

Title: Post-Equinox Evolution of Titan's Detached Haze and South Polar Vortex Cloud

Author Block: Robert A. West¹, A. Ovanessian¹, A. Del Genio², E. P. Turtle³, J. Perry⁴, A. McEwen⁴, T. Ray¹, M. Roy¹

¹Jet Propulsion Lab, Caltech, ²Goddard Inst. For Space Studies, ³Appl. Phys. Lab, Johns Hopkins Univ., ⁴University of Arizona,

1. **Abstract:** Instruments on the Cassini spacecraft discovered new phenomena related to the (presumably) seasonal behavior of photochemical haze and formation of the winter polar vortex. West et al. 2011 (*Geophys. Res. Lett.*, **380**, L06204. doi: 10.1029/2011GL046843) described a 'detached' haze layer that dropped in altitude from about 500 km in 2005 to about 360 km by late 2010. New images from the Cassini ISS camera show that the appearance of a detached layer is produced by a gap in the haze vertical profile and it is the gap rather than a haze layer that drops in altitude. Intensity profiles from different epochs form an envelope when plotted on top of each other, and the downward movement of the gap can be most easily seen when plotted that way. The movement of a gap rather than movement of a layer of enhanced haze density was suspected in the earlier publication but now it is more apparent. In recent months the gap became very shallow and the limb intensity profiles at a pixel scale ~ 10 km/pixel evolved from one local maximum/minimum into two local minima/maxima of smaller amplitude and appear to be trending toward the disappearance of relative maxima and minima, leaving a smooth envelope. These observations will require new developments in coupled dynamical and haze microphysical models as none of the current models account for this behavior. Titan's south polar vortex cloud was detected concurrently by the ISS, VIMS, and CIRS instruments on Cassini in May of 2012. It has an unusual color (more yellow than Titan's main haze in ISS images), morphology and texture (suggestive of a condensate cloud experiencing open cell convection) and displays a spectral feature at 220 cm^{-1} (Jennings et al., 2012, *Astrophys. J. Lett.* **761**, L15 DOI: 10.1088/2041-8205/761/1/L15). These attributes point to a condensate of unknown composition. The haze patch is seen in images up to the present (July, 2013), but the latest images suggest a 'softening' or more diffuse edge than the earlier images. The feature is being engulfed by shadow as the season progresses, eventually preventing future observations in reflected sunlight.

Acknowledgement: Part of this work was performed by the Jet Propulsion Lab, Calif. Inst. Of Technology.