

Estimates of Temperatures in Saturn's Upper Atmosphere from Cassini Radio Occultation Observations

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Abstract

The effective or slab thickness (τ) of an ionosphere is defined as the ratio between local total electron content (TEC) and peak electron density (N_{MAX}). In a photochemical ionosphere this parameter is approximately four times the scale height ($H=kT/mg$) of the ionized neutral gas.

We use the 59 radio occultations of Saturn's ionosphere obtained by Cassini's RSS instrument in order to estimate thermospheric temperatures, and we compare these estimates with temperatures derived from solar and stellar occultations.

The globally averaged slab thickness in Saturn's ionosphere is roughly 1500 km. Given certain assumptions, such slab thicknesses translate into average temperatures of 400-600 K, with a slight increase at higher latitudes. In addition, slab thickness values below 1000 km are found only at low latitudes, within 20° of Saturn's equator, perhaps indicative of relatively cooler equatorial temperatures.

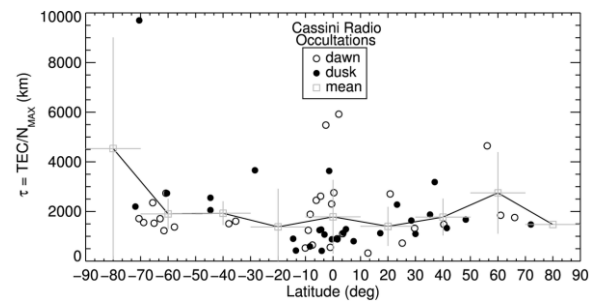


Figure 1: Slab thickness values from Cassini radio occultations.

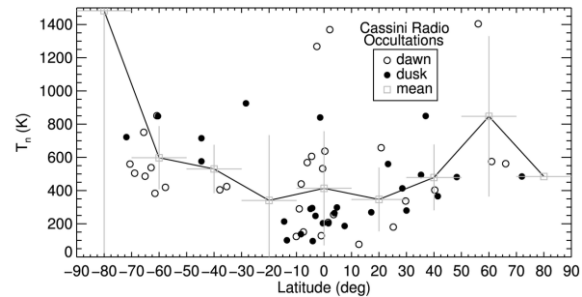


Figure 2: Thermospheric temperatures estimated from the slab thicknesses of Figure 1.