Estimation of precipitating electron energy of pulsating aurora by multiwavelength aurora optical observation

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Pulsating aurora (PsA) is a type of diffuse aurora that is mainly observed from post-midnight to the morning sectors during the recovery phase of substorms. PsA is characterized by quasi-periodic intensity modulation with ~2 -20 s intervals as a main modulation. The main modulation includes an internal modulation of about 1.5 to 3 Hz called an internal modulation.Mainly Electrostatic Cyclotron Harmonic (ECH) waves and whistler-mode waves cause the pitch angle scattering of energetic electrons in the magnetosphere, and PsA is generated by the precipitating electrons with high energy of several to 100 keV. In particular, the whistler-mode chorus waves play the role. The lower-band chorus (LBC) causes an electron precipitation of more than several keV, and the upper-band chorus causes steady precipitation of less than 1 keV. Estimations of the precipitating electron energy of the pulsating aurora from the ground-based observations have been performed. Ono et al.[1993] observed the emission intensities of a nitrogen molecule ion at 427.8 nm emission line and an oxygen atom at 844.6 nm emission line using a photometer, and estimated the energy of the precipitating electron by combining the ratio of the two emission intensities and the model calculation. However, Ono et al.[1993] conducted observations using narrow-field instrument, and the energy estimation by observation using an all-sky camera has not been performed. In Tromso, Norway, several high-sensitivity EMCCD cameras have been installed, which have been simultaneously observing the all-sky image of the emission intensity of sky image of the emission intensity of the 427.8 nm emission line and the 844.6 nm emission line at a sampling frequency of 10 Hz. In addition, a five-wavelength photometer that can observe the emission intensity of the emission lines at 427.8 nm and 844.6 nm in the magnetic zenith direction is also operated. In this study, we compared the data of the photometer and the EMCCD cameras installed in Tromso, and evaluated the sensitivity of the cameras. In addition, we estimated the precipitating electron energy of the pulsating aurora by compering emission intensity ratio of the two emission lines using the all-sky image reflecting the sensitivity evaluation results and the emission intensity calculation results obtained by the GLOW model[Solomon, 2017]. In this presentation, we report the results of the two-dimensional spatial distribution of the estimated precipitating electron energy. Moreover, we discuss the possible errors of the estimated energy.

Keywords: pulsating aurora, precipitating electron energy

