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Surface of Titan : model and VIMS observations

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Abstract

In this presentation we will describe how we explain the surface reflectivity observed by DISR and how we retrieved the surface albedo of Titan from VIMS observation, showing where are the main uncertainties. We show that the reflectivity at the Huygens Landing Site may be explained a layer of liquid methane at the surface. We also show that other zones on Titan may have the same type of surface reflectivity than the HLS.

1. Description of the work

The Huygens probe has allowed to describe the atmosphere and the surface of Titan in detail. The surface reflectivity that was measured by DISR shows some characteristic features : a redslope below about 0.75-0.8 µm, a blue slope beyond and the probable water ice signature at 1.5 µm. In this work we used a model based of the scattering of an aerosols layer above a ice substrate to explain the observed signal. We find that such a model qualitatively explains the observation but has a peak at 0.92 µm, consistently with the properties of the airborne aerosols. To explain a reflectivity peak below 0.8 µm, we have to assume a layer wetted by liquid methane. We show under which conditions such a model can reproduce the observations.

In a second step, we seek for indications that terrains have reflectivity peaks at different wavelength depending on the region. Especially, we know that terrain with only water ice and dry aerosols should have a reflectivity peak around 0.9 µm while terrains as at HLS as a reflectivity peak at smaller wavelength. 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**).

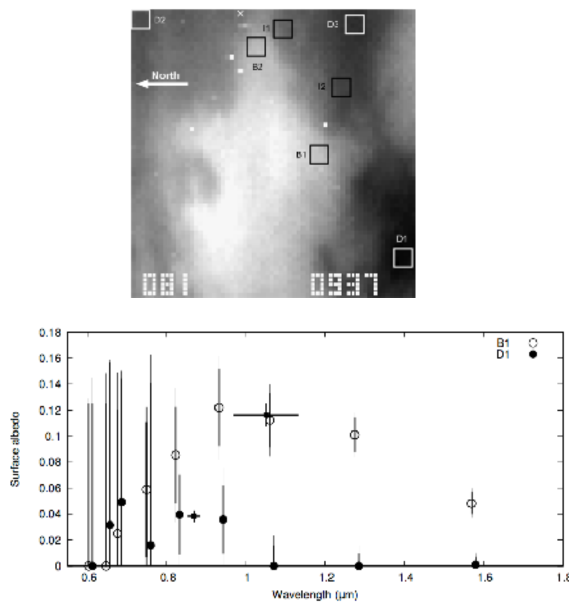

Figure 1: (top) *Image acquired by VIMS around the Huygens landing site at 937 nm. We selected 7 zones depending on the apparent reflectivity (Bright, Intermediate, Dark)* ***(bottom)*** *Radiance factor taken in a bright and in a dark zone of Titan, near the Huygens landing site. With the model, we are able to reproduce the outgoing intensity and to retrieve the surface albedo with significant values between 0.8 and 1.6 µm.*

We finally find that the darkest zone of the image has a reflectivity peak which is at a wavelength significantly smaller than the reflectivity peak of brightest zones. This shows that beyond the difference in reflectivity, Titan terrain also has a clear dichotomy regarding the spectral position of their reflectivity peak.