Imaging the Earth's Ionosphere with FUV and GPS Occultation Instrumentation

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Flight of new ionospheric remote sensors during recent years has resulted in a wealth of new data becoming available to support ionospheric studies. Two of the most important new technologies in this area are far ultraviolet (FUV) imaging and GPS occultation sensors. Measurements from two instruments that fall into these categories will be presented. The two instruments are the Global Ultraviolet Imager (GUVI) on the TIMED satellite and the Ionospheric Occultation Experiment (IOX) on the PICOSat spacecraft. The optically thin 135.6 nm emission is generated by radiative recombination of oxygen ions and electrons, providing a radiance that is proportional to the line-of-sight integral of the electron density squared. GUVI limb observations of this nightside emission can be used to infer electron density profiles, while disk observations can provide information on F-region peak densities and total electron content (TEC) below the TIMED spacecraft. These observations provide substantial information on ionospheric morphology not available from other sources. On the other hand, the IOX instrument provides line-of-sight TEC observations between PICOSat and up to 8 GPS satellites. Electron density profiles can be inferred using the Abel transform from TEC-tangent altitude plots obtained during Earth-limb occultation events. Because the distribution of occultations is driven by the time-varying geometry of the GPS-PICOSat spacecraft and is therefore pseudo-random in nature, it is easier to evaluate this type of data statistically through comparisons to climatology. However, direct comparisons with the GUVI instrument are also possible during time periods for which the PICOSat and TIMED orbit planes are aligned.