3D TOMOGRAPHY OF THE EARTH'S PLASMASPHERE USING TEC FROM LEO SATELLITES

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Abstract:

We use 3-dimensional tomographic data inversion techniques to estimate electron densities in the Earth's plasmasphere using GPS total electron content (TEC) measurements from low-Earth orbiting (LEO) satellites. Specifically, we use the Webb and Essex (2004) model to initialize our inversion of upward-looking TEC from the receiver onboard the Jason1 satellite. We compare the integrated TEC through the model to measured TEC to estimate representation error, and we use estimated vertical density profiles to parameterize and constrain our inversion. These exercises represent first steps toward producing 3D images of the plasmasphere's electron density structure.

Expanded Abstract / Summary:

The Earth's plasmasphere has long been studied using a variety of remote sensing techniques. Such techniques have yielded great insight into the density variability of the plasmasphere induced by changing levels of geomagnetic activity. We explore the use of tomographic data inversion techniques to estimate electron densities using total electron content (TEC) measurements between GPS satellites and dual frequency GPS receivers on low-Earth orbiting (LEO) satellites. In particular, we use the diffusive equilibrium model of Webb and Essex (2004) to initialize a 3-dimensional tomographic inversion of upward-looking TEC data from the receiver onboard the Jason-1 satellite. We compare the integrated TEC through the *a priori* model to the actual measured TEC to develop an estimate of the representation error, and we use an estimate of the dependence of density on vertical distance as a parameterization to help constrain our 3D tomographic inversion. These exercises represent a first step toward producing reliable 3D images of the plasmasphere's electron density structure.