



Update on CO₂ and temperature profiles retrievals from NOMAD-SO on board ExoMars TGO

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▪ The SO channel of the NOMAD instrument

The NOMAD-SO channel [1] is an infrared spectrometer working in the 2.2 to 4.3 μm spectral range (2200-4500 cm^{-1}) and started to perform solar occultation measurement on April 21, 2018. The instrument is composed of an echelle grating coupled to an Acousto-Optical Tunable Filter for the diffraction order selection. As TGO is on a quasi-circular orbit at around 400 km of altitude, it performs one orbit every two hours. During a solar occultation measurement, SO scans six diffraction orders each second. These diffraction orders are recorded on four bins leading to a vertical sampling lower than one km. The calibration of the SO channel is described in [2] and is still being fine-tuned.

▪ CO₂ density and temperature profiles retrievals

Several diffraction orders probe different altitude ranges as they contain CO₂ lines with different intensities that appear and saturate at different altitudes. Correct temperature profiles are necessary for the retrieval of several species and the profiles have to be carefully retrieved as their inversion is very sensitive to noise. We use the following retrieval scheme:

For each solar occultation measurement, we derive a slant column profile of CO₂ using ASIMUT-ALVL [3]. ASIMUT is a radiative transfer program developed at BIRA-IASB and uses the Optimal Estimation Method for regularization [4]. The GEM-Mars GCM provides the *a priori* profiles of CO₂

local density, pressure and temperature. We then apply an iterated Tikhonov regularization to derive a regularized local density profile using an improved version of the algorithm described in [5]. This method requires the selection of a regularization parameter to reduce as much as possible the presence of noise in the profile while keeping the real variations. This retrieval scheme allows a fine-tuning of the regularization parameter. We finally apply the hydrostatic equilibrium equation to derive the temperature profiles [6]. We derived the NOMAD-SO CO₂ and temperature profiles for MY34 and 35.

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