

Surficial Units on Titan: Equatorial Dunes and Polar Lakes and Seas

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From about eleven years, optical and microwaves imaging instruments are unveiling the surface of the intriguing and biggest Saturn's moon, Titan. The strong spatial resolution of the radar instrument (up to 170 m/px) and its insensitivity to atmospheric scattering effects [1], as well as the high resolution of the Imaging Science Subsystem camera (ISS, at 4 km/px) [2] and compositional information from the Visible and Infrared Mapping Spectrometer (VIMS) [3] provide a perfect combination. A large panel of geological and morphological features were identified and mapped, such as lakes, seas, fluvial valleys, dunes, impact craters, mountains, plains and putative cryovolcanic edifices. In this work we mapped the surficial features, i.e. the equatorial dunes (-fields and -seas) and the polar lakes and seas, considered to be the youngest features present and currently active on Titan's surface. Large fields of linear dunes dominate more than 18% of Titan's surface and are mainly confined in the equatorial belt ($\pm 40^\circ$), and are strongly similar to those observed in terrestrial deserts. Titan's dunes are typically 1-2 km wide, 1-4 km spaced, up to 150 m high and over hundreds of kilometers long [4]. Nonetheless, some exceptions are observed and isolated at higher latitudes, between 40-60° [5]. Recent work [6] suggests that some of these mid-to-high latitudes dunes are more likely mega-yardangs, which are usually related to ancient lacustrine activity on Earth. Yardangs are formed from sediments left behind in ancient lake beds and basins, which are then eroded by winds. While the equatorial regions are covered by dunes, polar regions are occupied by lakes and seas filled with liquid hydrocarbons. These lacustrine features cover more than 13% and 1% of the northern and southern polar regions, respectively. Few lake-like features are seen in mid-latitudes in VIMS [7-8] and radar [9] observations. In comparison to the northern pole, the southern polar regions show a deficiency in filled lakes and seas [10-11]. The geological mapping enables to better illustrate the dichotomy between the equatorial belt and the polar regions of Titan, as well as the asymmetry between the northern and southern poles. Observations of lacustrine features, as well as the mega-yardangs-like landforms in mid-latitudes suggest the existence of ancient lake basins in these regions, and hence a different climate in the past history of Titan.

References: [1] Elachi, C. et al. (2004) SSR, 115. [2] Porco, C. C. et al. (2004) SSR, 115. [3] Brown, R. H. et al. (2005) SSR. [4] Radebaugh, A. et al. (2008) Icarus, 194. [5] Radebaugh, A. et al. (2012) LPSC, 2224. [6] Paillou, P. et al. (2015) Icarus. [7] Griffith, C. A. et al. (2012) Nature, 486. [8] Vixie, G. et al. (2015) Icarus. [9] Moore, J. M. and Howard, A. D. (2010) GRL, 37 (22). [10] Hayes, A. G. et al. (2011) Icarus, 211 (1). [11] Aharonson, O. et al. (2009) Nature, 2 (12).