Multi-event analysis for 1 Hz modulation of pulsating proton aurora associated with Pc1 geomagnetic pulsations

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Electromagnetic ion cyclotron (EMIC) waves cause pitch angle scattering of high-energy (several keV ~ tens of keV) ions and relativistic (sub MeV ~ MeV) electrons via wave-particle interactions. Pulsating proton aurora (PPA) is observed as the scattered particles precipitate to the ground along the geomagnetic field line. EMIC waves are observed as Pc1 geomagnetic pulsations on the ground. We simultaneously observed PPA and Pc1 pulsations on the ground, using an all-sky EMCCD camera (110 Hz sampling) and an induction magnetometer (64 Hz sampling) at Athabasca, Canada (L value=4.3). We observed 1-Hz range of luminous modulation of PPA on 12 November 2015 and 2 January 2016. In order to understand the generation mechanism of 1 Hz luminous modulation, we analyzed the luminous characteristics of PPA. The fastest luminous modulation was observed at frequencies of around 1 Hz, which were twice the center frequency (0.5 and 0.6 Hz) of the simultaneously observed Pc1 geomagnetic pulsations. The 1 Hz range of luminous modulations could be generated by a relationship with the wave power of Pc1 geomagnetic pulsations. However, we observed similar PPA which did not show the 1 Hz luminous modulations at Athabasca on 2 April 2017, even when EMIC waves were observed. Therefore, the role of EMIC waves must be investigated carefully.
In the presentation, we will discuss the 1 Hz range of PPA luminous modulations observed at Athabasca in detail.

Keywords: Pulsating proton aurora, Pc1 geomagnetic pulsations, Wave-particle interaction, EMIC waves

