Martian Modelling for the Design of UV Sensors for Mars Surface.

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Introduction:

Martian surface UV radiation constitutes an important environmental parameter that remains still to characterise. A new sensor is currently under design. The modelling inputs necessary to optimise its return in terms of relevance to its objective that will be to assess the different biologically effective radiations at the Martian ground level.

Sensor definition: The proposed sensor will be a multiple channel radiometer covering the UV from Lyman α (121.6 nm) to UV-A (400 nm) with 8 to 10 channels some of them as narrow as a few nm. Optimally, the instrument should have a capability to monitor total irradiance, direct sun and diffuse irradiances as a function of time between sunrises and sunsets for an entire Martian year.

Modelling needs: This instrument, for its design requires preliminary modelling of its outputs using various inputs coming from both observations and modelling. One of the inputs will be the two-dimensional model developed since 1991 by Moreau (1991). An other will be a radiative transfer model which will be a modification of the MODTRAN 3.7 model used in figure 1 (Muller et al, 2001.). The main progress being the use of more elaborate products for multiple scattering and Martian dust analogues closer to the observations, using if possible, SPICAM light results (Bertaux et al, 2000).

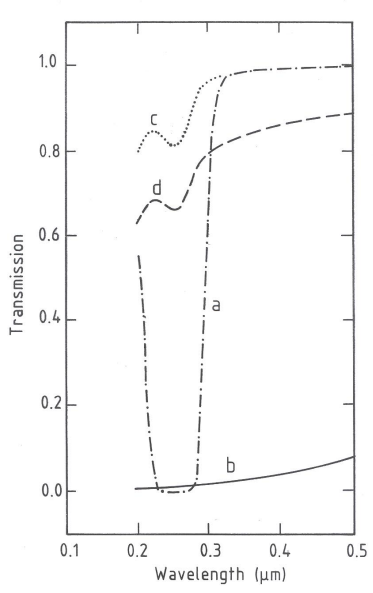

Figure 1: transmission of the solar spectrum at the surface.

Case a: ozone 100 times higher than equatorial minimum

Case b: extreme dust absorption, visible optical depth of 0.1 for a path of 1 km

Case c: clear atmosphere with equatorial ozone conditions

Case d: total optical depth for dust of 0.2 at 550 nm for a 60° zenith angle (PATHFINDER case). (Muller et al, 2001).

The UV part of the spectrum below 200nm will also be added to this study due to its extreme importance for biological studies as windows in the carbon dioxide spectrum exist and, especially at high Martian altitudes, energetic UV might be transmitted to the surface making it definitely sterile for non shielded organisms. These wavelengths could also be chosen for potential monitoring of organic gases desorption.

Conclusions : The large number of unknowns present in the observation of Mars UV needs to be confronted with the best available direct models already at design stage of Mars irradiance sensors.

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