

SUB-AURORAL ELECTRIC FIELD EFFECTS ON THE MID-LATITUDE IONOSPHERE

Foster, J.C.<sup>1</sup>, Coster, A.J.<sup>1</sup>, Colerico, M.<sup>1</sup>, Rideout, W.<sup>1</sup>, Rich, F.J.<sup>2</sup>

<sup>1</sup>MIT Haystack Observatory, Westford, MA 01886 USA

<sup>2</sup>Air Force Research Lab, Hanscom AFB, MA

Magnetospheric electric fields and ionosphere-magnetosphere feedback contribute strongly to the formation of ionospheric space weather effects over populous mid-latitude regions during severe geomagnetic disturbances. Electric fields often appear in regions of low ionospheric conductivity equatorward of auroral electron precipitation. Currents driven into the sub-auroral ionosphere from the disturbed ring current put into play a sequence of M-I coupling and feedback mechanisms with dramatic consequences for the electric fields and particle populations of the Plasmasphere Boundary Layer (PBL). The Sub-Auroral Polarization Stream (SAPS) defined by Foster and Burke [EOS, 83(36), 393, 2002] refers to the broad, persistent, poleward-directed electric fields which drive sunward plasma convection at sub-auroral latitudes in the evening local time sector. Observations of subauroral plasma convection with DMSP satellites and the Millstone Hill incoherent scatter radar, have been used to characterize SAPS phenomenology at low altitudes ( $\leq 1000$  km) in the coupled inner-magnetosphere / ionosphere system.

The effects of SAPS in the ionosphere and magnetosphere can be spectacular - including Storm Enhanced Density (SED) plumes of greatly enhanced ionospheric total electron content (TEC), erosion of the dusk-sector plasmasphere, and the formation of sunward-reaching plasmasphere drainage plumes. These features constitute significant space weather effects and an understanding of the global nature of the coupled upper-atmosphere systems which drive them is needed to model or predict their occurrence and severity. The inward extent of the SAPS electric field overlaps the outer plasmasphere on field lines mapping to the high-density cold plasmas equatorward of the ionospheric trough. We use ground-based GPS propagation data to produce two-dimensional maps depicting the evolution of the SED features as they are carried from their low-latitude source to the cusp ionosphere and across the polar caps.

Penetrating electric fields and storm positive-phase disturbances combine to produce greatly elevated TEC in the dusk-sector PBL. This solar-produced ionization constitutes the source plasma for the SED plumes which are carried to higher latitudes in the SAPS flow. Ground-based radio-propagation data provide a means of monitoring these phenomena over large portions of the globe.

Abstract Submission Form

2006 National Radio Science Meeting

Abstract: foster27606

Date Received: September 16, 2005

1. (a) John Foster  
MIT Haystack Observatory  
off Route 40  
Westford, MA  
01886 USA  
jfoster@haystack.mit.edu
- (b) 7819815621
- (c) 7819815766
2. G - Ionospheric Radio and Propagation
3. (a) G4
4. C - Contributed Paper, Program chair: Fuller-Rowell/Foster
5. No special instructions