EPSC Abstracts
Vol. 5, EPSC2010-126, 2010
European Planetary Science Congress 2010

Molecular Hydrogen in Titan's Atmosphere: Implications of the Measured Tropopsheric and Thermospheric Mole Fractions

D. F. Strobel, Johns Hopkins University, Baltimore, MD USA (strobel@jhu.edu, +1 (410) 516 7933)

Abstract

The third most abundant species in Titan's atmosphere is molecular hydrogen with a tropospheric/lower stratospheric mole fraction of 0.001 derived from Voyager and Cassini infrared measurements. The globally averaged thermospheric H_2 mole fraction profile from the Cassini Ion Neutral Mass Spectrometer (INMS) measurements implies a small positive gradient in the H_2 mixing ratio from the tropopause region to the lower thermosphere (~ 950-1000 km), which drives a downward H_2 flux into Titan's surface comparable to the H_2 escape flux out of the atmosphere (~2×10^{10} cm^{-2} s^{-1} referenced to the surface) and requires larger photochemical production rates of H_2 than obtained by previous photochemical models. From detailed model calculations based on known photochemistry with eddy, molecular, and thermal diffusion, the tropospheric and thermospheric H_2 mole fractions are incompatible by a factor of ~2. The measurements imply that the downward H_2 surface flux is in substantial excess of the speculative threshold value for methanogenic life consumption of H_2 (McKay and Smith, Icarus, 178, 274--276, 2008), but without the extreme reduction in the surface H_2 mixing ratio.