Electron Density Profile Inversions Obtained from FORTE Broadband Data

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Broadband (time delay versus frequency, 85 MHz bandwidth) data obtained from the FORTE satellite is used in non-linear inversion algorithms to retrieve the electron density profile along the transmitter-receiver path. Broadband data from both the Los Alamos LAPP transmitter and from lightning strikes will be used in the analysis. The lightning strikes alone provide over 100,000 data sets. Since FORTE is a low-earth orbiting satellite, it has the capability of retrieving many lines-of-sight broadband data sets as it passes overhead. Non-linear inversion of these 2D sets of data raises the interesting possibility of being able to estimate the 2D (altitude versus horizontal satellite trajectory) electron density field directly from the FORTE data.

Preliminary results will be presented for two separate non-linear techniques. In the fist technique, the Appleton-Hartree equation is used directly in a non-linear inversion scheme similar to Levenberg-Marquardt, and the profile along the path is retrieved. The second scheme makes use of the ionospheric imaging algorithm Ionospheric Data Assimilation Four-Dimensional (IDA4D). IDA4D ingests a wide variety of data sets both linearly and non-linearly related to electron density and applies the principles of data assimilation to retrieve the 4D global electron density field. IDA4D will use a 3D ray-trace forward model and apply iterative non-linear techniques upon the FORTE broadband data. IDA4D will be run both in modes where the primary data set is FORTE, and also where all data sets available, including FORTE are ingested.

These preliminary results will be compared to, and contrasted with, earlier work carried out by Jacobson and colleagues.