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Impact of gradients at the Martian terminator on the retrieval of ozone from TGO/NOMAD-UVIS

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1. Introduction

Rapid variations in species concentration at the terminator have the potential to cause asymmetries in the species distributions along the line of sight (LOS) of a solar occultation experiment. Ozone, in particular, displays steep gradients across the terminator of Mars due to photolysis [1]. Nowadays, most of the retrieval algorithms for solar and stellar occultations rely on the assumption of a spherically symmetrical atmosphere. However, photochemically induced variations near sunrise/sunset conditions need to be taken into account in the retrieval process in order to prevent inaccuracies.

Here, we investigated the impact of gradients along the LOS of the solar occultation experiment TGO/NOMAD-UVIS for the retrieval of ozone under sunrise/sunset conditions. We used the diurnal variations in the ozone concentration obtained from photochemical model calculations together with an adapted radiative transfer code.

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 [2,3].

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 [4].

Since the beginning of operations, on 21 April 2018, NOMAD UVIS acquired more than 3000 solar occultations with an almost complete coverage of the planet.

3. Retrieval technique

NOMAD-UVIS spectra are simulated using the line-by-line radiative transfer code **ASIMUT-ALVL**

developed at IASB-BIRA [5]. In a preliminary study based on SPICAM-UV solar occultations (see [6]), ASIMUT was modified to take into account the atmospheric composition and structure at the day-night terminator. As input for ASIMUT, we used gradients predicted by the 3D GEM-Mars v4 Global Circulation Model (GCM) [7,8]. UVIS ozone profiles will also be compared to SPICAM-UV retrievals.

4. Summary and future work

We will present ozone vertical profiles retrieved from the first Martian year of observations from TGO/NOMAD-UVIS. In addition, we plan to compare our retrievals to SPICAM-UV observations. As first step, we will retrieve O_3 profiles without taking in account gradients. Then, we will investigate the effects of ozone density gradients on the retrieval of ozone.

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