



Proton precipitation at sub-auroral latitudes during 27 May 2017 storm and its association to EMIC waves: Global modeling and multi instrument observations.

Shreedevi P R(1,2), Yiqun Yu(1), Yoshizumi Miyoshi(2), Xingbin Tian(1), Sandeep Kumar(2), Minghui Zhu(1), Satoko Nakamura(2), Chae-Woo Jun(2), Masafumi Shoji(2), Kazuo Shiokawa(2), Vania Jordanova(3), T. Hori(2), K.Asamura(4), I. Shinohara(4), S. Yokota(5), S. Kasahara(6), K.Keika(6), A. Matsuoka(7) , Martin Connors(8), Akira Kadokura(9)

(1)School of Space and Environment, Beihang University, Beijing, China,

(2) Institute for Space-Earth Environmental Research, Nagoya University, Japan,

(3) Los Alamos National Laboratory, Los Alamos, NM, United States,

(4) ISAS/JAXA, Sagamihara, Japan,

(5) Osaka University, Toyonaka, Japan,

(6) University of Tokyo, Tokyo, Japan,

(7) Kyoto University,

(8) Athabasca University, Canada,

(9) National Institute of Polar Research, Japan

Recent studies have shown that the ion precipitation induced by EMIC waves can contribute significantly to the total energy flux deposited into the ionosphere and severely affect the magnetosphere-ionosphere coupling. During the geomagnetic storm of 27-28 May 2017, the ARASE and the RBSP-A satellite observed typical signatures of EMIC waves in the inner magnetosphere. The DMSP and NOAA METOP satellites observed enhanced proton precipitation during the main phase of the storm. In order to understand the evolution of proton precipitation into the ionosphere, its correspondence to the time and location of excitation of the waves and its relation to the source and distribution of proton temperature anisotropy, we conducted two simulations of the BATSRUS+RAMSCBE model with and without EMIC waves included. At regions where Arase/RBSP-A satellite measurements recorded EMIC wave activity, an increase in the simulated growth rates of H- and He-band EMIC waves is observed indicating that the model is able to reproduce the EMIC wave activity. Simulation results suggest that the H- and He-band EMIC waves are excited within regions of strong temperature anisotropy of protons in the vicinity of the plasmapause. The RAM-SCBE simulation with EMIC waves reproduces the precipitating fluxes in the pre-midnight sector fairly well, and is found to be in good agreement with the DMSP and NOAA MetOP satellite observations. Results suggest that the EMIC wave scattering of ring current ions gives rise to the proton precipitation in the pre-midnight sector at sub auroral latitudes during the main phase of the 27 May 2017 storm.