Titan’s Equatorial Belt: Surface Composition and Geomorphology from Cassini's VIMS and RADAR data

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In thirteen years, infrared observations from the Visual and Infrared Mapping Spectrometer (VIMS) onboard Cassini provided significant hints about the spectral and geological diversity of Titan’s surface. The analysis of the infrared signature of spectral units enables constraining the surface composition, which is essential to understand possible interactions between Titan’s interior, surface and atmosphere. Here, we investigate a selection of areas in Titan's low-latitudes imaged by Cassini's VIMS IR spectrometer, which exhibit an apparent transition from the VIMS IR-bright to the IR-blue and IR-brown spectral units (from false-color composites using red: 1.57/1.27 μm, green: 2.01/1.27 μm, and blue: 1.27/1.08 μm). By applying an updated radiative transfer model [1-3], we extract the surface albedo of IR-units identified in these regions. Then, we compare them with synthetic spectra of mixtures of the two most expected components of Titan’s surface, namely water ice and laboratory tholins. This allows us to reconnect the derived composition and grain size information to the geomorphology observed from Cassini's RADAR/SAR images. Hence, we interpret IR-bright terrains as hills and plains coated by organic material and incised by fluvial networks. The erosion products are transported downstream to areas where IR-blue terrains are seen near the IR-bright terrains. These areas, enriched in water ice, are most likely outwash plains hosting icy and organic debris from fluvial erosion. Farther away from the IR-bright terrains, the IR-brown terrains are dominantly made of organics with varied grain sizes ranging from dust- to sand-sized particles that form the dunes fields. In this work, we show that transition areas exhibit trends in terms of water ice content and grain size supported by geomorphological observations [4].
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