

SAPS in the 2013 March 17 Storm Event: Initial Results from the Coupled Magnetosphere-Ionosphere-Thermosphere Model

*Dong Lin^{1,2}, Wenbin Wang², Wayne Scales¹, Kevin Pham², Jing Liu², Binzheng Zhang², Viacheslav Merkin³, Xueling Shi¹

1. Virginia Tech, 2. High Altitude Observatory, NCAR, 3. APL, John Hopkins Univ.

Subauroral polarization stream (SAPS) are latitudinally narrow flow channels of large westward plasma drifts in the subauroral ionosphere. In this study, the global structure and dynamic evolution of SAPS are investigated by using the National Center for Atmospheric Research (NCAR) Coupled Magnetosphere-Ionosphere-Thermosphere (CMIT) model with Ring Current extension, namely the LFM-TIEGCM-RCM (LTR) model, to simulate the 2013 St. Patrick's Day storm event. This is the first time that the global distribution and temporal evolution of SAPS are investigated using first-principle models. The model shows a strong westward ion drift channel formed equatorward of the auroral electron precipitation boundary on the duskside, which is identified as the SAPS structure. The simulated ion drift velocity and auroral electron precipitation sampled along the trajectory of the DMSP F18 satellite are in good agreement with the satellite measurements. SAPS initiate in the pre-dusk sector when the interplanetary magnetic field (IMF) turns southward. SAPS latitude generally decreases with magnetic local time (MLT) from dusk to midnight. The SAPS channel shows wedge, inverse wedge, and crescent morphologies during the storm, and becomes discontinuous when the IMF is weakly southward. The SAPS mean latitude has a correlation coefficient of 0.77 with the Dst index. The mean latitude moves equatorward and the flow channel broadens in the storm main phase. The simulation results are consistent with observational studies. They also illustrate the global distributions and highly dynamic behaviors of SAPS that are not readily apparent from observation data.

Keywords: SAPS, Magnetosphere-Ionosphere-Thermosphere coupling, LFM-TIEGCM-RCM