3rd Asia-Pacific Conference on Plasma Physics, 4-8,11.2019, Hefei, China

Statistical analysis of relativistic electron precipitation in the magnetosphere from POES observations

Huayue Chen[1], Xinliang Gao[1]*, Quanming Lu[1], N. A. Tsyganenko[2], Yongcun Zhang[3] and Shui Wang[1]

[1] CAS Key Laboratory of Geoscience Environment, School of Earth and Space Sciences, University of Science and Technology of China, Hefei, 230026, China,

[2] Department of Earth's Physics, Saint Petersburg State University, St. Petersburg, Russia,

[3] State Key Laboratory of Space Weather, National Space Science Center, Chinese Academy of Sciences, Beijing, China

e-mail: beat@mail.ustc.edu.cn

Abstract:

In this letter, we investigate the characters of relativistic electron precipitation (REP), which is derived from seven NOAA Polar-orbiting Operational Environmental Satellites (POES) in the time period from Jan 2012 to Dec 2017. Via an automatic algorithm, totally 62,212 REP events are identified, whose prefer regions are in the post-midnight, noon, and dawn sectors at 3.5<L<5, and pre-midnight sector at 4.5<L<6. And their occurrence rate has positive correlation with AE^* index. We suggest that REP events in the afternoon sector are associated with He^+ band EMIC waves. According to the GEOPACK model, the field line curvature radius R_C, which is anti-correlated with AE^* index, can trigger the REP in the nightside when R_C is comparable with the gyro-radius of relativistic electron. This is also supported by observations from Cluster satellites. As a summary, our results can shed light on the fundamental characters of REP events in the magnetosphere.

References:

1. Balogh, A., Carr, C. M., Acuña, M. H., et al. (2001), The Cluster Magnetic Field Investigation: overview of in-flight performance and initial results, Ann. Geophys, 19, 1207.

2. Carson, B. R., C. J. Rodger, and M. A. Clilverd (2012), POES satellite observations of EMIC-wave driven relativistic electron precipitation during 1998–2010, J. Geophys. Res. Space Physics, 118, 232–243, doi:10.1029/2012JA017998.

3. Matsumura, C., Y. Miyoshi, K. Seki, S. Saito, V. Angelopoulos, and J. Koller (2011), Outer radiation belt boundary location relative to the magnetopause: Implications for magnetopause shadowing, J. Geophys. Res., 116, A06212, doi:10.1029/2011JA016575.

4. Millan, R. & Thorne, R. M. (2007). Review of radiation belt relativistic electron losses. J. Atmos. Solar Terr. Phys. 69, 362-377.

5. Saito, S., Y. Miyoshi, and K. Seki (2010), A split in the outer radiation belt by magnetopause shadowing: Test particle simulations, J. Geophys. Res., 115, A08210, doi:10.1029/2009JA014738.

6. Sergeev, V. A. & Tsyganenko, N. A. (1982). Energetic particle losses and trapping boundaries as deduced from calculations with a realistic magnetic field model. Planet. Space Sci. 30, 999-1006.

7. Shen, C., X. Li, M. Dunlop, Q. Q. Shi, Z. X. Liu, E. Lucek, and Z. Q. Chen (2007), Magnetic field rotation analysis and the applications, J. Geophys. Res., 112, A06211, doi:10.1029/2005JA011584