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Investigating the UV properties of Martian terrains with the NOMAD/UVIS channel data

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Abstract

The behavior of the Martian surface reflectance factor is poorly constrained between 200 and 350 nm. In this spectral range the albedo is very low with no significant deviations that can be correlated with the different mineralogy observed on Mars. Here we investigate possible variations of the Martian terrains reflectance in the UV by exploiting the data of the NOMAD/UVIS channel. We focus first on a dark region and a bright one, covered by observations collected before the occurrence of the global dust storm that started at the end of May 2018.

1. Introduction

Previous observations of Mars surface properties in the UV have shown that the surface of the Red Planet is very dark and uniform in this spectral range. The behavior of the reflectance factor there is considered in a first approximation as linear. In the models, it is represented by only two values, 0.008 and 0.015 at 210 nm and 300 nm, respectively [e.g. 1, 2].

The NOMAD UVIS channel [3] on board the ESA TGO spacecraft is able for the first time to cover both the UV and Visible spectral range (200-650 nm) with a spectral resolution of about 1.5 nm and an instantaneous footprint of 5 km^2 in nadir mode. It has been designed to derive ozone abundances and aerosol (both ice and dust) opacities, but it offers also the opportunity to investigate possible variations of the Martian mineralogy in the UV and its correlation with the global scale composition derived at longer wavelengths from OMEGA/MEX [e.g. 4,5,6].

2. Data set

In this study we focus first on two areas of 10°×10° centered at -20°E and -7°S (dark region) and -140°E and 13°N (bright region). Data span the period with 164° < Solar Longitude (L_s) < 185°, before the starting of the last Martian global dust storm. UVIS data covering the selected boxes are reported in the following table.

Table 1: NOMAD/UVIS data used in this study for the dark terrain.

Bright box	Dark box
20180423_134437	20180426_064441
20180430_165028	20180503_093113
20180505_185539	20180510_123351
20180507_200149	20180515_143959
20180514_225424	20180517_020635
20180515_104335	20180519_170357
20180529_172514	20180524_052048
20180531_175632	20180526_065545
	20180531_084213

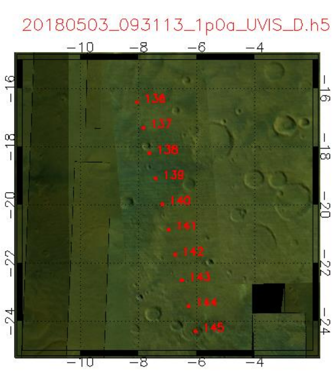

Figure 1: OMEGA/VNIR RGB maps of the dark terrain with the coverage of a UVIS orbit showing the lowest aerosol content.

3. Method

To investigate the surface properties in the UV, data with the lowest aerosol content will be selected. An example is shown in Figure 2. In the considered period, ozone abundances are expected to be lower than 4 µm/atm according to previous SPICAM/MEX results [1]. Radiative Transfer codes will be used to retrieve aerosol opacities, evaluate the Rayleigh scattering and confirm the ozone abundance.

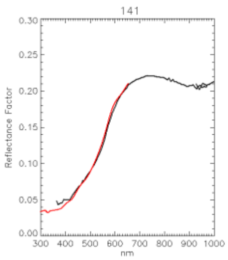

Figure 2: Red spectrum: An example from UVIS orbit 20180503 _093113 and scan number 141. Black spectrum: from OMEGA/VNIR on the same UVIS footprint but acquired during MY27, with a dust opacity of about 0.06 [7].

4. Summary

Two Martian terrains have been selected in order to infer possible variations in the UV range as derived from the NOMAD/UVIS data. For this purpose, UVIS data with the lowest content of aerosols and ozone are selected. The outcomes of this study will be presented and discussed.

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