



The role of H₂O in the Saturn ionosphere

Donald Shemansky and Xianming Liu

Space Environment Technologies, SETPSSD, Altadena, CA, United States (dshemansky@spacenvironment.net)

Stellar occultations in the Cassini Ultraviolet Imaging Spectrograph Experiment observation program have provided measurements of the vertical profiles of H₂ and minor components of the atmosphere. The minor species identified and measured in the extinction spectra to date are CH₄, C₂H₂, and C₂H₄. Measurements of abundance profiles are reported here, with limits on H₂O content. The focus of this paper is on H₂O because of the importance of this species to the understanding of upper atmospheric physical chemistry with significant consequences for ionospheric properties and energy budget. Ionospheric theory published in several papers beginning as early as 1984 have a common critical dependence on a sufficiently large H₂O mixing ratio to control the lifetime of the assumed dominant ion, H⁺. The vertical extinction profiles, which extend down to an impact parameter of 300 km above the 1 bar pressure level, show no evidence of H₂O in the spectrum at mid and low latitudes, establishing a mixing ratio $[H_2O]/[H_2] \leq 4 \times 10^{-8}$, compatible with earlier global average measurements. The upper limit on H₂O abundance at mid latitude establishes a mixing ratio more an order of magnitude too low to influence the ionosphere population in competition with calculated H⁺ + H₂ X(v:J) charge capture reaction rates. The analysis of the extinction spectra produces densities and mixing ratios of the observed species and these results are reported and discussed.