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NOMAD on ExoMars Trace Gas Orbiter: one year of results

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Abstract

The NOMAD (“Nadir and Occultation for MArs Discovery”) spectrometer suite on board the ExoMars Trace Gas Orbiter (TGO) has been designed to investigate the composition of Mars' atmosphere, with a particular focus on trace gases, clouds and dust. The instrument is a combination of three spectrometers, covering a spectral range from the UV to the mid-IR, and can perform solar occultation, nadir and limb observations. In this paper, we will report on the status of the instrument, and present the first results obtained during the Science phase which started in April 2018.

1. Introduction

NOMAD is a spectrometer operating in ultraviolet (UV), visible and infrared (IR) wavelengths covering large parts of the 0.2-4.3 µm spectral range [1]. NOMAD is composed of 3 spectrometers: a solar occultation only spectrometer (SO – Solar Occultation) operating in the infrared (2.3-4.3 µm), a second infrared spectrometer (2.3-3.8 µm) capable of doing nadir, but also solar occultation and limb observations (LNO – Limb Nadir and solar Occultation), and an ultraviolet/visible spectrometer (UVIS – UV visible, 200-650 nm) that can work in the three observation modes.

NOMAD has been observing Mars atmosphere using solar occultation, limb and nadir pointing geometries. The science phase started in April 2018, just before the global 2018A dust storm built up. This provided exceptional observations before, during, and after the dust event.

NOMAD has been optimized for the detection of trace gases, and here we will summarize the results obtained so far, with some highlight on the effect of the dust on the composition and structure of the Martian atmosphere.

2. Results

Science phase started in April 2018. Since then NOMAD performed solar occultation, limb and nadir observations. Several atmospheric species have been targeted, delivering profiles from solar occultation from 200km down to the surface and integrated abundances from nadir measurements. Observations optimized for the detection of dust and clouds and for the analysis of the surface have also been performed. The nominal strategy for solar occultations with SO consists in measuring 5 or 6 different spectral intervals within 1 s, to derive densities for CO_2, CO, H_2O/HDO, CH_4, and dust. LNO nadir observations were carried out using different numbers of spectral intervals (1 to 4) recorded sequentially. These measurements also focused on the same species as mentioned above. Moreover the UVIS observations allowed the determination of vertical profiles of dust and ozone, while nadir observations also provided clouds and surface information.

We will give an overview of the results so far obtained. The focus will also be laid on the effect of the global dust storm on the composition of the atmosphere [2]. Results of the continued search for methane by NOMAD will also be presented [3].

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