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Constraints on Titan's aerosols optical properties from VIMS observations in the 2 µm and 2.8 µm window.

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Abstract

The study of Titan properties with remote sensing relies on a good knowledge of the atmosphere properties. The in-situ observations made by Huygens combined with recent advances in the definition of methane properties enable to model and interpret observations with a very good accuracy. However, intensity at some wavelengths are poorly modeled because additional opacities must be studied. We focus here on the case of the 2 µm and 2.8 µm window, which are essential to determine atmosphere and surface properties.

1. Introduction

Despite a unique set of information now available, several recent studies have clearly indicated that the 2 µm window is not correctly modeled and this leads to uncorrect cloud altitude. For instance, the cloud properties found in windows at shorter wavelength than 2 µm and at 2 µm are not the same. Similarly, it is also expected that the retrieved surface albedo to be severely biased at 2 µm.

Several solutions can be invoked to solve the discrepancy, as for instance modifying the far wing cut-off of the line profiles [1], or to include the absorption by CH3D at 1.91 µm which is not yet included. In this presentation, we will describe our work to better constrain the photometry in the 2 µm window, and we will show how the different approach can change the retrieved surface albedo.

For the 2.8 µm, the problem is even more complex because at these wavelengths, many gas can absorb light and the aerosol properties vary rapidely with the wavelength [3].

2. Results

To constrain the atmosphere properties in these two windows, we study an image of Titan of the north polar region taken in dec. 2006 [2] (**Figure 1**). At this place, the polar cloud cover the pole beyond 62°N, and thus the outgoing intensity only depend on the haze properties, the gas absorption and in little extent the cloud. We investigate the impact of several parameters on the intensity in the windows. We especially investigate the role of the far wing cut-off, the presence of secondary gas and the properties of the aerosols.

We find that the shapes of the windows strongly depend on the gas properties and on the optical properties of the aerosols. In this work we are able to retrieve some important characteristics of optical constants of the aerosols and we are able to reconcile the characteristics of the line profiles in all the windows.

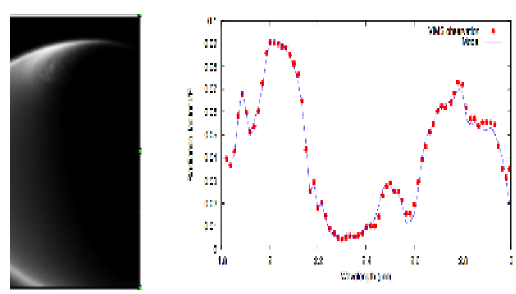

Figure 1: ***(Left)*** *Image of Titan northern polar region with a extended polar cloud. The intensity coming out from the atmosphere can be used to study the atmosphere properties in the stratosphere.**(Right)** Spectrum of a pixel taken above the noth pole cloud as measured by VIMS and the best fit obtained with our model.*

References

[1] Hirtzig et al., "Titan's surface and atmosphere from Cassini/VIMS data with updated methane opacity" Icarus, revised (2013)

[2] Le Mouélic, S. et al. , "Dissipation of Titan's north polar cloud at northern spring equinox", Planetary and Space Science, 60 , 86–92, (2012)