

3D Ionospheric Electron Density Reconstructions and Radio Propagation Modeling Using DMSP/SSUSI

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The Special Sensor Ultraviolet Spectrographic Imager (SSUSI) on board the DMSP F16 satellite launched in October 2003 has made several years of observations of the nightside ionosphere. Each night, SSUSI observes emission at 135.6 nm from the recombination of F-region O⁺ ions with thermal electrons. The low earth orbit of DMSP satellites allows for tomographic reconstruction of three-dimensional ionospheric electron density profiles from UV disk images. SSUSI is at an altitude of 830 km in a fixed 8AM/8PM local solar time orbit, observing the ionosphere during times when equatorial plasma bubbles and ionospheric irregularities are the strongest. These ionospheric anomalies can bend, distort, and reflect HF signal paths; HF communications are useful in mountainous regions with obstructed SATCOM line of sight and in regions with little indigenous communications, such as US AFRICOM. We have coupled these 3D reconstructions with an HF ray-tracing algorithm to simulate the effects of observed ionospheric bubbles and irregularities on radio signal paths. We present the three-dimensional tomographic reconstruction model, initial results, case studies to illustrate applications of the radio wave propagation model, and work in progress.