EPSC Abstracts
Vol. 13, EPSC-DPS2019-1282-1, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

First year of observations from TGO/NOMAD UVIS: retrievals of ozone and aerosols on Mars

Arianna Piccialli (1), Ann Carine Vandaele (1), Y. Willame (1), C. Depiesse (1), L. Trompet (1), L. Neary (1), S. Viscardy (1), F. Daerden (1), Ian R. Thomas (1), Bojan Ristic (1), J.P. Mason (2), M.R. Patel (2), Giancarlo Bellucci (3), Jose-Juan Lopez-Moreno (4), and the NOMAD Team.

(1) Belgian Institute for Space Aeronomy, Belgium, (2) Open University, UK, (3) INAF, Istituto di Astrofisica e Planetologia Spaziali, Italy, (4) IAA/CSIC, Granada, Spain (email: arianna.piccialli@aeronomie.be, Twitter: @apic79)

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 one year of observation of ozone and aerosols vertical distribution obtained from NOMAD-UVIS solar occultations.

1. Introduction

Ozone is a species with a short chemical lifetime and characterized by sharp gradients at the day-night terminator both on Earth and on Mars [1]. Odd hydrogen radicals play an important role in the destruction of ozone. This results in a strong anti-correlation between O_3 and H_2O [1].

Atmospheric aerosols are ubiquitous in the Martian atmosphere and they strongly affect the Martian climate [2]. This is particularly true during dust storms. In June 2018, after a pause of 11 years, a planet-encircling dust storm took place on Mars that lasted two months.

NOMAD will help us improve our knowledge of the climatology of ozone and aerosols. In particular, we will have the rare opportunity to analyze the distribution of aerosols during a dust storm.

2. The NOMAD UVIS channel

NOMAD is a spectrometer composed of 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 [3,4].

The UVIS channel has a spectral resolution <1.5 nm. In the solar occultation mode it is mainly devoted to study the climatology of **ozone** and **aerosols** content [5].

1.1 UVIS solar occultations

Since the beginning of operations, on 21 April 2018, NOMAD UVIS acquired more than 1000 solar occultations with an almost complete coverage of the planet.

Figure 1 displays transmission spectra obtained at different altitudes acquired on June 8, 2018. The **ozone** absorption band (Hartley band) is clearly visible around 250 nm. The **aerosols** affect the entire spectral range by changing the background level of the spectrum.

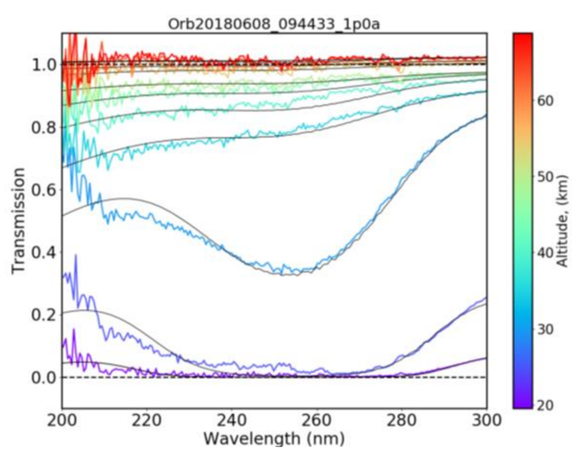

Figure 1: UVIS transmission spectra at different altitudes. (Blue) lower altitudes; (Red) higher altitudes. Black lines are the ASIMUT simulations.

3. Retrieval technique

NOMAD-UVIS spectra are simulated using the line-by-line radiative transfer code **ASIMUT-ALVL** developed at IASB-BIRA [6]. In a preliminary study based on SPICAM-UV solar occultations (see [7]), ASIMUT was modified to take into account the atmospheric composition and structure at the day-night terminator. We followed the same method described in [8] to check that the spectra are correctly calibrated and accurately normalized to the solar spectrum. As input for ASIMUT, we used gradients predicted by the 3D GEM-Mars v4 Global Circulation Model (GCM) [9,10]. UVIS ozone profiles will also be compared to SPICAM-UV retrievals.

4. Summary and future work

We will present ozone and aerosols vertical profiles retrieved from the first year observations of TGO/NOMAD acquired before, during, and after the global dust storm 2018. In addition, we plan to compare our retrievals to SPICAM-UV observations.

Acknowledgements

ExoMars is a space mission of the European Space Agency (ESA) and Roscosmos. The NOMAD experiment is led by the Royal Belgian Institute for Space Aeronomy (IASB-BIRA), assisted by Co-PI teams from Spain (IAA-CSIC), Italy (INAF-IAPS), and the United Kingdom (Open University). This project acknowledges funding by the Belgian Science Policy Office (BELSPO), with the financial and contractual coordination by the ESA Prodex Office (PEA 4000103401, 4000121493), by the Spanish MICINN through its Plan Nacional and by European funds under grants ESP2015-65064-C2-1-P and ESP2017-87143-R (MINECO/FEDER), as well as by UK Space Agency through grant ST/R005761/1 and Italian Space Agency through grant 2018-2-HH.0. The IAA/CSIC team acknowledges financial support from the State Agency for Research of the Spanish MCIU through the 'Center of Excellence Severo Ochoa' award for the Instituto de Astrofísica de Andalucía (SEV-2017-0709). This work was supported by the Belgian Fonds de la Recherche Scientifique – FNRS under grant numbers 30442502 (ET_HOME) and T.0171.16 (CRAMIC) and BELSPO BrainBe SCOOP Project. US investigators were supported by the National Aeronautics and Space Administration. Canadian investigators were supported by the Canadian Space Agency.

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The NOMAD Science Team

Ann Carine Vandaele, Jose-Juan López-Moreno, Giancarlo Bellucci, Manish R. Patel, Gustavo Alonso-Rodrigo, Shohei Aoki, Francesca Altieri, Sophie Bauduin, David Bolsée, Giacomo Carrozzo, R. Todd Clancy, Edward Cloutis, Matteo Crismani, Frank Daerden, Fabiana Da Pieve, Emiliano D'Aversa, Cédric Depiesse, Justin T. Erwin, Giuseppe Etiope, Anna A. Fedorova, Bernd Funke, Didier Fussen, Maia Garcia-Comas, Anna Geminale, Jean-Claude Gérard, Marco Giuranna, Leo Gkouvelis, Francisco Gonzalez-Galindo, James Holmes, Benoît Hubert, Nicolay I. Ignatiev, Jacek Kaminski, Ozgur Karatekin, Yasumasa Kasaba, David Kass, Armin Kleinböhl, Orietta Lanciano, Franck Lefèvre, Stephen Lewis, Giuliano Liuzzi, Manuel López-Puertas, Miguel López-Valverde, Arnaud Mahieux, Jon Mason, Michael J. Mumma, Hiromu Nakagawa, Lori Neary, Eddy Neefs, Robert E. Novak, Fabrizio Oliva, Arianna Piccialli, Etienne Renotte, Birgit Ritter, Séverine Robert, Frédéric Schmidt, Nick Schneider, Giuseppe Sindoni, Michael D. Smith, Nicholas A. Teanby, Ed Thiemann, Ian R. Thomas, Alexander Trokhimovskiy, Loïc Trompet, Jean Vander Auwera, Geronimo L. Villanueva, Sébastien Viscardy, James Whiteway, Valerie Wilquet, Yannick Willame, Michael J. Wolff, Paulina Wolkenberg, Roger Yelle.