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New Views of Titan's Surface Geology from the Cassini RADAR

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Cassini's Titan RADAR Mapper has imaged about 25% of the surface of Titan, collecting synthetic aperture radar (SAR) images at a spatial resolution ranging from ∼300 m to ∼2 km. The SAR data are distributed over a wide latitudinal and longitudinal range, enabling some conclusions to be drawn about the global distribution of processes. These data reveal that Titan's surface is very geologically complex and has been modified by cryovolcanism, tectonism, impact cratering, erosion and deposition. SAR data over the northern polar region have revealed numerous lakes, inferred to contain liquid methane [Stofan et al., 2006, Nature 445]. The first SAR images of the south polar region were obtained in December 2007 (T39 flyby). Only two features in the swath are sufficiently radar-dark to be interpreted as filled lakes. Three small radar-dark lakes were detected at about 70S in data obtained in October 2007 [Lopes et al., 2007, Eos 88]. Titan's southern polar regions appear to have a scarcity of filled lakes compared with the northern polar regions. This could be due to depletion by seasonal evaporation, or differences in elevation or surface properties between the northern and southern polar regions [Lunine et al., 2008, Lunar Planet. Sci. Conf.]. However, the south polar terrain shows some drained lakes and numerous channels and drainage basins, suggesting fluid transport, though perhaps not at the present time. The T39 data also shows mountainous and hummocky terrains that have been heavily eroded [Radebaugh et al., 2008, Lunar Plan. Sci. Conf.]. No dunes or impact craters have been

seen in either the northern or southern polar regions; dunes are concentrated at lower latitudes [Lorenz et al., 2006, Science, 312], and few impact craters have been unambiguously identified on Titan [Lorenz et al., 2007, Geophys. Res. Lett., 34; Wood et al., 2008, Lunar Planet. Sci. Conf.]. Channels and drainage features appear common at all latitudes [Lorenz et al., Plan. Space Sci., submitted], indicating that erosion by liquids has been a major modification process. The T41 flyby, to take place in February 2008, will obtain SAR coverage of the Tui Regio and Hotei Arcus regions, both of which have been suggested as cryovolcanic in origin [Barnes et al., 2006, Geophys. Res. Lett. 33; Nelson et al., submitted to Nature]. SAR images obtained up to T39 show that cryovolcanism is not ubiquitous on Titan, and that some features interpreted as cryovolcanic, such as Ganesa Macula [Lopes et al., 2007, Icarus 186] appear to be old and modified by other processes. T41 data may reveal other, perhaps better preserved, cryovolcanic features. Mapping of geological units from SAR data is revealing the distribution and relative ages of geological materials.