Geophysical Research Abstracts
Vol. 12, EGU2010-7710, 2010
EGU General Assembly 2010

Study on the source region and production mechanism of pulsating aurora based on the Reimei observations

Takanori Nishiyama (1), Takeshi Sakanoi (1), Yoshizumi Miyoshi (2), Yuto Katoh (3), Kazushi Asamura (4), Shoichi Okano (1), and Masafumi Hirahara (5)

(1) Planetary Plasma and Atmospheric Research Center, Tohoku University, Sendai, Japan, (2) Solar-Terrestrial Environment Laboratory, Nagoya University, Nagoya, Japan, (3) Graduate School of Science, Tohoku University, Sendai, Japan, (4) ISAS, JAXA, Sagamihara, Japan, (5) Graduate School of Science, University of Tokyo, Tokyo, Japan

Pulsating aurora is a phenomenon which shows periodic change of emission intensity in the diffuse aurora. The emission is characterized by not sinusoidal change but pulsation, and its typical period is from a few seconds to a few tens of seconds [e.g., Oguti et al., 1981; Yamamoto, 1988; Nemzek et al., 1995]. Precipitating electrons which generate pulsating aurora were observed with 3 Hz modulations by rockets and low-altitude satellites and the energy ranges from a few keV to a few tens keV and has been known to be higher than electrons' energy responsible for diffuse aurora [Sandahl et al., 1980; Yau et al., 1981; Sato et al., 2004]. Because pulsating aurora appears in diffuse aurora, electrons are thought to undergo cyclotron resonance with whistler mode waves in the equatorial region of the magnetosphere and to precipitate into the Earth's upper atmosphere by pitch angle scattering. This concept is widely accepted, but there is few observations conflicting this idea. Sato et al., [2004] recently suggested that the source region of pulsating aurora is located earthward, far from the equatorial plane, raising a question about a source region and the mechanism of pulsating aurora.

The purpose of this study is to search for the source regions and the mechanism of pulsating aurora using simultaneous image and particle observation data from REIMEI satellite in statistical basis. We used mainly MAC and Electron/Ion energy Spectrum Analyzer (E/ISA) in this study. MAC takes an image at three wavelengths; 427.8 (N2+ 1st Negative Band), 557.7 (O Green line) and 670.0 (N2 1st Positive Band) nm. The field of view is 7.6 degrees and the time and spatial resolutions are 120 ms and 1 km, respectively. E/ISA is a tophat type electrostatic analyzer with an energy range from 10 eV to 12 keV and time resolution of 40 ms.

We used image and particle datasets obtained from Reimei satellite's observations, and carried out Time-Of-Flight (TOF) analysis that takes the wave-particle interactions with propagating whistler mode waves into account, in addition to a traditional TOF analysis, for 29 pulsating aurora events in order to restrict source regions and production mechanism based on observations. As a result, while the sources identified by traditional TOF model distributed continuously from magnetic latitude of 50 deg to -20 deg, the sources obtained from TOF model taking account of whistler wave propagation were confined to the equatorial region up to about 15 deg. The source distribution obtained with the latter method agrees with the frequent occurrence region of chorus emission and, therefore, pitch angle scattering through wave-particle interactions with chorus is assumed to be one of main production mechanisms for pulsating aurora. In addition, cold plasma density inside the source regions of pulsating aurora and wave frequencies propagating along a field line were obtained as secondary products in the latter TOF analysis. Cold plasma density ranged from 1.0 to 14.2 /cc and wave frequency normalized by a cyclotron frequency was in a range of 0.22 to 0.82, and these values are also consistent with empirical plasma density model and whistlers' frequency, respectively. By improving our model, it will become possible to monitor plasma environment inside an individual source region, such as cold plasma density inside and whistler wave frequency through observation of pulsating aurora.