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Relationship between the ozone and water vapour vertical profiles on Mars observed by NOMAD-TGO

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Introduction

Recently, [1] characterized the relation between ozone and water vapor using SPICAM simultaneous measurements of O_3 and H_2O column densities covering four Martian years. They found that O_3 and H_2O columns are clearly anti-correlated at high latitudes while being uncorrelated at low latitudes.

In our study, we take advantage of the NOMAD capability to measure simultaneous vertical profiles of ozone and water vapor to characterize the O_3 – H_2O relationship at different altitude ranges and latitudes.

1. Ozone and water vapor profile retrievals

NOMAD (Nadir and Occultation for MArs Discovery) 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]. NOMAD-UVIS spectra are simulated using the line-by-line radiative transfer code ASIMUT-ALVL developed at IASB-BIRA [5] using the Optimal Estimation Method to derive the local density profile in one go (on all transmittances of one occultation observation).

Water vapor was observed by the infrared channel of the NOMAD SO. The results from a first analysis can be found in [6], while an extended dataset is presented in a companion abstract [7]. Water vapor and ozone are measured simultaneously, which allows us to investigate the water-ozone correlation, the key to address the atmospheric chemistry on Mars.

2. Preliminary results

We will present correlation plots of O_3 vs. H_2O at high latitudes (60° – 90°, both hemispheres), and at the equator (30°S – 30°N). **Figure 1** displays a preliminary example in the 60°N – 90°N latitude region. A clear anti-correlation is observed at lower altitudes (10 – 20 km and 20 – 30 km). O_3 is roughly inversely proportional to H_2O. At altitudes above 30 km, the O_3 – H_2O curve shows a plateau with a large scattering of the data points. This is visible especially in the altitude range 40 – 50 km.

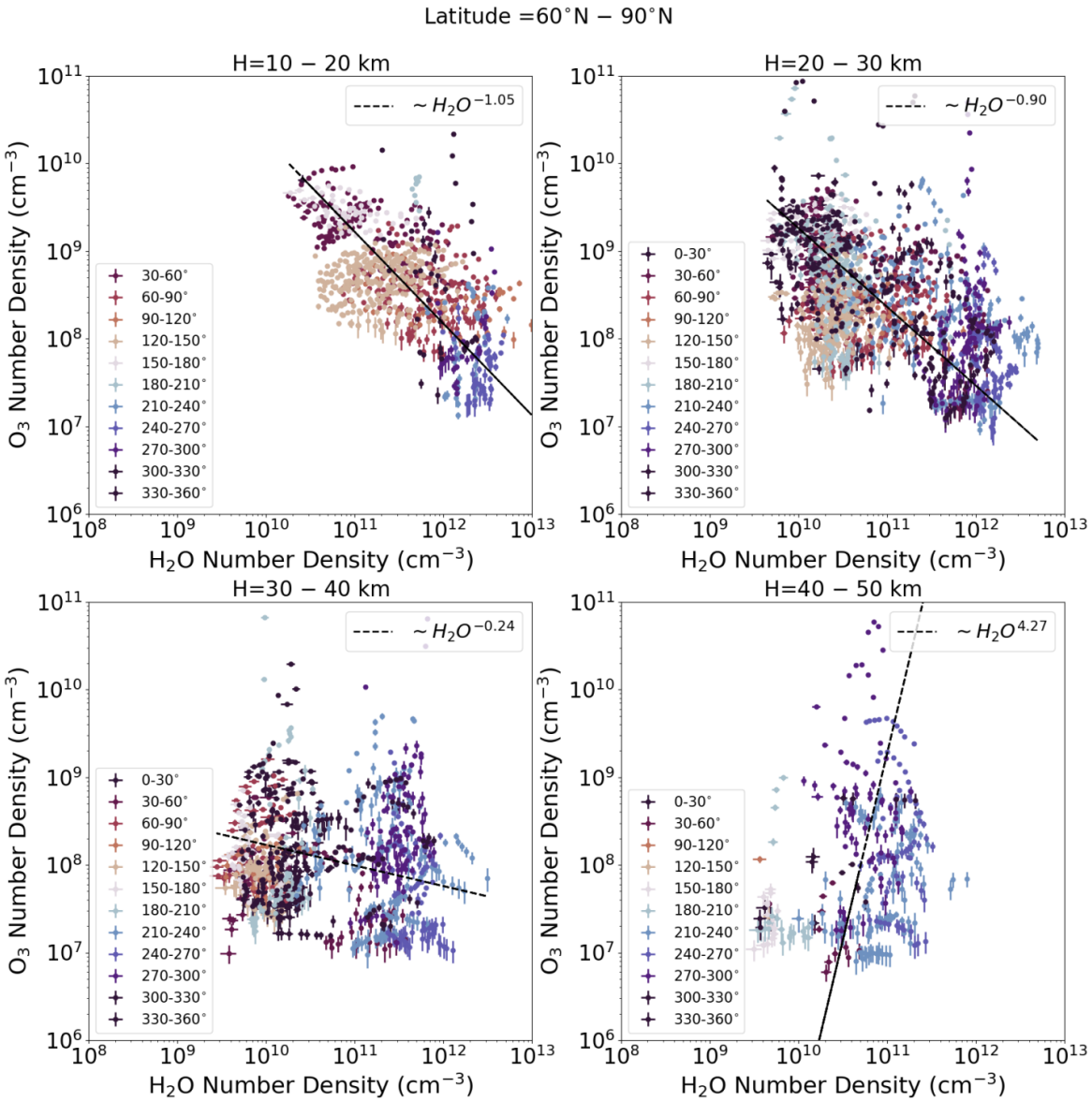

Figure 1: O_3 (cm^{-3}) vs. H_2O (cm^{-3}) vertical profiles measured simultaneously by NOMAD-UVIS at high latitudes in the Northern hemisphere (60°N-90°N). (a) 10 – 20 km; (b) 20 – 30 km; (c) 30 – 40 km; (d) 40 – 50 km. Colours indicate the L_s interval. The black line shows the function $O_3 = H_2O^x$, with x varying with the altitude range.

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