**COSMIC Observations of TEC Enhancements during a Geomagnetic Disturbance**

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COSMIC satellite data, acquired during five days in November 2007 were analyzed to study Total Electron Content (TEC) enhancements as a fast stream in the solar wind passed Earth. We calculated TEC by integrating electron density profiles over altitude and assigned values to the locations of ray-tangent points. TEC enhancements appeared at mid- to high-magnetic latitudes during the main phase of a magnetic storm driven by the fast stream's leading edge. Some TEC increases exceeded quiet-time values by factors of 3 to 4. We considered the Hardy model for distributions of auroral electron precipitation but found no stormtime source for new plasma creation in the range of magnetic latitudes where the TEC enhancements occurred. Thus, the TEC enhancements must reflect transport effects. Neutral winds generated at auroral latitudes should push dayside plasma equatorward, just the opposite of COSMIC observations. Rather, required transport implies plasma drifts from low to higher latitudes, due to penetration dawn-to-dusk electric fields. ACE measurements allow estimates of penetration electric field strengths. These are then mapped to the ionosphere and used to calculate plasma transport velocities. We compare empirical solutions of the continuity equation with TIEGCM predictions.