Geophysical Research Abstracts,
Vol. 11, EGU2009-12695, 2009
EGU General Assembly 2009

Titan's atmospheric and surface properties of the Ontario Lacus region from Cassini/VIMS remote sensing

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The existence of oceans or lakes of liquid hydrocarbons on Titan's surface was predicted more than 20 years ago. These would serve as a source of atmospheric methane and would also contain the end products of the photochemical reactions occurring high in the atmosphere. Although no oceans were ever found, lake-like features poleward of 70°N were first detected by the radar instrument onboard Cassini on July 2006. Before that, Cassini Imaging Science Subsystem (ISS) images of the south pole from June 2005 revealed an intriguing lake-like dark feature named Ontario Lacus.

Recently an interesting and important result has been published about the identification of liquid ethane contained within Ontario Lacus (Brown et al. 2008). The authors analysed a near-infrared Visual and Infrared Mapping Spectrometer (VIMS) observation of the Ontario Lacus performed the 2007 December 4, during the T38 flyby. Their result needs nevertheless to be confirmed and improved using a more detailed methodology.

Here we report on the analysis of this observation using a radiative transfer model (the libRadtran package) to simulate the atmospheric contribution. LibRadtran is a library of tools developed for radiative transfer calculations in the Earth's atmosphere, but adapted here to Titan's atmospheric conditions. Extinction sources were calculated for atmospheric methane and aerosols as a function of altitude and wavelength. Using the DISORT solver we were able to invert the surface spectrum of the lake interior and of an adjacent, non-lake region, in the near-infrared methane windows. The surface spectra were then compared with spectra of different ices and liquid hydrocarbons, yielding constraints on the possible constituents of Titan's lakes and their adjacent areas.

Reference: Brown, R. et al. 2008. The identification of liquid ethane in Titan's Ontario Lacus, Nature 454, 607-610.