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Surface of Titan : model and VIMS observations

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Abstract

In-situ observations made by Huygens combined with recent advances in the definition of methane properties enable to model the radiative transfer and to interpret observations with a very good accuracy. Although the atmosphere properties are not perfectly known at some wavelengths, wa can study the surface signature. In this presentation we will describe how we retrieve the surface albedo of Titan, showing where are the main uncertainties, and we will show how we model the surface signal to give an interpretation of the observations.

1. Introduction

The Huygens probe has allowed to describe the atmosphere and the surface of Titan in detail. Such a description would not have been possible from remote sensing, and it gives a unique set of information to further describe the atmosphere at other latitudes and at wavelengths not probed by DISR, beyond 1.6 µm. However, a thorough analysis of Titan spectra made by instruments onboard Cassini (e.g, VIMS) has also become possible thanks to a unique set of data that gives methane properties in extreme details (De Bergh et al., 2012, Hirtzig et al., 2013).

The surface signal, as observed by Huygens, or retrieved from the orbit, are highly complementary. In the first case, the signal is accurate and does not suffer from the filtering by the atmosphere. On the other hand, it is limited to the range 0.4 to 1.6 µm. From the orbit, we have to retrieve the surface albedo in methane windows from a signal that include information from the atmosphere, and the retrieval is quite delicate. But, we can have access to data all over the planet, and on a broader wavelength intervalle. With some observations, we can have access to the surface albedo in windows from 0.8 to 5.0 µm, thanks to an appropriate geometry. A retrieval of the surface properties in this large range allows to make a direct comparison with *in situ* observations.

2. Results

Using a model of radiative transfer, with a description of the atmosphere properties derived from analysis made by Huygens instruments, we are able to reproduce the intensity observed by VIMS, and we can retrieve the surface albedo. We essentially focus on the aera around Huygens landing site, and we characterize the differences between the bright and dark zones. (**Figure 1**).

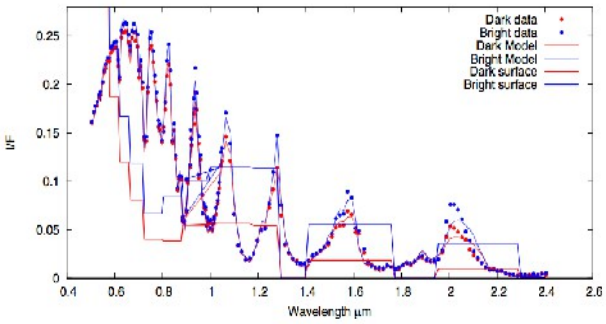

Figure 1: *Radiance factor taken in a bright and in a dark zone of Titan, near the Huygens landing site. With the model, we are able to reproduce the outgoing intensity and to retrieve the surface albedo with significant values between 0.8 and 2.4 µm.*

References

[1] de Bergh et al. "Applications of a new set of methane line parameters to the modeling of Titan's spectrum in the 1.58 µm window" Planetary and Space Science, Volume 61, Issue 1, p. 85-98 (2012)

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