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Evidence for Surface Modification Processes on Titan from Four Cassini Radar Passes

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Cassini's Titan Radar Mapper has imaged the surface ofTitan on four flybys, collecting high-resolution synthetic-aperture radar and larger-scale radiometry and scatterometry data. These data reveal several surface modification processes that are or have been active in the recent geologic past: impact cratering, fluvial, eolian and cryovolcanic. There are hints, but no conclusive evidence, of tectonic features as well. In this talk we will show and describe the evidence for surface modification processes on Titan and comment on current understanding of how these processes have modified the surface. At this writing there are two craters have been discovered that are clearly impacts, and many candidates that are difficult to separate from volcanic structures. Sinlap is an 80-km wide crater with no apparent central peak nor pit. It has a distinct halo that appears to be an ejecta deposit; Menrva is a well-developed multiring basin 450 km wide. Other candidates are smaller circular features, some with halos or radar-bright interior spots. Arcuate features that may be crater remnants are also candidate impacts. For both the certain and the candidate populations, however, there is a lack of craters in the 20 – 100 km range compared with the expectations based on Rhea and Iapetus. There is ample evidence of erosional and burial processes that may be removing or resurfacing craters. Fluvial activity is evidenced by surface drainage patterns, which take several forms. Linear channels occur that are a few km in width, a few hundred meters deep and several tens to hundreds of km long. Dendritic and braided systems with varying widths seem to collect over several hundred km^2. Other channels appear to be of volcanic origin. Regions as large as 3×10^6km^{2}of linear and curvilinear streaks 1 – 2 km wide and oriented roughly E – W are unambiguously of eolian origin. Some individual streaks stretch for $\sim$ 50 km. They exhibit flow-like interactions with bright features and sometimes appear to overlap them. Apparent specular reflections from slopes nearest the sensor are seen. Terrestrial analogs have been observed in SAR in both Namibia and Antarctica. Global wind models and the analogs suggest that these may be longitudinal dunes, which implies that there is an ample supply of whatever the material may be. Volcanism

is observed most obviously in the earliest data, which is also the farthest North. One roughly circular volcanic construct, Ganesa, is $\sim$180 km across, has a central depression and sinuous channels that appear to drain material, which takes the shape of radar-bright deltas as it traverses the flanks. There are suggestions of lobate fronts within these flows. Other, less well-defined examples of flow-like features, some associated with possible calderas, exist. Most probable flow materials are liquid methane or an ammonia-water mixture. Linear features that may have tectonic origin include an arrow-shaped feature and a series of radar-bright regions that resemble ridges or chains of hills. This work was partially performed at the Jet Propulsion Laboratory, California Institute of Technology, and funded by NASA. The Cassini Project is a joint endeavourof the National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), and the Italian Space Agency (ASI), and is managed by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with NASA.