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Surface Albedo retrieval from Cassini/VIMS data of Titan's geologically interesting areas

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The Cassini Visual and Infrared Mapping Spectrometer (VIMS) obtained data of Titan's surface from flybys performed during the last eight years. In the 0.8-5.2 μm range, these spectro-imaging data showed that the surface consists of a multivariable geological terrain hosting complex geological processes. The data from the seven narrow methane spectral "windows" centered at 0.93, 1.08, 1.27, 1.59, 2.03, 2.79, and 5.00 μm provide some information on the lower atmospheric context and the surface parameters that we want to determine. Atmospheric scattering and absorption need to be clearly evaluated before we can extract the surface properties. We apply here a statistical method and a radiative transfer method on three geologically interested areas on Titan: Tui Regio (20°S, 130°W), Hotei Regio (26°S, 78°W), and Sotra Facula (15°S, 42°W), where all of them have been suggested as volcanic-like sites presenting terrestrial analogues [e.g. 1;2]. With our method of Principal Component Analysis (PCA) we have managed to isolate heterogenic regions of interest (RoI) of distinct and diverse chemical composition. We have tested this method on the previously studied Sinlap crater, delimitating compositional heterogeneous regions compatible with the conclusions published by [3]. Our follow-up method focuses on retrieving the spectral differences among the regions of interest with different spectral response by applying a radiative transfer (RT) code [4]. We have used as inputs most of the Huygens Atmospheric Structure Instrument (HASI) and the Descent Imager/Spectral Radiometer (DISR) measurements, as well as new methane absorption coefficients, which are important to evaluate the atmospheric contribution and to allow us to better constrain the real surface alterations, by comparing the spectra of these regions. The dynamical range in surface albedo within the three regions indicates that the bright RoIs are always brighter than the dark by significant amounts. For Tui Regio and Hotei Regio the largest differences in surface albedo are in the longer wavelengths while for Sotra Facula the offsets are rather homogenously distributed throughout the spectrum ending with the largest ones at 5μm. Additionally, we were able to compare the albedos within the three areas concluding that Sotra Facula is never as bright as Tui Regio [5].

[1] Lopes, R.M.C., et al.: JGR, in press, 2012. [2] Solomonidou, A., et al.: PSS, in press, 2012. [3] Le Mouélic, S., et al.: JGR 113, E04003, 2008. [4] Hirtzig, M., et al.: submitted to Icarus. [5] Solomonidou, A., et al.: in prep.