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Looking at some equatorial regions on Titan using Cassini/VIMS and RADAR data: a case for changes in surface properties

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Titan, Saturn's largest moon, has a complex, dynamic and -in some aspects- Earth-like atmosphere and surface. Data from the remote sensing instruments on board Cassini, particularly VIMS and the RADAR, have shown the presence of diverse terrains on the surface, suggesting exogenic and endogenic processes [1;2;3]. In this research we focus on some equatorial regions that have been identified as possibly subject to changes, having particular spectral properties and possibly being the strongest cryovolcanic candidate regions, that is: Sotra Patera, Hotei Regio and Tui Regio [1,4,5]. We use VIMS data, to which we apply a state-of-the-art Principal Component Analysis (PCA) and radiative transfer methods [4;7] with updated parameterization for the spectroscopic data and infer the surface albedos of all of these regions, that we interpret in terms of possible surface composition and morphology combining with information from RADAR data. Indeed, by including despeckled SAR images we identify geomorphological units and investigate spatial and temporal geological relationships [6]. This combination provides us with implications on the surface composition of different units. By looking at evolution with time, we find that two of these regions show albedo changes with time, for Tui Regio from 2005-2009 (darkening) and Sotra Patera from 2005-2006 (brightening) at all wavelengths, indicating that dynamical processes control the regions, compatible with their complex morphology. In conclusion, we also associate radiometry and topographic data with the compositional information from VIMS to derive constraints on the chemical composition and the geology of the surface and finally the nature of these regions.
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