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Titan's surface and atmosphere from Cassini/VIMS data with updated methane opacity

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In this paper we present an updated analysis of VIMS data in view of recent developments on the methane opacity in the 1.3-5.2 μm region, a very important parameter in simulating Titan's spectrum. We use a multi-stream radiative transfer model, benefitting from the latest methane absorption coefficients available [1], which allows us to determine more accurately the haze and surface contributions. This code is applied to Cassini/VIMS spectro-imaging data of various regions with very different spectral responses to extract information on the content of the lower atmosphere (0-200 km) as well as on the surface properties. In particular, we update the DISR aerosol model [2] for the Huygens landing site that we then adjust to fit the data for other locations on Titan's disk.
Fitting VIMS data taken from 2004 to 2010 (TA to T70), around Titan's mid-latitudes (40°S-40°N), we determine the latitudinal and temporal evolution of the aerosol population, monitoring the North-South Asymmetry. While around the equinox [3] witnessed the collapse of the detached haze layer, we measure a continuous depletion of the aerosols throughout the atmosphere, although the NSA remains with a brighter northern hemisphere.
Using this improved atmospheric model, we also retrieve surface albedos simultaneously for all the seven windows in the whole VIMS range for these regions, also recovering the shape of the surface albedo within each window. Eventually, we look for Titan's surface probable chemical composition, using mixtures of dark and complex hydrocarbons like bitumens and tholins, as well as bright CH4, CO_2, NH3 and H_2O ices of various grain sizes. [4]

[1] Campargue, A. et al., (2012) Icarus, submitted.
[2] Tomasko, M. et al., (2008) Planetary and Space Science, 56, 669.
[3] West, R.A. et al., (2011) Geophysical Research Letters, 38, L06204.
[4] Hirtzig, M. et al., (2012) Planetary and Space Science, submitted.