Estimation of characteristic energy of precipitating electron responsible for pulsating auroras based on the two wavelength observations

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Pulsating aurora (PsA) is a kind of diffuse aurora and characterized by quasi-periodic intensity modulations with 2 s to 30 s intervals. PsA is mainly observed from the post-midnight to the morning sectors during the recovery phase of substorms. PsA is caused by precipitating electrons scattered by the cyclotron resonance interaction between electron and Lower-band chorus (LBC) on the magnetic equator with energy higher than 100 keV. Hosokawa and Ogawa [2015] showed that energy of precipitating electrons become larger with time on the late MLT sector based on the EISCAT observations.

In order to investigate MLT dependencies of the energy of precipitating electrons, we apply the method proposed by Ono [1993] to estimate the characteristic energy. We choose the two optical wave lengths at 427.8 nm and 844.6 nm. These two wave lengths have a short emission time constant. Auroral images at these emission lines were obtained by monochromatic EMCCD cameras installed in Tromso, Norway, and the emission intensity along the magnetic zenith is used for the energy estimation. We analyzed 9 nights (about 141 minutes) of pulsating aurora events from February 2017 to April 2017. And same events are used to take statistics about ON time, OFF time and period.

As a result, the estimated characteristic energies are distributed in a few keV, which is consistent with the estimated resonance energy of electrons through chorus wave-particle interactions. The electron energy at post-midnight tends to be higher than that at pre-midnight during the magnetic disturbance periods.

Moreover, duration time of pulsation ON time is consistent with the Yamamoto [1988], while OFF times are shorter than Yamamoto [1988]. It is interesting to note that occurrence distributions of OFF time shows so-called power law distributions.

Keywords: pulsating aurora, precipitation energy of electron, MLT

