as CO_2, CO, H_2O, and isotopic ratio.

2. CO_2 column densities and surface pressure

Since carbon dioxide constitutes 95% of the Martian atmosphere, CO_2 column densities can be reasonably used as a proxy for surface pressure [3].

We plan to analyze the data measured in diffraction orders 149, 167, 168, 169 for the CO_2 retrievals (Table 1). Orders 167-169 are particularly interesting since they contain water vapor as well, which may be retrieved simultaneously with CO_2 (See [4]). We will use the line-by-line radiative transfer code ASIMUT-ALVL developed at IASB-BIRA [5] to retrieve CO_2 column density and surface pressure. These retrieved quantities will then be compared with values predicted by the 3D GEM-Mars v4 Global Circulation Model (GCM) [6].

Table 1: Wavenumber ranges of the diffraction orders for the CO_2 analysis by the NOMAD LNO channel.

Diffraction order	LNO wavenumber limits [cm^{-1}]
149	3349.24-3375.99
167	3753.84-3783.83
168	3776.32-3806.49
169	3798.80-3829.15

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