

Saturn's Satellite Titan: Evidence for active surface processes

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The VIMS instrument on the Cassini spacecraft has observed surface of Titan through spectral 'windows' in its atmosphere where methane the principal absorbing gas is transmitting. We have found that the reflectance of a region on Titan's surface (latitude 26S, longitude 78W) increased twofold between July 2004 and March-April 2005. It then returned to the July 2004 level by November 2005. By late December 2005 the reflectance had surged upward again to a new maximum. It then declined for the next three months. Detailed analyses indicate that the changes are a surface phenomenon, making these the first changes seen on Titan's surface. The spectral differences between the region and its surroundings rule out the ices of H₂O, CO₂, H₂S, HCl, N₂O, NO₂, (NH₄)₂CO₃, NH₄HS and CH₄ as possible causes. Remarkably, the change is spectrally consistent with the deposition and removal of NH₃ over an H₂O

substrate. NH_3 has been proposed as a constituent of Titan's interior but not its surface or atmosphere. This transitory NH_3 spectral signature is consistent with occasional effusion events in which juvenile ammonia is brought to the surface. Its decomposition may feed nitrogen to the atmosphere. The size of the region suggests it may exceed the size of the largest active volcanic areas in the solar system.

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