32nd URSI GASS, Montreal, 19–26 August 2017

A new model for forecasting the Sub-Auroral Polarization Stream (SAPS).

Bharat S. R. Kunduri(1), J. Michael Ruohoniemi(1), Joseph B. H Baker(1), Evan G. Thomas(2), and Simon G. Shepherd(2)
(1) Center for Space Science and Engineering Research (Space@VT), Virginia Tech, Blacksburg, VA, USA
(2) Thayer School of Engineering, Dartmouth College,New Hampshire, USA

1 Extended Abstract

The Sub-Auroral Polarization Stream (SAPS) is a region of westward ionospheric flows equatorward of the main auroral oval which plays an important role in the mid-latitude space weather dynamics [1]. For example, SAPS has a controlling influence on the evolution of large-scale plasma features, such as storm enhanced density (SED) plumes, which in turn generate smaller scale irregularities that produce scintillation [2, 3]. This study examines the occurrence statistics of SAPS using a database of measurements obtained by the US mid-latitude chain of SuperDARN radars between January 2011 and December 2014. SAPS events were found to occur over a wide range of geomagnetic activity levels specified by the Dst-index, including non-storm and storm-time conditions. Spatial maps of SAPS occurrence probability and the most likely SAPS speed are presented for different Dst-index bins. During relatively quiet conditions (-10nT $<$ Dst-index $<$ 10nT) SAPS were observed 15% of the time and tend to be localized to the midnight sector and centered above 60° magnetic latitude. As the activity level increases, and Dst-index decreases, SAPS shifts equatorward and rotates duskward. During moderate storm conditions (-75 nT $<$ Dst-index $<$ -50 nT) SAPS are observed 87% of the time and tend to be centered at 20 magnetic local time and below 60° magnetic latitude. These results have been codified into a new empirical model which uses the Dst-index as input to estimate the probability of SAPS occurrence and most likely SAPS speed at a given magnetic latitude and local time. The accuracy of the model has been cross-validated using independent DMSP driftmeter data. Such a model will prove useful as a space weather forecasting tool as well as aiding future theoretical studies on SAPS formation and the generation of SAPS-associated small-scale ionospheric irregularities.

References

[1] Foster, J., and W. Burke , "SAPS: A new characterization for sub-auroral electric fields," *Eos, Transactions American Geophysical Union*, **83**(36), 2002, pp. 393–394.

[2] Foster, J. C., P. J. Erickson, A. J. Coster, J. Goldstein, and F. J. Rich , "Ionospheric signatures of plasmaspheric tails.," *Geophysical Research Letters*, **29**, 2002, doi:10.1029/2002GL015067.

[3] Thomas, E. G., J. B. H. Baker, J. M. Ruohoniemi, L. B. N. Clausen, A. J. Coster, J. C. Foster, and P. J. Erickson , "Direct observations of the role of convection electric field in the formation of a polar tongue of ionization from storm enhanced density.," *Journal of Geophysical Research: Space Physics*, **118**, 2013, doi:10.1002/jgra.50116.