

Wavelet analysis of Saturn's electron density profiles from the Cassini radio occultations

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Abstract

We report a study on the vertical variability present in the electron density profiles of Saturn's ionosphere. We use a wavelet analysis to derive the spectral characteristics of the dominant vertical scales and analyze the Cassini electron density profiles for latitudinal and hemispheric trends. We detect several discrete scales of variability present in the observations. Small-scale variations (less than 700 km) are observed in almost all data sets at all latitudes, both at dawn and dusk conditions. The most typical scale of variability is 300 km with scales between 200 km and 450 km being commonly present in the vast majority of the profiles. A low latitude dawn/dusk asymmetry is noted in the prevalent scales with the spectrum peaking sharply at the 300 km scale at dusk conditions and being broader at dawn conditions. Compared to dawn conditions the dusk ionosphere also shows more significant variability at the 100 km scale. Early 2005 observations show a dominant scale at 350 km whereas later in 2007-2008 the spectrum shifts to the shorter scales with the most prominent scale being 300 km.