Project Details

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Topic: Effects of Ionospheric-Magnetospheric Plasma Redistribution on Storms

Project Title:
Ionospheric Redistribution: Storm Enhanced Density as a Source for Ion Outflow in the Cusp and Polar Cap

PI Name: John Foster
PI Email: jfoster@haystack.mit.edu
Affiliation: MIT Haystack Observatory
Project Member(s):
- Erickson, Philip J.; Co-I; pje@haystack.mit.edu; MIT Haystack Observatory; 781-981-5769
- Coster, Anthea J.; Co-I; ajc@haystack.mit.edu; MIT Haystack Observatory; 781-981-5753
- St-Maurice, Jean-Pierre ; Collaborator; University of Saskatchewan
- Ruohoniemi, John Michael; Virginia Polytechnic and State University
- Rich, Frederick J.; Collaborator; MIT Lincoln Laboratory
- Sojka, Jan J; Collaborator; Utah State University
- Schunk, Robert Walter; Collaborator; Utah State University
- Shiokawa, Kazuo ; Collaborator; Nagoya University

Summary:
This is a multi-instrument investigation using both ground and space based systems to investigate the characteristics and dynamics of the ionospheric source plasmas in ion outflow/acceleration regions at the base cusp field lines and in the polar cap. An accurate specification of source plasma characteristics is need to model and understand the injection of ionospheric ions into the magnetosphere during storms. In particular, we will examine the conditions under which lower-latitude enhanced-density ionospheric plasma is supplied to the ion outflow and acceleration regions, and the conditions under which this material is drawn into the polar cap, forming a polar tongue of ionization (TOI). We will employ a wide range of available ground based [incoherent and coherent scatter radar, Global Positioning System (GPS) receivers] and DMSP in-situ satellite diagnostics. The results of our studies will significantly advance knowledge of the temporal evolution and ultimate impact of stormtime ionospheric restructuring on the source regions providing outflow of heavy ionospheric ions to the magnetosphere.

We will combine GPS TEC global maps with SuperDARN convection velocity determinations to investigate the role of electric field variability in structuring the cold source plasmas as it enters the cusp and polar cap. Incoherent scatter radar observations will provide vertical profiles of the redistributed ionospheric material in the mid-latitude source region, the cusp, and polar tongue of ionization. This will provide an accurate specification of the source plasmas feeding the ion-outflow mechanisms and will contribute to Team efforts attempting to model these processes.

Questions to be addressed include:

1. Under what solar wind and ionospheric/magnetospheric conditions does the SED plasma enter into the polar circulation pattern, and under what conditions does it not?

2. Is an active subauroral SAPS electric field required to efficiently provide SED material as a source for TOIs, and if so is there an identifiable threshold for this mechanism?

3. During events where a TOI forms, what is the spatial and temporal variation of the low altitude SED sunward plasma flux? How does this compare with the ionospheric material which continues onward into the polar cap general circulation as TOI?

4. How does the low altitude density distribution, plasma temperature, and plasma composition of ionospheric source material change as this material moves from the mid-latitude SED plume sunward into the cusp region and subsequently into a polar TOI?

5. Are there cusp velocity / electric field structures and/or fluctuations at ionospheric heights which are identifiable as causing plasma structuring? Do these structures enhance flux outflows?

Publication References:

no references